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Exploring Relationships Between Persons of Influence, Self-Efficacy, and Motivation Among Male and Female Construction Management Students

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Abstract

Researchers posit that persistence and achievement in science, technology, engineering, and mathematics (STEM) programs are related to students' self-efficacy beliefs. Vicarious experiences and verbal persuasions are often reported as sources of self-efficacy for women in non-traditional fields, and previous studies have observed a positive relationship between the influence of others and academic motivation. The existence of a role model or mentor has been shown to influence students' self-efficacy and motivation. These constructs were adapted to the construction education domain in a survey instrument that was administered to 587 students enrolled in construction management courses at three universities. Mentors and role models were defined in this study as "persons of influence" on a respondent's academic decisions; mentors give advice and support, whereas role models provide inspiration. Results indicate that having a person of influence was significantly and positively correlated with students' construction education self-efficacy and motivation ($r_s = 0.19$, $p < 0.001$ and $r_s = 0.26$, $p < 0.001$, respectively). When data were stratified by gender, the correlation between having a person of influence and motivation toward construction education was significant and positive for female ($r = 0.31$, $p < 0.05$) and male students ($r_s = 0.25$, $p < 0.001$). However, while having a person of influence was significantly and positively correlated with construction education self-efficacy for males ($r_s = 0.20$, $p < 0.001$), the correlation was positive but not significant at the 0.05 level for females ($r = 0.18$, $p = 0.175$). Perceived self-efficacy, motivation, and the presence of mentors and role models have value as predictors of career choice and student success. This paper contributes to the body of knowledge by increasing the understanding of the influence of others on students' academic performance within the construction education domain. Conclusions and opportunities for continued research are presented.

Introduction and Background

Research suggests that women in non-traditional fields who exhibit strong personal efficacy expectations are more resilient to obstacles and have greater persistence in their career and academic paths[11, 17, 30]. However, for male-dominated fields such as science, technology, engineering, and mathematics (STEM), women often feel a lack of inclusion which can result in lower perceived self-efficacy[17]. Construction management is a male-dominated, non-traditional, career choice for women. According to the U.S. Department of Labor, 12.7% of all persons employed in construction are women[29] and only 7.3% of persons employed as construction managers are women[28]. In general the construction industry has a poor reputation regarding female inclusion[4, 20] and negative work environments are linked to attrition for women in non-traditional fields[15].

An individual's career and academic choices, as well as the potential careers a student will consider, are influenced by factors including one's self-efficacy and motivation[11-13]. Bandura[2]

defined self-efficacy as "people's judgments of their capabilities to organize and execute the courses of action required to attain designated types of performances" (p. 391). Marra, Rodgers, Shen, and Bogue's[17] longitudinal study of engineering self-efficacy among women in engineering degree programs revealed significant positive, but short-term, changes in participants' perception of their ability to overcome difficult barriers in order to succeed in engineering education. However after one year, participants' feelings of inclusion within the engineering program were significantly lower suggesting the male-dominated and perhaps negative environment may have impacted their levels of self-efficacy.

According to Bandura[1, 3], personal efficacy expectations are developed through performance accomplishments (mastery experience), verbal persuasion, emotional reactions, and vicarious experiences (i.e. modeled behavior). Modeled behavior and mentoring generates expectations of how one's own performance can improve based on observing (e.g. vicariously experiencing) the performance accomplishment of others. MacPhee, Farro, and Canetto[16] observed gender differences among STEM-minority (underrepresented populations in STEM degrees) students on both academic self-perceptions and performance. Female STEM students had significantly lower self-perceptions of their study skills and academic self-efficacy compared to male students. Over the course of the program, which included workshops and mentoring, female students' academic self-efficacy increased at a rate greater than and eventually surpassed those of male students. Lower academic self-confidence contributed to the underrepresentation of women in STEM education and MacPhee et al.[16] suggest that mentoring programs are a viable option for overcoming the gender disparity in STEM education.

