Exploring the Relationship between Mindfulness and Personality to Improve Construction Safety and Work Performance

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ABSTRACT

The construction industry still leads the world as one of the sectors with the most work-related injuries and worker fatalities. Recent studies show that both a state of mindfulness and various personality traits contribute to individuals' safety and work performance. This study examines the relationship between mindfulness and personality by measuring the mindfulness state of individuals against their personality traits. To achieve this objective, data were collected from a sample of 55 undergraduate students at George Mason University. Scores from the Big Five Inventory were ranked by each traits' score (independent variable) and split into three groups: high, moderate, and low scores. The corresponding mindfulness scores (dependent variable) were analyzed to determine the relationship between high/low personality traits and mindfulness. Comparing the high/low groups using statistical analyses showed that three of the five personality traits—conscientiousness, agreeableness, and neuroticism—significantly correlate with higher mindfulness scores of individuals. As mindfulness has been shown to increase individual safety and work performance and to reduce stress, the results of this study help inform future work into translating personality and mindfulness characteristics into factors that predict specific elements of unsafe human behaviors.

INTRODUCTION

With more than 950 fatalities among construction workers every year in the United States alone (Bureau of Labor Statistics [BLS], 2017), the safety performance of construction workers demands improvement. Construction sites feature numerous moving parts, including heavy machinery, building materials, and various quantities of construction professionals trying to get the job done in time and on budget. Therefore, workers are under pressure to execute their work under hectic and immensely demanding conditions that can create inattentiveness (Hasanzadeh et al., 2018) or stress (Leung et al., 2007, 2009, 2012). Considering that inattentiveness and stress are factors that contribute to the unsafe behaviors of construction workers (Leung et al., 2012), such consideration demand safety managers seek practices that can be used to reduce distraction and stress on jobsites.

One technique to increase awareness and reduce stress is to implement mindfulness practices. Mindfulness is particularly related to attention and awareness (Brown & Ryan, 2003), which are essential factors in workplace safety (Nolan, 2017). Improving mindfulness can help enhance the situational awareness of construction workers and improve safety. Thus, measuring mindfulness may help identify at-risk workers who may need additional support or training to prevent accidents.

However, since measuring mindfulness on a routine basis for every worker can be cumbersome, researchers have attempted to link mindfulness to other common, more static human factors, such as personality. Current studies on personality show that certain personality traits are highly related to the safety and the attentional failures that can lead to unsafe behaviors (Hasanzadeh et al., 2019). Therefore, using personality traits to predict the state of mindfulness among construction workers presents a potential pathway toward helping safety managers detect distracted workers.

Unfortunately, only a limited number of studies have investigated how personality and mindfulness are related in the construction industry. Therefore, to address this knowledge gap, this study examines the relationship between mindfulness and personality in the context of construction safety. The results of this study offer solutions to reducing accidents in the construction industry by providing additional factors that may be used in a predictive index. Furthermore, the results may be used as inputs to design better safety trainings to enhance worker safety on job sites, which in turn will conceivably lead to better safety performance.

BACKGROUND

Mindfulness

Mindfulness helps individuals reduce the stress caused by work-related or personal issues that arise in day-to-day activities (Grossman et al., 2011). Investigations into the benefits of mindfulness have shown a positive interaction between dispositional mindfulness and task, and between dispositional mindfulness and safety performance in complex work environments (Zhang et al., 2013). In a follow-up study conducted on a sample of workers in a nuclear power plant, Zhang and Wu (2014) investigated the relationship between dispositional mindfulness and workplace safety; the study found that the mindfulness of individuals in a workplace has a positive influence on safety compliance and safety behavior. Zhang and his colleagues also concluded that dispositional mindfulness is a good predictor of safety performance for workers, and mindfulness training can improve workplace safety. Additionally, another study showed that incorporation of mindfulness training in the workplace increases safety and can be used as an intervention to enhance safety performance (Nolan, 2017). In summary, reviews of the mindfulness literature indicate that mindfulness and mindfulness-based practices have positive effects on the mental and physical health of individuals (Kabat-Zinn, 1990; Brown & Ryan, 2003; Chiesa & Serretti, 2010). Consequently, this attribute deserves attention within the construction-safety literature.

