BUILD AN ATTITUDE SCALE MEASURING ATTITUDE TOWARD MATHEMATICS

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ABSTRACT
The proposed study is to build an attitude measuring scale to measure attitude toward mathematics. The inquiry provides the baseline for understanding the reasons leading students to drop out of high school and others not to take math classes at university. However, an attitude scale is a complex undertaking and demands detailed research and comparative studies on theoretical constructs that define attitude, a working definition and comprehensive understanding of attitude in psychology and its connection with measuring attitude toward mathematics. Thus, different literature crystallizes attitude in cognitive psychology as psychological function, which constitutes affect toward social objects driven by goals, plans, cognitive responses, belief, and attraction toward an action. However, other literature takes the definition of attitude further by defining attitude toward mathematics as the psychological response in the domain of enjoying the subject, the belief that one is good or bad in mathematics, and the affect with emotional disposition toward mathematics, with varied definitions. In addition, the rationale for building an attitude measuring scale draws on the impact of the scale on measuring attitude toward mathematics for teachers, students, and stakeholders to progressively monitor earlier positive or negative attitude changes toward mathematics and make interventions by taking corrective actions.

1.0 INTRODUCTION

The goal of the study is to build an attitude measuring scale with numerical significance of student attitude toward math as one single most important factor influencing high school dropout rates for students studying mathematics as a subject at different academic levels. Attitude is fundamental in determining student commitment toward solving math problems both in class and in one's life, out of class. Thus, attitude can be either positive or negative. Attitude plays a key role in determining behavioral actions of a student and "It is our attitude at the beginning of a difficult task which, more than anything else, will affect its successful outcome" Chamberlin (2010). To determine the key driving reasons underlying attitude as an influencing factor toward mathematics completion rates, a scale assigned numerical values is proposed to provide a means of measure attitude showing the relationship between attitude, high school dropout out rates, and the failure of students to take mathematics at university level (Brecklers, 1984). Typically, the proposed attitudinal inquiry will draw on attitude as an influencing factor in the rational for students hating or liking mathematics, and taking math classes at university. That provides compelling reasons strongly correlating the learner's attitude to their mathematics performance as a leading cause of dropout rates, and failure to take mathematics at university. Conventional wisdom has largely shown a strong relationship between performance in mathematics and attitude and the future carriers of the learner in the subject. However, research in the academic discipline on developing a scale on math performance done show-varied reasons for relating attitude to performance, completion rates, and the desire for students to take math classes at university. Thus, making the latter a key area of research shows a distinct gap in knowledge in the relationship between math performance, completion rates, and a numerical scale-measuring attitude toward mathematics (Ma, 1997). Despite that, a number of researches on different scales showing the relationship between the attitude and math performance will provide the baseline and body of knowledge for the proposed research. One such inspiration is the scale developed in 1976 referred to as the Fennema-Sherman Mathematics Attitude Scales developed in 1976 (Fennema & Sherman, 1976). The scale by Fennema and Sherman (1976) contributed a rich body of knowledge toward building the proposed scale to measure attitude toward mathematics. During its introduction, the scale deviated from the initial purpose of measuring attitude toward mathematics of female students and incorporated the entire student body. The scale consisted of four subscales used to measure the confidence, usefulness, perception of the teachers, and male dominance in the student. However, further research into attitude toward mathematics scales with new changes makes it defunct for conducting any further research. However, development of scales to measure attitude toward mathematics made strides with the introduction of the Attitudes Toward Mathematics Inventory (ATMI) with Tapia and Marsh (2004) as the proponents. The 40 item measuring scale focused on measuring motivation, enjoyment, self-confidence, and value factors tom measure attitude toward mathematics. Other scales include the Inventory of Affective Aspects of Schooling (IAAS) that incorporated attitude, teacher quality, and social psychological climate as distinct factors to measure that lacked the class as the appropriate environment to measure attitude toward mathematics. Thus, the study considers working definitions of attitude, attitude toward mathematics, and borrows knowledge from other scales and considers the impact that the scale could have on attitude change toward mathematics.

1.1 Statement of the Problem

A significant number of students develop negative attitudes toward math at earlier stages of their academic life, hardly completing their studies, with a significant number dropping out of their high school life before graduating and the rest who progress academically strongly considering not taking math at university. Thus, the rationale for building an attitude measuring scale to provide teachers and other stakeholders in the academic an attitude measurement scale assigned numerical values to determine the relationship between attitudes, school dropout rates for high school students. It also establishes the connection between attitude and the avoidance of students to take math classes at university summed as the impact of attitude measuring scale on the attitude of leaners toward mathematics. The proposed scale provides numerical values as indicators of the relationship between math performance and student attitude in their math learning life.

1.2 Background of the Research

Building a numerical attitude scale to determine the influence attitude has on students dropping out of school based to their attitude toward mathematics, and the failure to take mathematics at university forms a strong background of the proposed research. Different factors, which influence student attitude toward mathematics, directly influence their math performance, dropout rates, and willingness to take math classes at university. In the context of the current research, attitude is the disposition of the student toward math and their willingness to use math for problem solving. Many parents and students have expressed strong negative feelings toward mathematics as one of the factors influencing failure of students to continue learning math, which leads learners to leave school while others fail to take math classes at university. Thus, either attitude expressed negatively or positively has the negative expression based on strong negative feelings having adverse effects on the learner in math performance. A significant number of educators have expressed strong feelings toward math performance as affecting the learner at different levels with the negative attitude leading to the adverse effects on the learner's educational life. Thus, attitude strongly affects continued interest in math. Conversely, if attitude is negative, its implications are likely to develop a negative effect in the leaner and lead one to the negative emotions while continuing to learn mathematics. To fully capture and comprehensively understand the complete impact of attitude on math performance on the learner, building an attitudinal measurement scale will form the baseline of the proposed research. The baseline intention is to provide teachers and other stakeholders the means to numerically determine attitude on a scale, evaluate the impact of attitude at all stages of the learning process, and identify the trend in learning math and student's continued interest in math at different levels of the student's academic life. That could position teachers and other interested parties including parents to identify weak points and take corrective actions at early stages in the academic life of learners. In the context of the proposed research, different definitions of attitudes toward math developed designate attitude in simple terms as a negative disposition toward math (McLeod, 1994). However, a knowledge gap appears in the definition coined by McLeod (1994) without incorporating positive emotional disposition toward math, a definition taken a notch higher by researchers including Ma and Kishor (1997), who affirmed another definition of attitude toward math. Thus, Ma and Kishor (1997) define attitude as "an aggregated measure of a liking or disliking of Mathematics, a tendency to engage in or avoid mathematical activities, a belief that one is good or bad at Mathematics, and a belief that Mathematics is useful or useless" (Ma & Kishor,1997). Thus, a definition of attitude toward math in the contexts of the proposed research embodies the like or dislike of mathematics, a belief in the ability or inability to solve mathematical problems mathematically, and sense that one does not do and cannot do well in mathematics at any academic level or disposition. Thus, experience, and the continued development of belief toward math play a significant role in determining the disposition of the student toward math and the relationship with the attitudinal scale.

1.3 Context of the Research

The proposed study will draw on available literature on attitude and the variables that influence attitude. In addition to that, working definitions of attitude and the environment to conduct the study will also constitute the study. A number of studies have been developed to quantify attitude by assigning attitude to a numerical scale. Numerical values are, however, difficult to assign into a scale due to varied definitions of attitude and the difficulty of quantifying attitude, based on literature and research on attitude. However, the proposed research will endeavor to establish working definitions of attitude by commencing the study on building attitude-measuring scale to measure attitude toward mathematics from the psychological perspectives including belief, anxiety, emotions, and other variations. Thus, the study will constitute an endeavor to build an attitude measuring scale constituting of a translation of psychological factors into empirical scientific facts measurable on a numerical scale. Thus, the study will endeavor to answer research questions on attitude in its wide context, methods for measuring attitude, the attitude construct validities, and the relationship to attitude toward mathematics. Thus, the measurement of attitude revolves around key factors such as belief, anxiety, emotions, and other factors identified in the study.

1.4 Research Questions

1. What is attitude in social psychology?
2. What is the definition of attitude in its various contexts?
3. Is attitude measurable on an empirical scale?
4. How can the attitudes toward mathematics get change, what are the key concepts underlying attitude change toward mathematics?
5. How is attitude toward mathematics measured and what are the challenges associated with building an attitude measuring scale toward mathematics?
6. What is the impact of attitude measuring scale of attitude toward mathematic?

