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SOME PSYCHOLOGICAL FACTORS AS PREDICTORS OF STUDENTS' ATTITUDE TOWARDS MATHEMATICS IN TECHNICAL AND VOCATIONAL INSTITUTIONS IN WESTERN NIGERIA

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ABSTRACT

Mathematics serves as a strong reinforcement that enables the students to develop logical, abstract thinking and the ability to recognise, formulate and evaluate problems in their different fields. The knowledge gained from mathematics is expected to be applied to the courses offered in technical and vocational institutions. This study examined the effect of some psychological factors on students' attitudes towards mathematics. This was designed specifically to consider the effect of interest in mathematics, mathematics phobia, and perceived usefulness of mathematics on students' attitudes towards mathematics. Data was collected using the Students' Questionnaire (SQ). A correlational analysis showed a positive relationship among the variables of the study. The result revealed that 77% of the variation in students' attitude towards mathematics was accounted for by the independent variables (interest, mathematics phobia and perceived usefulness of

mathematics). It is therefore recommended that all the psychological factors examined should be treated and made right in order to improve students' attitude towards mathematics in technical and vocational institutions for learning effectiveness in mathematics.

Keywords: *Interest, Mathematics phobia, Usefulness of mathematics, Attitude, Technical and Vocational Institutions.*

1. INTRODUCTION

Mathematics is useful in every area of life because it affects every facet of human activity, it is used to solve problems in all forms of discipline and provides answers to questions and problems which arise every day in our daily activities. It is an instrument created to deal with situations and to tackle unpredictable problems. It has therefore become the backbone for success in every field of life. This makes mathematics a precise language that helps to formulate ideas and identify underlying assumptions, which enables one to think, reason, analyse and articulate logically. Mathematics has also been accepted as a foundation of science and technology (Okeke, 2009; Okpalla, 2008). This makes it important in the scientific and technological development of countries (Enu et al., 2015). This explains the reason why there is hardly any discipline in which mathematics is not included, for mathematics skills are essential in understanding other disciplines (Patena and Dinglasan, 2013). Due to the importance that mathematics plays in the understanding of other disciplines, this subject becomes key in the school curriculum.

Despite the importance of mathematics as a subject, the majority of students go with the impression that mathematics is a difficult subject and should be left for exceptional students. This bias among students that mathematics is a difficult subject, no doubt, could affect their attitude towards mathematics.

Attitude is the favourable or unfavourable response or disposition to things, people, events or ideas (Koballa, 1995). Attitude, therefore, is a state that influences or modifies the individual choices of personal action towards something.

A positive attitude is a positive emotional disposition towards a thing, people, event or idea, and a negative attitude is a negative disposition. This attitude can change and develop with time (Syyeda, 2016). Hence, a student's attitude towards mathematics can be defined as the emotion that the student associates with mathematics as a course. Olisama et al. (2011) stated that mathematics attitude is a positive or negative emotional disposition towards mathematics. Attitude towards mathematics is then referred to as a student's tendency to respond positively or negatively towards mathematics. It is also regarded as the beliefs, opinions and feelings of students concerning mathematics, which can equally manifest in their behaviour.

Attitudes, behaviour, and feelings are interrelated in such a way that people's attitudes determine their behaviour and feelings towards objects, situations, and people (Mazana et al., 2019). Hence, attitude towards mathematics is what students think and believe about mathematics and the learning of mathematics. This student's attitude to mathematics is an essential component that contributes to students' academic

achievement in mathematics (Mohamed and Waheed, 2011; Michelli, 2013; Mazana et al., 2019)

Many students show difficulties when it comes to learning mathematics as a course; the thought of having mathematics as one of the courses to offer poses a lot of problems to them. Some of them see mathematics as a subject that can only be useful in the classroom and not relevant in real-world situations. This is an experience common in teaching mathematics at different levels of education. This fact is supported by (Udegbe, 2009), who stated that the majority of students show a lack of interest in learning mathematics as a course. He went further to say that, in most cases, students absent themselves from mathematics lessons, and those who stay in class pay little or no attention to their teachers.

