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ABSTRACT

This study was undertaken to understand a motivation model in the context of the Korean elementary school mathematics class. The sample consisted of 178 fourth graders (boys=95; girls=83) from 2 Korean elementary schools. This study showed that a goal mediational model could be modified and successfully applied to the context of the Korean elementary school math class. Students' learning and performance goal orientations directly influenced their learning strategies as Meece, et al. (1988) reported. However, students' learning goal orientation had the bigger influence on their learning strategies. Students' math attitudes and effort had direct effects on their learning goal orientation, and had indirect effect on their learning strategies. Students' competence beliefs had direct effects on their math attitudes, effort, and performance goal orientation, and had indirect effects on their learning goal orientation and learning strategies. (Contains 26 references.) (Author/SAH)

The Motivational Construct in Mathematics Learning Using Structural Equation Modeling: The Korean Elementary School Math Class

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Abstract

This study was undertaken to understand a motivation model in the context of the Korean elementary school mathematics class. The sample consisted of 178 fourth graders (boys = 95; girls = 83) from two Korean elementary schools. This study showed that a goal mediational model could be modified and successfully applied to the context of the Korean elementary school math class. Students' learning and performance goal orientations directly influenced their learning strategies as Meece et al. (1988) reported. However, students' learning goal orientation had the bigger influence on their learning strategies. Students' math attitudes and effort had direct effects on their learning goal orientation, and had indirect effect on their learning strategies. Students' competence beliefs had direct effects on their math attitudes, effort, and performance goal orientation, and had indirect effects on their learning goal orientation and learning strategies.

It has been reported that students must be involved in an active process of integrating and organizing new information, constructing meaning, and monitoring comprehension so that they can develop a sound understanding of a subject matter. However, students have difficulties in activating effectively their appropriate knowledge and strategies in their class. In addition, teachers also have difficulties in getting students to engage themselves purposefully and actively in their learning process. These problems may be attributable to both cognitive and motivational variables that play an important role in students' learning (Pintrich & Schrauben, 1992; Pintrich & Schunk, 1995; Weinstein & Mayer, 1986; Pokay & Blumenfeld, 1990; Wittrock, 1991).

Research on students' motivation and learning strategies has suggested that students' motivation relate to their learning strategies, as well as to their academic achievement (Meece et al., 1988; Pintrich & De Groot, 1990; Pintrich & Schrauben, 1992; Pintrich & Schunk, 1995; Pokay & Blumenfeld, 1990; Weinstein & Mayer, 1986; Wittrock, 1991). To investigate these theoretical constructs, Meece et al. (1988) developed a goal mediational model and successfully conceptualized students' motivational beliefs and learning strategies using the model in an elementary school science class.

Korean social and cultural characteristics ask children from their early days to realize how important mathematics is in their school life. One reason for this asking is that mathematics achievement is one of the most important entrance requirements for college. The Third International Mathematics and Science Study (TIMSS) reported that Korean 4th-graders had the highest mean scores in mathematics and science achievement tests compared to all fourth graders worldwide (Mullis et al., 1997). In addition, the TIMSS reported on how students' individual backgrounds related to their math learning: more than 90% of Korean fourth graders reported that individual ability was necessary to do well in mathematics, more than 95% of them also believed that individual effort was necessary to do well in mathematics, and more than one-quarter of them indicated that they didn't like mathematics. Because of these responses, we investigated how students' motivational beliefs related to their academic achievement, as well as to their learning strategies in the context of the Korean elementary math class in their math class under the Meece et al.'s (1988) model.

Students' Learning Strategies

Recent cognitive researchers argued that students must be considered as active learners in their class. They get involved in class activities and make meaningful connections between new incoming information and what they have already known. Thus, the outcomes of learning depend on what information is presented to students, as well as how they process that information (Weinstein & Mayer, 1986; Wittrock, 1991). In regard to learning strategies, researchers have examined two general learning strategies. The first one, general cognitive strategies, refers to integrating new material with prior knowledge. The second one, metacognitive strategies, refers to planning, monitoring, and evaluating their own cognition (Pintrich & Schrauben, 1992; Pintrich & De Groot, 1990; Weinstein & Mayer, 1986; Wittrock, 1991).

Motivation researchers have suggested that students' learning strategies relate to their academic achievement (Pintrich & Schrauben, 1992; Pintrich & De Groot, 1990; Pokay & Blumenfeld, 1990; Anderman & Young, 1994). Regarding relationships between academic achievement and learning strategies, however, it has been reported that metacognitive strategies are more predictive of students' academic achievement than are general cognitive strategies (Pintrich & De Groot, 1990; Pokay & Blumenfeld, 1990). On the other hand, factor analysis reported that general cognitive and metacognitive strategies highly correlated with each other (Pintrich & De Groot, 1990; Pintrich & Schrauben, 1992). For these reasons, we focused on metacognitive strategies that students used in math class, and investigated how they related to their academic achievement and motivational beliefs.