1.5 Significance of the Study

The strength of the relationship between attitude and students' math performance in the academic discipline demands a numerical scale that shows variations in attitude in relation to math performance and school completion rates. When students develop negative attitudes toward math at earlier stages of their studies, their school completion rates significantly decline with a drastic rise in the number leaving high school noted. That impels a strong cause for concern especially that the negative attitude or hatred for math developed at earlier stages of their studies continue into their university life, causing them to refuse to take math, a trait that continues into their entire lives. To find the connection between attitude and school dropout rates, and future prospects of students taking math at higher academic levels, the proposed research revolves around the rationale to build a numerical attitudinal scale showing the significance of the relationship between attitude, math performance, dropout rates, and taking math at university level. Thus, a research into the connection between attitude and math performance focuses on analytical evaluation of available literature on the development of attitudinal scale showing the influence of attitude on student math life. Different researchers have developed attitudinal scales showing the impact of attitude toward math performance, school dropout rates, and the trait that limits students taking math at university level. Thus, different research approaches on attitude and math performance have shown authors including Dutton (1954), Dutton & Blum (1968) basing their measurements of attitude on the Dutton scale that specialized on feelings toward arithmetic as one variable in math performance. Others authors later developed math attitudinal measurements emphasizing on math enjoyment, taking a unidimensional nature particularly by (Erlandson, Harris, Skipper, & Allen, S1993). The development of the of the attitude measurement scale has taken different dimensions based on different variables such as anxiety to numerically determine the rationale behind attitude and student dropout rates and their future relationship in their math academic life. However, in the context of the proposed research, a significant relationship between attitude, math performance, school dropout rates, and failure to take math at university provides a numerical scaling for educators and other stakeholders such as parents and teachers to evaluate the attitude of leaners toward math and take corrective actions at earlier stages of the learner. Typically, projections of the proposed research provides a rich body of knowledge as guiding principles for the development of corrective measures based on underlying factors influencing attitude toward math, enabling further research into corrective attitudinal actions during the student's carrier. One such inspiration is the scale referred to as the Fennema-Sherman Mathematics Attitude Scales developed in 1976, among other scale that shall provide knowledge contributions toward the study.

This study will undertake to build an attitude measuring scale by considering the basic working definitions of attitude in social sciences coined by different researchers in the context of attitude. This study will further examine in detail attitude construct validity, study in detail on attitude and its effects, examine different authorities and literature on attitude toward mathematics, and empirical approaches of measuring attitude toward mathematics. The study shall include techniques teachers and educational stakeholders can use to change attitude toward mathematics, the key concepts underlying attitude change toward mathematics, and the impact of the developed scale on the attitude of the student toward mathematics.

2.0 LITERATURE REVIEW

The intent of the proposed study is to build an attitude scale to measure the attitude of learners toward math. "It is our attitude at the beginning of a difficult task which, more than anything else, will affect its successful outcome" (Van Wagner, n.d.). Reinforced by McCleod's (1994) belief, which relates attitude toward mathematics to success in mathematics, Ma and Xu (2004) view the proposition by McCleod (1994) as true and view teacher's contribution in creating positive attitude in the student as a competing element in enabling students to complete and graduate at high school while others taking math classes at university. The scale constitutes numerical values on a numerical scale to determine the numerical relationship between attitude toward math that provides the baseline for understanding student drop out school rates, why students hate mathematics, and why students at university fail to take math classes. A significant number of researches conducted to build attitude-measuring scales have evolved over time based on new and challenging issues

related to attitude measurements experienced over time. Thorough research into the definition of attitude from physiological perspectives, underlying meaning of attitude toward mathematics, techniques for measuring attitude toward mathematics, attitude and math performance, and implications of attitude on students' performance will form a critical section of the literature review for the proposed research. In the context of the proposed research, literature associated with theoretical constructs will provide the key components in informing the research. Critical literature on physiological attitude in the endeavor to build an attitude scale will commence with a study of authorities that have researched in the field on attitude in psychologists. Thus, an understanding of attitude as defined by psychologists provides the basis for building the attitude scale.

2.1 Attitude in psychologists

In social psychology, the embodiments of theoretical constructs of attitude are recognized in emotions, cognition, and the behavior of individuals based on the propositions by (Newbill, 2005). Newbill's (2005) theoretical proposition draws on attitude as a social function that incorporates expressions, defensive functions, and utilitarianism. Thus, the theoretical foundations of Newbill's (2005) arguments are, analytically, an aggregate of varied views on attitude as a physiological function that propels the student to like or dislike mathematics and eventually make decisions that are in favor or out of favor with taking mathematics in their carrier path. Decisions made by student have implications on the students' academic lives. A number of authorities in social psychology to consider in the proposed study include (Dillard, 1994). Dillard (1994) has dwelled on emotion by linking it with the thinking of an individual, which drives the tendency in an individual to perform certain actions or exhibit specified behavior. Thus, in Dillard's (1994) assessment of attitude, the key components recognized as affecting attitude link to the cognitive process of the individual learner. Drawing on Dillard's (1994) findings shows attitude as strongly linked to attitude objects with math as a typical example, which is the attitude object. Dillard (1994) further shows that attitude emanates and is strongly associated with the activities in the brain and the long-term memory sections. The baseline component is the emotional node, which when subject to manipulation, can lead to attitude change. Therefore, a link between attitude and emotion specifically drawing on emotion nodes allows one to manipulate attitude for the better or for the worst. Zimbardo et al., (1999) relates attitude with positive and negative observations on different objects in the environment while Bain (1927) internalizes attitude in an individual as relatively stable and defines it as "the relatively stable overt behavior of a person which affects his status" (Bain, 1927). Thus, attitude is a strong pointer of an individual's status in relation to variables such as attitude toward math and the resulting math performance in the context of the proposed study. On the other hand, (Erlandson, Harris, Skipper, & Allen, S1993), theoretical contribution to attitude leads to the definition of attitude in the context of judgment by asserting that attitude is "a susceptibility to certain kinds of stimuli and readiness to respond repeatedly in a given way—which. That is possible toward our world and the parts of it which impinge upon us" (Erlandson, Harris, Skipper, & Allen, S1993). Thus, the judgmental model derived from this definition shows attitude to consist of three key issues including cognition, behavior, and affection. Affection relates to emotion, which defines an entity's preferences. In Lumley's (1928) arguments, cognition provides the baseline for evaluating prevalence of individual students toward mathematics, which shows the belief held by the students toward mathematics. In the context of Lumley's (1928) studies, attitude draws from experience of or from the learning process, with a basis on observations.

Studies by Efklides, Papadaki, Papantoniou and Kiosseoglou (1997) show attitude as a dynamically behavioral element in the human mind that is susceptible to change based on the driving motive for actions. Dillard (1994) takes the argument further and defines attitude in relation to the activity of an organism and other variables. Efklides, Papadaki, Papantoniou & Kiosseoglou's (1997) definition therefore shows attitude to be "the totality of those states that lead to or point toward some particular activity of the organism. Attitude, is, therefore, the dynamic element in human behavior, the motive for activity" (Efklides, Papadaki, Papantoniou & Kiosseoglou, 1997). Efklides, Papadaki, Papantoniou and Kiosseoglou (1997) do not seem to vary his definition from other authors, but provides a less distinct definition of attitude. Nonetheless, when combined with different authors, a common working definition relates attitude to the impelling motive for action emanating from the brain as a cognition process. Thus, despite the different definitions of attitude and the relationship between attitude and resulting actions, it is commonly agreed. However, an analytical process that attitude relates to three common factors, which include cognition, which shows one's thinking process influenced by attitude, feelings developed under the influence of attitude, and behavior that influences an individual's actions due to the influence of attitude (North, 1932; Lumley, 1928; Bain, 1927; Zimbardo et al., 1999; Newbill's, 2005 & Dillard, 1994). Dillard (1994) defines attitude in relation to the dynamism of the human nature, the tendencies in the human nature, and motivational issues influencing activity. On the other hand, Lumley (1928) dwells on stimuli, repetitive actions, and the impact such actions have on an individual. The key words in Bain's (1927) definitions include status and the placement attitude has on an individual in relation to intrinsic behavior. Zimbardo et al., (1999) theorize attitude based on positive and negative evaluations. On the other hand, Newbill (2005) defines

attitude in the context of utilitarianism while Dillard (1994) links attitude with the thinking of an individual and resulting actions.

In the proposed study, above literature sources and authors provide definitions of attitude proposed to form the baseline of the Dissertation in developing the proposed attitude measurements scale. In addition to that, in the proposed Dissertation, additional sources will provide further definitions of current definitions and views developed with time on attitude.

In the proposed study, a provision for change of attitude will provide the baseline for establishing the hope that the proposed scale will help teachers establish methods and procedures to change the attitude of the learner toward math. The proposed scale provides numerical values on a scale that shows the trend in the performance of the learner in relation to the leaner's attitude to attract positive interventions. These interventions enable teachers to change the attitude of the learners at earlier stages when an observation of a drop in attitude on the scale occurs.

