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RESEARCH ARTICLE

Assessing Creativity-Enhancing Learning Environments: Psychometric Model Validation for Undergraduates

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ABSTRACT

This study investigates a proposed measurement model, grounded in Amabile's (1996) componential model of creativity, to explore the causal relationships among perceived learning environments, proactive personality motivation, and creativity index. The study's primary objectives are threefold: i) To evaluate the goodness-of-fit indices of the Confirmatory Factor Analysis (CFA) measurement model, ii) to examine parameter estimates within the CFA measurement model and iii) to establish discriminant validity for the measured constructs. The measurement model's fitness is assessed using data collected from a survey of 374 undergraduate students and analyzed through AMOS. Goodness-of-fit indices, including the Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), and Normed Chi-Square (cmin/df), are employed to validate the model's fit with the data. Additionally, the study investigates convergent and discriminant validity of the instruments by scrutinizing disattenuated correlations among the constructs. Notably, this research expands Amabile's Componential Theory by incorporating proactive personality into the model. The study's findings hold potential value for enhancing program syllabuses, co-curricular activities, and soft-skill enhancement programs within higher learning institutions.

Contribution/Originality: This study enriches literature on creativity. It validates Amabile's (1996) componential model, deepening our insights into creativity's dynamics. These findings are vital for higher learning institutions, aiding in the development of graduates' creative potential by emphasizing the importance of supportive learning environment for academic and non-academic activities.

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1. Introduction

The study provides support for Amabile's Componential Theory of Creativity, which posits that the environment plays a crucial role in influencing individuals' creativity indexes through the mediating roles of motivational orientations (Amabile, 1996). Amabile's (1996) theory underscores the significance of individual and social contextual factors, asserting that creativity is influenced by both dispositional and situational variables. In the current study, we examined the perceptions of learning environmental factors, such as support from lecturers, peers, and the physical learning environment. Additionally, we incorporated proactive personality as an exogenous variable into the componential model. Consistent with Amabile's (1996) theoretical framework, social contextual factors were found to have a significant impact on individuals' motivation to engage in creative behavior. While the hypothesized model fit the data adequately, only specific aspects of the learning environment (support from lecturers, peers, and the physical learning environment) were found to significantly influence graduating students' motivational orientations for creative behavior.

In a university setting, graduating students often perceive themselves as central to their actions and are thus accountable for the consequences of their behavior. Amabile (1996) argues that creativity occurs when influences from the social environment align with Task Motivation, Domain-Relevant Skills, and Creativity-Relevant Skills. Creativity is the result of an appropriate combination of an individual's motivation, knowledge, and cognitive skills. In the context of this study, Creativity-Relevant Skills encompass environmental factors such as support from the physical learning environment, lecturers, and peers. Additionally, the inclusion of proactive personality falls under Domain-Relevant Skills.

2. Literature Review

The literature review aligns with the theoretical framework built upon Amabile's (1996) Componential Theory and its connection to learning environments and the cultivation of proactive student personalities. This review emphasizes the significance of literature in elucidating the concepts underpinning each variable investigated in this study. This encompasses prior research that delves into the various facets of each variable and their interrelationships. Additionally, the review delves into the role of motivation as a potential mediator in the nexus between learning environments, levels of proactive personality, and the creativity indices of undergraduate students.

