

Testing a Model of Work Performance in an Academic Environment

SAGE Open
 April-June 2012: 1–8
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 DOI: 10.1177/2158244012443543
<http://sgo.sagepub.com>


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Abstract

In modern society, people both work and study. The intersection between organizational and educational research suggests that a common model should apply to both academic and job performance. The purpose of this study was to apply a model of work and job performance (based on general expectancy theory) to a classroom setting, and test the predicted relationships using a causal/path model methodology. The findings revealed that motivation and ability predicted student expectations and self-efficacy, and that expectations and efficacy predicted class performance. Limitations, implications, and future research directions are discussed. This study showed how the research in industrial and organizational psychology is relevant to education. It was concluded that greater effort should be made to integrate knowledge across a wider set of domains.

Keywords

expectancy theory, work performance, job performance, academic performance, achievement motivation, ability, self-efficacy, self-esteem, path models, causal models.

Work and school are often intimately connected. Many people now combine working and studying as a normal part of their life, either as students who work or employees who study (Berker & Horn, 2003; Bureau of Labor Statistics, 2012; National Center for Education Statistics, 1998). The line between employment and academics is becoming blurred, and what happens in one domain influences activities in the other domain. Research has shown that both ability traits (e.g., intelligence, aptitude, talent) and nonability traits (e.g., personality, interest, motivation, self-concept, attitude) influence job performance and skill training (Barrick, Mount, & Judge, 2001; Colquitt, LePine, & Noe, 2000; Kanfer, Wolf, Kantrowitz, & Ackerman, 2010; Schmidt & Hunter, 1998). These same variables have also proven effective in educational settings for predicting classroom performance, grades, and academic success (Chamorro-Premuzic & Furnham, 2003; Kuncel, Hezlett, & Ones, 2001; Sackett, Kuncel, Arneson, Cooper, & Waters, 2009). The research presented in this article tests a causal model developed in the organizational and industrial (I/O) field to college classroom behavior.

A Model of Work and Academic Performance

The intersection between organizational studies and educational research suggests that a common model should apply to both academic and work performance (Kanfer et al., 2010). General expectancy theory (Donovan, 2001; Kanfer, 1990; Van Eerde & Thierry, 1996) is one such model. As

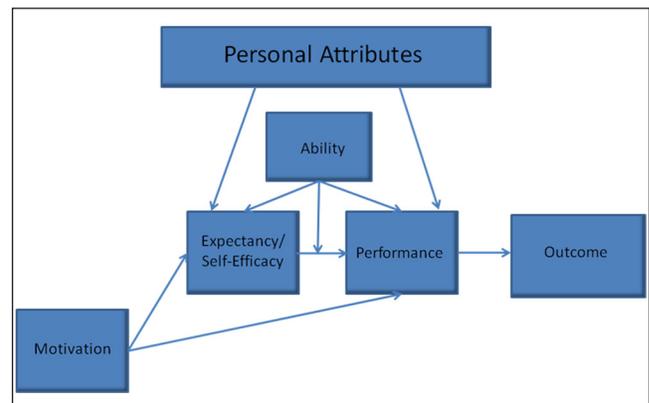


Figure 1. A model of motivation and performance in an academic setting

shown in Figure 1, expectancy theory describes the relationship between several constructs: (a) motivation (which includes many subelements such as goal setting, instrumentality, achievement orientation, effort, and expectancy), (b) ability (e.g., intelligence, aptitude, talent), (c) performance

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(e.g., goal achievement, task success), and (d) outcomes (which involve elements of reward and satisfaction). The model in Figure 1 has its origins with Vroom (1964), with further developments and refinements by Porter and Lawler (1968); Riedel, Nebeker, and Copper (1988); and Steel and Konig (2006). Other causal models have been tested in educational settings (Akey, 2006; Brown, Park, & Jung, 2010; Drew & Watkins, 1998; Murray-Harvey, 1993; Ofori & Charlton, 2002), but none is based on research from the I/O sphere.

Some Key Constructs

Figure 1 depicts a causal/path model of a number of constructs that have been investigated in both work and school environments. The discussion below is a brief review of some of the literature on the isolated effects of these constructs on work and scholastic performance.

Motivation

The term *motivation* is quite broad and refers to a variety of constructs. In some instances, it refers to effort, in other cases, it refers to expectations, and sometimes it refers to a drive for mastery (McClelland, Atkinson, Clark, & Lowell, 1953) and high levels of performance (Hermans, 1970).