In the study, it could be informative to establish the actual meaning of positive and negative as highlighted elsewhere in the paper. Thus, in the proposed research, the terms positive and negative draw from definitions of attitude presented above. However, other authors take the definitions to another level by arguing that relating attitude to affection alone is simplistic. However, a definition that integrates the definition with additional factors including belief, emotion, and behavior as already discussed in the paper compound to provide working definitions of positive and negative attitude in a leaner toward mathematics (Hart, 1989). In simplistic definitions, positive attitude implies a positive emotional disposition of the learner toward mathematics. On the other hand, negative attitude implies a negative disposition of the learner toward mathematics. In the context of the multidimensional nature of math definition, negative and positive attitudes the relationship established between emotion, belief, and behaviors and the resulting interactions between these components. However, a critical evaluation of the latter definition shows a failure to link positive and negative attitude to some scale. Therefore, the need to search for further comprehension of positive and negative, especially in relation to assigning numerical values of measuring attitude on a numerical scale. Drawing from research by Hannula's (2003) conclusions shows positive to be associated with emotion, belief, and behavior influenced by affect toward mathematics (Hannula, Evans, Philippou & Zan, 2004; and Hannula, 2003). In conclusion, therefore, the simplistic definition of positive and negative attitude toward mathematics seems to overlap complex definitions that might end failing to capture the actual meaning of positive and negative attitude toward mathematics.

Hannula (2003) and Hannula, Evans, Philippou and Zan (2004) discuss different methods used in different environments to investigate attitude, the key component in the study. One of the investigations uses essays to make the inquiry. According to the study, an essay implies in the context of the study by subjects telling their stories toward mathematics in essay form. Typically, the autobiographical essay demonstrates the feelings of attitude toward mathematics evoked in the mind of the participants. The study concentrates in evoked past feelings in the subject that call for remarks such as "how" and "who" and links their attitude toward social relationships with the mathematics. Hannula, Evans, Philippou and Zan (2004) continue to draw on one's statements made in relation to how students interpret their experiences and attitudes toward mathematics. Hannula, Evans, Philippou and Zan (2004) provided an analytical view of the essay research that could significantly contribute to the proposed paper to build an attitude scale to measure the student's attitude toward mathematics. In the study, core issues identified include vision of mathematics by the subject, emotional disposition of the leaners toward mathematics, and the perceptions held by the subject r student toward mathematics.

Thus, leading to the conclusion that emotion and perceptions bear strong connections to the attitude developed by a student toward mathematics, and the likely long-term impact in graduating and taking math classes at university.

2.2 Measuring Attitude

The proposed research centers on the rationale to measure attitude on a numerical scale to justify numerical evaluations of the students' attitude towards mathematics providing empirical approaches of enumerating attitude. Thus, various literatures will provide the source of knowledge for measuring attitude as one critical component in building a measuring scale. Greenwald (1990) provides a rich body of knowledge by theorizing the measurement of knowledge by concentrating on the specifications of attitude in the theoretical constructs. In theory, Greenwald's (1990) observations propose the theory of measuring attitude to include presentation of attitude objects and representations of objects constituting attitude. Greenwald (1990) attempts to scale attitude by defining attitude as "the evaluation or affect associated with a social object" and continues with the attitude

evaluation process by incorporating theoretical constructs based on social objects. However, it is critical to borrow from Greenwald's (1990) studies in relation to attitude toward mathematics.

However, a critical review of Greenwald's (1990) approach in building a scale to measure attitude could immensely contribute to the sale building process. In the sale building process, Greenwald (1990) borrows form social scientists on their definition of attitude in the social context as discussed in the next section. The key words Greenwald (1990) borrows relating attitude include definition of attitude as a mental construct as abstract mental representations. However, Greenwald (1990) observes a critical problem in the approach of attitude as an abstract metal representation by underlying approaches developed by Breckler (1984) to focus on cognition, affect, and conative. These approaches, according to Greenwald (1990) have long been overtaken by modern researches in cognitive psychology. Greenwald (1990) studied a number of authors and different attitude measurements scales developed by different researchers in the field of psychology. In search of an appropriate measurement scale, Greenwald (1990) made several investigations and comparisons of attitude measurement scales developed previously. Greenwald (1990) continues with the development of attitude measurement scales by considering social objects incorporated in measuring attitude universally. Thus, the measurement of attitude could be toward any social object. One of the social objects under consideration is mathematics.

The proposed research will therefore review different attitude measurements scales to provide a concrete basis for borrowing knowledge from the pioneers who had developed attitude based on different theoretical foundations. One such attitude measurement scale developed by Osgood was the semantic differential technique. Greenwald (1990) observed that Osgood, Suci, and Tannenbaum in their 1957 findings had drawn from a number of judgments on bipolar evaluative scales ranging from -3 to +3 at unit intervals to develop the semantic differential measurement method. Negative values signified bad attitude while positive values signified good attitude. However, the need to establish construct validity of the attitude measurement scale could reinforce the concrete facts about the validity of attitude measurements. In that context, Greenwald (1990) endeavored to draw on the vast body of experimental investigations conducted by different researchers by focusing on observations and findings according to reports by Ronis, Baumgardner, Leippe, Cacioppo in findings presented by Greenwald (1977). In their findings, Ronis, Baumgardner, Leippe, Cacioppo as reported by Greenwald (1977) made an attitude measurement scale based on persuasion effects that has found widespread acceptance in modern psychology on measurement toward change.

Contributions in attitude measurement scales were largely done by a wide selection of researchers, an approach borrowed by Greenwald (1990) as one key contributor to modern measurements of attitude. One such key source of knowledge were the contributions made by Likert (1932). Likert (1932) used items occupying extreme positions with an equal bearing on the scale with unit spacing. Thus, findings by Osgood, Suci, and Tannenbaum in their 1957 presented by Greenwald (1990) and Likert (1932) agree on their attitude measuring scale. Other contributions made towards attitude measuring scales included that of Wicker that showed a strong relationship between attitude and behavior, later on developed by other researchers in the field of attitude measurement. Thus, in an endeavor to develop attitude measurement scale, two key factors have surfaced. These include belief and a series of attributes of the belief that variedly related to attitude, and the characteristics of the attributes that relate attitude to a measurement scale. However, a lingering inquiry arises as to the extent of the validity of the construct of the attitude concept.

2.1.1 Attitude Construct Validity

The validity of the attitude measurement scale reinforces the confidence developed when using attitude-measuring scale to evaluate the level of attitude toward an object. The derived confidence from the measurements obtained from the attitude measuring scale reinforces the empirical evidence required to demonstrate confidence in different scales such as interval scale. Nonetheless, Coombs, Dawes, & Tversky (1970) argue that numerical values assigned attitude on interval scale lack the ability to drive into the mind of the user of the scale the confidence about empirical predications of behavior. That reinforces the concern that behavior is difficulty to measure on a numerical scale. Thus, in building attitude-measuring scale, Breckler and Wiggins (1992) strongly argue that the attitude-behavioral problem presents strong challenges in the field of social psychology when developing an attitude measurement scale. In addition to that attitude behavior problem, there is the replication problem associated with attitude measurement scale. To overcome the challenges associated with building an attitude measurement scale, the inquiry will search deeper into possible connections between attitude and its effects.

2.1.1.1 Attitude and Assigned Values

Myers and & Myers (1980) provide a ground to seek for a solution to the problem of replicating measurements on attitude and the significance of the effects in influencing attitude in an individual. The rationale of

establishing concrete relationship between attitude and assigned numerical values and their universal impact on different individuals were findings shown by Roberts (1992) as the hallo effects. Landy and Sigall (1974) showed in their studies that the halo effect duplicated across the field of psychology showed that individuals have a tendency to develop negative or positive feelings about objects in their environment. The hallo effects thoroughly researched by Higgins (1970) provided results showing some strong relationship between attitude and the behavior of individuals. Other factors included in the study included the similarity effects, a fact argued by Higgins (1970). Higgins (1970) theorized that varying degrees of agreement are possible with different subjects agreeing on common numerical values. In addition to that, Rosenbaum (19861) realized that a strong link between attitudinal changes and an individual relied on attitudinal agreement. On the other hand, Higgins (1970) and Greenwald (1969) impressively showed cognitive response effect's strong correlation with the liking of an object based on the cue of the subject. On the other hand, repeated experimentation of the above relationships between attitude and the variables strongly showed a repetition of similar results that were strong and robust. Thus, attitude bore a string relationship with the respondent's behavior.