Students' Motivational Beliefs

Motivation researchers have included students' competence-related beliefs as one of the important motivational factors in their model to explain why students are motivated to learn in their class (Eccles & Wigfield, 1995; Harter, 1982; Pajares, 1996; Pintrich & Schunk, 1995). Eccles, Wigfield, and ther colleagues have asked students to report their expectancy-related beliefs, such as how well they expect to do and how good they are in an academic subject (Eccles et al., 1983; Eccles & Wigfield, 1995; Wigfield et al., 1997). Harter (1982) developed a scale to assess how children perceive their competence. Other researchers have focused on students' self-efficacy in terms of competence-related beliefs (Pajares, 1996). Self-efficacy is defined in terms of individuals' perceived capabilities to attain designated types of performances and achieve specific results. In academic settings, for example, self-efficacy instruments may ask students to rate their confidence to solve specific mathematics problems (Pajares, 1996). Self-efficacy differs from the other constructs in assuming that self-efficacy perceptions are much more situation specific than the other expectancy beliefs. However, those three different constructs deal with individuals' judgements of their capabilities.

It has also been reported that students' competence beliefs related to their achievement, intrinsic motivation, task values, and learning strategies. Kloosterman (1988) argued that students' competence beliefs positively relate to their math achievement. Harter (1982) reported that children who perceived themselves as being academically competent generally developed an intrinsic motivation. Eccles and Wigfield (1995) suggested that students' competence beliefs and their task values are correlated with each other, but competence beliefs predict their academic achievement better than task values do. Regarding relationships between students' competence beliefs and learning strategies, Pintrich and his colleagues (Pintrich & De Groot, 1990; Pintrich & Schrauben, 1992) have found that students' competence beliefs positively related to their learning strategies. Pokay and Blumenfeld (1990) also reported that students' learning strategies were predicted by their expectancy.

In terms of the influence of cultural and social environment on students' expectancy beliefs, Eccles and colleagues (Eccles, 1983; Wigfield, 1994; Wigfield & Eccles, 1992; Wigfield et al., 1997) have argued that students' expectancy for academic success should be explained by their interactions with parents, peers, or teachers, and predicted by their past performance and achievement. In the Korean cultural context, mother plays a unique role in students' learning in many ways. Thus, we investigated how mother's involvement influenced their children's academic motivation and related to their academic activities in math class.

Dweck and Bempechat (1983) argued that children's definitions of intelligence determine their goals in achievement situations: children holding the entity view that intelligence is fixed will be more likely to adopt performance goals in which obtaining positive evaluations of competence is most important. Children holding the incremental view that their abilities can be improved will be more likely to adopt learning goals, in which improvement of skills is most important. In elementary math class, Kloosterman (1988) reported that there was a positive correlation between effort and self-competence in mathematics learning. Effort as a mediator of mathematical ability is defined as the extent to which students feel that they can increase their mathematical ability by studying math.

Stevenson (1993) suggested that there is evidence of cultural differences between American and Asian students and their mothers in the relative emphasis given to effort and ability in accounting for the achievement of elementary school children. For example, Chinese and Japanese fifth graders and their mothers stressed the importance of hard work as the route to success. The TIMSS (1997) reported how the Korean elementary students perceive their ability and effort in their math achievement: more than 90% of Korean fourth graders reported that individual ability was necessary to do well in mathematics, and more than 95% of them also believed that individual effort was necessary to do well in mathematics. Because of these findings, we investigated how students' effort and ability interact with other motivational variables and their academic achievement.

The goal mediatioal model suggested by Meece et al.'s (1988) suggested that students' attitudes toward science play an important role in explaining their learning strategies. These attitudes had an indirect effect on their learning strategies through their learning goal orientation. Ames and Archer (1988) also reported that students who were oriented toward learning goal had higher attitudes to the class than performance goal orientation. The TIMSS (1997) reported how much the Korean elementary school students liked their math learning, and more than one-quarter of the Korean fourth graders reported that they did not like mathematics. With these findings, we investigated how students' attitudes toward math interacted with other motivational variables and their academic achievement.

Achievement goals are assumed to be cognitive presentations of the different purposes that students may adopt in different achievement situation (Ames, 1992; Ames & Archer, 1988; Elliot & Dweck, 1988; Pintrich & Schunk, 1995). A number of researchers have discussed goal orientation theories using alternative terms and definitions (Ames, 1992; Ames & Archer, 1988; Elliot & Dweck, 1988; Nicholls, 1984). There may be a number of different orientations, but two contrasting achievement goal constructs have received the most attention in the research literature: learning goal and performance goal (Dweck & Elliot, 1983; Elliot & Dweck, 1988), task-involvement goal and ego-involvement goal (Nicholls, 1984), or mastery goal and performance goal (Ames & Ames, 1984; Ames, 1992). There is some disagreement among these researchers about whether all these goal pairs represent the same constructs, but there is enough conceptual overlap to treat them in similar ways (Ames, 1992; Pintrich & Schrauben, 1992; Pintrich & Schunk, 1995; Midley et al., 1998).

