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Creativity motivation construct development and cross-cultural validation

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Abstract

We conceptualized creativity motivation (CreMo) as the force (high-quality experience, instrumental purpose, and value) which drives individuals into creativity-related behaviors shown so as to do, learn, and accomplish new things. Based on the CreMo theory, we developed the creativity motivation scale (CMS) accordingly and tested its reliability, structural validity, and cross-cultural validity on multi-national samples in six countries: Chile (N=407), China (N=475), Kosovo (N=395), Russia (N=385), Saudi Arabia (N=335), and Turkey (N=381). Nine CMS items showed a high internal consistency in each country. Confirmatory factor analysis (CFA) model comparison results suggested the CMS three-factor model is statistically superior to the one-factor model and the second-order model. Multigroup CFA (MGCFA) results provide evidence of the measurement equivalence of factor structures, factor loadings, and factor variances and covariances across six country groups. Educators, psychologists, and researchers may find the CMS a useful tool for measuring individuals' creativity-related behavior dispositions, as well as explaining the force behind them. Immediate future research should focus on exploring the relationship between the CreMo and other creativity-related factors.

Keywords: creativity, motivation, creativity motivation, CFA, MGCFA

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1 Introduction

Creativity researchers usually look at creativity from the "four Ps" point of view: person, process, product, and press (Rhodes, 1961; Runco, 2004; Kozbelt, Beghetto, & Runco, 2010). Including all four Ps, creativity can be defined as *"the interaction among aptitude, process, and environment by which an individual or group produces a perceptible product that is both novel and useful as defined with a social context"* (Plucker, Beghetto, & Dow, 2005, p. 90). Of the four Ps of creativity, motivation is regarded as possibly the most crucial component because it plays the role of an engine (Csikszentmihalyi & Wolfe, 2014). Only when a person's engine is activated in the press can they apply their personal aptitude into creating process, potentially inducing a creativity product to come into being and undergo development (Amabile, 1983; Hennessey, 2010; Kreitler & Casakin, 2009; Runco, 2005).

In the research field of creativity, theorizing about and investigations of motivation have taken two basic approaches: regarding motivation as individual-difference traits (more focus on the *person* element) or as the result of environmental factors (more focus on the *press* element) (Hennessey, 2010). The first approach is typically used to describe the strengths of creativity-related behavioral dispositions (i.e., the extent to which people are motivated towards creative activities), whereas the second approach is typically used to explain the driving force behind certain dispositions (i.e., why people are motivated towards creative activities). From a social-psychological approach, the main force driving creative behaviors can be classified into two main kinds: intrinsic motivation and extrinsic motivation (Amabile, Hill, Hennessey, & Tighe, 1994; Harter & Jackson, 1992; Hennessey, 2000). Motivation is defined as *intrinsic* when the individual engages in some activity mainly for its own sake (such as: it is enjoyable, satisfying, or interesting), whereas *extrinsic* motivation means individuals engage in some activities for external reasons (such as winning a prize or fulfilling an obligation)(Amabile, 1990, 1993; Hennessey, 2010; Kreitler & Casakin, 2009).

Despite the abundant literature and measurement scales explaining the driving force behind creativity-behavioral dispositions, what creativity-related behaviors actually *are* has not been well clarified. This is partly due to the concept and manifestation of creative behaviors being too broad and so loose that any behavior or act could be fitted in. For example, in the personality approach, the action related to the openness personality attribute is trying new things such as eating new foods or learning a new language (Kaufman, Plucker, & Baer, 2008). These selected creative behaviors are usually short on framework. Indeed, *"Creative production does require a high level of motivation"* (Collins & Amabile, 1999, p. 297). However, it is hard to judge whether people have high or low motivation towards creativity without clarifying creativity-related behaviors. Therefore, the motivation theory of creativity will benefit from clarifying a framework or structure of creativity-related behaviors, and then can be used for judging the strength of these behavioral dispositions in individuals.