Zeldin and Pajares[30] found that vicarious experiences and verbal persuasions were pivotal sources for self-efficacy beliefs among women with careers in mathematics, science, or technology. Involvement with significant others, such as family members, teachers, peers, and supervisors formed self-efficacy beliefs and influenced their career decisions. Moore and Gloeckner[21] observed that women in construction careers with high self-confidence exhibited high career self-efficacy. The confidence to enter a non-traditional academic program was an outcome of several factors including mathematics and science skills, personality traits, self-efficacy, and the influence of role models, mentors, and significant others[21]. Research suggests that vicarious experiences are often reported as a self-efficacy source for women in non-traditional fields, such as STEM[11, 30].

Mentors, role models, and other supportive relationships generally fall into the following categories: family member, significant other (e.g., friend, partner), educational (e.g., teacher, advisor), career (e.g., co-worker, supervisor), and others (e.g., acquaintances, public figures, media personalities). Kram and Isabella[14] described a mentor as someone who "offers role modeling, counseling, confirmation, and friendship, which can help the young adult to develop a sense of professional identity and competence" (p. 111). According to Gibson[10], role model relationships influence self-concept and provide learning, motivation and inspiration. Mertz[19] defined role models as "someone to whom individuals look or to whom they turn for social and emotional support and affirmation or from whom they seek to learn something related to their 'person-ness'" (p. 552).

Purpose Statement

The current study investigated correlations between construction education domain-level self-efficacy and motivation, which are shown to influence academic pursuits and success, and the existence of mentors and role models among students enrolled in construction management (CM) classes. The ultimate goal of this research is to understand the impact of persons of influence (e.g., mentors and role models) and their relationship with the prevalent constructs (self-efficacy and motivation) that attract students to CM degrees and careers. The findings were compared with established occupational and educational literature. Interpretation of the findings, study limitations, and opportunities for further research are discussed.

Methodology

Since CM is male-dominated, while simultaneously suffering from a lack of adequately skilled workers[23, 26], investigation of the constructs shown to impact students' pursuit of CM education is warranted. STEM self-efficacy and motivation exhibit a positive relationship with the existence of persons of influence (mentors and role models). However, research regarding differences in the existence of persons of influence by gender or in relation to construction education domain-level self-efficacy and motivation are limited. In order to explore these constructs among construction management students within the construction-education domain, the following research questions and hypotheses were developed:

R1: Is there a statistically significant relationship between having a person of influence and construction education self-efficacy (CESE) amongst students? The null (H_0) and alternative (H_1) hypotheses were based on no relationship existing and a relationship existing, respectively, between these constructs.

R2: Is there a statistically significant relationship between having a person of influence and construction education motivation (CEM) amongst students? The null (H_0) and alternative (H_1) hypotheses were based on no relationship existing and a relationship existing, respectively, between these constructs.

R3: Is the relationship between having a person of influence and CESE different amongst male and female students? The null (H_0) hypothesis was based on the relationship between these constructs being different amongst male and female students. The alternative (H_1) hypothesis was based on the relationship between these constructs being the same amongst male and female students.

R4: Is the relationship between having a person of influence and CEM different amongst male and female students? The null (H_0) hypothesis was based on the relationship between these constructs being different amongst male and female students. The alternative (H_1) hypothesis was based on the relationship between these constructs being the same amongst male and female students.

Instrumentation

A quantitative survey was used to explore differences in construction education-domain level self-efficacy and motivation among construction management students. The following constructs from Elliott's[6] Construction Training Attitudes and Intentions Scale (CTAIS) were utilized for data collection: planned training behavior (PTB), construction training self-efficacy (CTSE), and training motivation attitudes (TMA). The CTAIS identifies characteristics intended to contribute to attrition and performance in construction training programs[7]. Therefore, items were adapted for use within the domain of construction education by replacing statements that pertain to training. For instance, the phrase "construction training" was replaced with "construction education" in CTSE and TMA survey items.

