Does Intelligence Influence Students' Academic Achievement? A Structural Equation Modeling Approach

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Research Article

Abstract

Purpose: *The study attempts to unearth the relative impact of intelligence and creative self-belief on creative capability and academic achievements.*

Methods: *Senior students from three different disciplines were purposively chosen from the business school of the University of Chittagong, Bangladesh. This study used 192 replies, with a response rate of 64 percent through a self-administered Survey. The study applied the structural equation model in AMOS 20 for data analysis.*

Results: *The results showed that neither intelligence nor creative self-belief, nor the students' creative capability significantly predicts the students' academic achievement. However, it is observed that intelligence and creative self-belief significantly influence the students' creative capability.*

Implications: *The most revealing implication of this study is to uncover the potential ways for exploring the relevance of the students' intelligence, creative self-belief, and creative capability with their academic achievement.*

Originality*: This study is a novel attempt to explore the topic in the context of developing countries, particularly in South Asian contexts. Additionally, most of the studies conducted in this area are noted in school and high school levels. Interestingly, there are very few studies happened to be in the business school context.*

Keywords: Intelligence, Creative Self-belief, Creative Capability, Academic Achievement, Business School, Undergraduate Students

1. Introduction

Is intelligence related to creative self-belief, creativity, and academic achievement? Do the relationships vary depending on the age, gender, and discipline of the pupils? These are the perennial and flattering questions that stand before the researchers, educators, and psychologists. Traditionally, intelligence and creative originality have subscribed that both of them are antecedents of academic achievement, regardless of the age, gender, and disciplines they study. Nevertheless, several studies found that students tend to underestimate their creative self-belief (Beghetto, Kaufman, & Baxter, 2011).

The predictors of academic achievement have become a very widespread and controversial domain of study within educational psychology. To date, it is observed that authors from multiple disciplines studied the predictors of the academic result. Particularly the influence of intelligence is widely studied among others (Ali & Ara, 2017; Chandra & Azimuddin, 2013; Furnham, Zhang, & Chamorro-Premuzic, 2005; Laidra, Pullmann, & Allik, 2007; Naderi, Abdullah, Aizan, & Sharir, 2010), Creativity on academic achievements (Arya & Maurya, 2016; Furnham et al., 2005; Hansenne & Legrand, 2012). Moreover, several attempts have been made to discover the relationship between Creative Self-Belief and Creativity (Beghetto et al., 2011; Tierney & Farmer, 2002). Furthermore, a considerable amount of researchers have been seeking to determine the connection between the emotional intelligence and academic achievement (Chișa & Rusua, 2016; Costa & Faria, 2015; Fayombo, 2012; Hansenne & Legrand, 2012; Kumar, Chowdhury, Panwar, & Kosala, 2016; Mohzan, Hassan, & Halil, 2013).

However, the debate continues as regards the factors that affect the academic achievement of the pupils since the findings of studies are not conclusive. This study aims to shed some new light on this debate through examining: a) the impact of self-reported intelligence on creative self-belief, b) the impact of self-reported intelligence on creative originality, c) the impact of self-reported intelligence, creative self-belief and creative originality on academic achievement (control variable: age, gender, and discipline of the students) among the business students.

2. Literature Review

2.1 Intelligence

Intelligence is a notion generally believed to be an essential antecedent that explains students' academic results more than anything. Further, it also guarantees success in students' later life and facilitates career development (Chandra & Azimuddin, 2013). To date, despite having a paramount of research, there has been little agreement on the definition of intelligence. Intelligence means different things to different people. Intelligence means the ability to solve problems and to process information in a complex environment in a proper manner (Nakashima, 1999) with insufficient knowledge and resources (Gudwin, 2000). Moreover, intelligence fits students to work well in a diverse working environment (Gudwin, 2000). Some researchers have also exhibited that workable intelligence can be comparatively independent of scores in school exams or psychometric tests. For example, Brazilian street children are quite proficient in doing the math necessary for survival in their street business even though they failed in mathematics in school (Neisser et al., 1996).