We argue that in real-life situations, creativity is a dynamic, developmental process in which creativity-related behaviors contributing to creativity is not limited to the process of making new things come into being (doing new things), but also includes behaviors

before the creating task (learning new things) and the outcome after creating (accomplishing new things). These three kinds of creating-related behaviors are interactive with each other. The exact extent of interaction involvement depends on many factors, such as the different nature of the tasks, or different stages of the creative process. Specifically, learning new things is the behavior involved in the incubation or preparation stage of creating, which contributes to an individual's knowledge and skills. As stated by Guilford (1950), *"no creative person can get along without previous experience and facts."* Learning new things contributes to one's fund of helpful knowledge and skills for creating, such as domain-specific or domain-general knowledge and skills, creative thinking skills, and so on. Doing new things is the behavior of prompting existing ideas, knowledge, and skills into action. It can refer to either doing something one has never done before or doing things in an innovative way. Doing new things is the process of making, thinking, and ongoing experience proceeding by trial and error, which may not necessarily lead to a final creative product. Accomplishing new things is the behavior of bringing a perceptible product into being and completion. "*Not until the product of creative thinking has been adopted is creative effort fully realized*" (Puccio & Cabra, 2010, p. 149). Accomplishing new things contributes not only to the quantity of products, but also the quality. Mass production is more likely to yield eminence than producing a few works, all else being equal (Kozbelt et al., 2010).

In general, individuals who have a high disposition towards creative activities will have a high disposition for all three of these behaviors. The disposition of learning new things is related to many creativity-related attributes, such as openness, or curiosity. The disposition of doing new things is related to the willingness to try new things, risk-taking, courage, exploration, and openness. The disposition of accomplishing new things is related to real-world accomplishments. Accomplishing new things is related to productivity and persistence. "*Indeed great creators are almost always very productive*" (Kozbelt et al., 2010, p. 146). Therefore, in order to describe an individual's disposition towards creating activities, we can disassemble it into doing, learning, and accomplishing new things.

For explaining creative behaviors, the main driving forces can be sorted into three categories: high-quality experience, instrumental purpose, and value. High-quality experience refers to the sheer pleasure and enjoyment experienced while approaching an activity, question, or problem, as the core of intrinsic motivation (Hennessey, 2010). Many creators have reported that they are driven by the pleasure, interest, and excitement behind a task (Feist, 2010). *High-quality experience* is an important affective component of intrinsic motivation (Hennessey, 2010). *Instrumental purpose* is the purpose outside of the task, considering external reward and usefulness while engaging in some activity as the core of extrinsic motivation (Tierney, 2015). Compare with a situation in which the drive is lacking, yet instrumental purpose is a strong impetus to engage in and complete tasks and activities. In addition, *value* refers to the level of importance that individuals ascribe to creativity and desirability (Dollinger, Burke, & Gump, 2007), which can be shown in the creative product. Value comprises a key element in people's conscious worldviews, which serves as a driving force behind creating behaviors (Dollinger et al., 2007). The value of regarding originality and creating as desirable can serve to justify the individual's choice or actions towards creating even without high-quality experience or

instrumental purpose. In real-life situations, all the aforementioned forces are helpful for motivating individuals involved in the creating process, which contributes to the quality and quantity of creative products.

Combining with three kinds of driving force and creativity-related behaviors, creativity motivation, therefore, can be described as the force (high-quality experience, instrumental purpose, and value) which drives an individual into creating activities, shown as doing, learning, and accomplishing new things.

In light of the importance of conducting research on Creativity Motivation theory with an instrument based on a valid theoretical conceptualization, we developed the creativity motivation scale (CMS), accordingly. This scale is made up of three subscales of three creativity-related behaviors (doing, learning, and accomplishing new things) and three forces (high-quality experience, instrumental purpose, and value). For example, a sample item with the combination of doing new things for high-quality experience force is: "*I experience pleasure when I discover new things I've never seen before.*" Given the importance of the psychometric qualities of the CMS, and the importance of assessing creativity motivation from a solid theoretical perspective, we cross-culturally validated the CMS in various countries. The final purpose of the scale is its application as an assessment tool for measuring individuals'(especially college students') disposition to creativity-related behaviors and can be used as an indicator for developing creative potential.

Table 1:
Theoretical dimensions of creativity motivation

Dimension 1	Dimension2
Do new things	Value
Learn new things	High-quality experience
Accomplish new things	Instrumental purpose

An established conceptualization of motivation theory combining both a behavior disposition dimension and a force dimension is needed to provide a more accurate understanding of describing and explaining creativity-related behaviors. The current study aimed at achieving three goals: to conceptualize creativity motivation; to develop the creativity motivation scale (CMS) for the measurement of creativity motivation; and to establish the structural validity, cross-cultural validity, and reliability of the CMS.