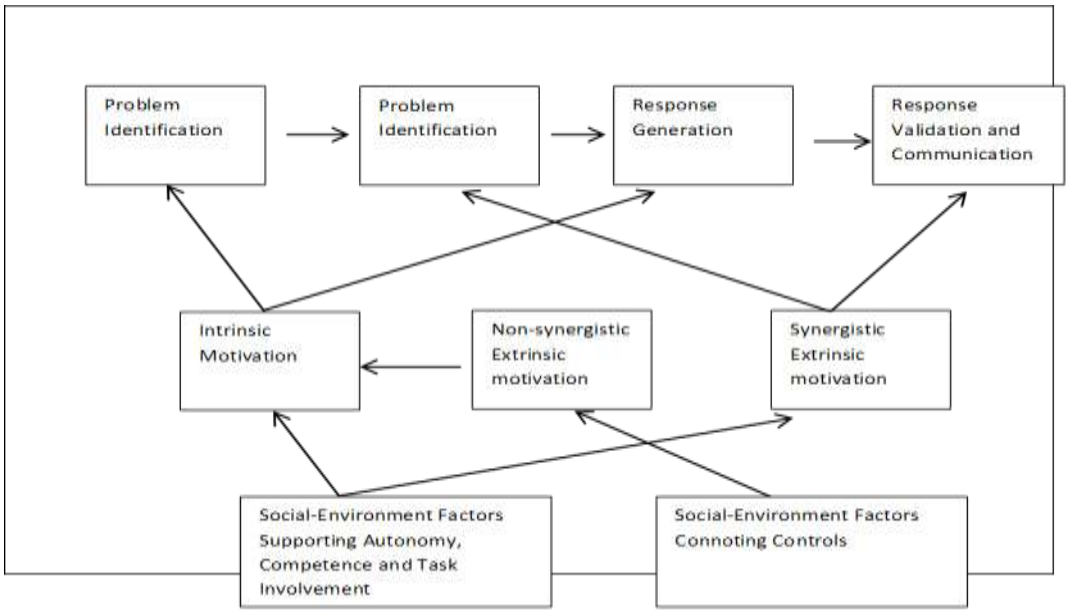
The theoretical framework underpinning this study is rooted in Amabile's (1996) conceptualization of motivational energy. According to this framework (as depicted in Figure 1), social environmental factors exert an influence on creativity through their impact on an individual's motivational state. Amabile's (1996) model introduces the distinction between two forms of extrinsic motivation: "synergetic extrinsic motivation" and "non-synergetic extrinsic motivation."

It is worth noting that Amabile (1996) highlights the potential synergy between external and internal motivation, particularly when internal motivation is high from the outset. A positive social environment is posited to bolster synergetic extrinsic motivation. As illustrated in Figure 1, social environmental factors characterized by control tend to foster non-synergetic extrinsic motivation while diminishing intrinsic motivation. In this model, Amabile (1996) proposes that intrinsic motivation plays a pivotal role in driving

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creative behavior. Conversely, close monitoring of extrinsic variables is deemed detrimental to creativity. However, it is noteworthy that enabling extrinsic motivation can be conducive to creativity when internal motivation is already high at the initial stage (Amabile, 1996:119).

Figure 1: Details of the Componential Model: Mechanism of Social-Environment Influence on Creativity



Research indicates that individuals who exhibit psychological creativity may experience reduced productivity in the absence of a conducive environment (Hsu & Chen, 2017). These insights align with Amabile's (1996) earlier work from 1983, where she identified specific environmental factors within educational settings that influence creativity. These factors exert a direct influence on the learning environment and encompass elements such as peer interactions, lecturer characteristics and behavior, as well as the overall classroom climate.

3. Research Method

This study adopted a quantitative research design, aiming to assess the psychometric properties of a measurement model encompassing the learning environment, proactive personality among undergraduate students, and their creativity index. Our investigation explored the potential mediation of these relationships by motivational scales, as proposed in Amabile's (1996) Componential Model.

To achieve this, we conducted a cross-sectional survey to collect data, enabling an in-depth examination of the intricate connections between the learning environment, proactive personality, motivational orientation scales, and creativity index. This method aligns with the research objective and the use of structural equation modeling (SEM), which requires a sizable sample size for model testing and validation. The quantitative approach facilitated systematic measurement and analysis of variable relationships, ensuring a rigorous and objective exploration of the research objectives.

This study targeted undergraduates at a public university in Selangor, which comprises three distinct study clusters: Social Science and Humanities, Science and Technology, and

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Management and Business. Our sampling approach consisted of two steps. Firstly, we employed proportional stratified sampling to determine the percentage of respondents. Secondly, due to the unavailability of a student name list, we employed cluster sampling as suggested by Chua (2020). Cluster sampling is a probability-based method that selects groups of individuals naturally associated. Clusters in our study were randomly selected from faculty lists, and once a cluster was chosen, all individuals within that cluster participated in the study.

