

How Does Self-Efficacy Belief Mediate the Effects of Achievement Goals Orientation on Students' Achievement: A Structural Equation Modeling Approach

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Abstract— This work in progress investigates the role of self-efficacy in mediating the effect of mastery and performance goals on student achievement. The role of achievement goals on academic achievement has received considerable empirical support. However, the mediating role of self-efficacy belief has not been explored within the engineering context. One hundred and seventy-one undergraduate students in the college of engineering in a public university in the United States completed questionnaires that assessed their goal orientations, and self-efficacy belief for learning and performance. The result of the structural equation modeling conducted in MPLUS shows a good fit: Chi-square = 206.76(df=95), TLI= .90, CFI=.92, RMSEA= .08, SRMR=0.06. Both performance and mastery goals significantly predicted self-efficacy for learning, and performance goal is both direct and indirect predictor of performance score through self-efficacy. The theoretical, practical implications and future direction of this study are discussed.

Keywords—self-efficacy, goal orientations, structural equation modeling

I. INTRODUCTION

The need to prepare engineering students for success in their academics and future careers is one of the aims of academic institutions. Students' success and academic achievement in complex and abstract courses such as Statics and electric circuit depend not only on cognitive factors such as memory and prior knowledge but also on motivational and contextual factors [1-3]. While cognitive factors explain some of the variances in students' academic achievements, educational research studies have reported on the effects other non-cognitive student characteristics also have on student performance. Two important students' characteristics that have been studied over the years are goal orientation and self-efficacy belief. Goal orientations explain the reasons that underlie students' achievement motivations. While some students are motivated by the goal of mastering or developing competence or skills, some others are typically more motivated by the goal to demonstrate better performance than their peers. Students who have mastery-focused goals seek to attain competence by developing mastery – and described as having a mastery goal orientation, while those are more motivated about normative comparisons are said to have performance goal orientation. Researchers in different fields of study including engineering have examined the roles of goal orientations in predicting student engagement, performance, and the use of self-regulation strategies [4-6].

Research has shown that students who adopt mastery goals have higher intrinsic motivation, learning engagement, task

enjoyment, greater persistence, and a positive attitude toward learning [4, 7]. On the other hand, students with performance goals are more concerned with how their performance compare with their classmates [6]. Researchers have examined the influence of mastery and performance goals on student achievement, howbeit, with inconsistent results [8-11]. Additionally, fewer studies have attempted to examine the mechanism by which these factors influence achievement within engineering.

The purpose of this study is to investigate the role of self-efficacy in mediating the effect of mastery and performance goals on student achievement. Based on the literature, it is hypothesized that the performance goal will lead to higher performance, and the mastery goal will indirectly influence course performance through self-efficacy.

II. THEORETICAL FRAMEWORK

A. The achievement goal theory

Achievement goal theory describes a framework for understanding how and why learners engage in achievement-related activities [12-16]. Different conceptual models of achievement goal orientation have been developed and validated over the past three decades[17]. Starting with the dichotomous model, achievement goal orientation was distinguished based on its definition to consist of two types: mastery and performance goals. The mastery goal, also known as the learning goal or task-related goal represents learning and understanding focused goals. Students with mastery goals are more inclined to try challenging tasks for the opportunity to learn and master skills. On the other hand, performance goal orientation also known as ego-related or self-goal, represents the need to demonstrate one's ability and to show off in comparison to others. When learners adopt performance goals, they focus more on optics of performance more than on just gaining mastery of the task. Other models of achievement goals include the trichotomous and the 2 by 2 achievement goal frameworks which have in addition to the definition types the valence: approach and avoidance goals[13, 14]. Taken together, we now have the mastery approach goal, mastery avoidance goal, performance approach goal and the performance avoidance goal. In this study, we focus on the mastery approach goal and the performance approach goal.

B. Self-efficacy belief

Self-efficacy for learning is the belief in one's ability to carry out a specific task to produce desired achievement[18]. Self-efficacy has been associated with increased commitment and persistence in the face of difficulty [19]. Students with

high self-efficacy would often attribute their success to the effort put into their study rather than luck. In the same token, students with low self-efficacy usually blame low ability for their failure [20, 21]. Researchers have found positive relationship between self-efficacy for learning and students' achievement in different subjects [22, 23]. Similarly, scholars have found self-efficacy to be positively associated with academic performance and persistence on difficult learning tasks [19, 24].