The conceptualization and assessment of creativity motivation are innovative in several ways. First, previous approaches to motivation as explaining creative behaviors either mostly focused on unstructured creative behaviors without explaining the force or focused on the force but without identifying related behaviors. The present creativity-motivation concept demonstrates the combination of creativity-related behavioral dispositions and the force behind them. Using the two-dimensional creativity-motivation theory proposed in this paper will allow a more comprehensive view. Moreover, this

study is perhaps the first study to establish the cross-cultural validity of a measurement instrument related to the motivation of creativity. The method used in this study provide valuable insight into the strategies while developing and validating the measurement instrument in a cross-cultural context.

2 Method

2.1 Participants and procedure

For the purpose of the cross-cultural validation of the creativity motivation scale, the participants are drawn from six countries, representing geographically and culturally contrasting regions: Chile (N=407), China (N=475), Kosovo (N=395), Russia (N=385), Saudi Arabia (N=335), and Turkey (N=381). All participants were enrolled in an education major, 35.7% of them in the first semester; 10.3% in the second semester; 24.4% in the third semester; and 29.6% enrolled in the fourth (or higher) semester at the university. These participants had a mean age of 19.58 years (*SD* = 2.15 years). Males comprised 27.5% of the sample, females 71.9%, with 0.6% of the sample not providing gender information.

We used convenience samples of participants from each country. The participants were given an unlimited amount of time to complete the questionnaire.

2.2 Measures

The Creativity Motivation Scale (CMS) is a 9-item self-report questionnaire constructed based on the conceptualization that creativity motivation is the force that drives individuals into creating activities shown as do, learn, and accomplish new things. Each item was developed as the combination of three types of forces (high-quality experience, value, and instrumental purpose) and three types of creativity-related behaviors (do, learn and accomplish new things). For instance, an item example from the combination of "high quality experience" and "learn new things" is*: I experience pleasure when I discover new things that I have never seen before*; an item example from the combination of "value" and "do new things" is: *It's important to do things in my own original way*. The final items are constructed as six-point Likert-type responses (1 = strongly disagree; 2 = disagree; 3 = slightly disagree; 4 = disagree; 5 = agree; 6 = strongly disagree). Participants were asked to read each statement in the scale and choose the extent to which they are agree or disagree with the statements.

The original CreMo scale was in English. A back-translation was conducted to create the versions in each country's local language for the study. Bilingual individuals in each country translated the scales from English into the six local languages. Then other bilingual individuals, who had not seen the original scales, translated these six versions back into English. Disagreements were resolved through discussion to obtain the final versions for the study.

2.3 Data analytic strategy

Firstly, we used confirmatory factor analysis (CFA) to test and compare three hypothesized Creativity Motivation theory models: the one-factor model (Figure 1), three-factor model (Figure 2), and second-order model (Figure 3) with the data from six countries separately, and compare which model fits the best in all the countries. The conceptual basis for the specification of three-factor model is that creativity motivation (CreMo) is assumed to be shown as three creativity related behaviors: do new things (Do), learn new things (Le), and accomplish new things (Ac). In addition, each creativity-related behavior is assumed to result from three forces: value (DoVa, LeVa, AcVa), high-quality experience (DoHi, LeHi, AcHi), and instrumental purpose (DoIn, LeIn, AcIn). These three behavioral dispositions are inter-correlated with each other. By comparing with the one-factor model, if the measure was better conceptualized as a three-factor construct across all six groups, we could assume that our theoretical structure of the CreMo scale is supported by the data. Afterwards, we consider whether there is a higher-level factor

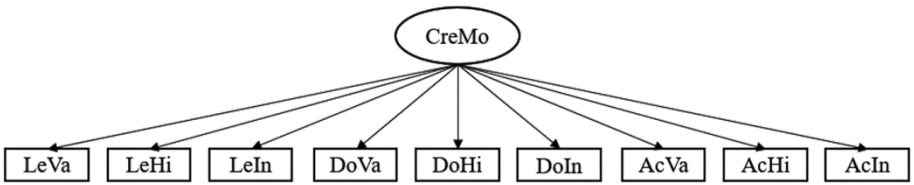

Figure 1:
Hypothesized one-factor CFA model for the CreMo Scale
Notes: *Le = learn new things; Do = do new things, and Ac = accomplish new things; Va = value, Hi = highquality experience, and In = instrumental purpose. For instance, LeVa refers to the item combining "learn new things" and "value"; DoHi refers to the item combining "do new things" and "high-quality experience" and so on.