2.2 Creativity

Creativity is a valuable human quality achieved through the interplay among imagination, innovation, and improvisation during the process of learning (Beghetto, 2014; Sawyer, 2006). Also, questions about how to teach creativity are crucial (Karwowski, 2015). Creativity can be viewed as a combination of two parts, First, it consists of generating an idea and second, it involves articulating that idea (Arya & Maurya, 2016). Sawyer (2006) argued that creativity tends to occur in complicated collaborative and institutional settings. Probably, J. C. Kaufman and Beghetto (2009) developed the most comprehensive view of creativity, in their seminal study named 'Beyond Big and Little: The Four C Model of Creativity.' In their research, they developed a model with four Cs of Creativity, that indicate four dimensions of creativity, namely: Little-c (everyday creativity, found in nearly all walks of life), Big-C (eminent creativity, which is only found in great people), Mini-C (Creativity inhibits in the learning process), Pro-C (Professional level expertise beyond little-C in any particular area)

2.3 Creative Self-belief

Beghetto & Karwowski (2017) define creative Self-belief as a perceived belief, trust, and confidence in the ability to perform a particular task creatively. They further opined that creative self-belief is based on holistic cognitive ability, across and within a specific domain. According to Jaussi, Randel, and Dionne (2007), "creative self-belief refers to one's self-belief on his/her creative capacity in doing something creatively." Similarly, Bandura (1994) opined that creative self-belief determines how people think of themselves and behave in distinct processes, such as cognitive, motivational, affective, and selection process. However, Karwowski, Lebuda, & Beghetto (2019), illustrated and organized creative self-beliefs into broad three categories: creative confidence beliefs (a combination of creative self-efficacy, and creative self-concept), creative self-awareness beliefs (a combination of creative metacognition, and creative mindsets), and creative self-image beliefs (creative identity).

2.4 Academic Achievement

Arya and Maurya (2016) argued that all parents commonly cherish academic achievement for their children. They further added that academic achievement is the indication (Quantitative) that results from the performance (behavior). Moreover, success in school plays a significant role in shaping students' future opportunities more favorably (Laidra et al., 2007). Traditionally, grades (CGPA), classroom assessments (internal evaluation), and external achievement tests represent the academic achievement that results from learning (Gajda, Karwowski, & Beghetto, 2017). The controversy over the empirical evidence regarding the antecedents of academic achievements has been continued for more than half a century. However, intelligence and creativity are two major factors commonly hypothesized to be influencing academic achievement that has been explored in several studies.

3. Hypothesis Development

3.1. Intelligence and Academic Achievement

The study of McCabe (1991) argued that intelligence is a more accurate predictor of academic achievement than creativity. Moreover, Laidra et al. (2007) investigated the differential impact

of personality and intelligence on a large sample of Estonian school children, whereas they analyzed data of 3618 students and concluded that, intelligence is the strongest predictor of GPA (academic performance). This result is further supported by the study of Chandra and Azimuddin (2013) on secondary school children of the Lucknow city, whereas they analyzed the data of 614 students and divulged that, intelligence has a significant influence on academic achievement, nevertheless they further argued that, gender ceases to influence academic achievement. In contrast, some researchers (Arya & Maurya, 2016; Naderi et al., 2010) revealed that intelligence has no significant association with achievement.

H1. Intelligence positively influences the academic achievement of the students.

3.2. Intelligence and Creativity

The influence of creativity and intelligence has become the center of interest in entrepreneurship and educational science for theorization and investigation (Plucker & Esping, 2015). However, the theory and empirical results seem fragmented and inconclusive. Intelligence is perceived as necessary but not sufficient for creativity (Yamamoto, 1964). The dual-process theory of intelligence delineates that creativity is a part of intelligence, i.e., they are not mutually exclusive (S. B. Kaufman, 2013). Interestingly, Nusbaum and Silvia (2011) suggest that certain types of intelligence may overlap with certain aspects of creativity but not others. Furthermore, Haensly and Reynolds (1989) argued that 'creativity is a distinct category of mental functioning that has limited overlap with intelligence, both in the processes used and in the characteristics of individuals who exhibit them. However, there is a quite a good number of studies that approved the influence of intelligence on students' creativity (Jauk, Benedek, Dunst, & Neubauer, 2013; Karwowski et al., 2016; J. C. Kaufman, 2009). Hence, the following hypothesis is developed:

H2. Students' intelligence significantly explains their creativity.