For this manuscript, the adapted CTSE construct was analyzed to assess respondents' perceptions of construction education self-efficacy (CESE). The CESE subscale contained fourteen items assessing respondent efficacy toward performance in, or completion of, construction education programs (e.g., "Successfully completing a construction education program is within the scope of my abilities"). Responses were reported on a 5-point Likert scale (e.g., strongly disagree = 1 to strongly agree = 5); higher scores indicate high perceived self-efficacy toward construction education. The adapted TMA construct was analyzed to assess respondents' construction education motivation (CEM). The nine CEM items assessed respondent attitudes and motivation toward construction training (e.g., "I am motivated to learn the skills taught in construction education programs"). Responses for CEM items were also reported on a 5-point Likert scale (e.g., strongly disagree = 1 to strongly agree = 5); higher scores indicate a high level of motivation for successful completion of construction education. For a full review of the CTAIS see Elliott[6] and Elliott and Lopez del Puerto[7]. For the adapted instrument see Elliott, Thevenin, and Lopez del Puerto[8].

The survey was also used to investigate the existence of mentors and role models. As separate items, participants were asked if they had a mentor and role model who influenced their academic decisions. In order to frame the questions, these terms were defined in the survey. A mentor, adapted from Fried and MacCleave[9] (p. 485), was defined as "a person who has influenced your academic decisions by actively giving advice, encouraging (or discouraging), supporting, providing information, or helping you make decisions." A role model, adapted from Nauta and Kokaly[24] (p. 85), was defined in this survey as "a person who, either by doing something or by being admirable to you in one or more ways, has had an impact on the academic decisions you have made in your life. Role models may be people you know personally, or they may be people you simply know of."

Participants with a mentor were asked to identify the mentor who has the greatest influence on their academic decisions by selecting one of the following five response categories: family member, friend/peer/significant other (spouse/partner), professor/instructor/academic advisor, co-worker/supervisor, other. Participants with a role model were asked to identify the role model who has the greatest influence on their academic decisions by selecting one of the following five response categories: family member, friend/peer/significant other (spouse/partner), professor/instructor/academic advisor, co-worker/supervisor, and "someone I know of, but do

not know personally". In addition, participants were asked to report the genders of the mentor and role model and indicated if that person works in the construction industry.

Administration, Data Collection, and Analysis

The survey was administered to a convenience sample of 828 students enrolled in undergraduate-level construction management courses at three universities (University 1, $n = 286$; University 2, $n = 349$; University 3, $n = 193$) during the spring semester of 2014. A total of 679 surveys were returned, yielding a response rate of 82%. The intent of this study was to measure the self-efficacy and motivation of adult undergraduate construction management students. Participants were classified as construction management students if they reported one of the following majors: construction management or pre-CM, dual major (including construction management), construction science, dual major (including construction science), construction, and dual major (including construction). Prior to analysis, 10 minors (participants who reported an age of "17 years old or younger"), 7 graduate students, and 46 non-construction majors (interior design, undeclared, etc.), were removed from the dataset. The data was then screened for outliers, missing, and invalid responses, which resulted in 29 surveys removed. Of the 679 surveys collected, 587 usable surveys were compiled into a single dataset for analysis.

Data were stratified by gender and students with a person of influence were compared to students without a person of influence. The variable "having a person of influence" was aggregated from responses to the mentor and role model items, which had dichotomous responses (i.e., yes/no). The existence of a person of influence was recognized if students reported "yes" to having a mentor and/or role model; students that reported "no" to both items were considered without a person of influence. The associations between having a person of influence and students' construction education self-efficacy and motivation were investigated. Because the distribution of mean CESE and CEM were skewed (-2.06 and -2.34, respectively) and violated the assumption of normality, two-tailed Spearman's rho correlation matrices were developed.