In conclusion, there is strong evidence to link the measurement of attitude to a linear scale. In addition to that, the measurement of attitude should draw on indirect measurements rather than directs measurements. That strongly correlates with the argument that strongly relates attitude with the cognitive process of the mind. It is critically valuable to consider the measurement of attitude based on the attributes of conscious and unconscious measurements of attitude. It is also important to consider the environment attitude is measured as a direct variable attribute of attitude. With the findings in mind, then the importance to attach the measurement of attitude toward mathematics forms the basis of the proposed study.

2.3 Attitude toward Mathematics

Having considered theoretical definitions of attitude, it is imperative to relate these definitions to the proposed study on attitude toward math. Hart (1989) researched and defined attitude toward math in the context of enjoying the subject or not enjoying the subject. Hart's (1989) dwells on the definitions based on two key words, enjoyment and non-enjoyment of mathematics. Thus, according to Hart (1989), enjoyment and non-enjoyment are the driving forces in defining math attitude when developing the attitude scale. The context of enjoyment and non-enjoyment revolves around the dislike or liking activities associated with math activities. In addition to definition proposed by Hart (1989), attitude renders one to determine the success rates or unsuccessful rates of a student in math performance. Hart (1989) particularly focuses enjoyment and dislike of math with repeated failures in math performance as a strong indicator leading to the development of negative attitude and belief that one is not good in mathematics. The resulting attitude leads the student to view math as a useful or useless subject. In Hart's (1989) arguments, the belief developed due to the attitude in math leads students to develop a strongly embedded belief of one's inability to solve mathematical problems and consent defeat. Accepting defeat leads to an entrenched negative attitude toward mathematics. Hart (1989), on the other hand suggests repeated success to indicate development of a positive attitude toward mathematics. However, Hart (1989) seemed to fall short of providing a scale with varied points of measures to measure dwindling attitude or developing attitude toward mathematics and its correlation to dropout rates and lack of desire to conduct math classes at university. Thus, Hart (1989) shows positive and negative measures of attitude as the most significant factors.

Zan and Martino (2007) have taken the definition of attitude toward math into the next level. Zan and Martino (2007) endeavored to show the definition of attitude toward mathematics as an area that has received inconclusive research and attempts to suggest the need for further research in attitude and attitude towards mathematics. Thus, Zan and Martino (2007) viewed available definitions to show a gap in knowledge. Zan and Martino (2007) again took the proposition for further research by coining two pronged definitions of attitude toward mathematics to include the degree of affection toward mathematics and draws on emotional dispositions of the learner. The literature of Zan and Martino (2007) falls short of integrating the cognitive element in the definition of attitude toward mathematics. One critical factor not experienced in the definition by DiMartino and Zan (2001) was the overreliance of paper work and pencil, which again fails the test of evaluating the emotional disposition of the learner. Nonetheless, the theoretical definitions of attitude toward mathematics by Zan and Martino (2007) serves to provide one of the baselines in conducting the proposed study in building a scale to measure attitude toward mathematics and the influence attitude has toward dropout rates from high school and refusal of students to take math classes at university.

Haladyna, Shaughnessy and Michael (1983) have incorporated the component of emotional disposition in their key definition of attitude towards mathematics. These authors fail to capture issues related to individual behavior, the learner's cognitive capabilities, and the learner's emotions toward attitude. Haladyna, Shaughnessy and Michael (1983) view attitude and define attitude in the context of math performance in class.

However, it is critical to incorporate positive and negative attitudes as key elements in defining attitude in the context of DiMartino and Zan's (2001) definition. On the other hand, definitions of attitude toward mathematics appear to dwell and direct to positive and negative attitudes. None of the authors have researched and shown a scale of negative attitude in mathematics, though, positive attitude can be scaled to provide a positive measure of attitude. In addition to that, a measurements scale constituting positive attitude on a numerical scale allows teachers and other stakeholders to determine the level of interest of the student in mathematics. That enables teachers and stakeholders keep track of the progress of the student's interest in mathematics, and determine the probability of the student dropping out of school due to their dislike of mathematics and failure to take math classes at university.

McLeod (1994) provides another working definition of attitude toward mathematics. In McLeod's (1994) proposition, attitude toward mathematics is a positive and negative disposition of the learner towards mathematics with strong attachments to individual emotional beliefs. On the other hand, "an aggregated measure of a liking or disliking of Mathematics, a tendency to engage in or avoid mathematical activities, a belief that one is good or bad at Mathematics, and a belief that Mathematics is useful or useless" (Ma & Kishor, 1997). Thus, in the light of the definitions, an attitude scale provides a clear indication of the tendency of the learner at different stages of the learning process to engage in math activities or to avoid math activities. In the definitions presented above, the impact attitude has towards math performance have not been shown to have an impact on the progress of the student in math performance, calling for further research in the field.

2.4 Measurements of Attitude toward Mathematics

To build an attitude measuring scale to measure attitude toward mathematics as an underlying factor that shows underlying reasons for students leaving high school and others avoiding to take math classes at university, a number of sources proposed focusing on attitude toward mathematics are considered in the current proposal. One of the attitude measuring scales includes the scale for measuring affect. Affect was considered as one of the key factors having strong relationship on the psychology of the learner toward mathematics as argued by Greenwald (1990) in their attempt to scale attitude by defining attitude as "the evaluation or affect associated with a social object" (Greenwald, 1990). Thus, drawing from the definition by Greenwald (1990), affect is observed as an attitude measurement scale toward mathematics. According to Chamberlin (2010), affect as one of the elements that influence attitude toward mathematics shows attitude as the motivating factor for students to develop a specified attitude toward mathematics. Analytically, the contention that motivation might not implicitly define affect, but might make the term redundant calls for further inquiry into "affect" in relation to attitude in mathematics. Thus, Chamberlin (2010) takes the definition of affect further by incorporating variables that might be included in the scale to include factors including "anxiety, aspiration(s), attitude, and interest, locus of control, self-efficacy, self-esteem, and value". However, affects is discussed in another section in detail (Bandura, 1982 and Singh, Granville & Dika, 2002).

One of the scales developed for college students to measure the attitude toward mathematics of college students was the Revised Mathematics Anxiety Rating Scale (RMARS) by (Baloglu & Zelhart, 2007). However, little enthusiasm could greet the scale due to its complexity and context of the research.

2.4.1 Challenges

However, the measurement of affect comes with a number of challenges in building the attitude measuring scale when expressed as a construct. The complexity of a construct draws on the complexity of measuring constructs in psychology due to the non-attributes associated with variables such as anxiety, and other variables used in the measurement of anxiety with its sub-components. Thus, from the perspective of numerical scales, it is clear that a common agreement and perspective of measurements scales such as the meter or the inch have commonly understood implicit meanings. Typically, therefore, quantifying psychological affect is difficult unlike measuring height and width. Other factors to include are intensity, target, and direction as specified in (Chamberlin, 2010). In the attitude building scale, target defines the idea and feeling directed toward mathematics and the consequences of directed feeling and the resulting attitude toward mathematics. On the other hand, intensity defines the strength of the feelings that leaners develop toward mathematics, which has direct implications on the options leaners take in either dropping out of high school or opting not to take math classes at university. Thus, Chamberlin (2010) illustrates the measurements factors as illustrated in table

1 below.
Table 1, adapted from Journal of Mathematics Education.

Factors	Value Anxiety Aspirations Interest Locus of control Self-esteem self-efficiency
Intensity	
Direction	
Target	

The items above are selected by the respondent to determine their attitude toward mathematics based on the impact the items ate perceived to have on the student.

Elsewhere in the paper are identified key factors influencing attitude. These, according to the current study, and from psychological perspective include cognition, behavior, and belief, among others. One element incorporated in building an attitude measuring scale to measure attitude toward mathematics is anxiety. Thus, an anxiety rating scale build to measure the attitude of learners toward mathematics is worth analyzing for the proposed study.