3.3. Intelligence and Creative Self-belief

Researchers are yet to go a long way to determine the impact of intelligence on creative self-belief. However, it can be generally hypothesized that there exists a link between these two variables. For example, one definition of intelligence states, "intelligence is not a single, unitary ability, but rather a composite of several functions (cognitive and affective). The term denotes that a combination of abilities is required for survival and advancement within a particular culture." (Anastasi, 1992, p. 613). On the other hand, the understanding of creative self-belief asserts that creative self-belief is a general cognitive and affective judgment (which is a part of intelligence) of one's creative ability"(Beghetto & Karwowski, 2017, p. 7). In consequence, students with high intelligence scores likely demonstrate stronger self-efficacious belief in their creative self-capacities in doing something. We hypothesize the following:

H3. The intelligence of students affects their creative self-belief.

3.4 Creativity and Academic Achievement

A study of Marjoribanks (1976) on 400, 12 years old English junior high school students reveals that after reaching a threshold, the achievement no longer depends on creativity. Moreover, the study of Arya and Maurya (2016) has noted an insignificant association between creativity and

academic achievement. Unlike the findings of Marjoribanks (1976) and Arya and Maurya (2016), numerous studies approved creativity is positively connected with students' academic results (Anwar, Aness, Khizar, Naseer, & Muhammad, 2012; Niaz, Nunez, & Pineda, 2000). Similarly, a meta-analysis of Gajda et al. (2017) of 120 studies since 1960 unveils that, creativity and students' scoring are positively correlated though they argued that, the relationship is stronger while creativity is assessed using self-reported test and academic performance is evaluated using a standardized test. In the same vein, the study of Sen and Hagtvet (1993) reported that creative people score higher in academic performance. Furthermore, the study of Tatlah, Aslam, Ali, and Iqbal (2012) revealed that creativity in association with emotional intelligence can explain better academic results. The following hypothesis is recommended:

H4. There is an influence of creativity on academic achievement.

3.5. Creative Self-Belief and Creativity

Researchers assert that creative self-belief, together with creative self-efficacy and creative metacognition help shape one's creativity (Beghetto, 2014; Beghetto & Karwowski, 2017). A longitudinal study of Furnham et al. (2005), on 64 third-year psychology students from the University College London revealed that creativity, as measured by the Barron Welsh Scale, was significantly and positively correlated with creative self-belief ($r = .27$, $p < .05$). The study of Beghetto et al. (2011) on elementary students divulged that students' creative self-belief and teachers' ratings of students' creative expression are differentiated by a tiny percentage (3.4%) whereas, students tend to underestimate their creative ability.

H5. There is a significant influence of creative self-belief on creativity.

The following is the conceptual framework of the model.

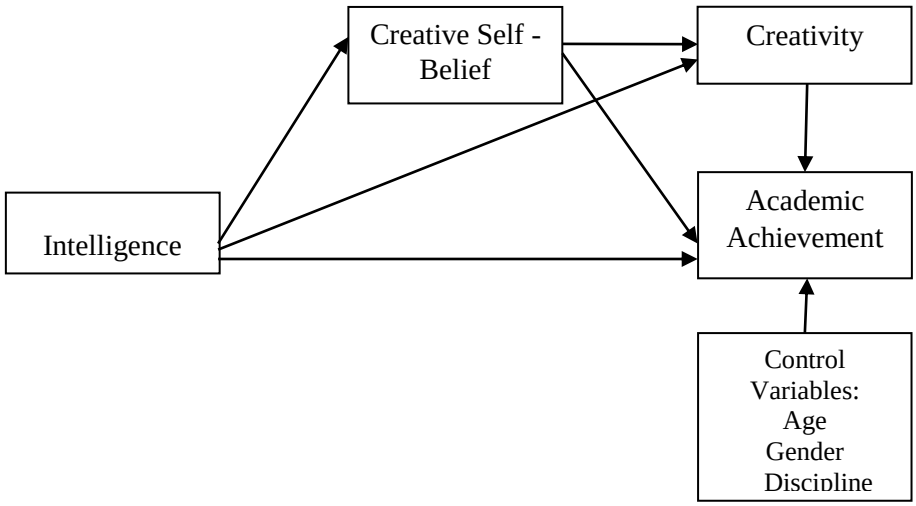

Fig. 1: The Research Framework

4. Method of the study

4.1.Participants and Procedure of the Survey

The respondent in the survey comprises the students of the business faculty at the University of Chittagong. We selected this university because it is one of the major public universities in

Bangladesh that hosts students from all walks of life. The authors randomly selected senior students from three randomly selected departments in the university. Initially, the authors contacted those three departments' teachers for allowing the research team to conduct the survey. After receiving permission, the research team approached the class of students and briefed them about the questionnaire and the procedure to respond to it.

