

SURVEY OF STUDENTS' ACADEMIC ACHIEVEMENT AND MATHEMATICS IDENTITY-FORMATION

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ABSTRACT

The study explored mathematics identity-formation and development, which concerned with how students come to orient themselves toward or away from engagement in mathematical activity due to a combination of perceptions of self as a high or low achiever in the learning of mathematics on one hand and perceptions of how others such as teachers, peers, parents and community see them in mathematical contexts. As a qualitative research study with an open-ended unstructured questions ($r=0.69$) and four research questions, an exploration of possible relationships that exist in mathematics achievements through the four faces of identity-formation of mathematics learning, namely engagement, imagination, alignment, and nature were considered. Findings through unstructured interview with the selected students reveal different variations of identity-formation, which serve as contributions to better articulate and conceptualizing the academic achievement of students in mathematics, which serves as an indispensable tool for Science and Technology.

Keywords: Engagement, Imagination, Alignment, Nature, Achievement, Identity-formation, Mathematics.

1. INTRODUCTION

Education is regarded as a crucial index to measure if a nation is developing or not. This is more reason why education is seen and taken as priority sector for development by all nations. Despite the government's efforts to ensure that there is provision for a uniform level of education for her citizen, non-uniform academic experiences of different schools are still evident especially in mathematics. These differences are not only between urban and rural schools, but also among the schools in similar location. The existences of varying academic experiences and achievements are more pronounced between the rich and poor, as well as rural and urban schools where various research studies carried out have tried to assist in the effective teaching-learning of mathematics, not only in Nigeria but beyond. The importance of curriculum reform through changes in evaluation process in the teaching-learning process is evidenced by such study of [Agrawal \(2004\)](#). The importance of quality education in a nation building has also been realized by several nations including developed countries, which have vantage position of leaders in the economy and capacity to produce wealth and quality jobs, depend directly on the quality of education system to produce students who could compete in mathematics and

science dominated subjects for the betterment of industries in the future. Thus, improving mathematics and science education has been the priority of in the agenda rational policymaking body worldwide. To this end, requirements changes in the national policies suiting their respective culture are emphasized in order to minimize the differences in performances among the countries. Also, the interactions of a large number of socio-economic as well as academic environmental factors influence the performance in school, and not only results in the child having a low self-esteem, but also causes significant stress to the parents (Karande and Kulkarni, 2005). Identification of dismal performances and execution of corrective action plan so that the students perform up to their full potential is required towards meaningful development.

Achievement in mathematics is an important concern for several reasons, such as the large scale of expenditures of public funds on seminars and workshops for mathematics teachers and the beneficial effects mathematics which has on the well-being of both an individual student and society as a whole. The factors involved in academic achievement in mathematics are innumerable considering the achievement of students, as it is evident that there is a multitude of influences on achievement, learning, and student retention. However, in recent Educational Psychology literature few specific factors have been studied in some depth like Ego-identity development and achievement goal orientation as two such factors in the academic achievement of students. Infact, identity-development and processing styles have been demonstrated to have an impact on academic achievement (Berzonsky, 1989). Also, achievement goal theory or goal orientation theory has also received a good deal of attention with different goal orientations studied in relation to achievement or outcomes. This why an academic goals are defined as motivation, academic in nature that guides behaviour in academic or classroom settings (Fuente, 2004). Achievement goal theory states that students have distinctive orientations towards certain types of goals. Learning mathematics involves the development of each *identity* especially in a mathematics classroom of a heterogeneous nature. Through relationships and experiences with their peers, learning materials, school environment, previous achievement in mathematics, teachers, family, and community, students come to know who they are relatively to mathematics. This why the notion of identity as it is related to achievement in mathematics need emphasise. Non-literal meaning of identity refers to associate or affiliate oneself closely with a person or group. According to Sfard and Prusak (2005), identity refers to the way we define ourselves and how others define us. It could synonymously refer to relationship between *character and reputation as ones* identity includes ones perception of ones experiences with others as well as ones aspirations. In this way, ones identity that is who one is formed in relationships with others, extending from the past and stretching into the future. Wenger (1998) postulated that identities are malleable and dynamic, an ongoing construction of whom we are as a result of our participation with others in the experience of life. As students move through school, they come to learn whom they are as mathematics learners through their experiences in mathematics classrooms; interactions with teaching materials, school environment, teachers, parents, and peers; and in relation to their anticipated futures. Without exaggeration, the complexities involved in putting the knowledge base on improving student achievement to work in classrooms must be recognized first, if not, the frantic efforts on how to combat these complexities cannot produce any useful outcomes.

