Relationship of Construction Engineering and Management Student Performance with Personality Traits: HEXACO and Emotional Intelligence

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Many researchers have tried to predict the factors that can influence the performance of individuals. Similarly, performance of construction engineering and management students in colleges have also been a topic of research for many researcher, for many feel performances in college has an influence on the performance in the construction industry. Previous research have mostly analyzed academic performance with factors such as, GRE, SAT, TOEFL score, and Self-Efficacy, while very little research has analyzed the performance of students with personality traits, HEXACO and Altruism, and Emotional Intelligence (EI). 269 students from different universities across the United States, filled out the HEXACO-PI-R survey and took the EQ test. The results of the survey and test were analyzed for individual student and team academic performance, using exam and project score. Kruskal-Wallis H test was conducted for the relationship between the personality trait's domain and academic performance. The results showed that Conscientiousness and Altruism were significant for individual student performance, while Altruism and Self-Management were found to be significant for team performance. Lastly, no significant result was found for diversity in team personality trait and team performance. This paper can help educators focus on domains that can have an influence on individual student and team performance.

Key Words: Personality Traits, Performance, HEXACO and Altruism, Emotional Intelligence, Kruskal-Wallis H test

Introduction

Performance of students in general, let alone in construction engineering and management degree, has always been a trending topic amongst the researchers. Researchers are striving to find different factors that can predict student performance. There were numerous reasons to find the factors that can predict the performance. Mainly, it can be helpful to concentrate on factors that can have positive affect on performance, therefore, saving time and cost by not focusing on things that are not important. Also, the performance of construction managers is mostly dependent on the performance of construction engineering and management student in colleges (Naveed et al., 2017) because the success of construction project is highly dependent on the skills and performance of construction managers (Ahmed et al., 2014). Student performance has been measured primarily by the academic achievement of the student. Researchers in the United States have measured student performance using high school grade, college entrance exam (Scholastics Assessment Test (SAT), American College Testing (ACT), Graduate Record Examination (GRE)), Grade Point Average (GPA), and subject-specific test scores (Wait and Gressel, 2009; Atwood, 2016; Tyson, 2011). Therefore, finding factors that can help predict student performance is very important.

Literature Review

Many researchers have analyzed the performance of students using many different factors. (Wao et al., 2016), analyzed the relationship of construction engineering student's academic performance, using GPA, with their GRE score. The results of the study showed no significant relationship between GRE and GPA. Similarly, (Wait and

Gressel, 2009) analyzed the relationship of Test of English as a Foreign Language (TOEFL) score with GPA, as a measure of academic performance of international students. Their results showed that TOEFL score does have a positive correlation with GPA, but still it was not considered a reliable criteria to predict performance. Moreover, researchers have also focused on performance of industry professional. One such study was conducted by (Blomquist et al., 2016), which developed a Self-Efficacy survey specifically for project managers, in order to predict the performance of the project managers.

Similarly, researchers have also used personality traits as a predictor of performance for engineering students. (Mischung et al., 2015), used Emotional Intelligence (EI) to predict the performance of construction management students, concluding that teams trained on EI was more likely to achieve better performance compared to those who were not. Personality traits have also been used to determine the relationship of performance on a job. (Sohn and Lee, 2012), used HEXACO to predict the performance of labor in tourism industry. Extraversion, Agreeableness, Conscientiousness, and Openness to Experience were the four domain found significant.

Personality traits have also been used as a predictor for many other variables. (Hall et al., 2015), used NEO Five-Factor, as a personality trait measure, along with other academic performance, SAT score and GPA, to determine the relationship with retention of engineering student. (Shu et al., 2017), used HEXACO and Cultural Quotient (CQ) to predict the cross-cultural adjustment of students. The research concluded that HEXACO was found to be a predictor of student's interaction and school related adjustment. (Weller and Thulin, 2012), used HEXACO to predict the risk preference as a function of whether the decision was presented as a potential gain or loss.

Point of Departure and Research Questions

As student performance is considered to be have a relationship with industry performance, it was therefore necessary to find factors which are predictors of student performance. As concluded by (Woa et al., 2016) that GRE was not a good predictor of student performance, and (Wait and Gressel 2009), though found a positive correlation of TOEFL score with student performance, but still advised not to base admission decision solely on TOEFL score. This creates a gap in the literature, to determine the factors that can have an impact on student performance.

