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Procedia Social and Behavioral Sciences 15 (2011) 2063–2067

Procedia
Social and Behavioral Sciences

WCES-2011

# Prediction of academic performance: the role of perception of the class structure, motivation and cognitive variables

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**Abstract**

The purpose of the present study is to investigate the effect of perception of the class structure (motivating tasks, autonomy support and mastery evaluation) on mathematics achievement with the mediating role of motivation variables (perceived instrumentality and achievement goals) and cognitive variables (self-regulated learning). 200 males and 200 females among third-grade mathematics students of the Isfahan public high schools were selected randomly, who completed a questionnaire consisting of seven subscales. Furthermore, the students' final exam math grades were used to assess their mathematics performance. Path analysis method was used for data analysis. The results showed the good fit of the model and revealed that motivating tasks as an independent variable, with the mediating role of mastery goals, perceived instrumentality and self-regulated learning had a meaningful indirect effect on mathematics performance. Autonomy support with the mediating role of mastery goals and mathematics perceived instrumentality had an indirect effect on self-regulated and mathematics performance. Mastery evaluation had a meaningful direct effect on mastery goals: Performance goals and self-regulated learning had an indirect effect on mathematics performance with the mediating role of mastery goals and self-regulated learning. The mediating role of self-regulated learning between mastery goals, perceived instrumentality and mathematics achievement was confirmed.

*Keywords:* Path analysis model, Perception of class structure, Achievement goals, Self-regulated strategies, Mathematics achievements;

## Introduction

Academic achievement has always been considered by education experts and has been the focus of attention in several researches. In these researches, firstly, the effect of each of the cognitive and motivational factors was separately investigated. This was the case until, at least, in 1980s these researches focused on how learning and academic achievement of students are affected by cognitive and motivation factors. For the first time, Corno & Mandinach (1983) studied cognitive engagement as one of the cognitive factors affecting academic achievement. They considered students as person engaging in class activities who had different cognitive perceptions of

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doi:10.1016/j.sbspro.2011.04.054

themselves and their environment. Cognitive engagement has an effect on quantity and quality of a student's efforts in the class and is considered as an activated behavior factor. Corno & Mandinach realize a self-regulated strategies as the strongest form of cognitive engagement and stated that students must be able to substitute strategies regarding diverse tasks of the class (learn to learn). Meanwhile, based on "process levels" and consequently "developed process theory" (Greene., Miller, Crowson, Duke & Akey, 2004). believe that using different strategies will lead to different consequences of learning and different levels of success. In several researches, the relationship between self-regulated learning strategies and academic achievement has been supported (Simons and Bokhef 1987; Vinstin and Mayer 1986; both cited in Zimmerman, 1990). Researchers who have studied the relationship between self-regulated learning strategies and academic achievement have concluded that motivational factors have an effective role in strategies usage (vansile-tamsen and Livingstone, 1999). For instance, use of self-regulated strategies depends on motivational factors such as self-efficacy (Pintrich and Degroot, 1990), attributions of effort and self-control in success and loss (Diener and Dweck, 1978), with achievement goal (Nolen, 1996), and perceived instrumentality (Greene and Miller, 1996). Achievement goals are considered as another motivational variable affecting self-regulated strategies. In achievement goals theory, it is predicted that the goal of students to engage in success tasks has an effect on their level of engaging in performing tasks.

In others researches, it has been shown that a student whose goal is to improve individual abilities (mastery goals) uses meaningful process strategies and self-regulated strategies more than a student whose goal is to confirm their abilities (Greene & Miller, 1996; Meece et al., 1988; Miller et al., 1993; Miller et al., 1996; Nolen, 1988; Pintritch and Garcia, 1991). In a study, Greene et al. (2004) showed that mastery goals, with the mediation of self-regulated strategies, affect academic achievements. This is while no such relationship was observed with performance goals. Another motivational variable affecting cognitive strategies is perceived instrumentality, which consists of the student's value and importance of performing class work for achieving personal goals (Miller & Brickman, 2003, 2004). With regard to the socio-cognitive theory of Bandura, Miller and Brickman (2003, 2004), believe that valuable future personal goals of individuals create a system of goals which facilitate achieving goals. Clarification and development of these goals help individuals to realize which options they encounter in their environment can help them as an instrument to achieve their valuable future personal goals. Miller & Brickman (2003, 2004) insist on the positive effect of perceived instrumentality of current class works on self-regulated learning, and achievement goals. In a series of researches (Miller, DeBacker & Greene., 1999; Miller , Greene, Montalvo, Ravindran, & Nicholls., 1996), it was found that perceived instrumentality, even when mastery goals and perceived abilities are controlled, is considered as an important predictor of self-regulation and using profound cognitive strategies. Elliott (1999), in his theory of achievement goals, depicts perception of competence (self- efficacy) and basic needs (perceived instrumentality) as effective factors on achievement goals. Elliott (Elliott, 1999; Elliott and Thrash, 2001) indicates basic needs of the individual and perception of competence as the basic reasons of achievement goals; however, he does not reject the probability of existence of other factors and states that other needs and issues can be the reason for achievement goals. Regarding the stated issues and according to Greene et al., (2004), it is possible to claim that students who believe in their abilities to perform special assignments and consider those assignments instrumental for the future and choose mastery goals to learn use self-regulated strategies leading to their achievements (Greene et al., 2004). In the proposed model of the present research, based on the above-mentioned issues, perception of the class structure directly affects perceived instrumentality of the class. Moreover, perceived instrumentality has a positive effect on mastery and performance goals, and finally using self-regulated strategies has a positive effect on the student's achievements in mathematics.

