Investigating Predictive Role of 2x2 Achievement Goal Orientations on Math Attitudes with Structural Equation Modeling

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Abstract

The purpose of this research is to examine the relationships between 2x2 achievement goal orientations and math attitudes with structural equation modeling. Participants were 517 university students. The 2X2 Achievement Goal Orientations Scale and Mathematics Attitudes Scale were used as measures. Results from structural equation model showed that negative attitudes were predicted positively by learning-avoidance and performance-approach/avoidance goal orientations. Further positive attitudes were predicted positively by learning-approach/avoidance goal orientations and negatively by performance-approach/avoidance goal orientations. The results were discussed in the light of the related literature and dependent recommendations to the area were given.

Keywords: Achievement goal orientations, math attitudes, structural equation modeling

Introduction

In the last two decades the achievement goal orientations theory, developed within a social-cognitive framework, has been gained scholarly attention and was firstly defined by Ames (1992) as an "integrated pattern of beliefs, attributions, and affect that produces intentions of behavior" (p. 261). Early studies have considered achievement goal orientations as a two-dimensional construct; learning and performance goals (Dweck & Leggett, 1988) and demonstrated that while the former is consistently related to both adaptive academic and psychological variables the latter is linked to maladaptive ones. In these studies it was found that students with learning goals are interested in learning new skills and improving their understanding and competence (Dweck & Leggett, 1988). In contrary, students who adopt performance goals engage with social comparisons and with present themselves as successful and want to receive desirable judgments or to avoid negative evaluations about their performance. They also focus on doing better and performing well than other students and not appearing clumsy (Dweck & Leggett, 1988). Studies on achievement goal orientations demonstrated that learning goals are associated with a lot of adaptive motivational variables such as internal academic locus of control (Akın, 2008a), self-compassion (Akın, 2010), task engagement, perceived ability, and attributions of success to effort (Dweck & Leggett, 1988; Meece, Blumenfeld, & Hoyle, 1988). Performance goals on the other hand were found related to maladaptive behaviors such as negative affectivity, lack of persistence, stress, and anxiety (Akın, 2008b; Eppler & Harju, 1997; Meece et al., 1988).

While the dichotomous model of achievement goal orientations has been widely accepted on academic area, in the past decade a group of researchers (Elliot & Church, 1997; Kaplan & Midgley, 1999; Midgley & Urdan, 2001) have argued that all parts of performance goal orientation might not be non-functional and it is possible that in some conditions it may lead students more adaptive patterns of

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achievement than do learning goal orientation. And thus achievement goal orientations theory has been reconsidered and performance goals have been divided into approach and avoidance dimensions. According to this trichotomous model, students who hold performance-approach goals are more concerned with demonstrating competence and outperforming other classmates while students with performance-avoidance goals are mainly interested in avoiding the demonstration of incompetence. However more recently it was suggested and empirically supported that learning goal orientation may also be divided into approach and avoidance dimensions (Elliot & McGregor, 2001; Pintrich, Conley, & Kempler, 2003). This new model has been called as 2x2 achievement goal orientations (learning-approach/avoidance and performance-approach/avoidance goal orientation) model and has proposed that some students may focus on avoiding being misunderstood the learning material or not mastering the task. These perfectionist students would not be concerned about doing it wrong on account of comparisons with others (a performance-avoidance goal), but rather in terms of their own high standards for themselves (Pintrich et al., 2003).

In educational psychology, attitudes towards math are by far the most popular study field since they influence the quality and outcomes of math learning (Furinghetti & Pehkonen, 2000; Yenilmez & Ozabaci, 2003; Zan, Brown, Evans, & Hannula, 2006). An attitude was defined by McLeod (1992) as an affective response that involves positive and negative feeling of moderate intensity and reasonable stability. Attitudes develop with time and have a relatively long-lasting effect. Regarding to this issue, Lester, Garofalo, and Lambdin Kroll (1989, p. 75) pointed out that, "any good mathematics teacher would be quick to point out that students' success or failure in solving a problem often is as much a matter of self-confidence, motivation, perseverance, and of many other non-cognitive traits."