Achievement Motivation. This meaning of motivation is reflected in individuals who set high standards of excellence and aspire to achieve difficult goals. One way to capture achievement motivation is to measure the performance of people against what would be expected given their level of ability (Farquhar & Payne, 1964; McCall, 1994). Using this approach, studies have shown that achievement motivation is related to persistence and later career success (Hustinx, Kuyper, van der Werf, & Dijkstra, 2009; Mandel & Marcus, 1988; McCall, Evahn, & Kratzer, 1992).

Expectancy/Self-Efficacy. Expectancy and self-efficacy are additional ways of viewing motivation. Expectancy has come to mean different things to different researchers (e.g., Nagengast et al., 2011; Porter & Lawler, 1968; Vroom, 1964), but in general it refers to a person's expectation or estimation of future performance. Self-efficacy (e.g., Bandura, 1997; Prat-Sala & Redford, 2010) is similar to expectancy. It reflects the belief people have in their capability to perform a specific task (e.g., a work or class assignment). Compared with people who have low levels of self-efficacy, high self-efficacy individuals are more likely to (a) persevere when faced with difficulties, (b) show intrinsic motivation, (c) engage in self-regulation, and (d) succeed in school but are less likely to show disappointment when their efforts are thwarted (Bong, 2001; Bong & Clark, 1999; Bouffard, Boileau, & Vezeau, 2001; Lane & Lane, 2001; Lane, Lane, & Kyprianou, 2004; Ofori & Charlton, 2002; Pintrich & De Groot, 1990; Richardson, 2007; Schunk & Zimmerman, 1997). Self-efficacy

has also been viewed as a more general personal trait (Liem, Lau, & Nie, 2008; Prat-Sala & Redford, 2010; Schwarzer & Jerusalem, 1995).

Ability

The positive relationship between traditional measures of ability (e.g., cognitive ability, aptitude, crystallized knowledge) and performance on the job and in school has been known for years (Ackerman, 2000; Horn & Noll, 1997; Kuncel et al., 2001; Schmidt & Hunter, 1998). Measures of self-estimated ability can also predict performance (Kanfer et al., 2010; Riedel et al., 1988). There is general agreement that motivation and ability interact with regard to performance (Feather, 1982; Porter & Lawler, 1968; Riedel et al., 1988; Vroom, 1964), which is shown in Figure 1 as ability moderating motivation and performance.

Personal Attributes

There are many personal and dispositional characteristics that could, potentially, be investigated in any given study. The constructs that appear most often in the organizational and academic literature are self-esteem, locus of control, attitudes, and general self-efficacy. There are many studies that support the notion that these personal attributes predict job and academic performance (e.g., Bakker, 2011; Hansford & Hattie, 1982; Harrison, Newman, & Roth, 2006; House & Prion, 1998; Judge, Thoresen, Bono, & Patton, 2001; Ma & Kishor, 1997; Meyer, Stanley, Herscovitch, & Topolnysky, 2002; Miujs, 1997; Oliver & Simpson, 1988; Partin et al., 2011; Ramanaiah, Ribich, & Schmeck, 1975; Riketta, 2008; Rosenberg, 1965; Sandler, Reese, Spencer, & Harpin, 1983; Watkins, 1989). The research, however, does not usually address the possibility that the relationship between these personal characteristics and performance is wholly or partially mediated by motivation, as shown in Figure 1. A few studies (e.g., Akey, 2006; Brown et al., 2010; Drew & Watkins, 1998; Murray-Harvey, 1993; Porter & Lawler, 1968; Riedel et al., 1988) suggest that motivation mediates, to some extent, the relationship between personal attributes and performance.

Method

Participants

The participants were 165 students (80% females) in a sophomore-level, psychology of learning class taught at a large university in the southwestern region of the United States. The ages ranged from 18 to 42 years ($M = 20.6$, $SD = 2.6$) with 20.6% Hispanics, 5.3% African Americans, 50.8% Whites, 13.8% Asians/Pacific Islanders, and 9.6% "Other."

Procedure

A paper-and-pencil survey was administered to the students at three points during the one-semester class. After completing the first exam, but before obtaining the results of their test, the survey asked a standard set of demographic questions (age, ethnicity, gender) followed by several self-report measures (exam self-efficacy, expected score on the first exam, estimate of exam performance if the student worked at “maximum effort,” locus of control, general self-efficacy, self-esteem, and academic attitudes). After the second exam, students were surveyed again and asked follow-up questions (the personal attributes were not part of the follow-up questions). Finally, at the completion of the third exam, additional follow-up questions were asked, along with the grade they expected to get for the class and what they thought their grade point average (GPA) would be upon graduation.