Although enormous research studies have been on student variables such as gender, attitudes, and perceptions, class level variables like composition and size, diversity of instructional practice and teacher experience, as well as school variables like climate, size, as they all contributed to the academic achievement of students in mathematics, and yet record of low achievement in mathematics persist. Identity is said to be pragmatically significant because it encompasses a range of issues that are typically subsumed under the heading of affective factors, including persistence, interest in, and motivation to learn mathematics. There is need for focus shifted and that is what this study intend to achieve on mathematics identity-formation and development, and its relationship with academic achievement in mathematics.

1.1. Framework on Identity

Erickson (1963; 1968; 1980) proposed a psychosocial theory of development in which adolescence is described as a time of identity crisis. He elaborated that late adolescence and early adulthood are a time when individuals make choices regarding their values, beliefs, and goals by exploring options and experiencing crises. Erikson (1963) described the concept as crisis and commitment where the former refers to an intense examination of values and beliefs in relation to one's self view, and latter refers to making decisions as to the values and beliefs, which one adopts. In an elaborate and extensive manner, Marcia (1966; 1980; 1993) named four identity statuses in which an individual may reside in the process of identity development. Accordingly, the relationship between crisis and commitment determines which identity state an individual resides. Identity foreclosure refers to adopting the goals, values, and significant lifestyle which others have prescribed for an individual. In this regard, individuals experience commitment without an internal analysis of the values and beliefs to which they commit. When an individual has neither experience a crisis nor committed to a set of values, goals, or beliefs, then an individual is in identity diffusion. In some cases an individual occurs to have made no conclusion about his or her identity, and thereafter make no clear direction. Also, identity moratorium refers to the gradual exploration of personal and occupational choices. This refers to time of instability regarding values, goals, and beliefs, and reflecting the experience of a crisis without the resulting commitment. As a result, self-theory determines the types of strategies one uses to interpret self-relevant information in day-to-day life, as well as approaches to problem solving and decision making. To this end, Berzonsky (1990) proposed that self-theory is in part determined by the identity-development status where one is currently found; and that the identity status in turn predicts the identity processing orientation one adopts. Due to the findings that *identity* states and relate to different behavioural and academic outcomes Berzonsky (1989; 1992) defined three identity processing orientations which in turn produce identity processing styles, and directly related to Marcia (1966) identity statuses. Berzonsky (1992) described self-identity as self-constructed theory of self, which contended with processing orientations that are grounded in the conceptualization of self. Berzonsky *et al.* (1999) described the model of identity processing orientations as operating on three levels namely the identity style, which is the most general level, pertaining to the array of strategies that individuals characteristically use or prefer to utilize across a diversity of environmental and social contexts. Secondly, the social-cognitive strategies which consist of organized sets or systems of the basic

behavioural and cognitive units. The last one is the most specific level that consists of the actual cognitive and behavioural responses of individuals to perform as they negotiate identity conflicts and make decisions. The different identity processing styles utilize different cognitive strategies to either modify or maintain the self-identity necessitated [Berzonsky \(1992\)](#) to propose three identity processing orientations as information-orientation, normative-orientation and diffuse or avoidant orientation. The third version of the Identity Style Inventory (ISI) by [Berzonsky \(2003\)](#) measured three identity processing styles as adopted by individuals based on their processing orientation. This makes information oriented individuals seek out self-relevant information when making identity relevant decisions. Meanwhile, individuals with a foreclosed identity status utilize a normative-orientation, conforming to the expectations of significant others, most often their parents. Those who procrastinate and avoid making self-relevant decisions, as well as resisting considering information that is inconsistent with their view of their identity, are considered diffuse or avoidant in their orientation. The concept of identity-processing orientation is concerned with the cognitive processing of self-relevant information. [Berzonsky \(1990; 2003\)](#) demonstrated that commitment to an identity is related to identity styles, and may act as a mediator between processing styles and outcome behaviours. As previously described, commitment refers to selecting options regarding self-relevant decisions and is often the conclusion of the identity achievement versus role confusion crisis ([Erikson, 1963; 1968](#)). Described by [Marcia and Archer \(1993\)](#) as an important step in late adolescence, commitment is defined; and a definitive choice among possibilities and adherence to the chosen direction in the face of distracting and inviting alternatives. When individuals experience “identity crisis” and they make choices regarding identity-relevant issues such individuals are identity-achieved. On the other hand, individuals who have made these choices without experiencing any exploring options are identity-foreclosed. The last category are the individuals who experience a crisis and explore options, but yet to make choices, are said to be in moratorium. These categories who have not experienced the crisis and have made no self-relevant choices are in diffusion. Significant to the current study is the research that indicates that the processing styles are correlated to ability to adapt to university life. [Erikson \(1963; 1968\)](#) originally hypothesized the identity versus role confusion crisis to be an attribute of adolescence, a more recent version of his theory stated that this crisis might occur in early adulthood ([Erickson, 1982](#)). In this regard adolescence and the ever more protracted apprenticeship of the later school and college years can be viewed as a psychosocial moratorium: a period of sexual and cognitive maturation and yet a sanctioned postponement of definitive commitment. [Schmidt and Hunt \(1994\)](#) provided evidence that there are individual differences in first-year college with psychosocial development as self-perceptions, and greatly influence the degree to which students are prepared to participate in college life. In light of this perspective, it is clear that how one copes with the transitions that occur during entry into university life would be greatly impacted by identity status, and in turn by the identity processing styles which the individual adopts to manage self-relevant information. [Berzonsky \(1989\)](#) provided evidence that academic achievement is in part affected by their identity processing styles. [Lange and Byrd \(2002\)](#) demonstrated that university students who had committed to aspects of their identity were more likely to feel as if they could plan and implement effective study strategies. [Boyd et al. \(2003\)](#) found that male university students that were diffuse or avoidant in their