Richardson and Suinn (1972) developed an attitude measuring scale referred to as the Mathematics Anxiety Rating Scale (MARS). According to the study, the attitude measuring scale suffered from critical limitations including inability for its use in lower educational levels making it not worth much analysis. Despite that, the scale has a significant level of validity at its level of use. On the other hand, one of the most significantly used attitude measuring scales toward mathematics was the Fennema-Sherman Mathematics Attitude Scale (FSMAS). In their studies, anxiety was excluded from the as it showed a strong correlation with the confidence scale. In the proposed attitude building to measure attitude toward mathematics study, FSMAS consists of a shortened version of FSMAS, which constitutes 108 items. The rationale behind shortening the attitude measurement scale is to reduce the number of items and makes its administration universal and widely applicable on different environments. In addition to that, the 108 items, as mentioned elsewhere, is time consuming particularly making it difficult for respondents to complete, since each of the 12 items takes approximately 45 minutes. Thus, the scale demonstrated in table 2 below show a number of variables used in the short form of FSMAS scale. The attitude measuring scale shows a comparison of items used in the study with the methods used summarized in the same table 2 below.
Table 2

Scale	(Fennema & Sherman, 1976a) (1)	Full-length (present study) (2)	All-pos method half-length (2)	Factor analysis half-length version (2)
Usefulness of Mathematics	0.88	0.88	0.73	0.84
Attitude Toward Success in Mathematics	0.87	0.77	0.52	0.72
Confidence in Learning Mathematics	0.93	0.87	0.68	0.87
Effectance Motivation	0.87	0.88	0.71	0.73
Mathematics as a Male Domain	0.87	0.81	0.58	0.81
Mathematics Anxiety	0.89	0.88	0.72	0.88
Father's Attitude	0.91	0.88	0.72	0.87
Mother's Attitude	0.86	0.87	0.71	0.87
Teacher's Attitude	0.88	0.88	0.72	0.80
Total scale	—	0.96	0.90	0.93

Importantly, a range of variables used to measure the attitude of the learner toward mathematics indicates variations in responses to each item. A number of items shown in table 2 above have a strong influence in determining the attitude of the learner toward mathematics and final implications in completing mathematics and opting to take math classes at university. Typically, the responses vary from the usefulness of mathematics as shown above with resulting responses based on "Fennema and Sherman 1976a", a full-length study of the literature being analyzed, all-pos methods responses, and the factor analysis of the full-length version.

An analysis of the above scale shows variations in reliability analysis. In the above study, a 0.96 alpha reliability registered for the full-length version of the FSMAS that is higher than the shortened version of the FSMAS attitude measuring scale. The shortened version of the scale shows a similar pattern in reliability analysis. A critical analysis of the scales also shows that split-half reliability used instead of alpha coefficients showing the use of methods based on factor analysis as more reliable than All-pos method as illustrated in table 2 above. One critical issue to consider is items selection for the study.

One other scale developed to measure attitude toward mathematics was the Attitudes Toward Mathematics Inventory (ATMI). In this scale, a number of issues were taken into consideration. Typically, the Attitudes Toward Mathematics Inventory (ATMI) consisted of 49 items with important factors deemed importantly influencing attitude incorporated. Though showing a slight variation with other attitude measuring scales, a critical evaluation of the method showed the scale to consist of "confidence, anxiety, value, enjoyment, motivation, and parent/teacher expectations". Evalauting the attitude measuring scale shows the scale to consist of anxiety, highlighted elsehwere in the current paper, enjoyment, and motivation. However, an additional factor incoprated into the attitude measuring scale are expectations from the parent and teachers. Thus, one concludes that measuing attitude draws from cmmonly identfied fgactor across different discipines and the spectrum, with a lot of analytical dependance on the physchology of the leaner and user of the scale. Goolsby (1988), Linn and Hyde (1989), Randhawa, Beamer and Lundberg (1993) advances confidence as one of the items used in the measurement of attitude toward mathematics. Confidence, according to Goolsby (1988), Linn and Hyde (1989), Randhawa, Beamer and Lundberg (1993) measure the confidence of students in mathematics, and the self-concept by inculcated in the student in their performance in mathematics. Contributions by Hauge (1991), Terwilliger and Titus (1995) were in the field of anxiety as discussed elsewhere in the paper. Anxiety relates to the feelings of the student and the consequences of the feelings in the context of attitude and performance and other factors discussed elsewhere in the paper toward mathematics. The Longitudinal Study of American Youth (1990) shows a strong correlation between value and the student's beliefs, relevance, and the worth of mathematics in real life situations. Other factors considered include enjoyment as proposed by Ma (1997) and Thorndike-Christ (1991) who related attitude toward mathematics to the degree students found pleasure in working math problems and attending math classes. Singh, Granville and Dika (2002) and Thorndike-Christ (1991) considered motivations that are discussed elsewhere in the paper and a fundamental issues driving student to attend math classes at different levels of academics development and its associated variables and implications as shown elsewhere in the paper. Motivation shows the inherent desire by students to pursue mathematics and attend math classes at university. On the other hand, to fill the gap identified in the study were the works proposed by Kenschaft (1991) and Dossey (1992). In their works, Kenschaft (1991) and Dossey (1992) identified parent/teacher expectations as compelling factors in determining attitude toward mathematics in the learner. Kenschaft (1991) and Dossey (1992) asserted that beliefs parents and teachers had on the abilities of the student in math performance were other compelling factors influencing attitude toward mathematics.

Findings from the studied by the authors Attitudes Toward Mathematics Inventory (ATMI) showed a strong relationship between the student's attitude toward mathematics. A report by Dwyer (1993), Kenschaft (1991), and Shashaani (1995) showed that parents and teachers could strongly influence a negative or positive attitude toward mathematics in the student. However, a critical analysis of the parent/teacher item showed a strong relationship with extremely low item-to-total correlations, leading the researchers to drop the item. Typically, the parent/teacher item was dropped in favor of the peer group due to different variations of the background of the students. Harris (1995) affirmed the influence of peers in developing attitude toward mathematics as having a stronger and upper basing on the student attitude compared with parents and teachers and strongly proposed the item to be dropped.

Thus, the consensus arrived at after an analysis of the proposed items was motivation and consequences, factors strongly agreed upon by other researchers and widely used to evaluate attitude of the learners toward mathematics.

The proposed research will begin by inquiring into the factors that influence the success of the leaner in mathematics. Ashcraft and Kirk's (2001) contribution to the findings will provide a basis for studying such

factors. According to Ashcraft and Kirk (2001), long-term avoidance of mathematics significantly contributed to a negative attitude toward mathematics. The argument is that "long-term avoidance of math and their lesser mastery of the math that couldn't be avoided, high-math-anxiety individuals are simply less competent at doing math" (Ashcraft & Kirk, 2001) provides one direction in driving attitude toward math. Fennema and Sherman (1976) developed a model that relates math performance to behavior, competence, anxiety, and the interactive nature of the environment that leads to the creation of an attitude toward math. However, different authors view this argument as being too simplistic. Fennema and Sherman (1976) confound the theory proposed by Ashcraft and Kirk (2001) by incorporating 108 elements in their model assigning 45 minutes before completion under an evaluation process. However, other authorities in the field of mathematics have strongly questioned the validity and integrity of the model for measuring attitude proposed by (Fennema & Sherman, 1976).

Among the factors identified as influencing performance is belief in mathematics. Development in the area of belief provides empirical evidence on the relationship between the performances of the student math, math problem solving abilities, and making sense, thus influencing the entire attitude of the student toward mathematics. Thus, the inquiry centers on the impact of belief in influencing positive or negative attitude toward mathematics in the student and the longer term effect of belief in student graduation rates and taking math classes at university. Other factors identified by other researchers include competence. However, the there is need to critically analyze of the attitude measuring scales in the proposed study as discussed below.

2.4.1.1 Attitudes Toward Mathematics Inventory (ATMI)

Attitudes Toward Mathematics Inventory (ATMI) was developed specifically to address anxiety in the leaner. Tapia and Marsh (2004) contributed to the development of the ATMI scale by focusing on enjoyment, a concept discussed in another section in the paper. Analytically, that makes enjoyment one of the factors to consider in building an attitude toward mathematics measuring scale. Typically, the ATMI scale consisted of 40 items to measure the attitude of the leaner toward mathematics. The basis of item construction for the study was on the Likert-format scale consisting of five alternatives to provided responses. In addition to that, item construction had its basis on Haladyna, Shaughnessy, and Michael's (1983) Inventory of Affective Aspects of Schooling (IAAS) constituting student motivation, the learning environment that included management or organizational environment, teacher quality that influences outputs from the student, and the social-psychological climate.

Critical evaluation of the above factors and drawing from other researches shows the class environment appropriately addresses the environment for studying the development of the attitude measuring scale. The rationale of using classrooms as appropriate for the study to build an attitude measuring scale to measure attitude toward math allows teachers to take notes and an interactive environment between the teacher and the student. In addition to that, responses based on the use of online tools significantly contribute to confidentiality in the study and good response rates due to the flexibility of using the scale.

2.3.0 Belief

Belief as one of the strongest factors determining behavioral characteristic attributes of a student toward mathematics has received wide and significant study.