Of 360 distributed replies, we obtained 233 answers yielding a response rate of 64 percent. However, finally, we have used 192 valid responses after rejecting incomplete responses. The majority (61 percent) of the participants in the survey are male (Male = 117; and Female = 75). The average age of the respondents is 23.32 years, and most of the students are 23 years old (32.33 percent) followed by 27.6 students are 22 years. 53.60% (103 participants) of the total received replies reported that they studied management as their core discipline.

4.2 Response bias

Authors took several precautions to prevent the response bias and method variance because the data are drawn from the same source using the same method (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). First, the authors assured the participants' anonymities after the responses. Second, informants were convinced that the data collected will only be used for educational use and kept private and confidential (Azim, Fan, Uddin, Jilani, & Begum, 2019; Mahmood, Uddin, & Luo, 2019). Second, we run the Harman one factor test and the scored which showed that not a single factor explains 50 percent of the variance (Uddin, Mahmood, & Fan, 2019). The first factor explains 41% (<0.50) stating that one element does not explain much. Also, following the criteria of Pavlou, Liang, and Xue (2007), we observed that the minimum correlation between the latent variables did not exceed 0.90.

4.3 Measurement tools

We have used several survey measures from prior studies, which are demonstrated on a 5-point Likert scale ranging from 1 (not true) to 5 (always true). For the face validity of the survey measures, several academics from business schools in Bangladesh have been consulted. Intelligence or intelligence quotient (IQ) is rated using the survey measure of Paulhus (1998). Paulhus (1998) measured intelligence through 10 items. We adopted the creative self-belief measure from Hartley, Plucker, and Long (2016) by using the 5-item survey measure. The survey measure representing 8-item from Hsu, Peng, Wang, and Liang (2014) was used to measure the creative capability of the students. Finally, students' cumulative grading point average in school, college, and university are considered as their academic achievement.

5. Evaluation of the Models

The study uses SEM, a second-generation model that explains the integrated results in the two-step process (Das, Biswas, Jilani, & Uddin, 2019; Fan, Mahmood, & Uddin, 2019; Yi, Uddin, Das, Mahmood, & Sohel, 2019). First, it examines the measurement model via confirmatory factor analysis. Finally, it estimates the structural model through path analysis and the model fitness test.

5.1 Measurement Model

We developed a measurement model using creative self-belief, intelligence, creativity, and academic achievement. The study, Table 1, shows a good fit since all the estimated value is within the threshold limit (Hair Jr., Hult, Ringle, & Sarstedt, 2014; Hooper, Coughlan, & Mullen, 2008; Souto, 2015).

Table 1. The Measurement Model Fit Indices

Index	(χ2/df)	GFI	AGFI	RMR	RMSEA	NFI	TLI	CFI
Threshold Value	< 5.0	>0.90	>0.90	<0.08	<0.08	>0.90	>0.90	>0.90
Measurement Model	3.5	0.899	0.877	0.061	0.030	0.929	0.987	0.988

Note: AGFI can range 0–1(higher the better). RMSEA: lower the better. NFI, TLI, and CFI can range 0–1.

The standardized coefficients of all the path coefficients are above 0.773 ($p<0.001$). The minimum average variance explained (AVE) of any construct (CSB) is 0.666 (AVE>0.50) (Hair Jr, Hult, Ringle, & Sarstedt, 2014). Since the threshold score for minimum AVE is more than 0.50, we have no concern about convergent validity issues. Reliabilities of all scales (CSB: α = 0.909; CRO: α = 0.947; and IQ: α = 0.954) are above the minimum threshold of 0.70 (Hair Jr, Black, Babin, & Anderson, 2014). Besides, discriminant validity is also tested and calculated with the square root of AVE of each construct. The estimates showed that the square root of the AVE of each construct is higher than its association with the rest of the constructs. Hence, there is no discriminant validity issue as well. Table 2 exhibits the AVE, composite reliability, and Cronbach's Alpha.