Conceptually, learning, task-involvement, and mastery goals can be distinguished from performance and ego-involvement goals (Ames, 1992; Ames & Archer, 1988; Elliot

& Dweck, 1988; Nicholls, 1984; Pintrich & Schunk, 1995). Learning goal orientation focuses on the intrinsic value of learning as well as effort utilization. With learning goal orientation, students believe that effort will lead to success. They are also oriented toward developing new skills, trying to understand their work, improving their level of competence, or achieving a sense of mastery based on self-referenced standard. It has also been reported that learning goals related positively to general cognitive and self-regulatory strategies. For example, students who are oriented to learning goal are more cognitively engaged in trying to learn and comprehend the material (Ames, 1992; Ames & Archer, 1988; Elliot & Dweck, 1988; Meece et al, 1988; Pintrich & Schrauben, 1992; Pintrich & De Groot, 1990; Pintrich & Schunk, 1995).

Performance goal orientation focuses on one's ability and sense of self-worth. Ability is evidenced by doing better than others, surpassing normative-based standards, or by achieving success with little effort. Especially important to a performance orientation is public recognition that one has done better than others or performed in a superior manner (Ames, 1992; Ames & Archer, 1988; Elliot & Dweck, 1988; Pintrich & Schunk, 1995). In the model of Meece et al.(1988), learning and performance goal orientations had a direct influence on students' learning strategies: learning goal orientation had bigger influence than performance goal orientation. Thus, we investigated how elementary school students' goal orientations interacted with other motivational variables and academic achievement.

Method

Subjects

The sample in this study consisted of 178 fourth graders (male = 95; female = 83) from two elementary schools in Korea. The students were from a middle class small town. Within each classroom, all students were asked to participate. Project staff members administered questionnaires to students who had returned their consent forms indicating their willingness to participate. All questionnaires were administered in the middle of February in 1999. All questions were also read aloud to all the students in mathematics class.

Procedure and Measures

In the middle of February, the students completed the questionnaire measuring their perceptions of their mothers' influence, competence beliefs, attitudes toward mathematics, effort, goal orientations, and learning strategies to see how those motivational variables interrelated to each other in students' math learning. Students completed the questionnaire just after the math class. All items were answered using a 5-point Likert-style response scale. In addition, we collected two previous mathematics achievement tests administered by the school district in the early spring and fall semesters in 1999.

Students' perceptions of their mothers' influence on math. The two mothers' influence items asked the children how important their mother thought it was to do well in mathematics in school and how important their mother thought it was to be placed in the high achieving class. Students rated each item on a 5-point scale in terms of their level of agreement. The reliability of the scale for this study was .68.

Attitudes toward mathematics. To obtain a general assessment of students' mathematics attitudes, we used 2 items from the TIMSS (1997) as well as Meece et al.'s

(1988) study. We included items assessing interest and enjoyment. Students rated each item on a 5-point scale in terms of their level of agreement. The reliability of the scale for this study was .83.

Effort. As a mediator of mathematical ability, effort was defined as the extent to which students felt that continued effort in mathematics would result in greater ability to do mathematics (Kloosterman, 1988). The scale included items developed by Kloosterman (1988), such as "By trying hard I can become smarter in mathematics" and "My ability in mathematics will increase if I study hard." A high score on this scale is indicative of an incremental view of intelligence. A low score on this scale indicates a feeling that mathematical ability is a constant quantity. The reliability of the scale for this study was .83.

Competence beliefs. To scale students' competence beliefs, we adapted 3 items from a couple of questionnaires (Eccels & Wigfield, 1995; Kloosterman, 1988). Students responded on a 5-point Likert-type scale to 3 items, such as " I can get good grades in mathematics", "Most subjects I can handle O.K, but I often do poorly in mathematics", and "I have a lot of self-confidence when it comes to mathematics". The reliability of the scale for this study was .84.

Goal orientations. We administered 3 items for learning goal orientation and 2 items for performance goal orientations. Learning goal orientation contained items that implied that the student's goal was to learn something new, to learn as much as possible, or to learn more than just the answer. The reliability of the scale for this study was .72.

Performance goal orientation contained items that implied that the student's goal was to impress others. The reliability of the scale for this study was .57.

Learning strategies. This scale included 3 items tapping dimensions of self-regulated leaning strategies, such as planning and monitoring. Students rated on a 5-point scale how well each statement described what they had done in class that day. A thought-matching methodology was used because this methodology has been successfully used in Meece et al. (1988). The reliability of the scale for this study was .61.