Performance on each of the three 50-point, objective (true/false, multiple choice) exams was recorded according to the student ID and these scores were then merged with the survey results. Using student IDs instead of names helped to ensure student confidentiality.

Measures

Exams. The first exam ($M = 38.22$, $SD = 5.59$) was used to calculate the Ability measure (see below). The second exam ($M = 38.28$, $SD = 4.99$) was used in the calculation of Achievement Motivation (see below). The third exam ($M = 41.45$, $SD = 4.46$) was used as the basis for Self-Efficacy (see below). All three exams were combined to determine the student’s final grade.

Ability. Ability and effort are usually considered as compensatory. People may do well on a task because they have high ability, but they can sometimes compensate for any lack of ability by working very hard. In this study, effort was assessed by asking students to estimate what their score would be on the first exam if they worked at their maximum effort. This estimated effort was then regressed on their actual score on the first exam. The residual score from this regression was used as the ability measure. The logic of this procedure is that the residual score is what is left over (ability) after we remove effort from their performance.

Achievement Motivation. Following the logic of Farquhar and Payne (1964) and McCall (1994), student motivation was measured by comparing the students’ actual exam performance against their expected performance given their ability. Exam performance was their score on the second exam. Ability was the ability measure described above. The scores from the second exam were regressed on this ability measure to obtain predicted exam performance. The difference between the student’s actual performance and the predicted performance (i.e., the residual score) became our measure of achievement motivation. Students who performed below expectation were low in motivation (underachievers)

and those who performed above expectation were high in motivation (overachievers). It may appear that the Ability measure and this measure of Achievement Motivation should be partially confounded because motivation is computed using the ability score. In fact, the two measures are not correlated (see the correlation matrix in Table 1) because we are using the residual from the regression equation and residual scores are independent from the predicted scores.

Expectancy/Self-Efficacy. Expectancy was defined as the student’s expectations of their class grade (expressed as a letter grade but converted into a numerical grade as described in “Performance”). The students’ self-efficacy was assessed using an assessment approach suggested by Bandura (1977). Following each exam, students were given a range of possible test scores (i.e., from 24 to 50 for a 50-item test) and asked to respond “yes” or “no” as to whether they were “capable” of performing at each level. A self-efficacy score for each student was recorded as the highest test score the student marked before he or she responded with a “no” (not capable of performing at that level). The self-efficacy score from the third exam was then multiplied by the expectancy score (see above) to obtain an overall measure of combined Expectancy/Self-Efficacy. The reason for combining these measures was to obtain a score that reflected both student expectations and perceived capability.

Performance. Performance was the final grade received by the student at the end of the semester (earned class grade). The grades were determined by combining the three exams and assigning letter grades based on the total points. Letter grades (with plus or minus values) were then converted into numerical scores according to the following conversation scheme ($A = 4.0$, $A- = 3.7$, $B+ = 3.3$, $B = 3.0$, $B- = 2.7$, $C+ = 2.3$, $C = 2.0$, $C- = 1.7$, $D+ = 1.3$, $D- = 1.0$, $F = 0$).

Outcome. The ideal outcome measure would be the student’s final GPA upon graduation from the university. Obtaining this information, however, would require waiting for each student to graduate, which was not practical. As a proxy for this variable, we asked the students to estimate the GPA they will earn when they graduate from the university.

Locus of Control. This was a standard Locus of Control measure based on the research by Rotter (1966) but written to reflect their perceived control over academic situations (e.g., “How well I perform in class is determined by my own efforts . . . Grades are a very subjective thing that students can’t always control”). There were six items and the responses were made on a Likert-type scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). (The following three measures were also based on the same 7-point Likert-type scale.) After reverse scaling selected items to obtain a common dimension from low to high, the high rating then reflected high levels of internal control. The Cronbach’s alpha reliability (.73) was acceptable.

General Self-Efficacy. Unlike the self-efficacy measure above, this was a measure of self-efficacy that was not task specific. This measure of General Self-Efficacy was based

Table 1. Descriptive Statistics and Correlations Among the Major Study Variables

	M	SD	Correlations								
			Achievement Motivation	Ability	Expectancy/ Self-Efficacy	Locus of Control	General Self- Efficacy	Self-Esteem	Academic Attitudes	Earned Class Grade	Estimated GPA
Achievement Motivation	0	4.43	1	-.02	.35**	.02	.06	.00	.18*	.44**	.27**
Ability	.4	5.34		1	.41**	.00	-.01	.04	.04	.80**	.23**
Expectancy/ Self-Efficacy	121.10	31.88			1	.23**	.21**	.17*	.25**	.57**	.34**
Locus of Control	4.82	.94				1	.33**	.43**	.42**	.040	.25**
General Self- Efficacy	5.24	.77					1	.63**	.55**	.04	.26**
Self-Esteem	4.91	.82						1	.40**	.07	.21**
Academic Attitudes	4.49	.65							1	.14	.26**
Earned Class Grade	2.44	.82								1	.33**
Estimated GPA	3.28	.37									1

Note: GPA = grade point average.