A variety of studies proposed to form the literature review on belief provides a multipronged approach to attitude toward mathematics. Belief provides the ability for the student to meet one's own emotional needs, one of the components used to measure attitude toward mathematics and salient features of an attitude measuring scale. Research shows that when students develop intrinsic belief with the inability to solve mathematics problems or born with the inability to solve mathematics problems, there is the possibility of developing a negative attitude toward mathematics, thus, relieving a student personal responsibility. Once that belief is established, the student develops an attitude, which becomes innate leading to the conclusion that it is not one's fault, but rather mathematics is naturally difficult and that one was born with the inability to solve mathematical problems. The belief assuages guilt in the student, leading to feelings and emotions, which result into particular types of behavioral patterns toward mathematics. In addition to that, when a student beliefs that one's mathematical abilities are fixed at a low level, that belief gives further impetus to the behavioral characteristics toward mathematics making the student attempt to avoid mathematics at every instance of the subject. In addition to that, an individual's value system contributes significantly to the belief one holds toward mathematics. Thus, belief provides the rationale for students to fail to work hard and perform better in mathematics. A student is likely to drop out of school based on belief and the development of attitude toward mathematics that negates the student's commitment toward mathematics (McGuire, Lindzey & Aronson, 1985).
Having established the rationale for the measurement of attitude toward mathematics, it is in imperative to answer the question as to whether attitude can change toward mathematics due to external stimuli. Typically, the importance of studying the susceptibility to change attitude toward mathematics draws on the need to create an

environment for the learner to change the learner's attitude toward mathematics to achieve positive results such as high school completion rates and to motivate students to take math classes at university (Wood, 2000). Thus, the following study answers the questions to whether attitude can be influenced to change the attitude of the leaner toward mathematics towards a specific goal (McGuire, Lindzey & Aronson, 1985).

Having established an attitude measurements scale, there is need to further the proposed research to answer the question on whether attitude can change. Typically, the rationale is to determine the susceptibility of attitude to change to allow for the use of the scale build to measure the attitude of learners toward mathematically since the attitude measurement scale is to help teachers and other stakeholders change the attitude of the learner toward mathematics positively. If attitude changes, then, the rationale of building an attitude toward mathematics measurement scale could contribute significantly toward inculcating a positive attitude toward mathematics to increase high school graduation rates and encourage students take math at university. Thus, there is the need to determine attitude change toward mathematics in the proposed study.

2.5 Attitude Change toward Mathematics

In the proposed study, attitude forms the baseline of the proposed research and is the key concept that influences student behavior. Attitude, according to observations in psychology shows a strong link between cognition and behavior. Thus, the importance to draw on theoretical propositions on attitude change to identify and evaluate approaches that teachers and other stakeholders can use to implement attitude change in the learners. Research has established various facts associating attitude toward mathematics with the student graduation rates and taking math classes at university. Thus, there is need to establish strategies to incorporate into attitude change toward mathematics in the learners.

Kolman (1938) extensively researched on attitude change and identified three key approaches teachers or instructors and other stakeholders in the education sector can use to influence attitude toward mathematics. Kolman (1938) identifies the concept of internalization, compliance, and identification as key factors in initiating change of attitude toward mathematics in the learners. Asch (1956) researched and was in agreement with Kolman's (1938) findings showing change of attitude to emanate from the consequences one experiences based on the consequences of one's actions.

2.5.1 Consequences

Consequences in the context of the proposed research are the failure of students to graduate due to negative attitude toward mathematics and refusal of students to take math classes at university. Thus, the learners, in the theoretical perspectives of Kolman (1938) and Asch (1956) agree that belief does not always relate to the consequences experienced by a learner, but strongly relates to the social outcome the leaner experiences in adopting a specific attitude toward mathematics. The intrinsic driving force in the student to adopt a positive attitude toward mathematics is the response to the consciousness that one is being urged to develop a positive attitude toward mathematics. Asch (1956) borrowed from findings from a series of experiments conducted to determine the power of conformity of individuals with groups, popularly known as Asch conformity experiments. Typically, the basis of the research experiments were to determine the response rate and number of cohorts required to induce conformity by varying the cohorts from unit to a significant number, about fifteen. Findings from the research showed a strong correlation between the number of cohorts included in the study and the attitude of the cohorts. Thus, the concept of compliance draws on the need for students to be accurate and correct in math performance.

2.5.2 Internalization

Another key approach to use in influencing attitude change toward mathematics will include the internalization concept. Research findings show internalization to include a change in belief when the learner finds contents in mathematics to have intrinsic values to the learners. Thus, the change in attitude will be consistent with the learner's value system. In the proposed research, the tendency to develop a positive attitude will draw on inculcated belief in the intrinsic benefits realized by the learner in mathematics. That could strongly contribute to the development of positive attitude toward mathematics and the possibility of raising the number of students who graduate at high school and who take math classes at university.

Typically, anticipated change in attitude toward mathematics will show a strong link with individual intent in developing a positive attitude toward mathematics resulting in high completion rates and taking of math classes at university.

2.5.3 Identification

Identification is proposed to provide another approach in influencing positive change in the student by developing a positive attitude toward mathematics.

Learning and attitude change is a psychological process. Thus, identification relates to the ability of the subject to assimilate the attributes of another subject, typically, leaners who have excelled in math performance and graduated through high school and leaners who have taken math classes at university. Typically, identification enables learners develop emotional attachments toward mathematics. Typically, the research proposes to incorporate students on identification done by (Sandler, 1987).

However, a number of discrepancies and knowledge gaps appear in the above approaches of attitude change.

2.5.4 Attitude Change based on Emotion

In the proposed research, there is need to factor the concept of attitude change based on emotions. As mentioned elsewhere in the paper, one of the key components that influence attitude is emotion. Emotion is a complex subject in phycology that requires further analysis and a strong candidate in influencing the outcome of attitude toward mathematics in the student. Emotion has been identified as a strong factor in influencing the persuasion on an individual, and change in attitude towards a specific object, in this case, mathematics. Emotion and cognition are driven on a similar platform, with emotion overly dependent on cognition as the underlying propellant. In addition to that, there is the importance to identify important components of emotion that includes self-efficacy in mathematics, the accessibility of attitude by the instructors, and issues related to change in attitude toward mathematics particularly psychological issues.

In the proposed study, the effects of attitude and the susceptibility to change due to external factors and the influence of emotion as a cognitive process in resistance to change will undergo detailed inquiry in the proposed study. In addition to that, the proposed study will inquire into factors that influence students to make certain judgments toward mathematics and decisions to drop out of school by developing positive or negative attitudes toward mathematics. Research by Shestowsky's (1998) will provide the basis of the relationship between attitude change and emotion.

Having studied a number of sources and considered a number of definitions on attitude, attitude toward mathematics, and varied factors that influence attitude of the student toward mathematics as baseline factors to build an attitude scale to measure attitude toward mathematics, the proposed research goes a step further to examine available literature on Measuring attitude toward mathematics.

Pierce, Stacey and Arkansas (2005) researched and developed an attitude measuring scale to monitor student attitude toward mathematics referred to as the Mathematics and Technology Attitudes Scale (MTAS) designed for high school students at their middle secondary years. The scale constituted variables categorized into 5 distinct groups based on their relationship with learning mathematics with technology. The five elements constituted in the scale were subdivided to into subscales to measure “mathematics confidence, confidence with technology, attitude to learning mathematics with technology and two aspects of engagement in learning mathematics” (Pierce, Stacey & Arkansas, 2005).

The rationale to build the scale followed a gap in knowledge identified in a number of scales previously developed to measure attitude toward mathematics and the changing trends in technology and the changing classroom environment where conducting the study is best suited. In addition, previous scales were time consuming to address a number of issues such as asking for responses based on the use of questionnaires. Most of the scales were identified to possess a further problem of failure to address the needs of children as young as the age of 14 with scholastic capabilities widely varying between them. Administration of previous scales consumed a significant amount of time. Typically, that was due to the number of items in the scale to evaluate attitude of the learner toward mathematics. Thus, there was need to factor issues including item development that focuses on current trends in education and well understood by the current cohort of students.

The study culminated with affect and behavioral engagement as critical factors to integrate into the scale. Contributions toward engagement literature were based on the studies done by Fredricks, Blumenfeld, and Paris (2004). However, Vale and Leder (2004) and Chapman (2003) contributed to the literature on affect. The behavioral context of the study included knowledge by Galbraith and Haines (1998) that had researched and discussed extensively on mathematic engagement.

The combined scale consisted of 27 items with five subscales. Among the critical factors constituting the scale were affective engagement and attitude toward mathematics, making attitude toward mathematics one of the sub factors to consider in developing the scale. Different response sets were used based on the item under investigation on a five-point scale. The scores varied between 5 and 1, with each score occupying a specific position on the scale.

A critical analysis of the scale indicated varied points. One of the key elements considered was factor analysis. Factor analysis provided the structural reliability of the scale along with inter-item correlations were each evaluated and showed the scale could be manipulated to accommodate sub-divisions of four items per factor. Additional factors were identified to make the administration of the scale much easier to the respondents while ensuring respondents could easily provide responses. Further factor analysis provided sufficient number of items to use in building the scale. Thus, the scale was flexibly made, and quick to administer.