As explained above, personality traits have been used by researchers as a predictor for many different variables. Many of these studies have also found significant results with these variables. Furthermore, many of the companies today in the construction industry, recruits new employee based on personality traits, which were benchmarked to their best performing employee. Therefore, seven factor, HEXACO and Altruism, and EI, were used as a predictor of student performance. This led to the development of the first research question,

Research Question 1) What is the relationship between the individual personality traits (HEXACO and Altruism, and EI) with individual performance (exam score)?

The first research question analyzes the relationship of individual personality traits, HEXACO and Altruism, and EI, with the individual performance, exam score. 269 students were categorized into top quartile and bottom quartile based on their exam score. Top quartile were students achieving exam scores greater than 75th percentile, while bottom quartile were students achieving exam scores lesser than 25th percentile.

Team work is considered a very important skill in the construction industry (Bahner, 1996; Natishan et al., 2000). But many industry professionals have criticized that there is a need for team building skills in the industry (Adams, 2003; Bahner, 1996). Many blame the traditional education strategies that inadequately prepare engineering student to work in a collaborative manner (Kalonji, 2005). Therefore, it was important to determine the factors that can predict the team performance. Once known, these factors could be focused on more to make teams perform better. Similarly, it was important to determine the team makeup which can lead to better performance. Yet, very little or no research has measured the team performance relationship with any factor. This was considered another gap in the literature, which led to the development of the other two research questions.

Research Question 2) What is the relationship between the team personality traits (HEXACO and Altruism, and EI) with team performance (project score)?

The second research question which was focused on the team performance, analyzes the performance of the team using project score, with team personality traits. Although no such survey was conducted that could measure the team HEXACO and Altruism, and EI, it was therefore, found logical to average the score of team members for each domain in order to determine the team personality score. 48 teams were categorized into top quartile and bottom quartile based on their project score. Top quartile were teams achieving project scores greater than 75th percentile, while bottom quartile were teams achieving project scores lesser than 25th percentile

Research Question 3) What is the effect of diversity in team members' personality traits (HEXACO and Altruism, and EI) on team performance (project score)?

The last research question which was focused on the diversity of the team. The objective of the research question was to determine how much effect does diversity in the personality traits of a team have on the team performance. This was done using a statistical measure, coefficient of variation (CV). Mathematically, CV is a ratio of standard deviation to mean. High value of CV means the team was diverse in that domain, while, low value of CV means that the team had clustered values in that domain, hence not much diversity.

Methodology

Data Collection

The paper analyzes 269 construction management and engineering students from three different universities across the United States. These students were enrolled in core construction management classes: estimating and bidding, construction planning, request for proposal (RFP), and research methods. Students were asked to fill out personality trait survey, HEXACO - Personality Inventory – Revised (HEXACO-PI-R). While, Emotional Intelligence (EI) was measured through Emotional Quotient (EQ) test. Out of the 269, 216 were male and fifty were female, while three chose not to reveal their gender. Moreover, forty-five students were surveyed in 2015, and the rest, 224 were surveyed in 2016. Analysis was conducted for the 269 students who filled out the survey and the 48 teams which were formed from these 269 students. Lastly, performance of students and teams was measured using the exam score and the projects score, respectively.

Variables

HEXACO-PI-R (HEXACO and Altruism)

Personality traits of a student were measured using the HEXACO model with Altruism as a separate domain. Although the Big Five model have mostly been used to measure personality traits, but for a past decade, researchers have suggested an adoption of a broad personality trait measure (Lee & Ashton, 2004), hence HEXACO model was used as an alternate to the Big Five. One other change to HEXACO was that Altruism was measured separately. Although, it was considered as one of the facets of Openness to Experience, later studies found that Altruism represents a blend of Honesty/Humility, Emotionality, Agreeableness, and as well as interstitial Altruism (Ashton et al. 2014). HEXACO-PI-R is a 60-item survey that was used, which contains 60 questions with 10 questions for each domain, and at least 2 questions for each of the four facets of each domain. The survey was measured on a Likert scale of 1 – 5, and hence, these domains were found to be ordinal (discrete) in nature.