Personality

Because a number of features of human behavior can be predicted by different personality traits, several studies have been conducted in the field of psychology and beyond to better understand the nature of personality traits (e.g., Pervin & John, 1999). Personality is typically measured using the Big Five personality traits model, which includes the following elements (Borgatta, 1964; McCrae & Costa 1989; Costa & McCrae, 1992): (1) extraversion or surgency (talkative, assertive, energetic); (2) agreeableness (good-natured, cooperative, trustful); (3) conscientiousness (orderly, responsible, dependable); (4) emotional stability or neuroticism (calm, not neurotic, not easily upset); and (5) culture or openness (intellectual, polished, independent-minded). Several data-collection instruments have been developed to measure these traits. One instrument that has been widely adopted by researchers is the Big Five Inventory (BFI) developed by John and Srivastava (1999), which consists of 44 items developed to represent an individual's personality. The five-factor structure of the BFI is the result of repeatable, scientific, and well-established measures of personality (Barrick, Mount & Judge, 2001). The relatively small amount of time required to complete the 44-item (relatively large) questionnaire makes it an ideal tool to accurately measure aspects of personality.

The literature on personality shows that personality traits can be used as a predictive index of one's relationship with accident involvement (Cellar et al., 2001; Clarke & Robertson, 2005). Most personality studies have been conducted in the field of psychology for clinical purposes, but limited studies have examined the role of personality in construction-safety performance. Sing et al. (2014) conducted a study on personality and the occupational accidents among Chinese bar benders and found that there is a significant relationship between personality, unsafe behavior, and frequency of injures. In a laboratory eye-tracking experiment, Hasanzadeh et al. (2019) explored the relationship between personality, attention, and hazard-identification performance for workers exposed to fall hazards; their outcomes show that extraversion, conscientiousness and openness are significantly related to attentional allocation and workers' search strategy for fall hazards.

Mindfulness and Personality

The relationship between personality and mindfulness has been of interest to researchers in the last decade. A meta-analysis conducted by Giluk (2009) on the relationship between personality and mindfulness found that neuroticism is negatively associated with dispositional mindfulness; conscientiousness and agreeableness are positively associated with dispositional mindfulness; and extraversion and openness have a weak positive relationship with dispositional mindfulness. Similar results were found by Tucker et al. (2014), with neuroticism being negatively associated with mindfulness while the other personality factors were positively associated. The relationship between mindfulness and personality (five-factor model) using a canonical correlation analysis showed that mindfulness is significantly correlated with each personality factor, with the strongest relationship appearing in the correlations between mindfulness and neuroticism, and mindfulness and conscientiousness (Hanley, 2016).

RESEARCH METHODS

To investigate the relationship between mindfulness and individual personality, the research team collected data from 55 undergraduate students at George Mason University. Participants had diverse work experience ranging from internships to 18 years of experience in the construction industry. The data were collected in a controlled environment to minimize any potential environmental disturbance that might impact participants' mindfulness scores. Participants were compensated for attending the experiments and all procedures were approved by the Institutional Review Board (IRB) at George Mason University.

To measure mindfulness, the research team used the Mindful Attention Awareness Scale (MAAS), developed by Brown and Ryan (2003), which is one of the most reliable techniques for measuring mindfulness. The MAAS uses a Likert scale ranging from 1 to 6 (almost always to almost never). For example, one item asks a participant "I rush through activities without being really attentive to them" to answer according to their day to day experience. The average score of the total items is computed to report the participant's mindfulness score, with high scores indicating a higher level of mindfulness and vice versa. Personality was measured using the Big Five Inventory (BFI) developed by John and Srivastava (1999). The BFI also uses a Likert scale ranging from 1 to 5 (strongly disagree to strongly agree). All the items in this questionnaire begin with the sentence "I see myself as someone who…" for e.g. likes to cooperate with others, is reserved, can be moody etc. and participants answer to which extent they agree or disagree with each item.

After collecting data but before conducting the analysis, the research team first tested the assumptions of randomness and normality to confirm the feasibility of the intended statistical analysis. The order of the data was kept consistent with the sequence in which the participants arrived to participate in the data collection, so the randomness of the data was justified. Both the independent and dependent variables were checked for normality; the results are shown in Table 1. Since the skewness and kurtosis values for the personality traits and the mindfulness measure were between -1.96 to 1.96, and since the corresponding Shapiro-Wilk (SW) p-values were greater than 0.05, the normality assumptions were satisfied for the entire set of data.