Results from administering the scale provided information about the factors that contributed to student effectiveness in learning mathematics, differences in math performance form different schools, thus learning environments, and was the baseline for discriminating among the cohort of students participating in the study.

.2.5.6 Impact of the Scale on Math Attitude

Building an attitude scale to measure attitude toward mathematics is proposed to have a positive impact on the completion rates of students and their values and innate desire to take math classes at university. The scale is proposed to provide teachers and other stakeholders information to assist students develop positive attitude toward mathematics to increase high school completion rates while inculcating a positive belief in their abilities.

Teachers, stakeholders, and students are supposed to use the scale to change various beliefs toward mathematics to open up the desire by the student to continue solving mathematics problems at different academic levels of study, and open up opportunities for higher level of achievements. Thus, one of the processes of changing attitude toward mathematics is to establish a context that is emotionally safe for the student.

Another impact of the proposed scale is to draw on the theoretical propositions of changing attitude toward mathematics proposed by (DeBellis & Goldin, 1993). In their propositions, the researchers introduced the concept of meta-affect to transform the emotional experience of affect on the student, which negatively affect the attitude of the student toward mathematics. Affect introduces emotional dispositions such as fear, considered to occupy the negative position in the scale, while feelings associated with anxiety sometimes heighten the intensity of the student's concentration and disposition to solve a challenging problem. Thus, the meta-affect becomes one of the critical components to consider when evaluating the impact of the attitude scale in measuring attitude toward mathematics.

Typically, changing the feelings a student has toward mathematics, by making the student feel safe is one of the impacts the meta-affect could have in a student's attitude toward mathematics. The scale further allows teachers and stakeholders work concertedly toward making students enjoy mathematics while solving mathematics problems.

In addition to that, the quality of the student's future life, learning of mathematics and its application in the future is guaranteed, identification of various attitude toward mathematics, and motivation of leaners to study mathematics are other benefits and impact of the proposed scale for measuring attitude toward mathematics. In addition to that, it is pertinent to note that the attitude toward mathematics measuring scale is bound to provide teachers with behavioral characteristics of the student in studying mathematics, and the ability of the teacher to provide earlier intervention if the student's reading behavior is poor.

On the other hand, parents and teachers, based on research findings, tend to associate student's success in mathematics to the attitude a student develops toward mathematics, and the attitude the parent has toward mathematics. Thus, an attitude measuring scale tom measure attitude toward mathematics could emphasize in the parent the need to invest more interest in inculcating positive attitude in the student toward mathematics and could be instructive in the context of the study.

Teachers form the fundamental baseline for instructing students in their math courses, thus an attitude scale could equip teachers with the capability to prepare students psychologically to agree on various issues. These include agreeing that everyone makes mistakes. In addition to that, it enables teachers create math-testing environments that addresses specific needs of the leaner, allow math teachers to design positive experience with the leaners, and make the learning and solving of math problems relevant to student's future life.

The attitude scales could enable teachers provide students with a flexible environment to input valued evaluations in contributing toward their advancement in mathematics. The proposed scale could also provide educators the flexibility to start leaning mathematics and appreciate manipulation of formulas at an early age. In addition, the scale enables teachers to equip students with skills for quality thinking, originality in thinking, and development of self-esteem in leaning mathematics.

The scale is proposed to be an instrument allowing for math therapy in the leaners through positive intervention by the teacher. Typically, the therapy draws on the theoretical propositions of attitude and its link with the phycology of the student in terms of the cognition process. In addition, in the context of variables such as anxiety that affect attitude toward mathematics, the proposed paper provides leaners with new coping skills in solving mathematics problems, and minimize the adverse impact of attitude toward mathematics.

The need therefore to develop a multipronged approach based on theoretical propositions in the fields of educational theories including the theoretical view on motivation and cognition. In addition to that, the proposed study calls for teachers and researchers influencing positive attitude toward mathematics in the student to integrate motivation, cognition, and emotion. There is also need to integrate the concepts in searching for approaches to inculcate positive attitude toward mathematics in the student. On the other hand, teachers, based on the attitude scale, are compelled to consider and incorporate goals, knowledge, belief, cognition motivation on the student, and self-regulation.

Self-regulation, as one of the conceptualized outcomes in using an attitude measuring scale, is an intrinsic attribute in an individual regulating the generation of negative or positive thoughts towards and object, leading to the development of actions, and the cyclic tendency in an individual to pursue a matter until the attainment of a specific goal. One of the strong points considered here in self-regulation is the goal directed behavior impelled by self-regulations. Thus, the teacher is able to inculcate in the leaner the three variants of self-regulation to ensure optimal performance and commitment toward solving mathematics problems in class and out of class. The proposed paper will integrate rapid self-regulation as based on the rapid response of the student in solving mathematical problems presented.

Further studies have shown a strong relationship between attitude change toward mathematics and achievements. Yara (2009) makes significant contributions of attitude toward mathematics and achievements bases these on observations. Yara (2009) shows that positive attitude change toward mathematics related strongly achievement rates in mathematics and student belief in solving mathematics problems as discussed elsewhere in the paper. However, a gap in knowledge appears in the entire research process of establishing empirical evidence relating change in attitude toward mathematics and student achievements. Thus, the proposed study will focus on determining the relationship between successes rates, attitude change toward mathematics, and attitude scale to measure attitude toward mathematics in the student. In addition, the study will endeavor to establish how the proposed attitude toward math measuring scale will contribute to motivating students take math classes at university.

3.0 METHODOLOGY

To conduct the proposed study with an aim to build an attitude scale for measuring attitude toward mathematics, in the proposed that methodology adopted addresses the proposed research to answer the inquiry into building attitude. The study is proposed to determine the attitude measuring scale toward of the learners toward mathematics, and provide a measure of the impact of measuring attitude on a numerical scale to determine its impact on dropout rates and taking math classes at university.

The proposed research is in common agreement that a number of scales have been developed used to measure attitude toward mathematics. Thus, the proposed research will constitute identifying the knowledge gap existing in a number of currently available attitude measuring scales, discrepancies in expectations from using currently available scales, and specific areas of improvement. In addition to that, the proposed scale is intended to be flexible to use and incorporate a smaller number of items compared with scales identified in the literature review.

Another factor to consider is a scale that factors the age of the learners. The proposed study intends to build an attitude scale to measure attitude toward mathematics in leaners as young as fourteen years of age identified with varying scholastic capabilities.

Other factors to consider when building the proposed attitude measuring scale is to consider a scale that allows students to be asked questions which allows the respondents to reflect briefly before providing an answer. It is

proposed, the approach will serve the purpose of a questionnaire though the questionnaire will not be excluded from the study.

New items well understood by the student will be developed with available scales forming the benchmark for evaluating the new scale proposed to be developed. Galbraith and Haines (1998) developed a scale with tertiary students as their subjects, but found it difficult to transfer the items to other students at different study levels. Definitions of key concepts used in the study will form the baseline of the study. These include concepts such as attitude, motivation, cognition, and other variables proposed for use in the study. In addition to that, student behavior will constitute another key concept to consider in the study, age, context, and culture of the student background will play a critical role in the study.

The proposed methodology will be tripartite. The study will commence with an analysis of available and published literature on attitude, attitude toward mathematics, and critical analysis of literature on scales developed to measure the learner's attitude toward mathematics. In addition to that, the scale will draw in detail from available body of knowledge on the psychological factors that define and determine attitude toward an object and the behavioral characteristics of the object whose attitude intended for measurement.

Typically, the current study will factor the use of questionnaires validated to measure variables used to measure the confidence of a student in mathematics, motivation toward mathematics, and other variables identified in the literature review. Among the contributors toward the development and validation of a scale were Fogarty, Cretchley, Harman, Ellerton, and Konki (2001). In the scale developed by Fogarty, Cretchley, Harman, Ellerton, and Konki (2001), 37 items were identified and used with some items consisting of long statements likely to distort the meaning of the question a respondent is asked. Thus, the proposed research will heavily borrow and build on current literature, with much modifications based on identified discrepancies with the aim of the study, and other weaknesses and knowledge gaps identified in other scales. Other factors to consider in building an attitude measuring scale includes the flexibility of using the scale repeatedly in a diversity of classes, gender, and study levels particularly to university level. In addition, the methodology will focus on building a scale to enable teachers, parents, and stakeholders determine the relationship between an attitude measuring scale and reasons students fail to complete their high school course to graduation and failure to take math classes at university.

The proposed scale is required to provide students with the flexibility to complete administered questions quickly. Thus, the scale is proposed to consist of short, clear, and précises statements, avoidance of negatively worded statements will define the scale, and straightforward questions to avoid negative feelings and attitude in the mind of the respondent, in this case the student. Thus, the proposed scale intends to avoid seeding negative thinking in the student. On the other hand, the prevailing culture of the school data is collected will be given due consideration.