III. PURPOSE OF STUDY AND RESEARCH QUESTIONS

The research objective is to examine the roles of students' achievement goal orientation in predicting student academic achievement among engineering undergraduate students and to assess whether the relationship is mediated by self-efficacy belief. Given the considerations in extant literature about the roles of mastery approach, performance approach, and self-efficacy belief on student achievement, we hypothesize that self-efficacy will mediate the effects of achievement goal orientations. Also, mastery goals, as well as performance goal orientations, would have both direct and indirect relationships with academic achievement.

The study will examine the following research questions:

- RQ1: What are the predictive effects of goal orientations on academic achievement?
- RQ2: Are the effects of goal orientations and prior knowledge on academic achievement mediated by student self-efficacy belief?

IV. METHOD

A. Sample and Procedure

The sample consisted of 171 full time undergraduate engineering students from 12 sections of statics course. Majority of the sample are in their sophomore (45.6 %), followed by junior (32.7 %), followed by freshmen (13.5%) and then senior (8.2%). Most of the participants were male (68%). About 75% of the participants were Caucasian, 9% African American, 8% Asian or Pacific Islander, 2% Hispanic, 2 % Mexican American, and 4% others. Personal information and confidentiality protection were assured, and all participants consented to participate in the study in line with the guidelines provided by the institution IRB.

B. Measures and data collection

The participants completed a questionnaire administered to them online through the Qualtrics survey platform. The questionnaire included two sub-scales that measured participants' achievement goal orientations, and self-efficacy for learning performance. All items on the scale were rated on a 5-point Likert scale that ranged from 1 (Never or only rarely true of me) to 5 (Always or almost always true of me). Students received links to complete the online questionnaire mid-semester. Measures of student prior course-content knowledge, and end-of course performance were obtained for this study.

C. Self-efficacy for learning performance

The participants completed two subsections of the 2 X 2 achievement goal questionnaire (AGQ) developed by Elliot and McGregor (2001) to assess participants' achievement goal orientations. The first subscale assesses the mastery-approach

goal orientation (3 items, e.g. "I am striving to understand the content of this course as thoroughly as possible") with a Cronbach alpha value of 0.86 and the second subscale measures students' performance-approach goal orientation (3 items, e.g. "I am striving to do well compared to other students") with a Cronbach alpha value of 0.78.

D. Self-efficacy for learning performance

Self-efficacy was measured using the self-efficacy for learning performance (SLP) sub-scale, which was taken from one of the motivational sub-scales of the Motivated Strategies for Learning Questionnaire (MSLQ), a validated scale for self-efficacy for learning [25, 26] with reliability of 0.92.

E. Prior knowledge and course performance measures

Students' prior knowledge was measured using combination of 30 items from the Half Force Concept Inventory, Purdue Visualization of Rotations Test, and the Mechanics Baseline Test [25-27]. Students' total score on this test represents their prior knowledge score.

The students' course performance was an aggregate score from their homework assignments, midterm exams and final exam scores.

V. ANALYSES AND RESULTS

A. Preliminary analysis

We screened the data to ensure basic multivariate assumptions for conducting the structural equation modeling were not violated. The skewness and kurtosis statistics result of the data showed univariate and multivariate assumptions for normality was met.

B. Measurement model

Confirmatory factor analysis was conducted in MPLUS software to examine the fits of the measurement model. The model comprises of three latent constructs and 14 observed variables as depicted in Fig. 1. Model fit statistics: Chi-square result, $\chi^2(74) = 171.02$, $p < 0.001$, RMSEA = 0.08, SRMR = 0.06, CFI = 0.92, TLI = 0.90 indicates that the measurement mode has good factor structure and construct validity. This interpretation is guided by literature indicating recommended model fit indices [28, 29] .