Previous achievement. Students' prior achievement tests were used as a measure of their academic achievement. We collected two previous mathematics tests that had been administered by the school district in the early spring and fall semesters in 1999. The reliability of the scale of the scale for this study was .81

Data Analyses

Confirmatory Factor Analysis (CFA) not only allows researchers to test more precisely the hypothesized structure of a set of factors, but also provides statistical information about the models that help researchers to choose the best fitting model. The particular program used for this study was EQS. To choose good fit indices to assess how well a given model fits the data, we considered that a good fit index should have a large model misspecification effect accompanied with trivial effects of sample size, distribution, and estimation method (Hu & Bentler, 1998).

The chi-square test assesses the magnitude of discrepancy between the original sample covariance and the covariance matrix that is reproduced, based on model specification. Therefore, the chi-square test based on Maximum Likelihood (ML) can be the mostly widely used summary statistics if the assumption of multivariate normality of variables is held. However, this test is considerably affected by the sample size. Because of the disadvantage of the chi-square test for model fit assessment, a variety of fit indices have been developed. Among fit indices, standardized root-mean-square residual (SRMR) can be generally used because this fit index is sensitive to model misspecification but less sensitive to estimation method, distribution, and sample size. Specially, when sample size is small (e.g., 250≥N), ML-based SRMR is preferable. Root mean-mean-square error of approximation (RMSEA) is moderately sensitive to model misspecification and less sensitive to distribution and sample size. So, ML-based on RMSEA is also recommended. Comparative fix index (CFI) is moderately sensitive to model misspecification and less sensitive to distribution and sample size. But, ML-based CFI is more preferred when sample size is small (e.g., 250≥N), even if this fit index can be used generally. We also used Turket-Lewis index (TLI) for this study, which compares the fit of a theoretical model to the model hypothesizing no relations between the variables (Eccels & Wigfield, 1995). Therefore, we used fit indices, such as chi-square, TLI, CFI, SRMR, RMSEA to assess the adequacy the hypothesized models (Fan et al., 1999; Hutchinson & Olmos, 1998; Hu & Bentler, 1998; Hu & Bentler, 1998).

Hypothesized Model of Students' Motivational Beliefs and Leaning Strategies

The hypothesized model was primarily based on previous research. First, we hypothesized that students' goal orientations had a direct effect on their learning strategies as suggested by motivation researchers (Ames, 1992; Ames & Archer, 1988; Elliot & Dweck, 1988; Meece et al, 1988; Pintrich & Schrauben, 1992; Pintrich & De Groot, 1990;

Pintrich & Schunk, 1995). Second, we hypothesized that students' attitudes toward mathematics had an indirect effect on their learning strategies through learning goal orientation. Third, we hypothesized that students' effort also had an indirect effect on their learning strategies through learning goal orientation (Kloosterman, 1988; Ames & Archer, 1988; Ames, 1992). Fourth, as Eccles (1983) and Wigfield et al. (1997) suggested, we hypothesized that students' perceptions of their mothers' influence had an influence on students' competence beliefs. Fifth, we hypothesized that their perceptions of the their mothers' influence also had an influence on their performance goal orientation. Sixth, we hypothesized that competence beliefs had an influence on students' attitudes and effort as well as on their learning strategies through goal orientations (Ames, 1992; Harter, 1982).

Results

Correlational Analyses

Table 1 shows the zero-order intercorrelations among students' previous academic achievement, their perceptions of their mothers' influence, their motivational variables, and their learning strategies [Insert table One]. Students' previous academic achievement had positive relationships with their mother's influence and learning strategies. It also had positive relationships with other motivational variables: competence beliefs, math attitudes, learning goal orientation and effort. However, it didn't have any relationship with performance goal orientation. Mother's influence had positive relationships with students' previous academic achievement and their learning strategies. It also had positive relationships with motivational variables: performance goal orientation, competence beliefs, math attitudes and learning goal orientation, but it didn't have any relationship with effort. Regarding relationships between students' learning strategies and other variables, they had positive relationships with previous academic achievement and mothers' influence. They also had positive relationships with motivational variables: competence beliefs, math attitudes, learning goal orientation, performance goal orientation, and effort.

In terms of relationships among motivational variables, most of them were positively correlated with each other. Students' math attitudes had positive relationships with competence beliefs, learning goal orientation and effort, but they didn't have any relationship with performance goal orientation. Students' effort had positive relationships with competence beliefs, math attitudes, and learning goal orientation, but it didn't have any relationship with performance goal orientation. Competence beliefs had positive relationships with math attitudes, effort, and learning goal orientation and performance goal orientation. Learning goal orientation had positive relationships with math attitudes, competence beliefs, effort and performance goal orientation. Performance goal orientation had positive relationships with competence beliefs, learning goal orientation and effort, but it didn't have any relationships with math attitudes.