Table 2. Reliability and Validities Estimates

LV	R^2	CR	AVE	CRO	IQ	CSB
CRO	0.126	0.947	0.690	**0.831**		
IQ	0.298	0.954	0.673	0.377	**0.820**	
CSB	0.395	0.909	0.666	0.493	0.354	**0.816**

LV. Latent variable, CR. Composite reliability, CRO. Creativity, IQ. Intelligent quotient, CSB. Creative self-belief.

5.2 Structural Model and Hypothesis Testing

At this stage, we evaluated the structural model and tested hypotheses. The study used bootstrap 5000 cases to estimate the path coefficient accurately and their significance levels. We examined the structural model by evaluating the direct effects. Hence, we estimated model fit ($\chi^2(311)$= 355.078, p=0.046; 1.14, GFI = 0.888, AGFI= 0.864, CFI = 0.988, TLI = 0.986, NFI=0.911, RMSEA = 0.027) which is above the minimum threshold limit (Hair Jr, Black, et al., 2014; Hooper et al., 2008). The results showed a good fit for further study. In addition, we further examined the R^2 of endogenous variables ($R^2_{\text{Creative self-belief}}$ = 0.126; $R^2_{\text{Creative originality}}$ = 0.298; and $R^2_{\text{Academic achievement}}$ = 0.395).

The study also examined the effect size of the overall model for determining the integrated goodness of fit (GoF). We used the guidelines of Tenenhaus, Vinzi, Chatelin, and Lauro (2005) to estimate the GoF, which equals the square root of the average AVE and R^2. Wetzels, Odekerken-Schröder, and Van Oppen (2009, p. 187) reported effect sizes for global fitness, such as GoF_{small}=0.10, GoF_{medium}=0.25, and GoF_{large}=0.36 upon maintaining the minimum AVE of 0.50 for each construct (Fornell & Larcker, 1981). The present study yields, in Equation 1, 0.43 (GoF) with a minimum AVE (0.515). The estimated GoF (0.430) and the minimum AVE for any construct (0.515) signifies that effect size is large (Cohen, 1988; Fornell & Larcker, 1981; Tenenhaus et al., 2005; Wetzels et al., 2009). Thus, the overall model is fit for the study.

$$GoF = \sqrt{AverageR^2 * Average\ Communality} \quad \text{.....Equation (1)}$$

$$GoF = \sqrt{0.273 * 0.676}$$

$$GoF = 0.430$$

5.3 Direct Effects

The first hypothesis studies the impact of intelligence on students' achievement. The results showed that the direct effect (β = 0.029, p < 0.661) of intelligence on students' achievement, which is insignificant. The H1 is not supported. The H2 examines the impact of intelligence and creative originality. IQ has a significant effect (β = 0.222, p < 0.000) on those observed variable such as creative originality. Thus, H2 is supported. The H3 is an attempt to describe the impact of intelligence on creative self-belief.