There is the possibility that consistent and defined interest in an activity may lead to a definite attitude pattern towards such activity; hence, a student who has an interest in mathematics might develop a positive attitude towards mathematics, while a student who has no interest in mathematics might develop a negative attitude towards mathematics. The negative attitude could also be attributed to the fact that students could not perceive or identify the importance or usage of mathematics in their course of study. Students seeing the importance or relevance of mathematics to their career choice will likely develop a positive attitude toward mathematics. However, students become more involved in mathematics if they perceive the content or topics being taught are directly connected to their chosen course (Hareau et al., 2005; Otavio and Otavio, 2008; Appah et al., 2019).

Mathematics questions are known as problems because of the challenges they pose in solving them. Solving these problems requires insightful thinking, critical reasoning, creativity and the use of previous knowledge. Mathematics questions are quantitative and involve mathematical issues requiring computations (Adedayo, 2011). These questions could be word problems which need to be translated into mathematical terms. It could be proof of theorems, numerical figures or mathematical diagrams. Solving these problems requires skills which include interpretation of information, planning and methodical working, checking results and trying alternative strategies. (Muir et al., 2008). Mathematical modelling is a process of problem solving that uses mathematics to explain and define events in real life, to test ideas and to make estimations about real-life events (Ayia, 2015). The mathematical modelling approach analyses mathematical problems in a real-world situation, therefore, interpreting mathematical solutions to suit real-world problems. It is one of the practices a student can engage in to move beyond computational skill (NCTM, 2000). This implies that students who are engaged in mathematics problem solving can make connections across mathematical areas as well as learning about its application outside the mathematics classroom setting. Knowledge acquired in mathematics classes plays a vital role in developing students' skills not only in mathematics but also in other courses (Lesh and Harel, 2003). Thus, mathematical knowledge enables students to formulate and evaluate problems in their areas of specialisation.

Previous researchers have identified many factors that affect students' attitude towards mathematics, such as students'

personality (Osborne, Simon and Collins, 2003), students' characteristics and teachers' characteristics (Anderson, 2005), Sakiz et al., 2013). Parental background and occupation of parents (Köğce et al., 2009), students' self-efficacy and self-concept (Tahar et al., 2010). This study focuses specifically on interest, mathematics phobia, and perceived usefulness of mathematics on students' attitudes towards mathematics.

There are inclinations and predispositions that guide an individual's behaviour (Rubinstein, 1986) and lead to an action that can be evaluated as either positive or negative (Fishbein and Ajzen, 1975). Attitudes develop and change with time (Rubinstein, 1986). According to the Multicomponent model of Attitude (Eagly and Chaiken, 1993), attitudes are influenced by three components. They are cognitive (beliefs, thoughts, attributes), affective (feelings, emotions) and behavioural information (past events, experiences) (Maio et al., 2010). When reviewing literature on students' attitudes towards mathematics, it reveals that several factors play a vital role in influencing students' attitudes.

These factors can be categorised into three distinctive groups. Firstly, factors associated with the students themselves. Some of these factors include students' mathematical achievement score (Köğce et al, 2009), anxiety towards mathematics, students' self-efficacy and self-concept, extrinsic motivation (Tahar et al, 2010) and experiences at high school (Klein, 2004; Bobis and Cusworth, 1994). Secondly, the factors that are associated with the school, teacher and teaching. Some of these factors that influence attitudes are teaching materials used by teacher, teachers‟ classroom management, teachers‟ content