Tests of the Hypothesized Model

The model that appears on Figure 1 had good fit indices (e.g. chi-square = 147.888, df = 107 ($p<.001$); TLI = 0.954 CFI = 0.963; SRMR= 0.058; RMSEA = 0.047) [Insert figure One]. The empirical hypotheses were generally confirmed. First, students' competence beliefs had a direct effect on their math attitudes, effort, and their performance goal orientation, and indirectly influenced their learning goal orientation and learning strategies (Ames & Archer, 1988; Ames, 1992; Pintrich & De Groot, 1990; Pintrich &

Schrauben, 1992). Second, students' math attitudes had a direct effect on their learning goal orientation and indirect effect on their learning strategies (Ames & Archer, 1988; Meece et al. 1988). This study also showed that students' effort had a direct effect on their learning goal orientation and indirect effect on their learning strategies (Ames, 1992; Kloosterman, 1988). Third, students' learning and performance goal orientations had unmediated effects on their learning strategies (Meece et al., 1988; Pintrich & De Groot, 1990; Schunk & Pintrich 1996). However, learning goal orientation had a bigger direct influence on students' learning strategies as reported by previous research (Ames, 1992; Ames & Archer, 1988; Meece et al., 1988; Schunk & Pintrich 1995). Fourth, students' perceptions on their mother's influence had a direct effect on their competence beliefs (Eccles, 1983; Wigfield, 1994; Wigfield & Eccles, 1992), as well as on their performance goal orientation. In addition, they indirectly influenced their math attitudes, effort, learning goal orientation, and learning strategies.

Finally, the direct, indirect, and total effects of motivational factors are shown in Table 2 [Insert table TWO]. As I explained before, the learning goal orientation had the biggest direct effect on their learning strategies. In terms of total effects of mothers' influence and students' motivational variables on their learning strategies, mother's influence was not statistically significant. However, students' competence beliefs had the biggest total effects on their learning strategies. The effects of their learning goal orientation, performance goal orientation, effort, and math attitudes were in order respectively regarding total effects of motivational beliefs on their learning strategies.

Discussion

Students need to connect and organize new information actively and elaborately with their previous knowledge to have a sound understanding of a subject matter. As pointed out by previous research, however, students have difficulties in activating and using their learning strategies because of their motivational and cognitive grounds (Pintrich & De Groot, 1990; Pintrich & Schrauben, 1992; Wittrock, 1991). Meece et al. (1988) developed a goal mediational model so that they could conceptualize an inner construct of students' motivational beliefs in elementary school science class. Thus, we modified and applied their goal mediational model into the context of the Korean elementary school math class to see what the Korean motivation model looked like.

First, this study shows how the goal mediational model suggested by Meece et al. (1988) can be expanded in the context of the Korean elementary school math class. The Korean social and cultural characteristics allow the Korean mothers to develop a close relation with their children and them to get closely involved in their children's math learning. For example, they ask their children from their early days to realize how much important it is to get good grades in math class. The close involvement leads their children to develop their competence beliefs as the results of this study shows. It has also been suggested that mothers' interactions with their children should have a unique influence on their children's competence beliefs (Eccles, 1983; Wigfield et al., 1997). The current study also shows that mothers' concern and interest have an influence on their children's performance goal orientation through their competence beliefs. Mothers also have an influence on their children's attitudes and effort as the results of this study shows. Thus, we suggest that the Korean mothers have a unique roles in their children's math learning. However, this study focuses on students' perceptions of their mothers' interest and concern. For the future study, we are recommended that we should directly interview mothers on their interest in their children's math learning.

This study indicates that both students' learning and performance goal orientations have direct influences on their learning strategies as reported in the goal meditional model by Meece et al. (1988). However, students' learning goal orientation has the bigger direct effect on their learning strategies than their performance goal orientation and the biggest direct effect on their learning strategies (Meece et al., 1988). Students' learning goal orientations mediated the effects of their math attitudes, efforts and competence beliefs. Consistent with previous research, students' learning goal orientation positively relates to other motivational variables such as math attitudes, effort, and competence beliefs, as well as to previous academic achievement (Ames & Archer, 1988; Ames, 1992; Anderman & Young, 1994; Meece et al., 1988; Pintrich & De Groot, 1990; Pintrich & Schrauben, 1992). For these findings, we suggest that students' learning goal orientation is a major factor in contributing to their learning strategies in elementary school math class.

Students' performance goal orientation positively relates to their learning goal orientation and learning strategies. But, it does not relate to either their academic achievement, or math attitudes. The results of structural model indicate that students' performance goal orientation has a direct effect on their learning strategies as reported by Meece et al. (1988). Midgley et al. (1998) indicated that performance goal orientation was sometimes linked to adaptive learning strategies and other times to maladaptive patterns of learning strategies. According to their theoretical approach to the confused roles of performance goal orientation, previous research has been done without separating performance goal orientation into the two constructs of ability-approach and ability-avoid. Our study also showed a positive relationship between performance goal orientation and learning strategies because we focused only on the ability-approach construct of performance goal orientation.