identity processing style were less likely to be in good academic standing within the three semesters after matriculation as compared to their counterparts utilizing other identity processing styles.

It is possible that identity processing style not only affects cognitive processing strategies, but also the way students adapt to school life in general. Marcia and Archer (1993) identified *identity* status domains as similar to those areas of interest indicated by other studies. Because an individual may be in a different status in various contexts, the current study employed a measure of academic identity status that was found to account for a greater amount of variance in the strategies students adopt in achievement settings than a measure of more general identity processing orientation (Was and Isaacson, 2008). The self-concept literature supports the argument that academic identity needs to be distinguished from a more global identity. In a review of the literature, Marcia and Archer (Op cit) found that there was a substantial amount of research supporting the conclusion that academic achievement was related to academic self-concept, but not related to global measures of self-concept. The Academic Identity Measure (AIM) was designed to distinguish four academic identity statuses: foreclosed, moratorium, diffuse, and achieved. Classifications for the AIM were chosen based on Marcia (1966) identity statuses. In the measure, academic identity foreclosure was represented by questionnaire items designed to capture commitment to academic values and ideals adopted, and based on the influence of significant others. This is why in most cases students do not understand an important reason why they choose to go to college than their family wanted them to go. Academic identity moratorium was operationalised as a time of academic indecision in which a student attempts to reach conclusions about their academic values and goals. Because this period represents an uncertainty regarding an academic identity, the items in the self-report questionnaire reflect the natural tendency of adolescents and young adults to explore the relevance of academic values that occur to the individual as self-relevant. For instance, some adolescents believe their priorities in school are in transition, and this why they take some days as serious, and other days having different priorities outside school activities. These items reflect the individual's academic indecision and consideration of different academic values. Academic identity diffusion refers to a lack of exploration or commitment often accompanied by procrastination regarding decision pertaining to academic values. Variations in all the aforementioned make individuals subject time to study into a back seat of social and recreational activities. Academic identity achievement refers to a commitment to a set of academic values following a period of exploration. Adolescent tends to have many priorities yet learning in school is always one of the most important goals. Important to the current study was an analysis conducted using hierarchical approach of identity-formation. Hence, the study is concerned with how students come to understand what it means to do mathematics as it is realized in the classroom and with whether and to what extent these students come to identify with that activity and in-turn determine their achievement via the four faces.

1.2. Statement of the Problem

The study explored *the* possible relationships that exist between academic achievements in mathematics through the four faces of identity-formation of mathematics learning, namely

engagement, imagination, alignment, and nature. This was possible through the under-listed research questions to the study.

Research Questions

RQ₁: What influence an engagement of identity-formation has on academic achievement?

RQ₂: What influence an imagination of identity-formation has on academic achievement?

RQ₃: What influence an alignment of identity-formation has on academic achievement?

RQ₄: What influence a nature of identity-formation has on academic achievement?

2. METHODOLOGY

2.1. Design

This study employed a qualitative design approach to unravel student academic achievement and mathematics identity. Employed a self-report measure of how identity-formation in mathematics classrooms aid or hinder their achievements in mathematics, the study took place in Lagos State, former federal capital territory city and commercial nerve centre of with a population of about 16 million people (National Population Commission, 2011).

2.2. Population

Population comprised of all secondary school students in Ojo local government area of Lagos State, skewed only to the senior secondary school levels.

2.3. Sample

A total number of 15 male and 19 female in SS3 class that sat for 2013 UTME Examination were purposefully selected for the study.

2.4. Instrument

The study made use of an open-ended interview which centered on different but pertinent questions on academic achievement and mathematics identity-formation. Though there were 16-items unstructured questions variation was made in terms of the four faces of identity-formation.

2.5. Validation of Instrument

Grammatical construct of the statements were carried out via ten selected students to authenticate the level of grammar was not ambiguous on one hand, and not beyond the understanding of prototype sample for the study and its pilot testing was done once.

2.6. Reliability of Instrument

Coefficient of 0.69 was obtained via split-half reliability method for the unstructured questions that were administered to the participated students.