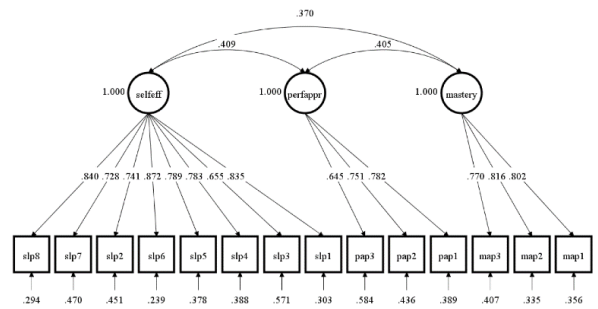


Fig. 1 Measurement model Structural equation model

The hypothesized structural model has a good model fit based on the criteria mentioned above. Structural model fit statistics: Chi-square result, $\chi^2(95) = 206.78$, $p < 0.001$, RMSEA = 0.08, SRMR = 0.06, CFI = 0.92, TLI = 0.90.

Direct effects: The standardized coefficients for the final model in Figure 2 shows that the direct effects of performance approach goal ($\beta = 0.210$, $p = 0.025$), and prior knowledge ($\beta = 0.202$, $p = 0.005$), on academic achievement were significant. On the contrary, the direct effect of mastery goal was not significant on academic achievement ($\beta = 0.068$, $p = 0.456$).

Indirect effects: The indirect path of performance-approach goal through self-efficacy belief was significant. That is, self-efficacy belief partially mediated the effects of the performance-approach goal ($\beta = 0.069$, $p = 0.036$) on academic achievement. However, the mastery goal did not have a significant indirect relationship with academic achievement.

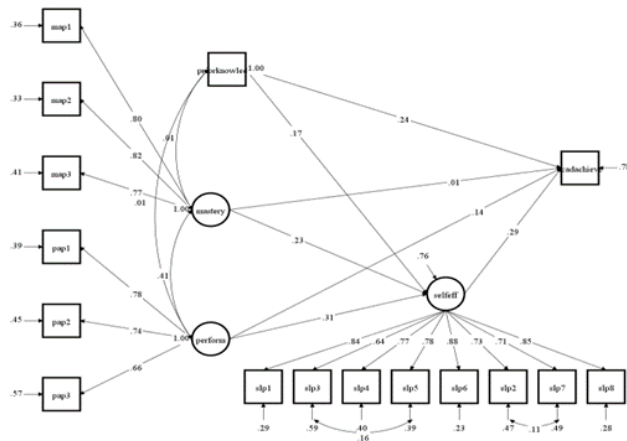


Fig. 2 Structural model

VI. DISCUSSION AND CONCLUSION

Our results provide support for the influence of self-efficacy and goal orientation on academic performance reported in literature. Self-efficacy belief has significant direct relationship to academic achievement. Both performance approach and mastery approach goals significantly influence students' self-efficacy belief. That is, students who adopted both mastery goals and performance-approach goals will feel confident about their ability to succeed in achievement situations. While performance approach goal has a significant direct effect on academic achievement, mastery approach goal did not. This could be interpreted as students who adopt performance goal orientation focused more on key areas that instructors are likely to include in their examination.

This study also highlights the mechanism through which self-efficacy mediates the effect of goal orientation on academic achievement. Performance approach goal significantly predicted academic achievement; however, the effect was partially mediated by self-efficacy for learning. This means that performance-approach goals have utility and could be enhanced by improving students' perception of their ability. Providing students with opportunities to succeed on small tasks and following it up with positive feedback could help them develop their self-efficacy belief. Additionally, putting students in groups where they can vicariously learn from their colleagues may also be a way to increase and foster their self-efficacy belief.

Our observation about no direct and indirect relationship between mastery goal orientation and academic achievement may suggest that mastery approach goals as conceptualized in the 2 by 2 framework are not important in our model.

Similarly, students that adopted mastery goals could have focused entirely on areas they thought important to them without giving attention to whether those areas would appear on their test or not. Lastly, in the 3 by 2 framework, mastery goal was divided into two separate constructs by definition: task goals and self-goals. Our next goal is to test a model where the dimensions of 3 by 2 goals are included in the model.

This study, like others, suffers from some limitations including the use of self-reported scores in its analysis. Additionally, the sample size is small and has a disproportionate number of males than females. It would be interesting to know how these hypotheses hold for different demography within the student population. We suggest researchers examine these relationships with a more diverse and larger number of participants.

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