3.1 Item development

In developing items for the study, available literature will provide the basis for developing items used in the inquiry. In addition to that, while developing on available literature and currently available item development techniques, inquiries into factors that influence appropriate items development will constitute the study. The number of items incorporated in the study, definitions based on literature review will provide the basis for item development. In addition to that, items used will be assigned numerical values to distinguish the items from others.

Based on Vale and Leder (2004) views on attitude toward mathematics, numerical values will be assigned items related to confidence and self-efficacy of the student in developing items for use in the study.

In developing items for use in the study, definitions used in the literature review and analytical information will form the baseline for items used in the study. Typically, examples include confidence in mathematics. Confidence in mathematics and can be restricted to ability of the learner to score well in mathematics and the ability to provide the promise that they can handle difficulties experienced in mathematics. In addition to that, the meaning of the items used in the study will be critical in the study.

It is important in the study to identify and incorporate construct validities of the items used in the study. Thus, the construct validity should be well established when developing items for use in the proposed study (Shavelson, & Stanton, 1975).

3.2 Sample Methodology

A sample for the study will include students at lower levels of study, to university level. In addition, Patton (1990) will form an inspiration of sample development providing the direction and range of students the attitude measuring scale will be applied. That will further provide significant statistical information for statistical analysis and study (Sackett et al., 2000). Thus, the study is proposed to use purposive sampling technique based on the rationale that the technique has widely been used with impressive results in academic fields and to determine the behavior of educators in the education sector. In addition to that, observations show that purposive sampling provides control in restricted range in measurements to avoid false findings in correlation measurements (Goertz, Floden, & O'Day, 1995; Ravitz, Becker, & Wong, 2000; Tschannen-Moran et al., 2000).

The importance to find heterogeneous patterns and problems likely to be inherent in the study reinforces the use of purposive sampling technique as proposed argies that "maximize discovery of the heterogeneous patterns and problems that occur in the particular context under study" (Erlandson, Harris, Skipper & Allen, 1993). In addition to the latter argument, "convenience sampling is suited for these studies rather than probabilistic sampling because the aim is not to establish population estimates, but rather to use correlational analysis to examine relationships between items and measures" (Viswanathan, 1993), thus, justifying the use of purposive sampling in the context of the proposed study.

In selecting the items for study, best practices as proposed by Gorsuch (1983), will form the basis for their selections. According to Gorsuch (1983), sample sizes used in the context of the current study are selected based on guidelines with the factor analysis with specific ratios of the participant and subjects are factored (Gorsuch, 1983). Other issues to factor when selecting items and participating subjects include number of questionnaires to administer, motivation for subjects to return administered questionnaires, type of questions in the questionnaires to administer, and the effective sample size to reduce biasness are considered (Singh, Granville & Dika, 2002).

3.3 Building the Attitude toward Mathematics Scale

In building attitude-measuring scale to measure attitude toward mathematics, the aim of the study will be focused on analytically identified factors influencing development of a scale to measure attitude. In addition, the items incorporated into the study will be evaluated to determine if they adequately and plausibly reflect theoretical propositions and definitions of the attitude and attitude measuring scales with empirical dimension on attitude measurements. In addition to that, the attitude measuring scale will reflect conceptualized in the context of the current study to include among other variables motivation. In addition, feelings, belief, and other variables will constitute theoretical constructs incorporated into the study Galbraith, & Haines, 1998).

The draft questionnaires administered in the study will include the cognition concept as stated in the latter statement as one of the attributes of attitude. Cognition, in the questionnaire will comprise perceptions of difficulty in solving mathematics problems by the student, perceived usefulness of mathematics in the life of the student in everyday life and future life, behavioral control that determines the behavior of the student as one component in measuring attitude toward mathematics, and belief of the learner toward mathematics. In addition to that, the questionnaire will contain section for affect as theorized and analyzed in the literature review and other variables for building an attitude scale to measure attitude toward mathematics (Forgasz, 1995).

The researcher will build on current knowledge and formulate other variables based on the gap in knowledge identified by analyzing available literature on attitude measuring scales. Thus, the researcher will formulate items and will ask for the assistance of professionals in the academic discipline to make knowledge contributions in item analysis. In addition, proposed items will be subject to analysis by additional by the team of professional contributing in knowledge toward building the scale and thus, will be susceptible to removal addition based on their knowledge contributions toward the proposed study. Thus, the validity of the items will include face validity, clarity, and salient. In addition to that, the items will be checked for theoretical consistency and any redundancy removed from the items list.

Negative and positive items in the proposed scale as proposed and discussed in the literature review are proposed to be integrated into the scale to measure negative attitude toward mathematics and positive attitude toward mathematics. Thus, each of the items and wording will be intended for use to represent a specific dimension.

Data Collections

Data collection will be done online with a lot of confidentiality. The proposed questionnaire administered online to students to capture students responses will be programmed to allow for radio buttons response method. In the proposed radio button response method, the respondent will be required to select a single item per question

without any options for more than a single response. In addition to that, the scripts used online will be validated and each data sheet made user friendly for the users to encourage responses.

Data Analysis

Data analysis forms one of the underlying factors in determining the rationale for the attitude scale to measure the attitude of students toward mathematics. In addition to that, the analysis will constitute the items and their implications on the proposed scale.

A multidimensional scaling will be applied in analyzing data collected for the study. In addition to that, a linear relationship between the items used in the study will be examined before data entry is done. Data entry for data collected in the study will be done using SPSS software version 14.0, which is a Statistical Package for the Social Sciences. Meaning scores based on coded items will provide the baseline for using negatively worded items. Univariate distributions at the level of the items used will contribute in making identifying any errors inherent in the data in use. The number of items to retain, as stated above will be determined based on the proposed attitude scale, and criterions including that proposed by Cattell (1966) based on the correlation matrix, and the plot levels of the items.

4.0 CONCLUSION

In conclusion, the study to build an attitude measuring scale to measure attitude toward mathematics enables teachers and other stakeholders in the education discipline determine the connection between student attitude toward mathematics, dropping out of school, and taking math classes at university. To establish the rationale for the relationship the above relationship, the study will focus on establishing working definition of attitude, established methods of measuring attitude and the effects of attitude on the student, establish attitude construct validity, and attitude toward mathematics. In addition, the paper is proposed to provide the baseline for measuring attitude and the challenges experienced to provide empirical scales for measuring attitude that are scientifically founded. The research is proposed t go further and establish the measurements of attitude toward mathematics and associated variables to establish the rationale for building an attitude measuring scale to measure attitude toward mathematics and key factors influencing the measurement of attitude. An analysis preliminary of findings indicate attitude to be a psychological function with emotion as the driver constituting cognitive processes that influence the liking or disliking mathematics. That sums up attitude in emotion, cognition, and behavior. Other views project attitude as a social function based on expressions and utilitarianism that allowing external factors to manipulate the social function based as the force driving. In its multipronged definitions, attitude is also viewed as influencing positive or negative behavior in a student toward mathematics with the consequence of a low or high likelihood of the student failing to complete graduate at high school and others failing to take math classes at university. Other research literature links attitude to internalization and external stimuli to take some kind of action through repeated responses to the external stimuli, which leads to the summative view of attitude to constitute cognition, behavior, and affection. Attitude is therefore, viewed as a dynamically changing element with a susceptibility to change. Despite the conflicting definitions of attitude, attitude is a dynamic aspect in the human mind that is subject to change based on applied stimuli. Thus, reinforcing the fact that attitude is susceptible to manipulation from environmental and psychological factors toward an object, in this case, attitude toward mathematics. To manipulate attitude positively, there is need to scale attitude empirically to allow teachers and stakeholders monitor the behavioral trend of the leaner toward mathematics and determine attitude interventions for learners from different backgrounds. Thus, use of empirical measures to measure attitude toward mathematics of the student renders one to determine the success rates or unsuccessful rates of a student in math performance. That particularly focuses enjoyment and dislike of math with repeated failures in math performance as a strong indicator leading to the development of negative attitude and belief that one is not good in mathematics. The resulting attitude leads the student to view math as a useful or useless subject. The belief developed due to the attitude in math leads students to develop a strongly embedded belief of one's inability to solve mathematical problems and consent defeat. Accepting defeat leads to an entrenched negative attitude toward mathematics. A number of scales mentioned show some variations in the number of items used, but there is need to use a number of items that leaners can easily provide responses to when administered, there is also need to intensively search literature on social psychology and the factors influence attitude toward mathematics. There is also need to study a variety of techniques suiting learners at different that teachers and other stakeholders might find valuable tools to manipulate attitude toward mathematics in the learners to instill positive behavioral change in the leaners to continue with math to higher academic levels of study.

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