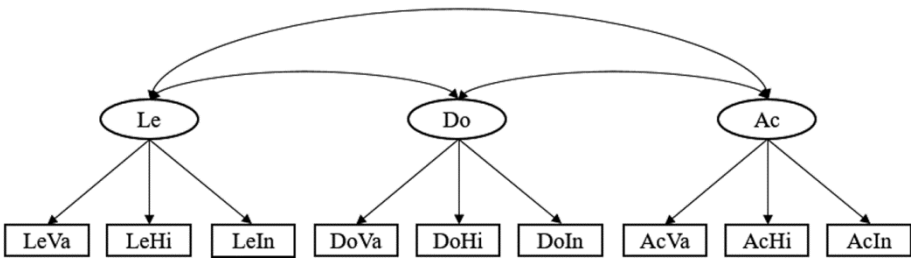

Figure 2:
Hypothesized three-factor CFA model for the CreMo Scale
Notes: *Le = learn new things; Do = do new things, and Ac = accomplish new things; Va = value, Hi = highquality experience, and In = instrumental purpose. For instance, LeVa refers to the item combining "learn new things" and "value"; DoHi refers to the item combining "do new things" and "high-quality experience" and so on.

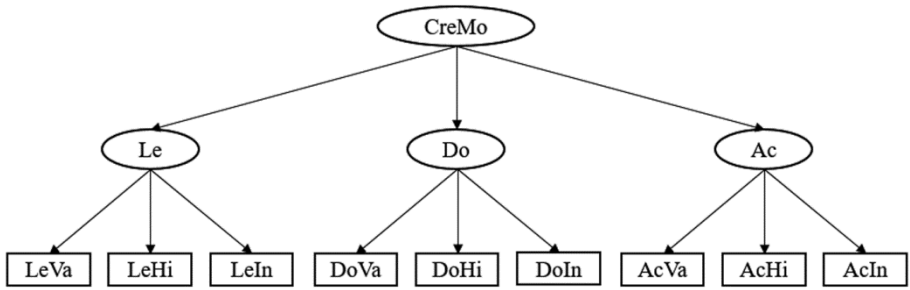

Figure 3:
Hypothesized second-order CFA model for the CreMo Scale
Notes: *Le = learn new things; Do = do new things, and Ac = accomplish new things; Va = value, Hi = high quality experience, and In = instrumental purpose. For instance, LeVa refers to the item combining "learn new things" and "value"; DoHi refers to the item combining "do new things" and "high-quality experience" and so on.

(Cre-Mo) that explains the relationships between the first-order factors (do, learn, and accomplish new things). Therefore, due to the theoretical rationale for a higher-order CreMo construct, a second-order analysis was performed.

To compare the above-mentioned three models, we use Bayesian Information Criterion (BIC) (Raftery, 1995) to judge the more favorable model. A difference in BIC of 10 is considered as a clear evidence in favor of the model with the model with the more negative BIC (Johnson & Bouchard, 2005; Raftery, 1995).

After selecting the best-fit model that fits each country, we used multigroup CFA (MGCFA) to test whether the measurement of CreMo can be interpreted in a similar way across different country groups. MGCFA can provide support for the meaning comparisons of self-report instruments across diverse groups (Klassen et al., 2009) by exploring cross-group measurement invariance (equivalence). In this way, by examining the measurement invariance of a proposed factor structure, we can judge the extent to which scale items and latent means are equivalent across different country groups. First, we used the best-fit model as a baseline model, in which the basic factor structure was maintained for all groups, with only error covariances allowed to differ across groups. Afterwards, we tested the invariance of baseline models across six groups with increasing levels of restrictions to test: (a) configural invariance (no constraints), (b) construct-level metric invariance (constraining the factor loadings to be invariant across countries), (c) invariance in the range of responses given to each item (constraining the factor variances and loadings to be invariant across countries), and (d) invariance in the relationship among latent constructs (constraining the correlations to be equal across countries). We did not test the differences in latent means across countries because we consider it normal for means to vary within and across groups due to individual attributes and environmental factors.

Both CFA and MGCFA analyses were conducted using R package lavaan (Rosseel, 2012). All models were estimated using the robust maximum likelihood estimator

(MLM) due to non-normal distribution of the data (Sosu, 2013). The model fit in CFA and MGCFA were examined using widely used practical indices which included the root mean square error of approximation (RMSEA), the standardized root mean square residual (SRMR), the comparative fit index (CFI), and Tucker-Lewis index (TLI). Acceptable model fit was defined by the following criteria: RMSEA (≤ 0.90), SRMR (≤ 0.08), CFI (≥0.90), and TLI (≥0.90) (Hu & Bentler, 1999; MacCallum, Browne, & Sugawara, 1996). In addition, we examined χ^2/df ratio, for which different researchers have recommended using ratios as low as 2 or as high as 5 to indicate a reasonable fit (Marsh & Hocevar, 1985). In MGCFA, when additional constraints are imposed, we use the changes in the comparative fit index (ΔCFI) to evaluate hierarchical goodness-of-fit, wherein a ΔCFI less than or equal to .01 indicates invariance (Klassen et al., 2009).

