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Procedia Social and Behavioral Sciences 1 (2009) 953–957

Procedia
Social and Behavioral Sciences

World Conference Education Science 2009

# The relationship between mathematics self-efficacy and achievement in mathematics

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**Elsevier use only:** Received date here; revised date here; accepted date here

**Abstract**

This study examined the relationship between Mathematics Self-Efficacy and achievement in Mathematics. Three hundred and fifty-two (352) Senior Secondary 2 students in Oyo State were used for the study. Three hypotheses were used. The results show no significant difference between male and female achievement in Mathematics. Also, no significant difference was also obtained between male and female Mathematics Self-Efficacy and Mathematics achievement. The paper recommend that teacher should find ways of enhancing Mathematics Self- Efficacy in student and should place emphasis on student's confidence to succeed in Mathematics achievement.

*Keywords:*Mathematics self-efficacy; achievement in mathematics and gender difference.

## 1. Introduction

In an effort to improve students cognitive and affective outcomes in mathematics and/or school learning, educational psychologists and mathematics educators have continued to search for variables (personal and environmental) that could be manipulated in favour of academic gains especially in the subject mathematics due to student's disposition, low enrolment and poor performance in the subject (Chief Examiner Report, 2005, 2006 and 2007). Of all the personal variables that have attracted researcher in this area of educational achievement, mathematics self-efficacy seem to be gaining more popularity (Pajares & Miller, 1994, Zimmerman, Bandura & Martinez-Pons, 1992). Learning involves both a personally and a socially negotiated construction of meaning (Cobb, 1990). In the classroom context this mean that children develop cognitively by being agents in their own learning Well & Chang-Wells, 1992, p. 49). The view of agency to be advanced here is based upon three central premises; (a) that children construct scientific concepts by drawing on their existing ideas and experience (Rieber & Carton, 1987), (b) that social interactions both direct and indirect mediate knowledge construction (Vygotsky, 1986), and (c) that knowledge is personally constructed by the learner based upon prior ideas and social interactions (Tobin &

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1877-0428 
doi:10.1016/j.sbspro.2009.01.169

Tippins, 1993). According to Bandura's (1986) social cognitive theory, student's judgements of their capability to perform academic tasks or self efficacy beliefs, predict their capability to accomplish such tasks. Researchers have demonstrated that the value of self-efficacy beliefs for predicting student's performances in mathematics. For example, self-efficacy predicts mathematics problem-solving to a greater degree than to self-beliefs such as mathematics anxiety or self-concept, previous mathematics experience, or self-efficacy for self-regulatory practices (Pajaris & Miller; 1994; Zimmerman, Bandura & Martinez-Pons, 1992). It has also been demonstrated that students whose self-efficacy is stronger and more accurate in their mathematics computation and show greater persistence on difficult items than do students with low self-efficacy (Collins, 1982). Similarly, researchers have shown that student's confidence in mathematics problem-solving skills is related to their problem-solving competence (Pajares, Miller & Johnson, 1999; Pajares & Valiante, 1999). Researchers have also demonstrated that self-efficacy beliefs differ by race/ethnicity and gender. Graham's (1994) summary of the literature on the competence beliefs of African American students revealed that they maintain optimism and positive self-regard in the face of social and economic disadvantage. Graham also found that the academic self-beliefs of African Americans are strong even in the face of achievement failure. Pajares (1997) has suggested that the assessment of beliefs at differing levels of specificity might help explain the relationship between perceptions of competence and academic achievement, how these perceptions are related to other motivation constructs, and whether the origins of these beliefs differ for minority children and across socio-economic levels (Edelin & Paris, 1995). The relationship between gender and self-efficacy has also been a focus of self-efficacy research. Researchers report that male students at high school and college levels tend to be more confident than female students in mathematics, science, and technology (Lent, Lopez, & Bieschke, 1991; Pajares & Miller, 1994) although achievement differences in these area are diminishing (Eisenberg, Martin, & Fabes, 1996). Conversely, in areas related to language arts female students tend to exhibit stronger confidence (Pajares, 1997).

Self-efficacy researchers have focused clearly exclusively in the academic areas of language arts, science and writing, paying scant attention to mathematics, particularly at academic levels in which these sorts of self-beliefs begin to take root. This is an unfortunate omission. Mathematics hold a prominent place in the academic curriculum, and academic success in these subject is imperative in this age of rapid scientific and technological level that academic self-beliefs become more pronounced and that gender differences begin to appear.

The purpose of this study was to extend existing findings regarding the influence of self-efficacy in language arts, science and writing to secondary school mathematics. First, we sought to discover whether mathematics motivation beliefs vary as a function of gender, second, we sought to determine whether the confidence with which students approach mathematics makes an independent contribution to the prediction of mathematics achievement. To obtain insights regarding the competence beliefs of senior secondary school students II in our sample, we assessed competence belief as typically assessed that correspond to the achievement outcome in the study (mathematics self-efficacy).

## 2. Statement of the Problem

The problem of this study is to determine relationship between student's mathematics self-efficacy and academic achievement in Mathematics.

## 3. Hypotheses

$H0_1$: There is no significant difference between the mean achievement scores of secondary school male and female in Mathematics.

$H0_2$: There is no significant difference in the Mathematics self-efficacy scores of male and female students.

$H0_3$: There is no significant relationship between secondary school student's mathematics self-efficacy and achievement in Mathematics.