Mathematics attitudes are linked to a wide range of variables such as parental and societal influences, students' classroom experiences, and teachers' classroom behaviors (Fisher & Rickards, 1998; Forgasz & Leder, 1996; Papanastatsiou, 2000). In his large scaled study in which investigated 21,000 students' math attitudes, Tymms (2001) found that the teacher and students' academic level was the most important factors while age, gender, and language were weakly associated with attitudes. Fisher and Rickards's (1998) research demonstrated that positive math attitudes are related to teachers' helping/friendly behaviors and negative math attitudes are related to teachers' scolding and enforcing strict behaviors. Also gender differences were found in math attitudes with girls showing more negative attitudes than boys (Casey, Nuttall, & Pezaris, 2001; Vermeer, Boekaerts, & Seegers, 2000).

Although the relationships between math attitudes and some psychological and educational variables have received extensive scholarly attention, documenting their association with motivational variables has received relatively less attention. Achievement goals are linked to crucial motivational factors of learning such as academic locus of control, engagement with learning material and task, to consider success as a result of effort, persistence, stress, and anxiety (Akın, 2008a, b; Dweck & Leggett, 1988; Eppler & Harju, 1997; Meece et al., 1988; Midgley & Urdan, 2001). These motivational variables have also been viewed as playing a crucial role on math attitudes, while different kinds of achievement goals may play different roles. Thus achievement goals and math attitudes may be related to each other. Since achievement goals are pattern of beliefs and attributions and they produce intentions of behavior and math attitudes are affective responses that involve positive or negative feelings, in the current research math attitudes are considered as outcome and achievement goals as predictor variables. Based on the 2x2 achievement goal orientations model, in the current study it was aimed to examine the possible links between math attitudes and four achievement goal orientations via structural equation modeling. The hypotheses to be tested in this study as follows:

1) Learning-approach goal orientation would be associated negatively with negative math attitudes and positively with positive math attitudes

2) Performance-approach goal orientation would be related negatively to positive math attitudes and positively to negative math attitudes.

3) Performance-avoidance goal orientation would positively associate with negative math attitudes and negatively with positive math attitudes.

4) Learning-avoidance goal orientation would be related positively to both positive and negative math attitudes. This model is represented schematically in Figure 1.

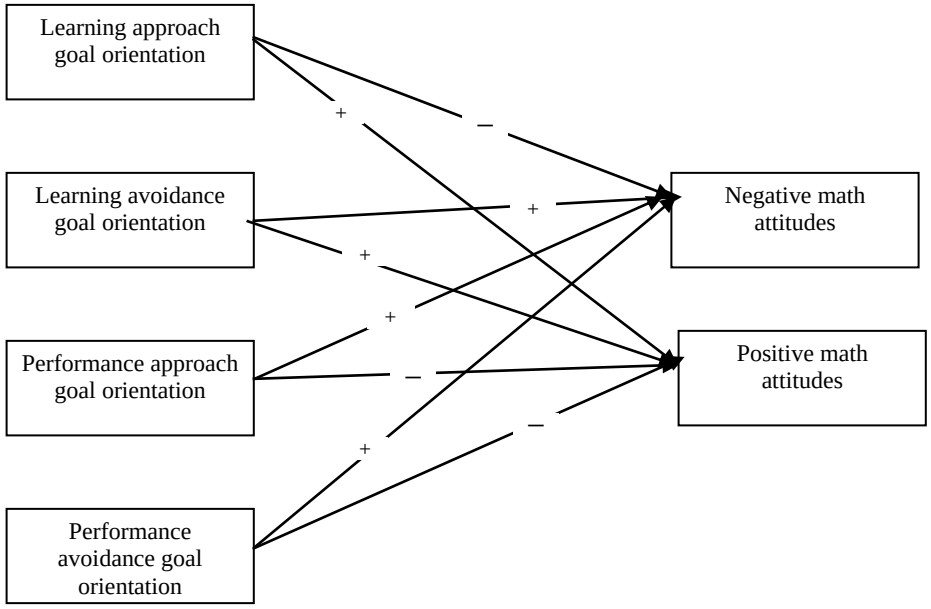

Figure 1. Hypothesized model of the relationships between achievement goal orientations and math attitudes

Method

The study was descriptive-correlational in nature, quantitative research and was designed to gather data concerning the strength of relationships between achievement goal orientations and math attitudes. Data were collected from a self-administered questionnaire.