3 Results

3.1 Descriptive statistics and reliability

Descriptive statistics for the nine items of CreMo scale and Cronbach's alpha coefficients are shown in Table 2. In each country, each item's mean values ranged from 3.87 to 5.46. The standard deviation ranged from 0.85 to 1.55. Cronbach's alpha reliability

Table 2:
Descriptive statistics of CreMo items and reliability

	Chile (N=401)		China (N=469)		Kosovo (N=386)		Russia (N=378)		Saudi Arabia (N=318)		Turkey (N=377)	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
LeVa	5.14	1.09	4.87	1.07	5.07	1.17	4.77	1.06	3.87	1.55	4.68	1.17
LeHi	5.31	1.06	4.94	1.06	5.25	1.00	4.99	1.01	5.32	1.16	5.31	1.00
LeIn	5.25	1.04	5.18	0.85	5.46	1.03	4.82	1.08	5.27	1.08	5.05	1.05
DoVa	4.62	1.24	4.24	1.22	5.34	1.01	5.09	0.90	5.03	1.10	5.06	1.04
DoHi	5.07	1.11	4.98	0.94	4.76	1.15	4.50	1.15	4.57	1.39	5.09	1.10
DoIn	4.90	1.16	5.03	0.90	4.87	1.11	4.96	0.94	4.80	1.11	5.14	0.94
AcVa	4.55	1.18	4.15	1.03	4.96	0.94	4.19	1.19	4.74	1.21	4.96	0.99
AcHi	5.37	0.96	5.04	0.87	5.24	0.95	5.00	0.98	5.24	1.06	5.27	0.97
AcIn	4.92	1.15	4.87	1.07	5.07	1.17	4.77	1.06	3.87	1.55	4.68	1.17
Cronbach's alpha	0.85		0.80		0.77		0.81		0.79		0.88	

Notes: N is the valid number of participants in each country after deleting missing cases listwise.
*Le = learn new things; Do = do new things, and Ac = accomplish new things; Va = value, Hi = high-quality experience, and In = instrumental purpose. For instance, LeVa refers to the item combining "learn new things" and "value"; DoHi refers to the item combining "do new things" and "high-quality experience" and so on.

indices ranged from 0.77 in the Kosovo sample to 0.88 in the Turkey sample. These reliabilities are higher than the recommended threshold of 0.70 (Garver & Mentzer, 1999). Thus, overall, the scales have the required levels of composite reliability.

3.2 CFA model comparison

Table 3 shows the CFA results in each country of three models, respectively. The model fit results showed that a three-factor model is more favorable than the one-factor model, due to overall acceptable goodness-of-fit indices and more negative BIC in which the BIC in Chile's and Kosovo's three-factor model decreased by more than 10 (Raftery, 1995). The second-order construct model was not supported by the data, wherein the data

Table 3:
Model fit: one-factor models, three-factor models, and second-order models in each country group

Model	MLMχ^2	df	χ^2/df	CFI	TLI	RMSEA	SRMR	BIC
One-factor models								
Chile	82.502	27	3.06	0.918	0.890	0.090	0.048	9987.01
China	52.194	27	1.41	0.961	0.948	0.052	0.037	11074.34
Kosovo	56.015	27	2.07	0.922	0.896	0.068	0.050	9643.08
Russia	67.494	27	2.50	0.932	0.909	0.070	0.042	9292.98
Saudi Arabia	59.787	27	2.21	0.924	0.899	0.077	0.047	8418.68
Turkey	52.666	27	1.95	0.967	0.956	0.063	0.034	8739.06
Three-factor models								
Chile	58.940	24	2.46	0.948	0.923	0.075	0.041	9957.61
China	45.154	24	1.88	0.968	0.951	0.051	0.034	11073.06
Kosovo	45.299	24	1.89	0.945	0.917	0.061	0.043	9631.00
Russia	57.009	24	2.37	0.947	0.920	0.066	0.038	9285.30
Saudi Arabia	51.503	24	2.14	0.935	0.903	0.075	0.045	8415.25
Turkey	46.319	24	1.93	0.972	0.958	0.062	0.031	8735.85
Second-order models								
Chile	*No convergence*							
China	45.154	24	1.88	0.968	0.951	0.051	0.034	11073.06
Kosovo	*No convergence*							
Russia	57.009	24	2.37	0.947	0.920	0.060	0.038	9285.30
Saudi Arabia	*No convergence*							
Turkey	*No convergence*							