2.7. Procedures

During the interview section with some selected students, researcher made them feel at ease to an extent that level of communication was quite informal as face to face interview was executed.

2.8. Data Analysis

The data from the recorded interviews were harmonized to arrive at a concise report that constitutes the findings below with the four faces of identity as a mathematics learner described below.

3. FINDINGS

Identity is paramount in mathematics classroom with heterogeneous nature because it encompasses a range of issues that are typically subsumed under the heading of affective factors, including students' persistence, interest in, and motivation to learn mathematics. These four faces of identity of mathematics learning are: engagement, imagination, alignment, and nature. Study discovered that 88.7% of interviewees have experienced both crisis and commitment. Secondly, about 94.5% of them agreed that the identities they have formed contributed greatly to their levels of achievements in mathematics while 73.8% of these students are of the view that their achievement in mathematics influenced their achievement in other subjects.

An excerpt from one of the students is as follow:

Q: How do you classify yourself; high or low achiever? A: High achiever.....

Q: What is the main contributing factor to this success? A: Hmm..... I think because I believe that Mathematics is interesting and that I can also do well like some of my friends in the class.

Q: Do you think your ability has influenced your achievement in Mathematics?

A: Yes it has..... and even in other subjects

Q: What do you do when confronted with difficulties in Mathematics?

A: My mathematics teacher is always there for us, and some of my friends are always helping me out during crisis.

These above excerpts supported the view of Berger (1998) and Berzonsky (1989) where they argued that identity achievement is essential to academic success. Also, in a study of 208 middle school students, Streitmatter (1989) demonstrated that students with an achieved sense of identity performed better on a measure of mathematics achievement than students in the other identity statuses. This also corroborate Epstein (1973) postulates that identity structure is an unconsciously constructed self-theory; and in line with (Schank and Ableson, 1977) that an individual's interpretation of environmental and social information, that is self-relevant, is supported by a framework that contains self-schema. In order to provide answer to the research questions, the study adapted the work of Anderson (2007), using the social learning theories of Gee (2001) and Wenger (1998) as a basis for the discussion.

RQ: What influence an engagement of identity-formation has on academic achievement?

Wenger (1998) describe engagement as our direct experience of the world and our active involvement with others. Learning in classrooms comes through varying degrees of engagement with the mathematics, teachers, and peers, as each student sees her or himself, and is seen by others, as one who has or has not learned mathematics. Study discovered that about 82.5% of low achievers are

disengaged from Mathematics activities. To corroborate this an excerpt from a student interviewed represents the central response from students that considered themselves as low achievers:

Q: How do you classify yourself- high or low achiever? A: Hahaha.... am a low achiever when it comes to Mathematics

Q: What is the main contributing factor to your low achievement in Mathematics? A: May be because my interest is not there or probably because of fear.

Q: Do you think fear has influenced your achievement in Mathematics negatively? A: Yes it has and my parents wanted me to study a Mathematical related course

Q: What efforts have you put in to resolve this crisis you are experiencing in Mathematics? A: Really I just do not know where to start from

Q: Are you an active participant in Mathematics activities? A: Am trying my best

Q: Is your Mathematics teacher not giving any helping hands? A: My teacher is trying but my phobia is the problem.

Q: Are your friends not assisting you to overcome this crisis? A: Which crisis?

Q: The difficulties you are encountering with Mathematics activities? A: I think we are all the same

Q: Do you feel ashamed whenever you achieve low in Mathematics activities? A: Yes and in most times I do not go for Mathematics classes

Engaging in a particular mathematics learning environment aids students in their development of an identity as capable mathematics achievers. Other students, however, may not identify with this environment and may come to see themselves as an outcast in the mathematics classroom. In conventional mathematics classrooms where students work independently on exercises, an emphasis is placed on getting right answers, students not only learn mathematics concepts and skills, but they also discover something about themselves as learners (Boaler and Greeno, 2000; Anderson, 2006). Additionally, when correct answers on exercises are emphasized more than mathematical processes or strategies, students come to learn that doing mathematics competently means getting correct answers, often quickly. Students who adopt the practice of quick and getting correct answers may view themselves as achievers in mathematics classrooms. In contrast, students who may require more time to obtain correct answers may not see themselves as capable of achieving anything in mathematics classroom, even though they may have developed effective strategies for solving mathematical problems.

RQ₂: What influence an imagination of identity-formation has on academic achievement?