Participants

Participants were 517 (277 (54%) were female and 240 (46%) were male) university students from Sakarya University, Faculty of Education. Of the participants, 128 (25%) were first-year students, 131 (26%) were second-year students, 120 (23%) were third- year students, and 138 (26%) were fourth-year student. Their ages ranged from 18 to 33 years old (M = 20.42, SD = 1.40) and GPA scores ranged from 1.64 to 3.72.

Measures

2X2 Achievement Goal Orientations Scale (AGOS). The 2X2 AGOS (Akın, 2006) is a 26-item self-report scale using a five-point Likert scale (1=*strongly disagree* to 5=*strongly agree*) and has four sub-scales: learning-approach goal orientation (LPGO; eight items, e.g., "I like school work that I'll learn from"), learning-avoidance goal orientation (LVGO; five items, e.g., "I do my best to avoid making mistakes"), performance-approach goal orientation (PPGO; seven items, e.g., "It is important for me to perform better than others"), and performance-avoidance goal orientation (PVGO; six items, e.g., "I worry about the possibility of getting bad grades"). A score for each dimension was assessed by summing the total score of the questions for each dimension. The structure validity of the scale was evaluated with factor analyses in 728 Turkish university students. The amount of total variance explained by four factors was 67% and

factor loadings ranged from .41 to .98. Internal consistencies were .92, .97, .97, and .95 and three-week test-retest reliability estimates were .77, .82, .84, and .86 for LPGO, LVGO, PPGO, and PVGO, respectively.

The Mathematics Attitude Scale (MAS, Aşkar, 1986). The MAS was developed by Aşkar (1986) in order to determine students' math attitudes. This scale has 20 items and two subscales; positive attitudes (ten items, e.g., "I like mathematics") and negative attitudes (ten items, e.g., "Taking math is a waste of time"). Each item was rated on a 5-point Likert scale (1=unsuitable to me to 5= definitely suitable to me). Aşkar (1986) reported Cronbach alpha reliability coefficient of the scale as .96.

Procedure

Firstly permission for administration of the scales to the participants was obtained from related chief departments. Than participants were informed of the purpose and of the voluntary nature of study and were ensured anonymity for all responses given. Self-report questionnaires were administered in a quiet classroom setting and the scales were administered to the students in groups in the classrooms. The measures were counterbalanced in administration. To test the hypothesis model (Learning-approach goals would be associated negatively and learning-avoidance and performance-approach/avoidance goals positively with negative math attitudes. And learning-approach/avoidance goals would be related positively and performance-approach/avoidance goals negatively with positive math attitudes) structural equation modeling (SEM) was used. Using SEM, all the parameters of models can be tested simultaneously in one step. The variables which were entered in structural equation modeling were measured by summing the items of each scale and the specifications on the model were direct paths from achievement goals to math attitudes. This analysis was carried out via LISREL 8.54 (Jöreskog & Sorbom, 1996).

Results

Structural Equation Modeling

Before applying SEM the assumptions of it were investigated. Multivariate normality tests which check a given set of data for similarity to the multivariate normal distribution were conducted via LISREL. The results of multivariate normality tests proved that the evidence was sufficient to say that the distributions of data are multivariate normal. According to this model, math attitudes are predicted by achievement goal orientations. Figure 2 presents the results of SEM analysis.