HEXACO consist of six personality domain, Honesty/Humility, Emotionality, Extraversion, Agreeableness, Conscientiousness, and Openness to Experience. Each of these domains has it owns characteristics and questions in each domain were based on its four facets. For instance, high scores in Honesty/Humility shows that the individual avoids manipulating other individuals and were not interested in lavish wealth and luxuries. Whereas, High scores in Emotionality indicates an individual experiences anxiety to life's stresses, feels empathy and get attached to people easily. High scores in Extraversion indicates that an individual feels optimistic about things, feels confident, and enjoy social gathering and high scores in Conscientiousness indicates that an individual was better organizer of their time and physical surrounding, were disciplined, and strive to achieve perfection in their task. Individuals with high scores in Openness to Experience tends to be absorbed in beauty of art and science, were imaginative, and take

interest in unusual ideas. Lastly, High scores in Altruism shows that an individual was soft-hearted and avoid causing harm to other. Lower scores in all the domains represent the attributes opposite to high scores.

Emotional Quotient (EQ)

Emotional Intelligence scores have shown to be predictor of performance in a workplace amongst teams and in leadership and a lot of different companies now offer training in EI, to make their employee more emotionally intelligent, in order to achieve better productivity and performance (Mischung et al., 2015). Emotional Intelligence was measured using the Emotional Quotient (EQ) test. EQ consisted five domains: Self-Awareness, Self-Management, Social Awareness, Relationship Management, and overall EQ. Individuals with high Self-Awareness scores tends to have a well-grounded sense of self-confidence. Individual with high scores in Self-Management tends to have a positive behavior. Individuals with high scores in Social Awareness have ability to pick up on emotions and read situations. Individuals with high scores in Relationship Management have ability to use the awareness of one's own emotions and the emotions of others to manage interactions successfully.

Performance

Performance of student was measured for both, individual students and team. There are many ways to measure the performance of students in the United States, of them the mostly used were high school grade, college entrance exam (SAT, ACT, GRE), grade point average (GPA), and subject-specific test scores (Wait and Gressel, 2009; Atwood, 2016; Tyson, 2011). Individual performance in this research was measured using subject specific course that was the exam score for students in courses they took. Team performance was measured using the project score in that course.

Exam Score: It was used to measure the individual performance of the student. These values were measured in percentage, from 0 to 100%. Exam score was continuous data, but in this paper, it was only used to categorize the performance of student based on top quartile (more than 90.44%) and bottom quartile (less than 74.25%). The median exam score was 83.45%, with a maximum of 100.00% and minimum of 25.52%.

Project Score: It was used to measure the team performance of the student. These values were measured in percentage, from 0 to 100%. Exam score was continuous data, but in this paper it was only used to categorize the performance of teams based on top quartile (more than 93.63%) and bottom quartile (less than 87.00%). The median project score was 90.00%, with a maximum of 100.00% and minimum of 54.67%.

Results

Descriptive Testing

Descriptive analysis such measure of central tendency and spread was used for different domains of personality traits and performance. Descriptive statistics was applied to both, individual and team personality traits and performance as shown in Table 1 below.

Table 1

Descriptive analysis of personality traits for individual students and teams.

Personality Trait	Individuals						Teams					
	N	Max.	Min.	Mean	Median	S.Dev.	N	Max.	Min.	Mean	Median	S. Dev.
Honesty/Humility	269	4.81	2.00	3.30	3.31	0.51	48	3.88	2.88	3.23	3.22	0.22
Emotionality	269	4.50	1.38	2.99	3.00	0.53	48	3.52	2.10	2.97	3.00	0.27
Extraversion	269	4.88	1.94	3.44	3.44	0.50	48	3.98	2.84	3.43	3.44	0.24
Agreeableness	269	4.75	1.38	3.09	3.13	0.48	48	3.53	2.56	3.03	3.01	0.24
Conscientiousness	269	4.94	2.06	3.60	3.63	0.51	48	4.22	3.22	3.64	3.63	0.24