4. Result

In testing and validating a measurement model, there is a need to employ a holistic approach in which several fit indices were verified instead of only relying on a single criterion. The traditional chi-square test of exact fit typically imposes a very stringent criterion (Samuelsen & Dayton, 2018). Furthermore, chi-square tests are also sensitive to the sample size especially when data involves a large sample size which will end up in rejection of the null hypothesis, and vice versa that is to accept the null hypothesis when the study engages in a small size (Kyriazos, 2018). As a consequence, it was generally accepted that the chi-square results present an unreasonable and unreliable goodness of fit indicator (Byrne, 2005; Maydeu-Olivares, Fairchild, & Hall, 2017) hence, the presence of chi-square results in this report was merely for informative purposes.

Considering the impracticality of the chi-square result, this study employed alternative fit indices, following the recommendations of Brown (2006) and Byrne (2005). These indices encompass the Comparative Fit Index (CFI) and the Root Mean Square Error of Approximation (RMSEA) (Collier, 2020). To gauge model adequacy, prescribed thresholds were applied: a CFI value exceeding .90 (Byrne, 2005) and an RMSEA below .08 (Brown & Cudeck, 1993). Furthermore, the robustness of individual parameters was scrutinized, ensuring no negative variances or correlations exceeding 1.00. Additionally, parameters were considered significant when their estimates exhibited t-values above 1.96 and p-values below .05.

The model integrated measurements for all constructs within this study. To assess the overall measurement model's validity, several goodness-of-fit indices were employed, including the Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), and Normed Chi-Square (cmin/df). Additionally, to ensure convergent and discriminant validity of the instruments, disattenuated correlations among the constructs were thoroughly examined.

Table 1 presents the Goodness-of-fit indices resulting from the CFA of the comprehensive measurement model, with all parameter estimates obtained through confirmatory factor analysis. The results indicate that the overall measurement model exhibits a strong fit, as demonstrated in Table 2. All β-weights were statistically significant at $p < .05$, with loading values ranging from .50 to .97. Furthermore, the analysis confirmed the presence of discriminant validity, as none of the disattenuated correlations between the constructs exceeded .90 (John & Benet-Martinez, 2000).

This study also emphasized the assessment of convergent validity, as per the criteria outlined by Fornell and Larcker (1981). Convergent validity assesses the extent to which indicators or items within a specific construct converge or share a substantial proportion of common variance. To evaluate convergent validity, the researcher should examine

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construct loadings, variance extracted (AVE), and construct reliability. The following rules of thumb are typically applied to assess convergent validity:

i. Standardized loadings of indicators should ideally be .7 or higher, but a minimum of .5 is acceptable.
ii. AVE estimates should exceed the square of the correlation between the target factor and other factors, providing evidence of discriminant validity.
iii. Reliability should be at least .7 or higher, indicating satisfactory internal consistency and convergence.

Table 1: Goodness-of-fit indexes of the CFA measurement model

Goodness-of-fit indexes	
CFI	.936
RMSEA	.038
Cmin/df	1.54

The results obtained through the structural equation-based approach of CFA provided parameter estimates for the eight constructs, as summarized in Table 2. The assessment of convergent validity revealed that all loadings were statistically significant, surpassing the threshold of .50. Construct reliability, except for Peer, Impersonal, and Autonomous, exceeded the acceptable threshold of .70, demonstrating adequate internal consistency and convergence. However, it is worth noting that the variance extracted for all constructs fell below .50, except for Creativity. Specifically, the variance extracted for Proactive Personality (.49), Learning Environment (.42), Controlled (.45), and Autonomous (.43) was slightly below the recommended threshold of .50, as suggested by Fornell and Larcker (1981).

Table 2: Parameter estimates for the CFA measurement model of the 8 constructs.

Constructs	**Indicators**	**Factor loading**	**Construct reliability**	**AVE (Variance extracted)**
Proactive Personality	PAP2	.69	.85	.4918
	PAP4	.59		
	PAP6	.72		
	PAP7	.85		
	PAP9	.74		
	PAP15	.54		
Learning Environment	en7	.57	.81	.4245
	en8	.68		
	en9	.71		
	en11	.76		
	en12	.68		
	en14	.50		
Lecturer	L11	.50	.82	.3388
	L14	.65		
	L17	.61		
	L18	.64		
	L20	.57		
	L21	.65		
	L23	.56		
	L25	.53		