Results

The demographic data of the cleaned sample ($n = 587$) is provided in Table 1. The profile of the 587 respondents was 11.0% ($n = 64$) female and 89.0% ($n = 520$) male. The items related to having a mentor and role model were independent of one another, as described previously. For these items, 50.3% ($n = 290$) responded "yes" to having a mentor and 73.6% ($n = 398$) responded "yes" to having a role model. If a participant responded "yes" to having a mentor and/or to having a role model, they were considered as having a person who influenced their academic decisions. Participants who responded "no" to having a mentor and "no" to having a role model were considered as having no person of influence. Among construction management students, 80.6% ($n = 441$) reported having a person of influence and 19.4% ($n = 106$) reported having no person of influence.

Table 1. Sample Demographic Data of Construction Majors (n = 587)

Characteristic	n	%
Age (years)		
18-19 years	153	26.1
20-21 years	250	42.6
22-24 years	138	23.5
25 years or older	46	7.8
Current year in school at the time of survey		
Freshman	95	16.2
Sophomore	239	40.7
Junior	120	20.4
Senior	133	22.7
Gender		
Female	64	11.0
Male	520	89.0
Has a mentor		
Yes	290	50.3
No	286	49.7
Has a role model		
Yes	398	73.6
No	143	26.4
Has a person who influenced their academic decisions*		
Yes (reported "yes" for mentor and/or role model)	441	80.6
No (reported "no" for both mentor and role model)	106	19.4

Note. Includes Construction, Construction Management, and Construction Science majors

The sample demographic data of CM students were analyzed by the students' gender. As shown in Table 2, 86.4% (n = 51) of female students and 80.0% (n = 389) of male students reported having a person of influence.

Table 2. Sample Demographic Data of Construction Majors by Gender (n = 584)

	Female (n = 64)		Male (n = 520)	
Characteristic	n	%	n	%
Age (years)				
18-19 years	22	34.4	131	25.2
20-21 years	18	28.1	231	44.4
22-24 years	20	31.3	117	22.5
25 years or older	4	6.3	41	7.9
Current year in school at the time of survey				
Freshman	10	15.6	85	16.3
Sophomore	22	34.4	216	41.5
Junior	14	21.9	105	20.2
Senior	18	28.1	114	21.9

Table 2 Continued

Characteristic	Female (*n* = 64)		Male (*n* = 520)	
	n	%	*n*	%
Has a mentor				
Yes	35	56.5	254	49.6
No	27	43.5	258	50.4
Has a role model				
Yes	47	79.7	351	73.1
No	12	20.3	129	26.9
Has a person who influenced their academic decisions*				
Yes (reported "yes" for mentor and/or role model)	51	86.4	389	80.0
No (reported "no" for both mentor and role model)	8	13.6	97	20.0

Note. Includes Construction, Construction Management, and Construction Science majors

Participants also reported demographic characteristics of the mentor and/or role model who had the greatest influence on their academic decisions. As described previously, participants identified the person by selecting one of five response categories, then reported the gender of the person identified in the previous item and documented if that person works in the construction industry. For a full review of the mentor and role model demographics, including cross tabulation analysis for male and female students, see Thevenin and Elliott[27].

The 23-item instrument exhibited internal consistency reliability (Cronbach's α) of 0.95. The construction education self-efficacy (CESE, $n = 14$) and construction education motivation (CEM, $n = 9$) subscales had internal consistency reliabilities of 0.93 and 0.91, respectively.

Addressing the Research Questions

Research question one investigated the relationship between having a person of influence and students' self-efficacy towards construction education (CESE), and research question two investigated the relationship between having a person of influence and students' motivation towards construction education (CEM). In order to address these research questions, Spearman's rho correlation matrices were developed to investigate if there was a statistically significant association between having a person of influence and students' construction education self-efficacy and motivation.

The results for having a person of influence and CESE are displayed in Table 3. Having a person of influence and CESE were significantly and positively correlated ($r_s = .19$, $p = 0.000$). The effect size was small[22] and approximately 4% (r^2) of the variance in construction education self-efficacy can be predicted from having a person of influence. Since CESE was related to having a person of influence the null hypothesis for research question one was rejected.