Openness to Exp.	269	4.69	2.06	3.39	3.38	0.52	48	3.80	2.66	3.33	3.35	0.26
Altruism	269	5.00	1.75	3.60	3.50	0.61	48	4.13	2.63	3.54	3.50	0.29
Self-Awareness	269	98.00	30.00	74.92	75.00	11.93	48	89.00	57.00	74.89	72.92	6.77
Self-Management	269	99.00	47.00	73.03	73.00	10.82	48	91.33	61.00	73.17	73.25	6.04
Social Awareness	269	100.00	35.00	72.44	74.00	11.42	48	88.50	57.00	72.59	72.50	6.53
Relationship Mng.	269	97.00	37.00	72.50	73.00	11.93	48	86.33	60.00	72.62	72.75	6.81
Overall EQ	269	97.50	47.25	73.22	73.50	9.43	48	87.50	61.88	73.32	73.81	5.39

Inferential Testing

Kruskal-Wallis H test was used to answer all three research questions. Kruskal-Wallis H test was a non-parametric test, which was most applicable here, as the dependent variables used i.e. the personality traits were ordinal in nature and EI values were not normally distributed.

Research Question 1: Relationship of Individual Personality Traits (HEXACO and Altruism, and EI) With Individual Performance (Exam Score).

First area of analysis was to analyze the relationship of individual personality trait with individual performance. Kruskal-Wallis H test was conducted between individual personality traits, HEXACO and Altruism, and EI, and individual performance, exam scores. Table 2, below shows the results for the test. It was found that median values for individual personality traits were only found statistically significant for Conscientiousness, with p-value of 0.021, significant at 0.05, and Altruism, with p-value of 0.042, significant at 0.05. The significance showed that, students with high scores in Conscientiousness and Altruism, achieved high exam score, and vice versa. This was found to be consistent with (McAbee et al., 2014), which conducted bi-factor model of personality trait (HEXACO) with student academic performance, and found that Conscientiousness was significant with academic performance. This study further builds on it, and shows that Altruism was also a factor in predicting student performance.

Table 2

Kruskal-Wallis H test for individual performance in exam and personality traits

| Personality Traits | Top Quartile | | Bottom Quartile | | p-value |
	N	Median	N	Median	
Honesty/Humility	57	3.44	57	3.25	0.319
Emotionality	57	2.94	57	3.06	0.204
Extraversion	57	3.56	57	3.31	0.152
Agreeableness	57	3.13	57	3.13	0.676
Conscientiousness	57	3.88	57	3.50	0.021*
Openness to Experience	57	3.38	57	3.25	0.254
Altruism	57	3.75	57	3.50	0.042*
Self-Awareness	57	75.00	57	75.00	0.422
Self-Management	57	73.00	57	71.00	0.298
Social Awareness	57	74.00	57	74.00	1.000
Relationship Management	57	73.00	57	77.00	0.502
Overall EQ	57	73.50	57	74.75	0.780

*Significant at 0.05

Research Question 2: Relationship of Team Personality Traits (HEXACO and Altruism, and EI) With Team Performance (Project Score)

The second area of analysis was to determine the relationship between team personality traits and performance. Kruskal-Wallis H test was conducted between team personality traits, HEXACO and Altruism, and EI, and team performance, project scores. Table 3, below shows the results for the test. It was found that median values for team personality traits were only found statistically significant for Altruism, with p-value of 0.014, significant at 0.05, and Self-Management, with p-value of 0.036, significant at 0.05. The significance showed that, students with high scores

in Altruism, achieved high exam score, and vice versa. Conversely, students with lower scores in Self-Management achieved high project score, and vice versa.

Table 3

Kruskal-Wallis H Test for team performance in project and personality traits

| Personality Traits | Top Quartile | | Bottom Quartile | | p-value |
	N	Median	N	Median	
Honesty/Humility	12	3.33	13	3.19	0.243
Emotionality	12	3.02	13	3.00	0.594
Extraversion	12	3.43	13	3.53	0.812
Agreeableness	12	2.98	13	3.02	0.793
Conscientiousness	12	3.58	13	3.63	0.602
Openness to Experience	12	3.43	13	3.40	0.937
Altruism	12	3.71	13	3.63	0.014*
Self-Awareness	12	73.63	13	72.33	0.631
Self-Management	12	70.42	13	74.33	0.036*
Social Awareness	12	72.54	13	73.67	0.911
Relationship Management	12	72.58	13	77.50	0.408
Overall EQ	12	71.56	13	75.75	0.542

*Significant at 0.05

Research Question 3: Diversity in Team Members' Personality Traits Effect on Team Performance

The third and last area of analysis was to determine the effect of diversity in personality traits in a team on the team performance. Kruskal-Wallis H test was conducted between team personality traits CV values and team performance, project scores. Table 4, below shows the results for the test. None of the domains of personality trait were found to be significant.