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Peer	P4	.64	.65	.3823
	P5	.66		
	P6	.60		
Controlled	CT9	.60	.76	.4504
	CT10	.60		
	CT11	.80		
	CT13	.67		
Impersonal	IMP6	.54	.57	.3065
	IMP7	.55		
	IMP8	.56		
Autonomous	AU7	.71	.60	.4303
	AU8	.66		
Creativity	Flu	.97	.95	.8660
	Flex	.89		
	ori	.93		

Discriminant validity measures how distinct a construct is from others. In fact, for all constructs, the values of Variance Extracted (AVE) should exceed the corresponding Squared Interconstruct Correlation estimates (SIC). Table 3 below presents the AVE and SIC values for the involved constructs.

Table 3: Discriminant Validity Checks by comparing the Average Variance Extracted and the Square of Correlation

Average Variance Extracted (AVE)	.4918	.4245	.3388	.3823	.4504	.3065	.4303	
Interconstruct Correlations Squared	pro	lenv	lec	peer	cont	imp	auto	creativity
proactive								
Learning env	0.13							
lecturer	0.20	0.37						
peer	0.17	0.18	0.28					
controlled	0.01	0.00	0.00	0.02				
impersonal	0.00	0.01	0.02	0.01	0.14			
autonomous	0.12	0.04	0.10	0.07	0.06	0.00		
creativity	0.06	0.03	0.01	0.01	0.00	0.00	0.01	

In Table 3, all Variance Extracted (AVE) values are greater than their corresponding Squared Interconstruct Correlation estimates (SIC). This suggests that the indicators share a higher proportion of common variance with their respective constructs than with other constructs. Consequently, based on this observation, the study's measurement model successfully demonstrates discriminant validity.

5. Discussion

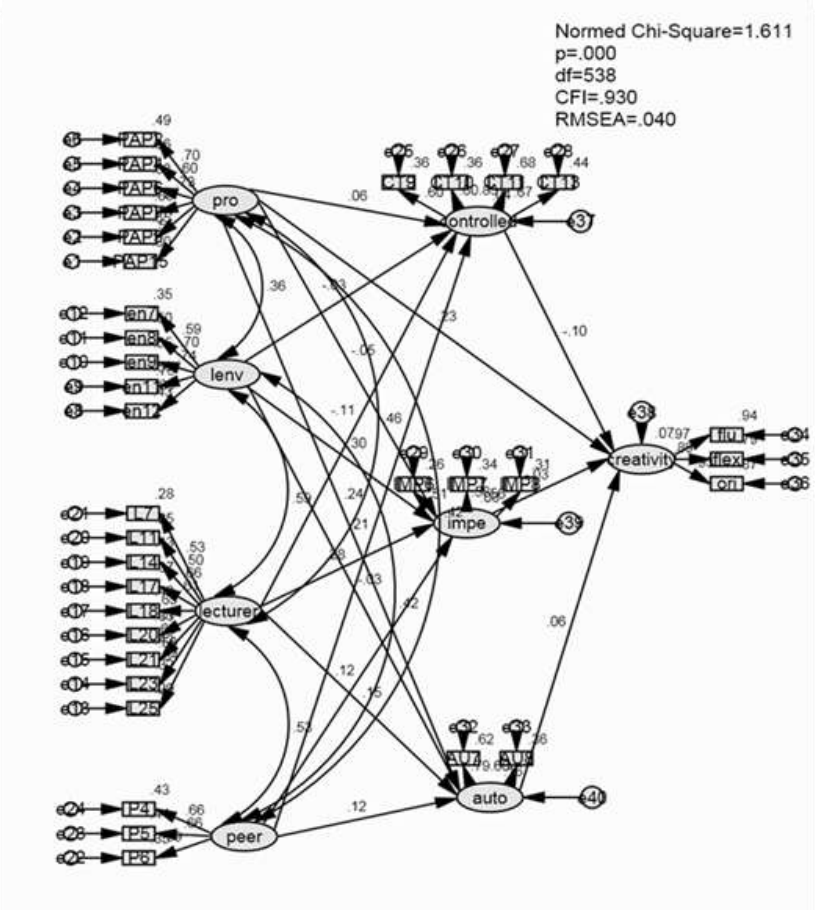
In this study, the overall measurement model, which included measurements for all constructs, constituting the first step of a two-step modelling process was evaluated. The objectives extended beyond confirming convergent validity; but also examined disattenuated correlations among the constructs. All latent constructs were permitted to intercorrelate, with the scale items integrated into the same measurement model.