knowledge and personality, teaching topics with real life enriched examples, other student's opinions about mathematics courses (Yilmaz et al., 2010), teaching methods, reinforcement (Papanastasiou, 2000), receiving private tuition (Köğce et al, 2009), teachers‟ beliefs towards mathematics (Cater and Norwood, 1997) and teachers‟ attitude toward mathematics (Ford, 1994, Karp, 1991). Thirdly, factors from the home environment and society also affect students‟ attitude towards mathematics. Factors such as the educational background of parents, occupation of parents (Köğce et al, 2009), and parental expectations (Tobias, 1993) play a crucial role in influencing students' attitude towards mathematics. Due to these several factors, students have different attitudes towards mathematics. More often, the public image of mathematics is labelling it as a difficult, cold, abstract, theoretical and ultra-rational subject (Ernest, 2004). However, some studies show that students have a relatively positive attitude towards mathematics (Tezer and Karasel, 2010; Yilmaz et al, 2010; Fan et al, 2005). Sometimes, Mathematics is also considered a very important and largely masculine subject (Ernest, 2004). Several studies give evidence that compared to boys, girls lack confidence in doing mathematical sums and view mathematics as a male domain (Meelissen and Luyten, 2008; Odell and Schumacher, 1998; Hyde et al., 1990).

The focus of this study is to determine the effect of interest, mathematics phobia and perceived usefulness on students' attitude towards mathematics. This study aims to collect empirical evidence about the effect of students' interest, mathematics phobia and perceived usefulness of mathematics on students' attitude towards mathematics.

This paper addresses the following key questions:

a) What are the relationships between students' psychological variables (self-confidence, interest, mathematics phobia and perceived usefulness of mathematics?
b) What is the composite contribution of students' psychological variables (self-confidence, interest, mathematics phobia and perceived usefulness of mathematics) on students' attitude towards mathematics?
c) What is the relative contribution of students' psychological variables (self-confidence, interest, mathematics phobia and perceived usefulness of mathematics) to students' attitude towards mathematics in this?

2. REVIEW OF LITERATURE

2.1 Conceptualising Students' Attitude Towards Mathematics

Attitude towards mathematics has long been acknowledged as a key affective determinant of students' academic engagement and success. It encapsulates students' beliefs, emotions, and behavioural tendencies towards learning mathematics (Mazana, Montero & Casmir, 2019). According to Koballa (1995), attitude can be understood as a favourable or unfavourable predisposition towards an object or activity, which, in the context of education, influences both effort and performance. More specifically, mathematics attitude represents students' emotional and cognitive orientations such as enjoyment,

anxiety, motivation, and perceived importance, toward mathematical learning and problem-solving (Mohamed and Waheed, 2011).

A growing body of literature affirms that attitude towards mathematics is not static; it evolves based on personal experiences, instructional quality, peer influence, and contextual relevance of content (Syyeda, 2016; Erturan and Jansen, 2015). Furthermore, attitudes are typically conceptualized using the tripartite model, comprising cognitive (beliefs), affective (feelings), and behavioural (action tendencies) dimensions (Eagly and Chaiken, 1993). In the context of technical and vocational education, the functionality and application of mathematics in real-life tasks may mediate students' attitudes, enhancing engagement if relevance is perceived (Erdogan et al., 2020).

2.2 Interest in Mathematics

Interest is a fundamental motivational construct that plays a decisive role in students' willingness to engage in and persist with mathematical tasks. It is a form of intrinsic motivation that drives learners toward exploration and self-regulated learning (Renninger and Hidi, 2016). In technical and vocational settings, where learners often seek practical relevance, interest in mathematics is heightened when students can connect mathematical concepts to vocational tasks such as measurement, cost estimation, and data analysis (Appah et al., 2019; Uka et al., 2022).

Recent studies confirm the predictive power of interest in mathematics achievement and attitudes. For example, Jain and

Dowson (2022) found that students with sustained interest in mathematics demonstrated greater emotional resilience and higher performance levels. Moreover, the presence of subject-specific interest can override other negative affective conditions like anxiety, thereby fostering a positive attitude and sustained effort (Wigfield et al., 2021). Therefore, designing mathematics instruction to build or sustain situational interest is critical, especially in vocational institutions where learners may not initially see its value.

2.3 Mathematics Phobia and Anxiety

Mathematics anxiety, also termed mathematics phobia, refers to a state of fear or apprehension experienced when dealing with numerical or abstract mathematical tasks. This fear can lead to avoidance behaviour and reduced academic performance, creating a self-reinforcing cycle of negative outcomes (Carey et al., 2016). In technical education, where mathematics is often a core course but not always aligned with students' interests or prior preparation, this anxiety can be especially prevalent and detrimental.