According to Wenger (1998), the images we have of ourselves and of how mathematics fits into the broader experience of life constitute imagination in mathematics. For instance, the images a student has of herself in relation to her achievement in mathematics, application of mathematics in everyday life, the place of mathematics in post-secondary education, and the use of mathematics in a future career all influence imagination. The ways students see mathematics in relation to the broader context contribute either positively or negatively to their identity and inwardly affect their achievement in mathematics as learners. When some of the interviewed students were asked to give reasons for their decisions regarding study mathematical related courses in the higher institution, about 67.5% respondents revealed a few of the ways they saw themselves in relation to Mathematics. For example,

students had very different reasons for studying mathematics related courses. One survey respondent stated I want to study mathematics related course because I like mathematics, while another claimed It will help me to excel in other courses. These students see themselves as learners of mathematics and members of the community for mathematics learning because they need mathematics for their present or future lives. Other studies corroborating this included [Martin \(2000\)](#), [Mendick \(2003\)](#) and [Sfard and Prusak \(2005\)](#) that have similarly noted that students cite future education and careers as reasons for studying mathematics. Conversely, images of the way mathematics fits into broader life cause students to view their learning of further mathematics as unnecessary. Responses for why students chose not to put in serious efforts in mathematics classes included the careers they intended in mind, and that will not require mathematics. Also, the belief of not in need of mathematics in a course resulted to putting serious efforts in the classes. Students who do not see themselves as needing or using mathematics outside of the immediate context of the mathematics classroom may develop an identity as one who is not a mathematics achiever. If secondary school mathematics is promoted as something useful only as preparation for higher institution, students who do not intend to further their education may come to see themselves as having no need to learn mathematics ([Anderson, 2006](#)). Students may pursue careers that are available in their geographical area or similar to those of their parents or other community members if these careers do not require a formal mathematics education beyond high school mathematics. These students may limit their image of the mathematics needed for work to arithmetic and counting. When students are not able to make connections between the mathematics they learn in school and its perceived utility in their lives, they may construct an identity that will hinder their achievement in mathematics.

RQ: What influence an alignment of identity-formation has on academic achievement?

Secondary school students must meet many requirements set by teachers, school districts, state education departments, colleges and universities, examinational bodies and professional organizations. According to [Gee \(2001\)](#) students come to see themselves as certain types of people by following simple requirements and participating in the required activities. Alignment as a third phase of identity contribute immense energies within institutional boundaries and requirements. For example a student seeking admission into higher institution may just be attending Mathematics classes because it is required for admission to higher institution. Infact, study conducted showed 56.8% of the sample interviewed were of the opinion that if given the choice they would not have sat for mathematics in all external examinations. While some students come to see themselves, and are recognized by others, as Mathematics achievers from their achievement so far in Mathematics, the opposite is true for others. Students who are low achievers in Mathematics may be less likely to see themselves, or be recognized by others, as students who are Mathematics achievers. The three faces of identity discussed to this point are not mutually exclusive but interact to form and maintain identity. When beginners of secondary school are required to attend Mathematics classes because it is a core subject it contributes to identity through alignment. As they participate in Mathematics classes, the activities may appeal to them, and their identity is further developed through engagement. Mathematics is both a requirement for entrance into a career and necessary knowledge to pursue such a career. Thus, identity in Mathematics can be maintained through imagination and alignment.

RQ₄: What influence a nature of identity-formation has on academic achievement?

Q: Why are some students high and low achievers in Mathematics classes?

A: I think it is just in a gift from God. (Mathew an SS 3 student)

A: I think it is more of hereditary factor (Mary an SS 3 student).

The nature of identity describes whom we are from what nature gave us at birth, as well those things over which we have no control (Gee, 2001). Typically, characteristics such as gender and skin colour are viewed as part of our nature-identity. The meanings one makes of ones natural characteristics are not independent of ones relationships with others in personal and broader social settings. That is, these characteristics comprise only one part of the way one sees oneself and others see one. In Gee (2001) social theory of learning, the nature aspect of ones identity must be maintained and reinforced through ones engagement with others, in the images one holds, or institutionalized in the requirements one must follow the environments where one interacts. Mathematics teachers are in a unique position to hear students and parents report that their mathematics learning has been influenced by the presence or absence of a mathematics gene, which often credit nature for not granting them the ability to learn mathematics. The claim of a lack of a Mathematics gene and, therefore, the inability to do Mathematics contrasts with Devlin (2000b) belief that everyone has the Mathematics gene, which also fall in line with National Council Teacher of Mathematics (National Council of Teachers of Mathematics, 2000) statement that Mathematics can and must be learned by all students. It arises from our bodies, our brains, and everyday experiences in the world (Lakoff and Nunez, 2000). As Mathematics has been created by the human brain with its capabilities recreated and learned by other human brains, the fallacy persists for some students that learning mathematics requires special natural talents possessed by only a few. *Here is an excerpt from a student interviewed:*

Q: Are you doing well in Mathematics?

A: I am not good at mathematics (Mary an SS 3 student).