Table 1. Normality tests for mindfulness and personality traits

	Skewness	Kurtosis	P-values (SW)
Mindfulness	-0.63	0.61	0.20
Extraversion	-0.19	-0.31	0.77
Agreeableness	-0.29	-0.05	0.45
Conscientiousness	0.01	-0.57	0.39
Neuroticism	0.10	-0.37	0.55
Openness	-0.23	-0.26	0.60

Second, the average scores between personality traits and the mindfulness measure were compared to test whether there was any statistically significant difference between these variables. Personality traits were treated as independent variables

because they do not change much with time; mindfulness was treated as a dependent variable. Accordingly, the two null hypotheses tested in this study were:

- **H_1**: There is no correlation between personality traits (i.e., extraversion, agreeableness, conscientiousness, neuroticism, openness) and the mindfulness measure (i.e., MAAS)
- **H_2**: There is no relationship between personality traits and the mindfulness measure (i.e., MAAS)

To test the above hypotheses, the data points were sorted in descending order for each personality trait (extraversion, agreeableness, conscientiousness, neuroticism and openness). To explore the relationship between each personality trait and subjects' mindfulness scores, the data were then divided into groups defined by low and high personality scores. As recommended by Gelman and Park (2009), splitting data into tertiary categories is more effective than a binary split. The first group comprised the top 33 percentile, (those with high scores per trait), and the second group comprised the bottom 33 percentile (those with low scores per trait). As the middle third would be moderately similar to either high or low scores, these data were removed from the analysis.

After grouping the data points based on each independent variable, the research team tested the assumption of normality again for the corresponding MAAS scores. One data point (same score) was removed from the high extraversion and low neuroticism group because it was determined as an outlier (more than 1.5 times the interquartile range below the first quartile). Each group was checked for normality; the results are shown in Table 2.

Table 2. Normality tests for different groups of personality traits

Personality traits	Group	MAAS scores			
		N	Skewness	Kurtosis	P-values (SW)
Extraversion	High	19	0.49	-0.68	0.22
	Low	19	-0.95	0.41	0.09
Agreeableness	High	19	-0.30	-0.01	0.97
	Low	21	-0.59	-0.70	0.12
Conscientiousness	High	19	-0.35	0.93	0.73
	Low	21	0.06	-0.91	0.77
Neuroticism	High	19	-0.23	-0.78	0.73
	Low	18	-0.16	-0.11	0.83
Openness	High	21	-1.12	1.34	0.07
	Low	20	-0.31	0.61	0.98

Because the normality assumption was not violated, a two-sample t-test was used to test the differences between mindfulness scores for each of the personality traits. To run the two-sample t-test, the research team used JMP Pro 14.1.0.

RESULTS

First, descriptive statistics of mindfulness scores for different groups of personality traits were computed; the results are shown in Table 3. Individuals with high extraversion, high agreeableness, high conscientiousness, and low neuroticism had higher mindfulness scores. There was minimal difference between individuals with low or high openness.

Table 3. Descriptive statistics of mindfulness scores for different groups of personality traits

Personality Traits			MAAS scores		
	Group	N	Mean	Median	Standard deviation
Extraversion	High	19	4.33	4.33	0.63
	Low	19	3.88	4.07	0.85
Agreeableness	High	19	4.28	4.27	0.64
	Low	21	3.63	3.80	0.68
Conscientiousness	High	19	4.39	4.33	0.59
	Low	21	3.61	3.53	0.63
Neuroticism	High	19	3.48	3.47	0.86
	Low	18	4.39	4.43	0.68
Openness	High	21	3.99	4.27	0.99
	Low	20	3.99	4.07	0.77

Second, the correlation between high and low personality traits and the corresponding mindfulness measure was calculated (Table 4). It was found that extraversion, agreeableness and conscientiousness have statistically significant positive correlations with mindfulness scores, while neuroticism is negatively correlated with the mindfulness measure. There was no statistically significant correlation between openness and the mindfulness measure.