A meta-analysis by Barroso et al. (2021) revealed a moderate to strong inverse correlation between math anxiety and performance, particularly in post-secondary students. Mathematics anxiety also affects working memory and impairs information processing, especially during high-stakes tests or problem-solving situations (Ashcraft and Ridley, 2005). Moreover, such anxiety has been shown to disproportionately affect female students and those from disadvantaged backgrounds (Dowker et al., 2016). Within the Nigerian context, Onu et al. (2022) found that math anxiety significantly predicted

both negative attitudes and low performance among vocational education students.

2.4 Perceived Usefulness of Mathematics

Perceived usefulness represents the extent to which students believe that mathematics has practical value or relevance to their academic or professional futures. According to the expectancy-value theory of achievement motivation (Eccles and Wigfield, 2002), a student is more likely to invest effort in a task if they perceive it as important, useful, or aligned with personal goals. In vocational and technical contexts, this utility perception becomes even more crucial, as students often expect immediate application of their knowledge to tasks like carpentry measurements, engineering drawings, or agricultural estimations.

Empirical evidence supports the role of perceived usefulness in enhancing attitudes and academic performance. A study by Wang and Eccles (2021) emphasized that perceived task value was a robust predictor of students' interest and performance in STEM fields, including mathematics. Similarly, in the Nigerian context, Adegboye et al. (2023) found that when vocational students understood how mathematical knowledge applied to their chosen careers, their engagement, confidence, and performance improved markedly. Therefore, instructional design that makes mathematics visibly relevant is key to fostering positive attitudes in vocational students.

2.5 Self-Confidence and Self-Efficacy in Mathematics

Self-confidence in mathematics, closely tied to self-efficacy, reflects students' beliefs in their ability to understand and succeed in mathematical tasks. Bandura's (1997) social cognitive theory posits that self-efficacy influences students' choices, persistence, and resilience. High levels of mathematical self-confidence are consistently associated with lower anxiety, greater task engagement, and improved achievement (Pajares and Miller, 1994; Zakariya and Adigun, 2021).

Recent studies have continued to validate this relationship. For example, Yüksel and Gündoğdu (2020) reported that self-confidence significantly predicted students' mathematics achievement across secondary and vocational institutions. Moreover, when students perceive themselves as competent in mathematics, they are more likely to attempt challenging problems and less likely to fear failure (Karabenick and Urdan, 2022). Given the heterogeneity in academic backgrounds among vocational students, fostering mathematics self-confidence through positive feedback and scaffolded instruction is essential.

2.6 Integrated Empirical Evidence from Technical and Vocational Education

Technical and vocational education settings often feature diverse learners with varying levels of preparedness and motivation. As such, research increasingly emphasizes the importance of psychological predictors in shaping students' engagement and performance in these institutions. Studies in Nigeria and sub-Saharan Africa underscore the importance of

interest, perceived relevance, and emotional factors in determining students' success in mathematics (Enu et al., 2015; Olusola and Oyelere, 2021). For instance, Oyewole and Aremu (2023) revealed that mathematics anxiety and perceived usefulness jointly predicted over 70% of the variance in students' attitudes in vocational colleges in southwestern Nigeria.

Moreover, these psychological factors interact. A student with high interest and confidence but low perception of usefulness may still hold a neutral or even negative attitude towards mathematics. Similarly, students with high perceived usefulness but severe mathematics anxiety may underperform. This highlights the need for integrated approaches in pedagogy and student support services.

3. RESEARCH METHODOLOGY

3.1 Research Design

A correlational survey was adopted for this study. A correlational survey seeks to establish the relationship that exists between two or more variables.

3.2 Population

The target population for this study consisted of all Federal Technical and Vocational Tertiary Institution students in Ibadan, Oyo State and Lagos State.

3.3 Sample and sampling technique

A multi-stage sampling technique was employed to select the sample for this study. Purposive sampling was used to select the three Federal technical and vocational tertiary Institutions in Oyo and Lagos State, the College of Forestry, the College of Animal Health Production, Ibadan and the School of Vocational and Technical Education, Lagos State University of Education. A simple random sampling technique was used to select two hundred and seventy (270) students, ninety (90) students from each of the three Institutions.