This study shows that students' learning goal and performance goal orientations positively relate to each other (Midley at al., 1998). As suggested by previous research, of course, learning goal orientation leads to deeper levels of cognitive engagement, but lacking an intrinsic goal, it is also important for students to be motivated extrinsically, to participate in the classroom and not be alienated from it (Pintrich & Schrauben, 1992; Pintrich & Schunk, 1995). Thus, we suggest that students can hold both goal orientations even if they have different sources in their math learning as previous studies have shown (Ames, 1990; Pintrich & Schrauben, 1992; Pintrich & Schunk, 1995).

Students' math attitudes take a similar role in the context of the Korean elementary school mathematics class as reported by Meece et al. (1988). Math attitudes positively relate to other motivational variables such as effort, competence beliefs and learning goal orientation, as well as to their academic achievement and learning strategies (Ames & Archer, 1988; Meece et al., 1988). Math attitudes have a direct influence on their learning goal orientation and have an indirect effect on their learning strategies. They also mediate their competence beliefs. Students' effort takes a similar role as math attitudes do in this study. It positively relates not only to other motivational variables such as attitudes, competence, but also to learning goal orientation and learning strategies. Students' effort has a direct effect on their learning goal orientation and have an indirect effect on students' learning goal orientation. It also mediates their competence beliefs. Taking into account those mediating roles played by both student's math attitudes and effort, we suggest that they play take a similar role in students' math learning: They give students one of reasons to sustain learning goal orientation, based on their competence beliefs.

Students' competence beliefs have positive relations with previous achievement, attitudes, effort, learning goal orientation, performance goal orientation, and learning strategies as suggested by previous research (Ames, 1992; Harter, 1982; Kloosterman, 1988; Eccles & Wigfeld, 1992; Meece et al., 1988; Pintrich & De Groot, 1990; Pokay & Blumenfeld, 1990). Students' competence beliefs have a direct effect on students' math attitudes and effort. They have an indirect effect on their learning goal orientation and have a direct effect on their performance goal orientation. In particular, their competence beliefs mediate mothers' interest and concern. For these findings, we assume that the Korean elementary students who are competent in their math ability and who believe that it is important to get good grades in math class hold onto performance goal orientation: they try to do better than others in class and show them how smart they are. However, we also suggest that students' competence beliefs have a very important effect on students' attitudes, effort, learning goal orientation and learning strategies.

In summary, this study expands the goal mediational model suggested by Meece et al. (1988) in the context of the Korean elementary school math class. The Korean mothers play a unique role in students' math learning. They develop a close relation with their children and ask their children from their early ages to perceive the importance of mathematics in school life. Their close interactions with their children help their children help their children to develop their competence beliefs in math learning and lead them to hold their performance goal orientation. However, students who are confident at their math ability and believe that it is important to get a good grade in math class also try to use their learning strategies effectively in their math class. On the other hand, the Korean elementary school students who like math and believe that they can increase their math competence by their own effort hold on to their learning goal orientation. They also try to use their learning strategies effectively in their math class. In conclusion, the Korean elementary students who hold either learning goal orientation or performance goal orientation, or hold both goal orientations try to use their learning strategies effectively in their math class. However, learning goal orientation has a more important influence on students' learning.

Regarding the limitation of this study, we used only the two elementary schools in a small school district and didn't validate whether or not this model could be applicable to a different context- different schools, and different subject matter. Thus, we will conduct a validation study using a bigger sample size for the future study. Second, girls' math achievement in early elementary school is higher than boys' according to previous research. However, this pattern reverses from junior high school through the remainder of schooling (Dweck, 1986; Pressley & McCormick, 1995). Regarding this topic, it has been explained that girls' expectations about academic achievement tend to be lower than boys' expectations, and these different expectations lead to different challenges in math class. Even if we agree on their suggestions, however, we didn't focus on the sex differences in math learning. So, we will investigate whether or not boys and girls have the same construct of achievement motivation in math class for the future study. Students' academic goal orientations could be investigated with three conceptual constructs as discussed before (Midley et al., 1998). However, this study focused only on ability-approach goal orientation. As a consequence, we will investigate the extent to which we will be able to modify the goal mediational model suggested in this study with the concept of three goal orientations, and see how the modified model will play a mediational role in math learning. Finally, we will include student's task values in the goal mediational model, and figure out the extent to which they have an influence on students' learning strategies, as previous research has suggested that students' task values have not been highlighted by motivational researchers even if they are important variables to explain students' motivational beliefs (Eccles et al., 1983; Eccles & Wigfeld, 1995; Wigfield & Eccles, 1992).

References

Ames, C. (1992). Classroom: Goals, structures, and student motivation. *Journal of Educational Psychology, 84,* 261-271.

Ames, C., & Archer, J. (1988). Achievement goals in the classroom: Student learning strategies and motivation processes. *Journal of Educational Psychology, 80,* 260-267.