## 1. Methods

*1.1. Participants:* The population under investigation in the present research consists of all students who study in the third grade of high school in Mathematics-Physics in Isfahan (7287 students). Because the goal of this research is to investigate a causal model through path analysis, a large sample of 400 students was selected through stratified random sampling with appropriate appointment. (200 girls and 200 boys).

*1.2. Measures*

*1.2.1. Self-regulated strategies:*

The scale introduced by Miller et al. (1996) was used to measure self-regulated strategies. Self-regulated strategies have five items and Miller et al. have reported the alpha coefficient equal to 0.8 for it. In the present study the alpha coefficient is equal to 0.72. Moreover, a confirmatory factorial analysis was performed to confirm the factor structure of the measurement model of self-regulated strategies. This was confirmed, and AGFI= 0.97, GFI= 0.98, SRMR= 0.04 indices showed the complete fitness of the model.

1.2.2. *Achievements goals*:

The scale introduced by Middleton and Midgley (1997) which concerns the mathematics field was used in order to measure achievement goals, which includes two subscales of mastery goals and performance goals. The mastery goals subscale consists of 5 items and the performance goals subscale includes 4 items. The alpha coefficient reported by Middleton and Midgley was 0.84 for both scales. In the present study the alpha coefficient for mastery goals was calculated at 0.66, and for performance goals it was calculated at 0.77. Meanwhile, the GFI= 0.96, AGFI= 0.94, SRMR= 0.06 indices of confirmatory factorial analysis indicate the important and meaningful role of each question in the measurement of self-regulated learning factor.

1.2.3. *Perceived Instrumentality:*

The questionnaire provided by Miller et al., (1996) was used to measure perceived instrumentality. This scale, through which the students' perception of the instrumentality of mathematics is measured, consists of 4 items, and students must state their ideas about each statement selecting one of the five options, from "completely agree to "completely disagree". All questions have a positive direction, and the Cronbach alpha by Miller et al. is 0.9. In the present study, the alpha coefficient was calculated at 0.7. Moreover, the indices (GFI= 0.96, AGFI= 0.94, SRMR= 0.06) of confirmatory factorial analysis indicate the important and meaningful role of each question in the measurement of self-regulated learning factor.

*1.2.4. Perception of the class:*

Perception of the class scale consists of three subscales of motivating tasks, autonomy support, and mastery evaluation, which has been provided by Blackburn (1998) cited by Barbara & et.al(2004). The motivating tasks subscale consisted of 8 items, autonomy support had 5 items, and the mastery evaluation subscale was made up of 5 items. The Cronbach alpha obtained in the research carried out by Blackburn has been reported at 0.85 for motivating tasks, 0.65 for autonomy support, and 0.8 for mastery evaluation, and the alpha coefficient of these three subscales in the present study was calculated to be 0.71, 0.68, 0.68, respectively Additionally, goodness of fit indices GFI=0.92, AGFI= 0.89, SRMR= 0.06, indicate that the model completely fits the observed data. All questions were prepared in a likert scale, from "completely agree to "completely disagree", and the students had to state their ideas about each question considering the current year's mathematics class.

## 2. Results

Descriptive indices (mean, SD) of the data for each variable and the correlation coefficients between the variables under investigation have been presented in the correlation matrix in Table 1.

Table 1.The correlations among variables involved in the model (N = 400)

| No. | Variables | Mean | SD | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. | Motivating tasks | 26/15 | 6/53 | — | | | | | | |
| 2. | Autonomy support | 16/58 | 4/14 | .78* | — | | | | | |
| 3. | Mastery evaluation | 16/45 | 4/24 | .65* | .67* | — | | | | |
| 4. | Mastery goals | 19/54 | 3/60 | .32* | .29* | .31* | — | | | |
| 5. | Performance goals | 14/28 | 3/70 | .19* | .09 | .16* | .25* | — | | |
| 6. | Perceived instrumentality | 16/76 | 2/61 | .34* | .31* | .36* | .53* | .24* | — | |
| 7. | Self-regulated learning | 26/77 | 4/32 | .27* | .33* | .31* | .43* | .27* | .43* | — |
| 8. | Mathematics Performance | 13/52 | 3/76 | .17* | .23* | .21* | .20* | .06 | .48* | .32* |

*p < 0.05

The path analysis model after measuring the path coefficient the between the variables has been shown in Figure 2.