3.4 Instrument for Data Collection

The instrument used for collecting data in this study was the Students' Questionnaire (SQ). The questionnaire consists of two sections, A and B., A comprises personal data of the students, and Section B consists of thirty (33) items rated on a 5-point scale ranging from 5 = strongly agree to 1 = strongly disagree. Section B comprised 5 items on self-confidence, 7 items on interest, 5 items on mathematics phobia, 6 items on perceived usefulness of mathematics and 10 items on students' attitude towards mathematics. This instrument was validated by 4 experts, and all the observations raised were addressed before the instrument was administered to the respondents. Cronbach's Alpha was used to determine the reliability of the variables, and the values obtained are all greater than 0.70, which means that all the values are considered appropriate.

Table 1. Summary of Reliability Analysis

Variable	Cronbach's Alpha	Number of Items
Self-confidence	0.8	5
Interest	0.82	7
Mathematics Phobia	0.78	5
Perceived Usefulness	0.83	6
Attitude Towards Mathematics	0.76	10

Source: The authors' own work.

3.5 Data Collection

The researchers administered the instruments to the students. The face-to-face method was adopted to make sure that the students filled out the questionnaire effectively.

3.6 Data Analysis

The data collected was analysed using descriptive statistics (frequency and percentage) to determine the personal data of the respondents, Pearson Product Moment Correlation coefficient was used to determine the relationship that exist between dependent variable (attitude towards mathematics) and the independent variables (interest, mathematics phobia and perceived usefulness of mathematics) and Multiple Regression was used to determine the joint contribution of independent variables on the dependent variable as well as the relative contribution of each independent variables.

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4. RESULTS

Table 2. Demographic data of the students (n = 270)

Variables	Frequency	Percentage (%)
Gender		
Male	145	53.71
Female	125	46.29
Age		
16-20	110	40.74
21-25	108	40
Above 25	52	19.26
Programme		
ND	135	50
HND	135	50

Source: The authors' own work.

Research Question 1. What are the relationships between students' psychological variables?

Table 3. Correlation Matrix Showing Relationship between Independent Variables and Dependent Variables

	Interest	Mathematics Phobia	Perceived usefulness of mathematics	Attitude
Interest	1			
Mathematics Phobia	0.188**	1		
Perceived usefulness	0.476**	0.205**	1	
Attitude	0.858**	0.255**	0.566**	1

*Significant at P<0.05
Source: The authors' own work.

Table 3 presents the correlation coefficients among the predictors (interest, mathematics phobia and perceived usefulness of mathematics) and the criterion (attitude towards mathematics). There is a positive significant relationship between students' interest in mathematics and attitude towards mathematics (r=0.858), mathematics phobia and attitude towards mathematics (r=0.255) and also between perceived usefulness of mathematics and attitude towards mathematics (0.566). This implies that as students' interest, mathematics phobia, and perceived usefulness of mathematics improve, students' attitude towards mathematics also improves.

Research Question 2: What is the composite contribution of students' psychological variables (self-confidence, interest, mathematics phobia and perceived usefulness of mathematics) on students' attitude towards mathematics?

Table 4. Summary of Regression Analysis Showing Composite Contribution of Combined Independent Variables on Dependent Variable

Model	df	Sum of square	Mean Square	F	Sig
Regression	3	7260.50	2420.17	280.23	0.00
Residual	243	2124.55	8.64		
Total	249	9385.04			

R=.880, R = .774 Adj R^2 = .771
Source: The authors' own work.

Table 4 shows the multiple correlation coefficients (R) of all the combined independent variables with students' attitude to mathematics, giving the value of 0.880, where R square is 0.774. The adjusted $R^{2,}$ which estimates the variance of dependent variables, gave the value of 0.771. The regression Anova produced ($F_{(3,243)}$ = 280.230, P<0.05).