Table 4. Results of correlation analysis between high and low personality traits and corresponding MAAS scores

Personality Traits	Correlation	P-value
Extraversion	0.43	<0.01*
Agreeableness	0.45	<0.01*
Conscientiousness	0.56	<0.001**
Neuroticism	-0.54	<0.001**
Openness	-0.05	0.77

* Sig. at the 0.01 level (2-tailed)

** Sig. at the 0.001 level (2-tailed)

Finally, the results of a comparison between mindfulness scores for individuals with high and low scores for different personality traits using a two-sample t-test is shown in Table 5. The p-values in Table 5 show that agreeableness, conscientiousness, and neuroticism were found to be significantly related to the subjects' MAAS mindfulness scores. Extraversion was moderately related to mindfulness score and openness was found to not be significantly related to mindfulness scores.

Table 5. Results of two-sample t-test for different groups of personality traits

Personality Traits	P-value
Extraversion	0.07
Agreeableness	<0.01*
Conscientiousness	<0.001**
Neuroticism	<0.001**
Openness	0.99

* Sig. at the 0.01 level (2-tailed)
** Sig. at the 0.001 level (2-tailed)

DISCUSSION

The research finding shows that there is significant positive correlation between high and low personality traits (extraversion, agreeableness, conscientiousness and neuroticism) and the corresponding mindfulness measure, and therefore rejecting our first null hypothesis except for openness personality trait. The results of the t-test indicate that there is a significant relationship between high and low personality traits (agreeableness, conscientiousness and neuroticism) and the corresponding mindfulness measure, and therefore also rejecting the second null hypothesis except for extraversion, openness and corresponding mindfulness measure.

Both the correlation and two-sample t-test analyses showed significant relationships between the personality traits of agreeableness, conscientiousness, and neuroticism and their respective MAAS mindfulness measures. Agreeableness and conscientiousness are positively related to mindfulness scores because highly agreeable people tend to work well with others, have great team and interpersonal skills whereas exhibiting high conscientious is related to high attentiveness which are highly related to greater mindfulness state. In contrast, neurotic personality is associated with being unstable and nervous that is negatively associated with mindfulness. This finding is consistent with past literature: In a meta-analysis of 29 different studies about the relationship between personality and mindfulness, Giluk (2009) found that neuroticism and conscientiousness had the strongest negative and positive relationships respectively with mindfulness.

The results of this study have several implications for both academia and practice. Firstly, this study is one of the first to provide proof of the relationships between personality traits and mindfulness in the context of construction safety. Traditionally, researchers have attempted to attribute construction workers' involvement in occupational incidents with certain personality traits (Clarke & Robertson, 2005); however, recent studies show there may be dependent variables that mediate this relationship (e.g., Hasanzadeh et al., 2019). Considering that previous studies have shown that personality traits have significant impacts on cognitive processes—such as attention (Hasanzadeh et al., 2019)—and that mindfulness is also highly related to attention (Brown & Ryan, 2003), the results of this study suggest that mindfulness may mediate the impact of personality traits on the attentional failures of construction workers. Because workers' lack of attentiveness in detecting hazards is a major

contributing factor to occupational incidents (Hasanzadeh et al., 2016, 2017a, b, c), further study on the impact of mindfulness within this arena would be rewarding.

Determining the relationship between personality traits and mindfulness will benefit practitioners, too. Since low mindfulness is an indicator of lower attention and situational awareness, measuring personality traits related to lower mindfulness provides an indirect measure for detecting potentially inattentive workers. In response, safety managers can provide personalized training for workers based on their individual needs. In addition, by understanding differences in the capability of workers, project managers can assign workers with different personalities to activities that are more suited to their cognitive capabilities. More efficient allocation of human resources will improve both safety and productivity.

CONCLUSIONS

The results of this study demonstrate that individuals with highly agreeable and conscientious personalities have higher mindfulness scores and are positively related. In contrast, highly neurotic personality scores correspond to low mindfulness scores and are negatively related. The results show that the relationship between extraversion and mindfulness is moderately significant ($0.05 < p < 0.1$), whereas the relationship between openness and mindfulness is not significant at all. As discussed in the previous section, these findings have important implications for better understanding the role of the human factor in incident involvement, designing personalized safety interventions, and allocating safety resources more efficiently.

One of the main limitations of this study relates to the small sample size. While this manuscript describes one of the earliest studies to investigate the role of personality in determining the mindfulness and attentiveness of construction workers, future studies should be conducted with larger sample sizes to increase the confidence and generalizability of the results. Furthermore, future research should be conducted to shed light on the relationships between personality and the other cognitive processes that act as mediators affecting hazard identification and safe behavior.

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