Table 3. Correlation Matrix (Spearman's rho) for CESE and Influenced by Others

Factor	1	2	*n*	*M*	*SD*
1 CESE	1	--	544	4.20	0.53
2 Person of Influence	.193**	1	544	1.19	0.40

**. Correlation is significant at the 0.01 level (2-tailed).

The results for having a person of influence and CEM are displayed in Table 4. Having a person of influence and CEM were significantly and positively correlated ($r_s = .26$, $p = 0.000$). The effect size was small[22] and approximately 7% (r^2) of the variance in construction education motivation can be predicted from having a person of influence. Since CEM was related to having a person of influence the null hypothesis for research question two was rejected.

Table 4. Correlation Matrix (Spearman's rho) for CEM and Influenced by Others

Factor	1	2	*n*	*M*	*SD*
1 CEM	1	--	546	4.33	0.57
2 Person of Influence	.255**	1	546	1.19	0.39

**. Correlation is significant at the 0.01 level (2-tailed).

The data were stratified by gender to investigate if the associations between these variables differed by gender. Research question three investigated if the relationship between having a person of influence and students' self-efficacy towards construction education (CESE) was different amongst male and female students. Since the distribution of mean CESE for male students was skewed (-2.15), a two-tailed Spearman's rho correlation matrix was developed to address this research question, and the results are shown in Table 5. For male students, there was a significant and positive correlation between having a person of influence and CESE ($r_s = .20$, $p = 0.000$), and the effect size was small[22]. For male students, approximately 4% (r^2) of the variance in construction education self-efficacy can be predicted from having a person of influence.

Table 5. Correlation Matrix (Spearman's rho) for Male Students' CESE and Influenced by Others

Factor	1	2	*n*	*M*	*SD*
1 CESE	1	--	483	4.20	0.53
2 Person of Influence	.198**	1	483	1.20	0.40

**. Correlation is significant at the 0.01 level (2-tailed).

The mean CESE for female students was normally distributed (-.02). Therefore, a Pearson correlation was computed to address research question one for female students and the results for the parametric data are shown in Table 6. The correlation between having a person of influence and CESE was positive ($r = .18$, $p = 0.175$) but was not significant at the 0.05 level for female students. The results indicated that CESE and having a person of influence are not related amongst both male and female students; therefore, the null hypothesis was retained for research question three.

Table 6. Correlation Matrix (Pearson) for Female Students' CESE and Influenced by Others

Factor	1	2	*n*	*M*	*SD*
1 CESE	1	--	59	4.24	0.48
2 Person of Influence	.179	1	59	1.14	0.35

Research question four investigated if the relationship between having a person of influence and students' motivation towards construction education (CEM) was different amongst male and female students. Since the distribution of mean CEM for male students was skewed (-2.34), a two-tailed Spearman's rho correlation matrix was developed, and the results are shown in Table 7. For male students, there was a significant and positive correlation between having a person of influence and CEM ($r_s = .25$, $p = 0.000$); the effect size was small[22]. For male students, approximately 6% (r^2) of the variance in motivation can be predicted from having a person of influence.

Table 7. Correlation Matrix (Spearman's rho) for Male Students' CEM and Influenced by Others

Factor	1	2	*n*	*M*	*SD*
1 CEM	1	--	485	4.31	0.56
2 Person of Influence	.245**	1	485	1.20	0.40

**. Correlation is significant at the 0.01 level (2-tailed).

The mean CEM for female students was normally distributed (-.28). Therefore, a Pearson correlation was computed to address this research question for female students, and the results for the parametric data are shown in Table 8. Having a person of influence and CEM were positively and significantly correlated ($r = .31$ $p = 0.017$) for female students. The effect size was typical[22]. For female students, approximately 10% (r^2) of the variance in construction education motivation can be predicted from having a person of influence. The results indicated that CEM and having a person of influence are related amongst male students as well as female students, therefore the null hypothesis for research question four was rejected.