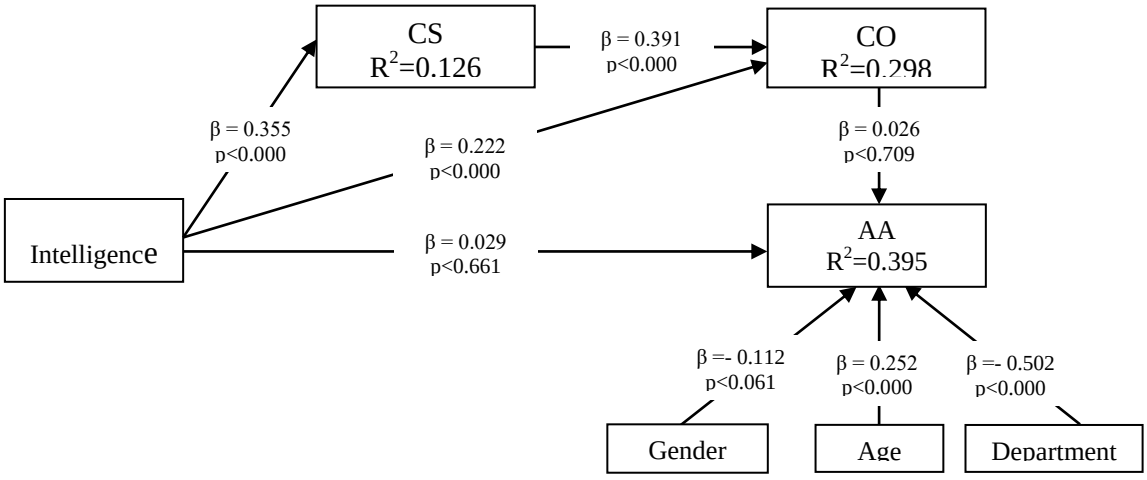

Fig. 2. The Structural Model and their Path Estimates

The results revealed that intelligence has also a significant impact (β = 0.354, p < 0.000) on creative self-belief. The H4 studies the potential effect of creative self-belief on creative originality. The estimated results reported that creative self-belief has significant influence (β = 0.388, p < 0.000) on the employees' creative originality. The H4 is also accepted. We will estimate the impact of the creative originality on creative achievement. The observed results posited the direct effect (β = 0.026, p < 0.709) of former antecedents on academic achievement is not significant. Thus, the H5 is not supported.

6. Discussion

This study set out with the aim of assessing the impact of the intelligence, creative self-belief, and creativity on Academic Achievement. Moreover, the relationships between intelligence, creativity, and creative self-belief have been assessed. The **H1** has been rejected that asserts that Intelligence is not a significant predictor of students' Academic Achievement. This particular finding is supported by the results of numerous previous studies (Arya & Maurya, 2016; Naderi et al., 2010).

Moreover, the study estimated the relationship between creativity and Academic Achievement through **H4**. The results reveal that there exists no impact of creativity on Academic Achievement. Arya and Maurya (2016) reported similar conclusions in their study, whereas the result contradicts the findings of the study of Sen and Hagtvet (1993). The study of Naderi et al. (2010) on the Iranian student studying in Malaysia supports the findings of the present study.

Therefore, the present study posits no significant association of Academic achievement with intelligence and creativity. Findings, such as no relationship between creativity and academic results imply a likely problem in the education system (Nwosu, 2004). Furthermore, when there is no significant or inverse association exists between creativity, intelligence, and academic achievement, it points to an anomaly in the approaches of knowledge dissemination and school curriculum (Arya & Maurya, 2016). As predicted by **H2**, there exists a significant relationship between intelligence and Creativity. Intelligence, therefore, found to be significantly and affirmatively affecting the creative capability of Business students, which contradicts the findings of Furnham et al. (2005) and Arya and Maurya (2016).

Nevertheless, Jauk et al. (2013) found a significant correlation between intelligence and creativity. However, they further argued that the level of intelligence moderates the relationship between intelligence and creativity. According to their findings, in a lower IQ range, intelligence significantly predicts creative performance but, in higher IQ range intelligence ceases to relate to creative performance. Karwowski and Gralewski (2013) also support this threshold proposition. However, no previous literature was found to support three of the hypothesis. The hypothesis **H3** predicted that the Intelligence of students affects their creative self-belief, and findings confirm its acceptance. Therefore, the study asserts that the intelligence of students positively influences the student's creative self-belief. Similarly, it is found in line with the hypothesis **H5**, there exists a significant effect of creative self-belief on creativity, which is supported by the study of Furnham et al. (2005).

7. Conclusion and Implications

This study attempts to unveil the much-studied areas worldwide, such as the impact of intelligence and creativity on academic achievement. The observed results demonstrated that both intelligence and creativity are not important predictors of academic achievements. These estimates pose significant implications for academics and researchers in developing countries in revealing the potential loopholes in the academic system. Despite the considerable importance of creativity and intelligence of the students, the present study shows that the intelligent and creative students are not scoring well in their current academic settings. Thus, it posits that either there are weaknesses in the way the academic programs are designed or the problems

may lie with the method of evaluating the students' academic achievement. Thus the present study recommends to researchers and academia to bring in the necessary changes in the entire education systems so that it nurtures the intelligence or creativity of the students.

8. Limitation of the Study

Several constraints in the present study prevent the generalizability of the findings. First, we collected the cross-sectional data through a self-administered survey which limits the causality of the result. Longitudinal information for future researchers replacing cross-sectional data might be a solution for ensuring the causal inference of the study. Second, the sample size is minimal (n=192) which might be the reason for the lower GIF. Also, several authors recommended that the minimum sample size (n) must be higher than 200 for running SEM in AMOS. Finally, we administered the survey in only three out if six departments of the faculty of business administration of Chittagong University. The future study might include all the departments for drawing the causal inference on the result.

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Conflicts of Interest: The authors declare no conflict of interest.

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