A: I think Mathematics is meant for boys (Shurat an SS 3 student)

A: I do not just like Mathematics (Raphael a SS 3 student)

A: Mathematics is not meant for me. (Habib a SS3 student)

Although scientific evidence does not support the idea that Mathematics learning is related to genetics, some students attribute their Mathematics learning to nature. The SS 3 student who says I am not good at solving mathematics may feel that he is lacking a natural ability for mathematics. He is likely as capable as any other student but he has come to the above conclusion based on his experience with Mathematics, and the way it was taught in his class. Students who are not fast enough to get the correct answers may learn, albeit erroneously, that they are not capable of learning Mathematics. They do not engage in the practices that are recognized, view themselves as viewed by others to be peripheral members of learners. In most of secondary schools such students are tagged as low achievers in Mathematics classroom.

4. DISCUSSIONS

The results of survey conducted support the hypothesis that a relationship exists between a academic identity and achievement in Mathematics. Each phase of identity as discussed above suggests

different ways to describe how one sees oneself as either high achiever or low achiever mathematics learners although they are all part of the one whole. This representation of identity maintains Gee (2001) four strands that may vary and woven together as a given person acts within a given context. When considering the four phases of identity as a Mathematics achiever, this context is a traditional secondary school Mathematics classroom. While all four phases contribute to the formation of identities as mathematics achievers, the *nature* face provides the most unsound and unfounded explanations for participation in the mathematics community. To allow for the development of *all* students to identify as mathematics achievers, students and teachers must discount the nature face and build on the other three faces of identity. As shown by the provided responses from students, each of the four faces of identity exists as a way that students come to understand their practices and membership as either a high achiever or low achiever within the community of mathematics learners. Kabiri and Smith (2003) suggested that a good starting point is open-ended mathematical tasks, questions or projects that have multiple responses or one response with multiple solution paths. The mathematics classroom should be organized to encourage discussion, sharing, and collaboration (Boaler and Greeno, 2000). In this type of classroom setting, teachers pull knowledge out of students and make the construction of knowledge part of the learning experience (Ladson-Billings, 1995). With respect to imagination, the development of identities as Mathematics achievers may require long-term effort on the part of Mathematics teachers across various levels of education because various images which students have of themselves and of mathematics extend outside the classroom in the past or present, which future may be contradictory and change over time. Teachers should facilitate this alignment by keeping students abreast of the mathematics requirements for entrance into higher institutions and careers. Students may commonly reference the nature phase of identity, but this phase is the least useful and potentially the most detrimental for supporting students as they become Mathematics achievers. As mentioned earlier, the ability to learn Mathematics is not determined by genetics or Biology (Lakoff and Nunez, 2000). All students could become Mathematics achievers, identifying themselves and being recognized by others as capable of doing it. As suggested above, the other three phases of identity could sustain mathematics identities through engaging students in the classroom, developing positive images of students and mathematics, and establishing high expectations and requirements regardless of beliefs in an innate mathematical ability. Gee (2001) points out that the nature of identity will always collapse into other sorts of identities. Mathematics teachers need to be aware of the four faces of identity of mathematics achievers and of how their students see themselves as mathematics achievers and doers. The four phases of identity discussed in this study contribute to our understanding of how students come to be mathematics learners. Through consistent and sustained efforts by mathematics teachers to develop positive identities in their students, more students may develop interest in studying mathematics and mathematics related courses, and improve their identities as mathematics achievers. As pointed out throughout this study, identities are developed in relationships with others, including their teachers, parents, and peers. We cannot assume that all students develop positive identities if they have experiences that run to the contrary. We must take action so each phase of identity mutually supports the others in developing all identities as Mathematics achievers.

5. CONCLUSION

As a result many of these students were tagged as low achievers and they also may be alienated from mathematics and learned that they are not valuable members of the mathematics community. Hence, mathematical tasks that engage students in doing mathematics, making meaning, and generating their own solutions to complex mathematical problems could be beneficial in engaging students and supporting their identity as a mathematics learner (National Council of Teachers of Mathematics, 2000).

5.1. Implication of the Study

Although many of students' mathematical requirements are beyond the control of teachers and students yet latter might not be fostered within the alignment face of identity-formation unless teachers could hold their students to high expectations so that these expectations become as strong as requirements to see reason to teach the subject so as to achieve nation goal of development.