Table 4

Kruskal-Wallis H Test for diversity in team personality trait and team performance in project

| Personality Traits | Top Quartile | | Bottom Quartile | | p-value |
	N	Median	N	Median	
Honesty/Humility	12	10.38%	13	18.59%	0.157
Emotionality	12	8.27%	13	12.03%	0.391
Extraversion	12	15.49%	13	7.09%	0.187
Agreeableness	12	7.72%	13	16.00%	0.241
Conscientiousness	12	9.16%	13	10.87%	0.855
Openness to Experience	12	13.01%	13	14.24%	0.363
Altruism	12	12.86%	13	15.23%	0.456
Self-Awareness	12	12.07%	13	14.85%	0.287
Self-Management	12	11.81%	13	13.54%	0.474
Social Awareness	12	11.66%	13	13.77%	0.733
Relationship Management	12	9.78%	13	12.90%	0.446
Overall EQ	12	10.09%	13	11.55%	0.968

*Significant at 0.05

Discussions

Only two domains were found to be significant with individual student performance. Table 2, shows that relationship of individual student personality traits with individual student performance. It was found that top quartile tends to have higher Conscientiousness and Altruism score. Students that have Conscientiousness qualities

i.e. were better organizers of their time and physical surrounding, were well-disciplined, and look for perfection in their work, or have Altruistic qualities i.e. were soft hearted and avoid causing harm to others, were usually placed in the top quartile.

Similarly, only two domains were found significant with team performance. Table 3, shows the relationship of team personality trait with team performance. It was found that teams in top quartile had on average, higher Altruism scores and lower Self-Management scores. Therefore, teams should either have members with high Altruism scores or with equal members of very high and moderate Altruism scores in order for the average Altruism score to be high. Similarly, for Self-Management, teams should either have all members with low score, or equal number of members with very low scores and moderate scores, in order to achieve an average of low score. In a nut shell, the teams should have Altruistic qualities such as, being soft-hearted and avoid causing harm to other, would achieve better performance. On the other hand, top quartile team did have lower Self-management scores, but these scores were high, never the less. This means that being too self-managed as a team or not being self-managed at all, can both lead to performing low.

No significant result was found for relationship between team diversity and team performance. The last table, Table 4, shows CV values of team personality traits with top and bottom quartile. Although, no result was found to be significant, at level of significance at 0.05, but Honesty/Humility and Extraversion were significant at significance level of 0.2. A larger sample size can be helpful in showing some significance.

Conclusions

A data sample of 269 construction engineering and management students was collected from different universities across the United States. A HEXACO-PI-R 60 item survey and an EQ test was sent out to all students to complete at the end of the semester. Apart from the survey, individual student exam and team project score was gathered for the course the students were enrolled in that semester.

With various studies trying to find the factor that best predicts the performance of the students, very little or no study have yet analyzed the relationship of performance with personality traits. This led to the formation of the first research question, that if there exist a relationship between individual personality traits, HEXACO and Altruism, and EI, with individual performance, exam score. Team building and collaboration, was considered to be very important part of successful construction projects. Therefore, the second and the third research question was developed to find the relationship of team personality trait and the diversity in team personality trait with the performance, project score.

The results showed that students in top quartile had a higher Conscientiousness and Altruism scores. While, teams in top quartile had a higher average Altruism and lower Self-Management score. Diversity in team personality was not found to be significant for project performance, although at higher level of significance top quartile teams had a lower diversity in Honesty/Humility and higher diversity in Extraversion. The results from this study show that individual personality can be a predictor of individual performance. The results of the study can also be helpful in forming teams to achieve better performance. Although, the limitation of the research was lower sample size when analyzing team, it is recommended for future research to use a larger sample size for much accurate results. Also, similar research framework can be used to analyze the performance of professionals in construction and other industry. Future research also includes comparison of students based on gender and different field of study.

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