Research Question 3: What is the relative contribution of students' psychological variables (self-confidence, interest, mathematics phobia and perceived usefulness of mathematics) to students' attitude towards mathematics in this era?

Table 5. Multiple Regression Analysis Showing Relative Contribution of the Independent Variables to the Dependent Variable

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig
	B	Std. Error	Beta		
(Constant)	0.71	0.99		0.72	0.47
Interest	1.13	0.05	0.75	21.69	0.00
Mathematics Phobia	0.07	0.03	0.07	2.38	0.02
Perceived usefulness	0.21	0.04	0.19	5.54	0.00

*Significant at P<0.05
Source: The authors' own work.

Table 5 revealed the relative contribution of each Table 4 reveals the relative contribution of each of the independent variables (interest, mathematics phobia and perceived usefulness of mathematics) to dependent variables attitude towards mathematics as follows: Interest (β=0.752, P=<0.05),

Mathematics phobia ((β=0.074, P <0.05) and usefulness of Mathematics and perceived usefulness of mathematics (β=0.193, P <0.05). This implies that the three independent variables contributed significantly to students' attitudes toward mathematics.

5. DISCUSSION

The intercorrelation analysis results for the variables studied are shown in Table 2. The result revealed the relationship among dependent (attitude towards mathematics) and independent variables (interest, mathematics phobia and perceived usefulness of mathematics), which shows that all the psychological factors considered in this study were positively correlated with students' attitude towards mathematics, which is consistent with Mazana et al., (2019). The highest correlation occurred between interest in mathematics and attitude towards mathematics (r=0.858). This indicates that these factors contribute significantly to the students' attitude towards mathematics, and that as these variables increase, students' attitudes become more positive. This indicates that these factors contributed significantly to students' attitudes, and that as these variables increased, students' attitudes towards mathematics became more positive.

The result in Table 3 showed the joint contribution of all the independent variables. Mathematics phobia and perceived usefulness of mathematics) investigated in this study with the students' attitude towards mathematics was statistically significant. It showed that R=.880, R = .774 and Adj-*R2* = .771. This implies that 77% of the variation in students' attitude towards mathematics was accounted for by the independent

variables (interest, mathematics phobia and perceived usefulness of mathematics). This buttresses the assertion of (Osborne et al., 2003), Yilmaz et al., (2010), students' factors.

The result in Table 4 showed that the entire independent variable (interest, mathematics phobia and perceived usefulness of mathematics) contributed significantly to students' attitude towards mathematics in technical and vocational tertiary institutions in Oyo and Lagos states. The value of the standard regression weight associated with the three independent variables showed that students' interest in mathematics, mathematics phobia and students' perceived usefulness of mathematics to their course of study were the potent predictors of students' attitude towards mathematics. This implies that all the independent variables considered in this study are major predictors of students' attitudes towards mathematics.

However, students' interest in mathematics had the greatest contribution. This could be attributed to the fact that students' interest is a very strong factor that determines their attitude towards mathematics. This agrees with Obodo (1997) that the degree and direction of students' attitudes towards mathematics are largely determined by the kind of interest developed by the students. The next contribution is students' perceived usefulness of mathematics. This could be attributed to the fact that mathematical concepts are useful in solving problems in other fields. This buttresses the assertion of Uhumuavbi and Umuru (2005) that most mathematical concepts are useful in solving problems in applied engineering

and also assist science students in understanding other science subjects.

6. CONCLUSION

With regards to the data collected and analysed, this study revealed that students' interest, mathematics phobia and perceived usefulness of mathematics affect students' attitude towards mathematics positively, even in this COVID-19 era. It is interesting to note that the COVID-19 pandemic, which ravaged the world and took its toll on many sectors of the economy, especially in Nigeria, has not really had an effect on the psychological factors that predict students' attitudes towards mathematics. It is therefore recommended that these factors should be addressed and made right by the teachers and curriculum planners in order to improve students' attitudes towards mathematics in technical and vocational institutions. It is therefore recommended that these factors should be considered by the school authorities to enable students to acquire a positive attitude towards mathematics, which will be useful in solving problems in their fields.

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