*Correlation is significant at the .05 level (two-tailed).

**Correlation is significant at the .01 level (two-tailed).

on a scale developed by Schwarzer and Jerusalem (1995). The scale presents a series of general statements regarding how confident people feel about dealing with difficult or unexpected situations (e.g., “I can always manage to solve difficult problems if I try hard enough . . . I am confident that I could deal efficiently with unexpected events”). There were 10 items and the Cronbach’s alpha reliability (.88) was high.

Self-Esteem. Self-Esteem was evaluated by a 20-item Self-Esteem Scale modified from the scales developed by Fleming and Courtney (1984). The items were slightly changed to reflect a school environment (e.g., “I often worry about criticisms that might be made of my work by my teacher . . . I am intellectually better than most of my fellow students”). Some of the items were reverse scaled so all ratings were on a common dimension from low to high self-esteem. The Cronbach’s alpha reliability (.86) was high.

Academic Attitudes. This was a 9-item scale composed of statements that reflected positive or negative attitudes about grades, schoolwork, teachers, criticism, praise, and other aspects of school and schoolwork (e.g., “Students should be graded on effort rather than the quality of their work . . . Students should not be criticized for poor work . . . Teachers should not correct students when they make mistakes”). Some items were reverse scaled to achieve a common response dimension. The Cronbach’s alpha reliability (.64) was marginal.

Results

Descriptive Statistics

The means, standard deviations, and correlation coefficients for the major variables are shown in Table 1. The skew and kurtosis indexes were within the normal range for all of the variables except Ability, Achievement Motivation, and Estimated GPA. When the subsequent analyses were done on the transformed (normalized) scores, the results were unchanged, so the original scores and not the transformed scores were used and reported. Outliers never amounted to more than 2% of the total number of responses on any variable so no attempt was made to remove or correct for outliers.

Path Analysis

The path analysis was conducted as described by Grimm and Yarnold (1995). Three regression analyses were performed. The first analysis used the combined Expectancy/Self-Efficacy measure as the criterion variable, and Achievement Motivation, Ability, and all personal attributes (i.e., Locus of Control, General Self-Efficacy, Self-Esteem, and Academic Attitudes) were the predictor variables. The path coefficients for all the predictor variables (i.e., the β coefficients) are shown in Figure 2. All of the path coefficients are significant ($p < .05$) except for General Self-Efficacy, Self-Esteem, and Academic Attitudes.

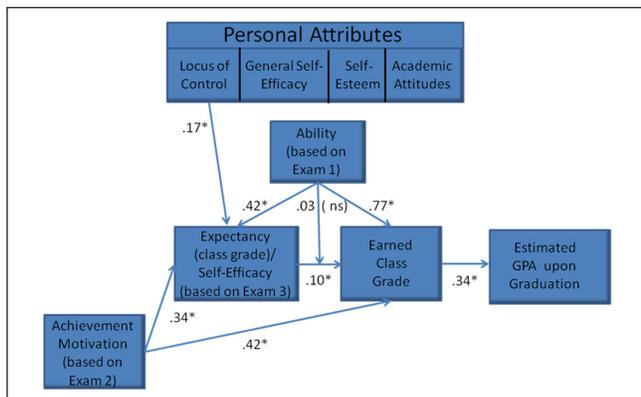


Figure 2. Path model of academic motivation and performance

The second regression analysis used performance (Earned Class Grade) as the criterion measure and Expectancy/Self-Efficacy, Ability, Achievement Motivation, and all the personal attributes as the predictor variables. In addition, Achievement Motivation and Ability were multiplied together and the product of these two variables (the interaction) was entered as a separate block in the analysis. Contrary to theory, this product variable did not add significant variance to the analyses (R^2 change = .001, $p > .05$). Consequently, the product variable path coefficient (.03) in Figure 2 was not significant. All other path coefficients, except for the personal attribute variables, were significant ($p < .05$) as shown in Figure 2.