## 4. Methodology

The subjects for the study were drawn from twenty (20) selected secondary schools within Ibadan metropolis of Oyo State. Stratified random sampling was used in the selection of the schools. The sample include students from Boy schools, Girls schools and co-educational schools. In all, a total of 352 senior secondary II students (192 male and 160 female) were randomly selected for the study. The target population for this study were the students in SSS

II. This category of students were selected on the assumption that they were matured enough to form independent opinion about mathematics in relation to their self-efficacy, their personal approach and confidence towards the subject and their achievement in it.

## 5. Instrumentation

In carrying out this study, the investigators used Mathematics Self-Efficacy Scale (MSES) and Mathematics Achievement Test (MAT). The MSES instruments asked students to express their level of confidence in successfully solving each of 25 mathematics problems drawn from MAT. The MSES is an adapted version of Parajes & Kranzler 1995 and Pajares and Miller 1995 while MAT was self-constructed by the researchers. It consists of the same mathematics problems on which students provided their confidence judgements. The Cronbach's alpha coefficients of the two scales were 0.87 and 0.94 respectively. On the basis of the magnitude of these indices the instrument were found to be adequate for testing purposes and were subsequently group administered by training researchers near the end of the third term of the academic session. With the assistance of the various class teachers whose classes were used for the study, the completed questionnaires and tests were collected for the subjects and scored accordingly.

## 6. Data Analysis

Data from the study were subjected to appropriate statistical analysis to be able to draw up inferences from it. The t-test and Spearman rank order correlation coefficient were used for data analysis.

## 7. Results

The results are presented in the tables as follows:

Table 1. Results of t-test of the mean scores of male and female in mathematics

| Gender | N | $\bar{x}$ | t-cal | t-crit. | df | Decision |
|---|---|---|---|---|---|---|
| Male | 192 | 68.4 | -0.89 | 1.96 | 350 | NS |
| Female | 160 | 51.6 | | | | |

N.S- Not significant at 0.05 confidence level.

Table 1 present the mean scores responses of the respondents. The result of the t-test revealed that there is no significant difference between the mean achievement scores of secondary schools male and female in mathematics ($H0_1$).

Table 2. T-test showing the comparison in the mathematics self-efficacy of male and female students

| Gender | N | $\bar{x}$ | t-cal | t-crit. | df | Decision |
|---|---|---|---|---|---|---|
| Male | 192 | 65.2 | -2.81 | 1.96 | 350 | NS |
| Female | 160 | 72.5 | | | | |

N.S- Not significant at 0.05 confidence level

Results in Table 2, shows that a critical t-value at 350 degree of freedom at 0.05 level of significance is 1.96 while the calculated value is -2.81. The result of the t-test revealed that there is no significant difference in the mathematics self-efficacy scores of male and female students ($H0_2$).

Table 3. Results of correlation (r) between students self-efficacy and achievement in mathematics

| Gender | N | r | p |
|---|---|---|---|
| Students | 352 | 0.7254 | 0.0001* |

* significant @ 0.01 significant level.

The result in Table 3 showed that there is clear and strong positive relationship between students' mathematics self-efficacy and achievement in mathematics.

## 8. Discussions

From the analysis of data, it was found that there is no significant differences between the mean achievement scores of secondary school male and female in mathematics. This result was supported by that of (Hyde, Fennema, Ryan, Frost & Hopp, 1990) and that of Popoola (2000) and Tella (1998), who also found no gender difference in students mathematics achievement. Achievement in mathematics correlate highly with general intelligence in which no consistent gender difference are found.

However, Osafehinti (1988) disagreed with this, as he found gender difference in Mathematics Achievement Test to be highly significant in favour of male students.

It was also observed that there is no significant difference in the mathematics self-efficacy scores of male and female students. This result agreed perfectly with the work of previous researchers who also found no evidence of gender difference at any age level. We also found that male and female did not differ in mathematics self –efficacy. There are three possible reasons for this finding. The first is that our sample size was not large enough to detect significance. The near significant value suggests that the increase in power that would result from a larger sample would detect such significant. This is supported by the strong goodness of fit indices of the scale with the relationship with gender and mathematics self-efficacy. The second possibility is that, although differences in mathematics self-efficacy between male and female secondary school students is consistently found, this difference may be less pronounced in mathematics confidence of males and females at the secondary school level. The third possible possibility is that secondary school females may continue to exhibit weaker mathematics self-belief, than the males, but these differences may be less pronounced when female are asked to provide a judgement of confidence to solve a specific problem. In other words, their weaker self beliefs may be more generally experienced and less contextually based.

It was also revealed that there is a strong positive relationship between mathematics self-efficacy and achievement in mathematics. This is supported by (Hackett, 1985; Lent & Hackett, 1987; Pajares 1996b).

Findings from this study support Bendura's (1986, 1997) claim that self-efficacy beliefs predict academic outcomes. They also support the work of investigators who report significant relations between self-efficacy, other motivation constructs, and academic achievements. The implication that arise is that researchers and school counsellors should be looking to student's beliefs about their mathematics capability, for they are important components of motivation and of academic achievement (Bandura, 1997; Pajares, 1997; Schunk, 1991; Zeldin and Pajares in stress). It also seems warranted to suggest that researchers should continue to identify the contexts in which certain motivation constructs may be better predictions of mathematics related outcomes as well as the unique role that the construct plays in the general development of self – regulatory and performance skills. The result will be a clearer and deeper understanding of the nature of the interplay among the differing self-beliefs, and mathematics achievement.

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