Anderman, E.M., & Young, A.J. (1994). Motivation and strategy use in science: Individual differences and classroom effects. *Journal of Research in Science Teaching, 31,* 811-831.

Bandura, A. (1989). Human agency in social cognitive theory. *American Psychologist, 44,* 1175-1184.

Dweck, C. S. (1986). Motivational processes affecting learning. *American Psychologist, 41,* 1040-1048.

Dweck, C. S., & Bempechat, J. (1983). Children's theories of intelligence: Consequences for learning. In S. G. Paris, G. M. Plson & H. W. Stevenson (Eds), *Learning and motivation in the classroom* (pp. 239-256). Hillsdale, NJ: Erlbaum.

Dweck, D., & Leggett, E. (1988). A social-cognitive approach to motivation and personality. *Psychology Review, 95,* 256-273.

Eccles, J. (1983). Expectancy, values, and academic behaviors. In J. T. Spence (Ed.), *Achievement and achievement motives: Psychological and social approaches* (pp. 75-146). San Francisco: Freeman.

Eccles, J., & Wigfield, A. (1995). In the mind of the actor: The structure of adolescents' achievement task values and expectancy-related beliefs. *Personality and Social Psychology Bulletin, 21,* 215-225.

Elliott, E., & Dweck, C. (1988). Goals: An approach to motivation and achievement. *Journal of Personality and Social Psychology, 54,* 5-12.

Harter, S. (1982). The perceived competence scale for children. *Child Development, 53,* 87-97.

Hu, L., & Bentler, P. M. (1998). Fit indices in covariance structure modeling: Sensitivity to underparameterized model misspecification. *Psychological Methods, 3,* 424-453.

Kloosterman, P. (1988). Self-confidence and motivation in mathematics. *Journal of Educational Psychology, 80,* 345-351.

Meece, J. L., Blumenfeld, P. C., & Hoyle, R. H. (1988). Students' goal orientation and cognitive engagement in classroom activities. *Journal of Educational Psychology, 80,* 514-523.

Mullis, I.V.S., Martin, M. O., Beaton, A. E., Gonzalez, E. J., Kelly, D. L., and Smith, T. A. (1997). *Mathematics achievement in the primary school years: IEA's Third International Mathematics and Science Study (TIMSS).* Chestnut Hill, MA: Boston College.

Nicholls, J. G. (1984). Achievement motivation: Conceptions of ability, subjective experience, task choice, and performance. *Psychological Review, 91,* 328-346

Pajares, F. (1996). Self-efficacy beliefs in academic settings. *Review of Educational Research, 66,* 543-576.

Pintrich, P. R., & DeGroot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology, 82,* 33-40.

Pintich, P. R., & Schunk, D. H. (1996). *Motivation in education: Theory, research, and application.* Englewood Cliffs, New Jersey: Merrill.

Pintrich, P.R., & Schrauben, B. (1992). Students' motivational beliefs and their cognitive engagement in classroom academic task. In: D. H. Schunk & J. L. Meece (Eds.), *Student perceptions in the classroom* (pp. 149-183). Hillsdale, NJ: Erlbaum.

Pokay, P. & Blumenfeld, P.C. (1990). Predicting achievement early and late in the semester: The role of motivation and use of leaning strategies. *Journal of Educational Psychology, 82,* 21-50.

Stevenson, H.W., Chen, C., & Lee, S.H. (1993). Mathematics achievement of Chinese, Japanese, and American Children: Ten years later. *Science, 259,* 53-58.

Wigfield. A. (1994). Expectancy-value theory of achievement motivation: A developmental perspective. *Educational Psychological Review, 6,* 49-78.

Wigfield. A., & Eccles, J. (1992). The development of achievement task values: A theoretical analysis. *Developmental Review, 12,* 265-310.

Wigfield, A., Harold, R.D., Freedman-Doan, C., Eccles., J.S., Yoon, K., Arbreton, A.J.A., & Blumenfeld, P.C. (1997). Change in children's competence beliefs and subjective task values across the elementary school years: A 3-year study. *Journal of Educational Psychology, 89,* 451-469.

Wittrock, M. C. (1991). Generative teaching of comprehension. *The Elementary School Journal, 92,* 169-184.

Table 1

Zero-Order Correlations for Motivational Variables and Learning Strategies

Variable	1	2	3	4	5	6	7	8
1. Previous achievement	-----							
2. Mother's influence	.21**	-----						
3. Attitude	.36**	.24**	------					
4. Effort	.22**	.12	.45**	-----				
5. Competence	.52**	.25**	.64**	.52**	-----			
6. Learning goal	.36**	.23**	.49**	.44**	.47**	-----		
7. Performance goal	.04	.35**	.13	.18*	.29**	.24**	-----	
8. Learning strategies	.31**	.33**	.47**	.29**	.54**	.45**	.33**	-----

*p<.05. **p<.001.