The third regression analysis used outcome (Estimate GPA) as the criterion variable and performance (Earned Class Grade) as the predictor variable. This path coefficient (.34) was also significant ($p < .05$) as shown in Figure 2.

Goodness of Fit

A “goodness of fit” index (Q) was calculated for the path model according to a procedure described by Pedhazur (1982) and Wuensch (2008). The fit between the full model and the restricted model shown in Figure 2 was adequate, $\chi^2(df = 8) = 14.22$, $p > .05$. In other words, there was not a significant difference between the full model and the restricted (Figure 2) model. This nonsignificant difference is the desired outcome. This shows that the more restricted model represents the path relationships as well as the full model and is a plausible representation of these relationships (see Pedhazur, 1982, and Wuensch, 2008). A larger study with more participants and observations would be required for a structural equation model analysis with latent variables (Kline, 1998; Tabachnick & Fidell, 2001).

Discussion

The model shown in Figure 1 was derived from the work on expectancy theory by several I/O researchers over many

years (Ajzen, 1991; Porter & Lawler, 1968; Riedel et al., 1988; Rotter, 1954; Steel & Konig, 2006; Vroom, 1964). The question posed in this study was whether this model applies as well to students in the classroom. A path analysis revealed that the predicted path relationships were, for the most part, confirmed. Ability and Achievement Motivation predicted student grade expectations and self-efficacy. Only one of the personal characteristics predicted student expectations/self-efficacy (i.e., Locus of Control), but none of these personal attributes predicted performance (actual grades). The study also showed that Expectancy/Self-Efficacy was significantly related to the grades, but the path coefficient was small (.10). Grades were significantly related to an ultimate outcome (college GPA).

The predicted interaction between ability and motivation on performance was not supported by the data. Motivation was reflected by two variables in this study: Achievement Motivation and the combined Expectancy/Self-Efficacy measures. It is possible that Expectancy/Self-Efficacy does not capture the full meaning of motivation, and therefore this was not a fair test of the prediction. Although not reported in the “Results” section, the interaction also failed to appear for a moderated regression analysis using Achievement Motivation and a combination of Achievement Motivation and Expectancy/Self-Efficacy. It is not clear why ability and motivation failed to interact. Perhaps the sample size was too small to detect the effect, which has been an issue with other interaction effects (e.g., Nagengast et al., 2011).

Limitations and Future Research

One limitation with this study is the question of generality. The study was done on one class at a single university, and it is not clear whether these results would generalize to other classes, other universities, or other educational situations. Also, as with any structural model, the model in Figure 2 is only one of several possible representations of the interrelationships of the constructs. The data do, however, show that the model as tested is plausible.

Another limitation is the implied causal relationships among the variables. The path model in Figure 2 suggests that the sequence of events form a causal chain. Although the time sequence was correct (e.g., ability was measured before expected class grade, expected class grade was measured prior to actual class grade), not all of the conditions for genuine causality were met. Nevertheless, this causal sequence is certainly plausible given the obtained results. Future research should employ controlled, experimental research.

It might appear that a limitation to the study is common method/common source bias (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). This problem is mitigated by the fact that the survey measures are mixed with performance measures, and thus the source and methods are not consistently shared. For example, the survey measures of expected class grade or self-efficacy are not predicting other survey measures;

they are predicting the earned class grade which is a performance measure.

Another set of limitations arise from some of the measures that were employed. For example, the outcome measure (students' estimate of their GPA upon graduation) was not the ideal measure. A measure of their actual GPA would have been ideal, albeit impractical. Future research may attempt to obtain these data or some other outcome measures (e.g., performance in future classes for which this class is a prerequisite). As another example of measurement limitations, we cannot say with certainty that the set of personal variables was optimal. But, there was considerable prior research to suggest that the four selected variables are very important, despite the poor showing in this study.

Practical Applications

One way in which these findings could be used is to predict students' expected success and then attempt to improve the chances of greater success. Teachers and educators could assess the ability and motivational levels of students and, based on the model, predict their expected and actual performance. Special programs and encouragement could be provided to low performing students, or "enrichment" programs to high performers, to enhance motivation and future success. Such efforts may capitalize on Pygmalion and Galatea Effects (see Chapman & McCauley, 1993).

General Conclusions

Work and school are connected in many ways. What motivates an employee to do a good job also motivates students to do well in school. This study showed the commonality of work and school by testing a motivation and performance model (developed in I/O research) to an educational setting. Research on this and other I/O models should also spread into other domains of education such as leadership, group processes, or instructional technology. Educational institutions are organizations, and organizational research should be relevant to them.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research and/or authorship of this article.

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Bio

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