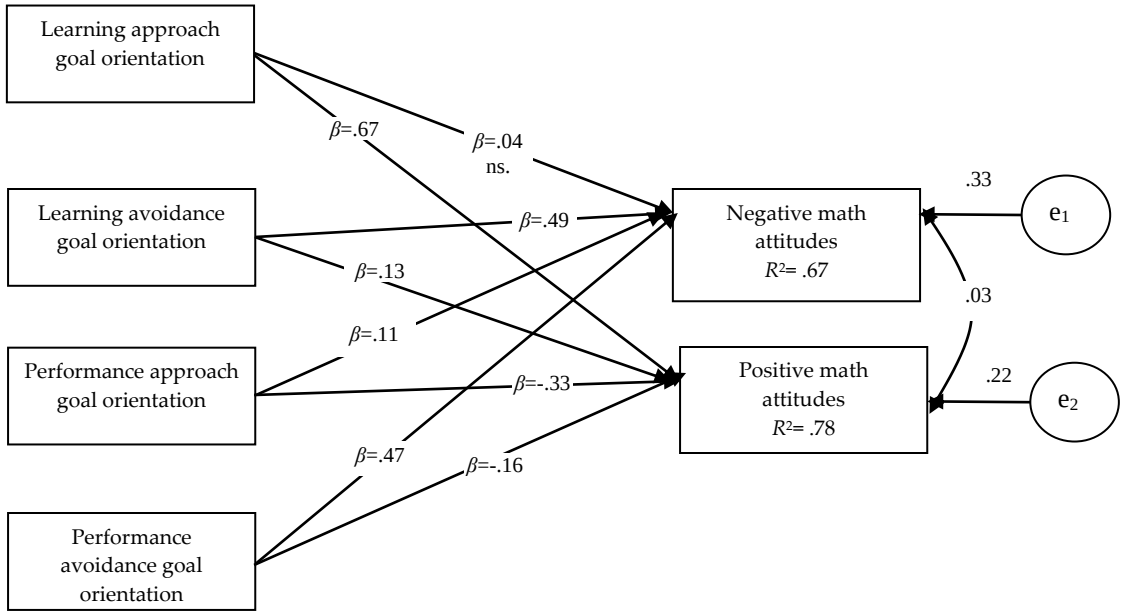

Figure 2. Path analysis between achievement goal orientations and math attitudes

Several indices may be considered to assess the model fit. Though no index is perfectly reliable separately, it is advised that several fit indices should be used in conjunction to make a decision. It is recommended that the ratio of chi square (x^2) to degrees of freedom (df), root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR), goodness of fit index (GFI), adjusted goodness of fit index (AGFI), comparative fit index (CFI), and normed fit index (NFI) should be used to assess the model fit in general (Kline 2005). The model demonstrated good fit (χ^2/df= 1,21, GFI= 1.00, AGFI= .99, CFI= 1.00, NFI= 1.00, RFI= .99, SRMR=.009, and RMSEA= .019) and four achievement goal orientations accounted for 67% of the negative math attitudes and 78% of the positive math attitudes variances. The standardized coefficients in Figure 2 clearly showed that negative math attitudes were predicted positively by LVGO, PPGO, and PVGO (β= .49, β= .11, and β= .47, respectively). On the other hand while LPGO and LVGO predicted positive math attitudes positively (β= .67 and β= .13, respectively), PPGO and PVGO predicted positive math attitudes negatively (β= -.33 and β= -.16, respectively). However, the path from LPGO to negative math attitudes was not significant.

Discussion

The aim of this research was to determine the predictive role of 2x2 achievement goal orientations on math attitudes with structural equation modeling. It was hypothesized that learning-approach goal orientations would be associated negatively and learning-avoidance, performance-approach, and performance-avoidance goal orientations would be associated positively with negative math attitudes. It was also expected that learning-approach and learning-avoidance goal orientations would be related positively and performance-approach and performance-avoidance goal orientations would be related negatively with positive math attitudes. The fit indexes indicated that correlations among measures were explained by the model and that its formulation was psychometrically quite acceptable (Hu & Bentler, 1999). The results of SEM confirm these hypotheses and the importance of achievement goal orientations, specifically learning-approach goal orientation, for better understanding of math attitudes. These findings also show achievement goal orientations as important determinants of math attitudes.