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In this study, the overall measurement model, which included measurements for all constructs, constituting the first step of a two-step modelling process was evaluated. The objectives extended beyond confirming convergent validity; but also examined disattenuated correlations among the constructs. All latent constructs were permitted to intercorrelate, with the scale items integrated into the same measurement model.

Figure 2 showcases the comprehensive measurement model, displaying all parameter estimates derived from the confirmatory factor analysis. The results indicated that the model exhibited satisfactory fit, as evidenced by a χ^2/df ratio of 1.54, a CFI exceeding .9 (.93), and an RMSEA value of 0.38. All β-weights were statistically significant at $p < .05$, with loadings ranging from .50 to .97. Additionally, we established discriminant validity, as none of the disattenuated correlations between the constructs exceeded .90. To further assess discriminant validity, Table 3 presents a comparison between Average Variance Extracted and the Square of Correlation.

Figure 2: Overall measurement model



The findings also highlight the tendency of undergraduate students to amalgamate their internal traits linked to creativity indices, underscoring the significance of domain-relevant skills. Furthermore, when individuals perceive their learning environments as supportive of their motivational orientations, it enhances the likelihood of creative behavior.

This study is grounded in Amabile's (1996) theoretical framework of motivational energy, which posits that social and environmental factors influence creativity by

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shaping an individual's motivation state. However, the study's findings challenge previous reviews, highlighting the imperative to align individuals with their environments more effectively. Matus and Infante (2020) also emphasized the importance of recognizing the diverse needs of students within educational settings. To foster the development of desired skills, it is essential to address both individual and developmental requirements in the educational milieu. Therefore, within the university context, it becomes crucial to attend not only to the variables mentioned earlier but also to students' affective needs. By providing ample emotional support, universities can encourage students to exhibit the necessary actions and skills expected of them.

6. Implications

The current study distinguishes itself by focusing on the perceptions of various factors within the learning environment, such as the support received from lecturers, peers, and the physical learning environment. Additionally, this research introduces proactive personality as an additional exogenous variable within Amabile's (1996) componential model. Consistent with Amabile's (1996) theoretical framework, social factors within the learning environment are deemed highly influential in motivating individuals to engage in creative behaviors.

While the measurement model was generally found to be a good fit with the data, the results indicate that only specific aspects of the learning environment, specifically the support from lecturers, peers, and the physical learning environment, significantly influence graduating students' motivational orientations toward creative behavior. Therefore, it is imperative that future research takes into account the personal traits of undergraduate students when exploring this topic further.

7. Conclusion

In conclusion, Amabile's Componential Model posits that social settings play a pivotal role in shaping creative thinking through their impact on task motivation. This study makes a significant contribution to existing literature by incorporating proactive personality into the theoretical framework, thereby reinforcing Amabile's (1996) Componential Theory. Consistent with Amabile's insights, social factors exert a substantial influence on individuals' motivation for creative behavior. While there is ample research on the relationships between learning environments, motivational orientations, and creativity indices, our study bridges a gap in the literature by introducing proactive personality as a noteworthy exogenous variable, substantiated by the model's robust fit with the data.

Moreover, the replication of this study should encompass samples from private higher learning institutions and individuals with other levels of studies. Furthermore, it is essential to extend the study's replications beyond the borders of this country. In order to provide cross-cultural evidence that can enhance the generalizability of findings in the broader educational context, researchers can consider including samples from different nations.

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Ethics Approval and Consent to Participate

The data utilized in this study was gathered during a Ph.D. study conducted in 2013, a period during which a formal Research Ethics Committee was not yet established. However, it is important to note that all procedures involving human participants in this study were strictly voluntary and conducted under the supervision of the Ph.D. supervisory committee. Informed consent was diligently obtained from all participants as an ethical practice.

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Conflict of Interest

The authors have disclosed no conflicts of interest in relation to this work and affirm that there are no potential conflicts of interest regarding the research, authorship, or publication of this article.

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