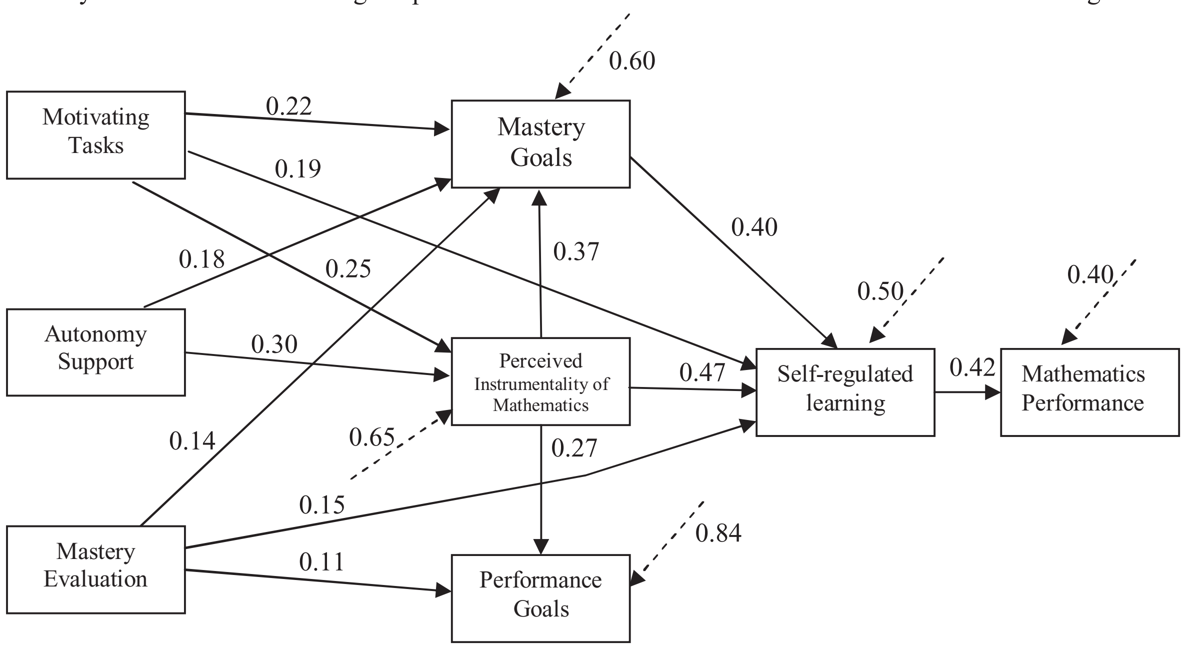


Fig. 1. Path model with path coefficients for predictions from perceptions of class structures to achievement via Perceived instrumentality, goals and self-regulated learning.

The Fit of the model (Table 2), will be investigated when parameters are estimated. The five measurement statistics GFI, AGFI, SRMR, $\chi^2$, and the ratio of chi-square to the degree of freedom (df), amongst all fit indices are of higher importance.

Table 2. Good of Fit indices

| AGFI | GFI | SRMR | P | df | $\chi^2$ |
|---|---|---|---|---|---|
| 0.95 | 0.99 | 0.04 | 0.40 | 12 | 34/07 |

By investigating all fit indices, it is concluded that the data and the given model are completely in agreement.

## 3. Discussion and Conclusion

As the findings show, when students perceive the class as having diverse and challenging, assignments and tasks, they choose mastery goals, consider the class more useful use more self-regulated learning strategies, and their mathematics performance will be improved. In addition, when students perceive the class as a safe environment, which improves their independence and sense of responsibility, they will consider it as a useful lesson for their future, and use more learning strategies that lead to their mathematics achievement and higher scores in mathematics. In such a structure, meanwhile, the perceived instrumentality approach of the students to performance goals does not lead to self-regulated learning and better academic achievement of the students. On the other hand, if the class is perceived by the students as a part of their learning, not a means of competition and comparison with other students, their self-regulated learning and consequently their mathematics achievement will be improved. These findings are compatible with those of Ames & Archer (1984), and Miller & Brickman (2004). Also, the motivational variables had meaningful direct effects on each other and the meaningful relationship between perceived instrumentality and achievement goals are compatible with the research findings of Miller and Brickman (2004). The findings of this research point out the fact that motivational variables (achievements goals and perceived instrumentality) are the direct and meaningful predictor of self-regulated learning which is in accordance with the works of Elliott (1999), Miller & Brickman (2004) and Greene et al,( 2004). Also, the direct effect of self-regulated learning and achievement was meaningful, which was in the same line with researches like Desoete,Royers and Busse (2001) .In general, this model has been able to determine 60% of the variance in mathematics performance. The exogenous variables do not have a direct effect on mathematics performance and only affect mathematics performance indirectly and through perceived instrumentality, mastery goals, and self-regulated learning. The observed effects of these variables call for special attention to the class structure as an important factor in academic achievement.

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