Table 2

Standardized Direct and Total Effects of Predictors in Hypothesized Model

	Predictors					
Endogenous	Mother's Influence	Math Attitudes	Effort	Competence Belief	Learning Goal	Performance Goal
Math Attitudes						
Direct Effect	0.00			0.77***		
Cum. Indirect	0.26***			0.00		
Total Effect	0.26			0.77		
Effort						
Direct Effect	0.00			0.84***		
Cum. Indirect	0.28*			0.00		
Total Effect	0.28			0.08		
Competence Belief						
Direct Effect	0.33***					
Cum. Indirect	0.00					
Total Effect	0.33					
Learning Goal Orientation						
Direct Effect	0.00	0.37*	0.58**	0.00		
Cum. Indirect	0.26	0.00	0.00	0.77***		
Total Effect	0.26	0.37	0.58	0.77		
Performance Goal Orientation						
Direct Effect	0.48***			0.36***		
Cum. Indirect	0.12			0.00		
Total Effect	0.60			0.36		
Learning Strategies						
Direct Effect	0.00	0.00	0.00	0.00	0.67**	0.50**
Cum. Indirect	0.47	0.25*	0.39*	0.70***	0.00	0.00
Total Effect	0.47	0.25	0.39	0.70	0.67	0.50

* p < .05

** p < .01

*** p < .001

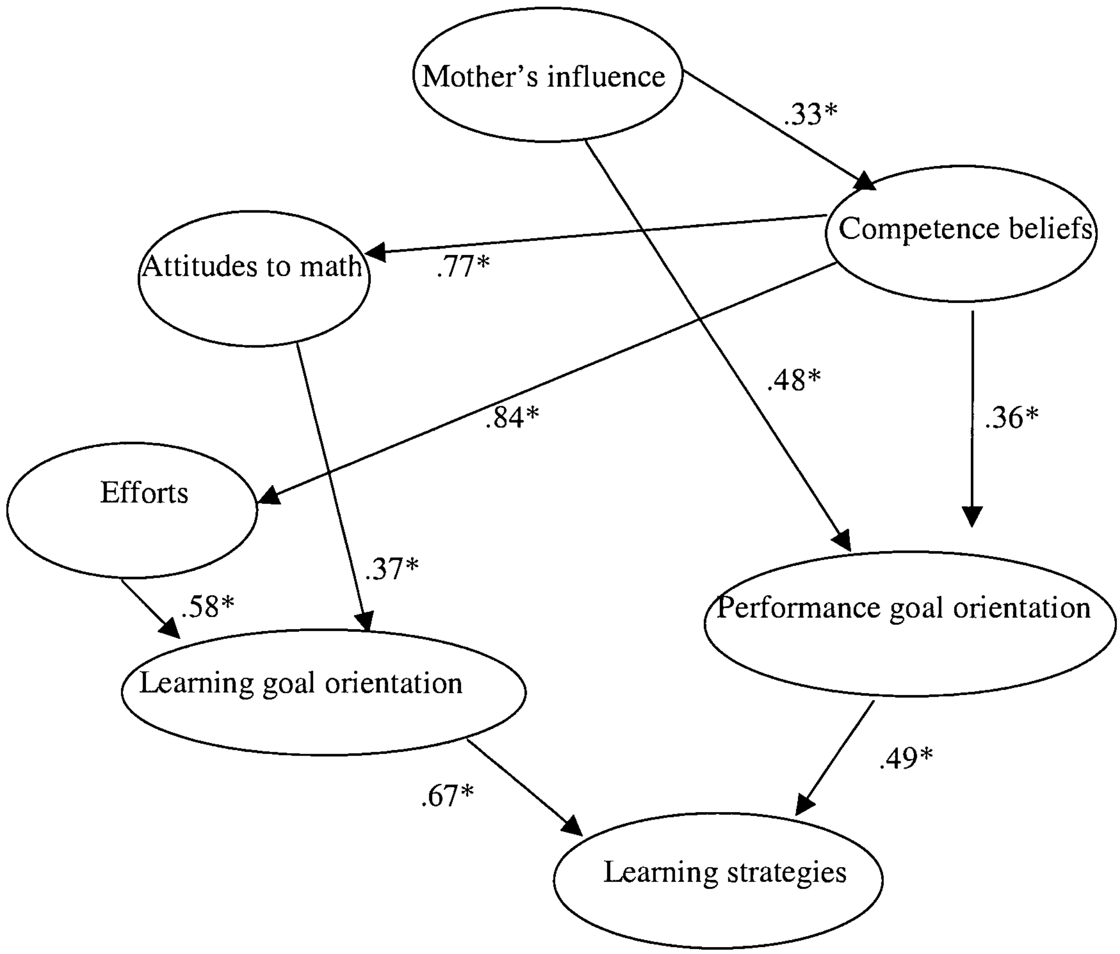

Figure 1. Estimated Structural Model of Students' Motivation and Learning Strategies (*p<.05).

27

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