In interpreting the results of the present findings, several plausible explanations exist. First, the path model indicated that learning-approach goals predicted positive math attitudes in a positive way. This result is parallel with previous studies (Akın, 2008a, b; Akın, 2010; Ames, 1992; Dweck & Leggett, 1988; Meece et al., 1988; Midgley & Urdan, 2001; Roeser, Midgley, & Urdan, 1996) which demonstrated that learning-approach goal orientation has strong associations with numerous adaptive academic and motivational outcomes, including perceived ability, task engagement, attributions of success to effort, academic achievement, self-efficacy, use of cognitive and self-regulatory strategies, internal academic locus of control, and self-compassion. Moreover students with learning-approach goal orientation have more positive attitudes about themselves (Robins & Pals, 2002) and they believe that they need to make the necessary effort to succeed and that succeeding or failing are directly relevant to them. It is also important to note that both positive math attitudes (Gallagher & De Lisi, 1994; Hannula 2002; Lopez, Lent, Brown, & Gore 1997; Midgley, Feldlaufer, & Eccles 1989; Tapia & Marsh 2001; Webster & Fisher, 2000) and learning-approach goal orientation (Albaili, 1998; Tanaka & Ysmauchi, 2001) are related positively to greater performance and achievement. Therefore the positive association between learning-approach goals and positive math attitudes is not surprising and this result suggests that learning-approach goal orientation is a strong predictor of positive math attitudes.

Second, as expected, learning-avoidance goal orientation predicted both positive and negative attitudes positively. Learning-avoidance goal orientation is related to some adaptive or maladaptive variables and therefore, this orientation is less adaptive compared to learning-approach goal orientation. Also students with learning-avoidance goal orientation have some concerns such as not to be able to learn the subject with its all details or to forget what they learn (Elliot & McGregor, 2001). Besides, these students display perfectionist behaviors, try to avoid failure, and when they cannot do this, they feel much guiltiness (Conroy, Elliot, & Hofer, 2003). As a result students who adopt LVGO can experience negative and positive outcomes in their learning process and can develop both negative and positive attitudes toward learning and privately toward mathematics.

Third as anticipated, results demonstrated that performance-approach goal orientation predicted positive math attitudes negatively and negative math attitudes positively. Since students who high in performance-approach goal orientation are also have higher level of negative affectivity, anxiety and lower level of persistence (Eppler & Harju, 1997; Meece et al., 1988) they are less likely to sustain their efforts, react maladaptively when they fail (Ames & Archer, 1988), and behave in a learned helplessness way when faced with difficulties (Dweck & Leggett, 1988). So they may develop more negative math attitudes. And last, consistent with the hypothesis performance-avoidance goal orientation predicted positive math attitudes in a negative way and negative math attitudes in a positive way. Negative math

attitudes can produce negative results in mathematics thus creating mathematics anxiety (Vinson, 2001). Parallelly, students with performance-avoidance goal orientation tended to avoid appearing unsuccessful and clumsy (Elliot & Church, 1997) and thus they give more importance to other students and peers than themselves. The negative focus of this orientation may drive students to experience anxiety, evaluated threat, shame, and fear of failure (Elliot & Church, 1997). This means that the negative math attitudes and performance-avoidance goal orientation share the same motivational properties and the positive relationship between these two variables is quite reasonable.

Limitations of the present study should be considered when interpreting these results. First of all, perhaps the most important limitation is that the results obtained in this study should not be generalized neither to all university students nor to other student populations, since the data were collected at just one campus in Sakarya University, Turkey. Therefore further study is required to assess the relationship between achievement goals and math attitudes that targeting other student populations to generate more solid relationships among the constructs examined in this study. Secondly, because this research intended to build a model rather than test a model which is already exists, findings from the research are of explanatory characteristics. Therefore, if it is not tested on another sample, it is wise to avoid taking the findings as definite. Thirdly, even though structural equation modeling suggests results related to causality, it is difficult to give a full explanation related to causality among the variables examined in the research, because correlational data were used. Fourthly, the data reported here for achievement goals and math attitudes are limited to self-reported data and did not use a qualitative measure of these variables. In conclusion, this research proves that the achievement goal orientations affect math attitudes directly. However more research is needed to examine the antecedents of the math attitudes.

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