6. RECOMMENDATIONS

Developing an identity as mathematics achievers follow recommendations to teachers for developing and supporting students' positive identities as mathematics achievers, members of a community that develops the practices of mathematics learning. The four faces of identity described here are used to understand how students see themselves as mathematics achievers in relation to their experiences in the heterogeneous mathematics classroom and through the ways these experiences fit into broader life experience and achievement. Experiences will not necessarily reflect just one of the four faces described (Gee, 2001). In fact, some experiences may be stretched over two or more faces. For example, achievements in mathematics at secondary school could contribute to an identity in two ways: (a) through imagination with the image of mathematics as a core subject for entrance to higher institution and (b) through alignment since further mathematics is required to attend some higher institutions. Taken together, however, we can see that a focus on a particular face of identity suggests particular experiences that help to develop strong positive identities as a mathematics achiever in all students. The engagement face of identity is developed through experiences with mathematics and, for most secondary school students, their mathematics experiences occur in the mathematics classroom. Therefore, the most significant potential to influence identities exists in the mathematics classroom. To develop identities as mathematics achievers through engagement, teachers should consider mathematical tasks and classroom structures where students are actively involved in the creation of mathematics while learning to be people who study in school (Lampert, 2001). That is, students must feel the mathematics classroom is their scholarly home and that the ideas they contribute are valued by the class (Wenger, 1998). As indicated earlier, teacher-led classrooms with students working independently on single-answer exercises can cause students to learn that mathematics is not a vibrant and useful subject to study. Boaler (2000), for example, identified monotony, lack of meaning, and isolation as themes that emerged from a study of students and their mathematics experiences. Teachers and others in schools should consistently reinforce that mathematics is an interesting body of knowledge worth studying, an intellectual tool for other disciplines, and an admission ticket for

colleges and careers. Since identity development through imagination extends beyond the classroom, teachers should provide students with opportunities to see themselves as mathematics achievers even outside the mathematics classrooms. For example, resource persons could be invited to discuss ways they use mathematics in their professional lives; many students may not be aware of the work of engineers, actuaries, or statisticians. Another suggestion is to request students to keep a log and record the ways in which they use mathematics in their daily lives in order to become aware of the usefulness of mathematics (Masingila, 2002). This activity could provide an opportunity for assessing views on mathematics and discussing the connections between the mathematics taught in school and that used outside the classroom.

6.1. Suggestion for further Study

Since each of the above-listed identity-formation were observed in an exclusive of one another study recommend another look into the *identity-formation* to high and low students via *engagement, imagination, alignment* and *nature* of mathematics as a whole.

REFERENCES

- Agrawal, M., 2004. Curricular reform in schools: The importance of evaluation. *Journal of Curriculum Studies*, 36(3): 361–379.
- Anderson, R., 2006. Mathematics, meaning, and identity: A study of the practice of mathematics education in a rural high school. Unpublished Doctoral Dissertation, Portland State University, Oregon.
- Anderson, R., 2007. Being a mathematics learner: Four faces of identity. *The Mathematics Educator*, 17(1): 7–14.
- Berger, K.S., 1998. *The developing person through the life span*. 4th Edn., New York: Worth.
- Berzonsky, M.D., 1989. The self as a theorist: Individual differences in identity formation. *International Journal of Personal Construct Psychology*, 2(4): 363–376.
- Berzonsky, M.D., 1990. Self-construction over the life-span: A process perspective on identity formation *Advances in Personal Construct Psychology*, 1: 155–186.
- Berzonsky, M.D., 1992. Identity style and coping strategies. *Journal of Personality*, 60(4): 771–788.
- Berzonsky, M.D., 2003. The structure of identity: Commentary on Jane Kroger's view of identity status transition. *Identity*, 3(3): 231–245.
- Berzonsky, M.D., J. Nurmi, A. Kinney and K. Tammi, 1999. Identity processing style and cognitive attribution strategies: Similarities and difference across different contexts. *European Journal of Personality*, 13(2), 105–120.
- Boaler, J., 2000. Mathematics from another world: Traditional communities and the alienation of learners. *Journal of Mathematical Behavior*, 18(4): 379–397.
- Boaler, J. and J.G. Greeno, 2000. Identity, agency, and knowing in mathematical worlds In J Boaler (Ed.), *Multiple perspectives on mathematics teaching and learning*. Stamford, CT: Ablex. pp: 45–82.
- Boyd, V.S., P.F. Hunt, J.J. Kandell and M.S. Lucas, 2003. Relationship between identity processing style and academic success in undergraduate students. *Journal of College Student Development*, 44(2): 155–167.