Table 8. Correlation Matrix (Pearson) for Female Students' CEM and Influenced by Others

Factor	1	2	*n*	*M*	*SD*
1 CEM	1	--	59	4.50	0.43
2 Person of Influence	.311*	1	59	1.14	0.35

*. Correlation is significant at the 0.05 level (2-tailed).

Discussion and Limitations

Previous studies have observed that career and academic decision-making are influenced by others[13, 21, 30]. In this study, a student was considered as having a person of influence if they reported having a mentor (i.e., a person who gives advice and support) and/or a role model (i.e., a person who is admirable) who influenced their academic decisions, as described previously. A summary of the results are show in Table 9. Having a person of influence was related to CESE ($r_s = .19$, $p = 0.000$) and CEM ($r_s = .26$, $p = 0.000$). These correlations mean that students with a person of influence tend to have higher efficacy toward performance in and completion of

construction education programs and higher levels of motivation to complete or perform well in construction education.

Table 9. Correlation Matrix Summary

Correlation (r_s) CM Students

Factor	1	2	3
1 CESE	1		
2 CEM	.705**	1	
3 Influenced by Others	.193**	.255**	1

Correlation (r_s) Male CM Students

Factor	1	2	3
1 CESE	1		
2 CEM	.695**	1	
3 Influenced by Others	.198**	.245**	1

Correlation (r) Female CM Students

Factor	1	2	3
1 CESE	1		
2 CEM	.785**	1	
3 Influenced by Others	.179	.311*	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

These findings are supported by research indicating that vicarious experiences are a source of self-efficacy beliefs[1, 3, 11, 30] and the influence of others is related to protégé motivation[5, 25, 30]. A review of literature revealed numerous studies on self-efficacy, motivation and the influence of others among women in STEM careers and education programs. However, very few studies examining these relationships for students in construction education were identified through an exhaustive review of literature. Furthermore, few studies comparing these relationships by students' gender were found. In this study, having a person of influence was related to CESE (r_s = .20, p = 0.000) and CEM (r_s = .25, p = 0.000) amongst male students. Having a person of influence was also related to CEM amongst female students (r = .31 p = 0.017); however, having a person of influence and CESE were not related amongst female students.

This study was limited to a quantitative cross-sectional survey designed to assess students' perceptions of self-efficacy and motivation regarding construction education. The study sample was composed of 587 college students enrolled in construction management courses at three universities with Construction, Construction Management, and Construction Science programs. The unequal size of the sample limited comparisons by gender between female (n = 64) and male (n = 520) students. However, the distribution of genders in the sample was representative of the ratio of women to men employed in construction. While the conclusions of this study may not be generalizable to other construction education programs, this paper represents an initial step in understanding the relationship between having persons of influence and levels of self-efficacy and motivation.

Conclusions and Further Research

This study provides exploratory results that indicate the influence of mentors and role models have a positive relationship with self-efficacy and motivation toward construction education. The results indicated that having a person of influence is related to CESE and CEM. However, these relationships are different amongst male and female students; having a person of influence and CESE were not related amongst female students in this study. Further research is needed to determine if the scale of measurement (i.e., dichotomous response for having a person of influence) and small, unequal sample (i.e., amongst female students, 51 reported having a person of influence and eight reported having no person of influence) contributed to the results of this study.

The limited number of females participating in both construction careers and education programs is a documented problem, especially in light of the construction industry's skilled labor shortage and lack of diversity[18, 20, 26]. Further investigation would provide educators with a better understanding of how mentors and role models influence both male and female students' self-efficacy, motivation, and academic decisions. This paper supports ongoing research which explores students' levels of self-efficacy and motivation within the construction education domain. Future articles will compare the existence of role models and mentors with students' levels of self-efficacy and motivation, and a forthcoming journal article by Elliott, Thevenin, and Lopez del Puerto[8] compares CESE and CEM by gender and experience (i.e., hands-on experience and construction management experience).

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