- Devlin, K., 2000b. The math gene: How mathematical thinking evolved and why numbers are like gossip. New York: Basic Books, Differences and classroom effects. *Journal of Research in Science Teaching*, 31: 811-831.
- Epstein, S., 1973. The self-concept revisited: Or a theory of a theory. *American Psychologist*, 28(5): 404-416.
- Erickson, E.H., 1980. Identity and the life cycle. 2nd Edn., New York: Norton.
- Erickson, F., 1982. Transformation and school success: The policies and culture of educational achievement. In E. Jacob & C. Jordan (Eds.), *Minority education: Anthropological perspectives*. *European Journal of Personality*, 13(2): 105-120.
- Erikson, E., 1963. *Childhood and society*. 2nd Edn., New York: Norton.
- Erikson, E.H., 1968. *Identity, youth, and crisis*. New York: Norton.
- Fuente, D.L.J., 2004. Recent perspectives in the study of motivation: Goal orientation theory.
- Gee, J.P., 2001. Identity as an analytic lens for research in education. *Review of Research in Education*, 25: 99-125.
- Kabiri, M.S. and N.L. Smith, 2003. Turning traditional textbook problems into open-ended problems. *Mathematics Teaching in the Middle School*, 9: 186-192.
- Karande, S. and M. Kulkarni, 2005. Poor school performance. *Indian Journal of Pediatrics*, 72(11): 961-967.
- Ladson-Billings, G., 1995. Toward a theory of culturally relevant pedagogy. *American Educational Research Journal*, 32(3): 465-491.
- Lakoff, G. and R.E. Nunez, 2000. *Where mathematics comes from: How the embodied mind brings mathematics into being*. New York: Basic Books.
- Lampert, M., 2001. *Teaching problems and the problems of teaching*. New Haven, CT: Yale University Press.
- Lange, C. and M. Byrd, 2002. Differences between students' estimated and attained grades in a first-year introductory psychology course as a function of identity development. *Adolescence*, 37(145): 93-107.
- Marcia, J.E., 1966. Development and validation of ego identity status. *Journal of Personality and Social Psychology*, 3(5): 351-358.
- Marcia, J.E., 1980. Identity in adolescence. In J. Adelson (Ed.), *Handbook of adolescent psychology*. New York: Wiley. pp: 159-187.
- Marcia, J. E. 1993. The status of statuses: Research review. In J. E. Marcia, A. S. Waterman, D. R. Matteson, S. L. Archer, & J. L. Orlofsky (Eds.), *Ego Identity: A Handbook for Psychosocial Research*. New York: Springer-Verlag. pp: 22-41
- Marcia, J.E. and S.L. Archer, 1993. Identity status in late adolescence: Scoring criteria. In Marcia, J.E., Waterman, A.S., Matteson, D.R. Archer, S.L. & Orlofsky, J.L. (Eds), *Identity: A handbook for psychosocial research*. New York: Springer. pp: 205-240.
- Martin, D.B., 2000. Mathematics success and failure among African-American youth: The roles of socio-historical context, community forces, school influences, and individual agency.
- Masingila, J.O., 2002. Examining students' perceptions of their everyday mathematics practice. In M. E. Brenner & J. N. Mathematical knowing and teaching. *American Educational Research Journal*, 27: 29-63.

- Mendick, H., 2003. Choosing maths/doing gender: A look at why there are more boys than girls in advanced mathematics classes in England. In L. Burton (Ed.), Which way social justice in mathematics education.? Westport, CT: Praeger. pp: 169–187.
- National Council of Teachers of Mathematics, 2000. Principles and standards for school mathematics. Reston: VA: Author.
- National Population Commission, 2011. Lagos state claim on the provisional result of the 2006 census is unfounded. [Retrieved 10 April 2014].
- Schank, R.C. and R.P. Ableson, 1977. Scripts, plans, goals, and understanding: An inquiry into human knowledge structures. Hillsdale, nj: Lawrence earlbaum. Academic identity status and the relationship to achievement goal orientation electronic. Journal of research in educational psychology. 7(2): 627-652. ISSN: 1696-2095 - 651
- Schmidt, J.A. and P.F. Hunt, 1994. Relationship between pre-college attributes and subsequent development in college students. Journal of College Student Development, 35: 481-485.
- Sfard, A. and A. Prusak, 2005. Telling identities: In search of an analytic tool for investigating learning as a culturally shaped activity. Educational Researcher, 34(4): 14–22.
- Streitmatter, J.L., 1989. Identity development and academic achievement in early adolescence. Student Development, 44(2): 155-167.
- Was, C.A. and R.M. Isaacson, 2008. The Development of a Measure of Academic Identity.
- Wenger, E., 1998. Communities of practice: Learning, meaning, and identity. Cambridge, UK: Cambridge University Press.

BIBLIOGRAPHY

- Berzonsky, M. D., 1997. Identity development, control theory and self-regulation: An individual differences perspective. Journal of Adolescent Research, 12(3), 347-353.
- Berzonsky M.D, and Kuk L.S., 2005. Identity status, identity processing style, and the transition to university. Journal of Adolescent Research, 15(1), 81.
- Boaler J. and Greeno J. G., 2000. Identity, agency, and knowing in mathematics worlds In J. Boaler (Ed.), Multiple perspectives on mathematics teaching and learning, Westport, CT: Ablex, 171– 200.
- Boaler, J. and Humphreys C., 2005. Connecting mathematical ideas: Middle school video cases to support teaching and learning. Portsmouth, NH: Heinemann.
- Devlin, K., 2000a. The four faces of mathematics In M. J. Burke & F. R. Curcio (Eds), Learning mathematics for a new century, Reston, VA: NCTM, 16–27.
- Martin, J. B., 2000. Mathematics success and failure among African-American youth, Mahwah, NJ: Erlbaum.
- Pickering, A., 1995. The mangle of practice: Time, agency, and science. Chicago.

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