Notes: RMSEA = the root mean square error of approximation; SRMR = the standardized root mean square residual; CFI = the comparative fit index; TLI = Tucker-Lewis index; MLM = robust maximum likelihood.

in Chile, Kosovo, Saudi Arabia, and Turkey was not converged, indicating poor model fit, and the goodness-of-fit indices in China and Russia were not improved, compared to the three-factor model. Therefore, from the model-fitting results, the three-factor model its well with χ^2/df ratios ranging from 1.88 for Chinese participants to 2.46 for Chilean participants. The CFIs ranged from 0.935 in the Saudi Arabia group to 0.968 in the China group, all above the minimum CFI threshold (Byrne, 2004).

In addition to the model-fitting results of three-factor models, evaluation of the loadings and latent variable correlations are shown in Table 4. In all the samples from six countries, all estimated factor loadings are statistically significant (all p <.001) and salient.

Table 4:
Factor loadings and correlations between constructs

		Chile (N=394)	China (N=467)	Kosovo (N=385)	Russia (N=377)	Saudi Arabia (N=313)	Turkey (N=377)
Factor loadings							
	LeVa	1.000	1.000	1.000	1.000	1.000	1.000
Learn	LeHi	1.068**	1.145**	1.463**	1.272**	3.573*	1.036**
	LeIn	1.037**	0.996**	1.717**	1.228**	3.033*	1.176**
	DoVa	1.000	1.000	1.000	1.000	1.000	1.000
Do	DoHi	1.386**	1.382**	0.651**	1.229**	0.790**	1.144**
	DoIn	1.452**	1.320**	0.744**	1.240**	0.760**	1.191**
	AcVa	1.000	1.000	1.000	1.000	1.000	1.000
Accomplish	AcHi	0.990**	1.158**	1.011**	1.028**	1.216**	1.150**
	AcIn	1.100**	1.095**	1.162**	0.984**	1.186**	1.130**
Correlations							
Learn	Do	0.358**	0.246**	0.326**	0.223**	0.164*	0.412**
Learn	Accomplish	0.385**	0.256**	0.168**	0.322**	0.124*	0.409**
Do	Accomplish	0.385**	0.212**	0.291**	0.271**	0.475**	0.393**

Notes: * $p < .05$. ** $p < .01$. N is the valid number of participants in each country after deleting missing cases listwise. *Le = learn new things; Do = do new things, and Ac = accomplish new things; Va = value, Hi = high-quality experience, and In = instrumental purpose. For instance, LeVa refers to the item combining "learn new things" and "value"; DoHi refers to "do new things" and "high-quality experience" and so on.

3.3 Cross-cultural validation: MGCFA

The baseline model showed an acceptable fit for the combined six country groups (CFI=0.983, TLI=0.975, χ^2/df=3.27, and RMSEA = 0.031). We assessed the cross-cultural measurement invariance by imposing more and more restrictive constraints on the baseline

model. Model A tested configural invariance in which no constraints were imposed in multigroup CFA. This yield in acceptable model fit statistics with χ^2/df value of 2.10, df=144, CFI=0.955, TLI=0.932, and RMSEA = 0.065. This result suggested a common factor structure across six country groups. Model B tested metric variance invariance in which factor loadings across groups were constrained. Compared to Model A, the procedure of Model B resulted in a negligible ΔCFI of 0.007, less than the 0.01 limit, with χ^2/df =2.04, CFI=0.948, TLI=0.936, and RMSEA = 0.063. Therefore, the constrained Model B was accepted compared to the less constrained Model A. This result suggested that the factor loadings are invariant across countries. Further constraints were added by constraining the factor variances and loadings in Model C, which yielded acceptable model fit statistics (χ^2/df =1.97, CFI=0.946, TLI= 0.938, and RMSEA = 0.062) and a ΔCFI of 0.002. Lastly, constraining structural convariances in Model D resulted in an acceptable fit (χ^2/df =1.95, CFI=0.941, TLI= 0.938, and RMSEA = 0.062) and a ΔCFI of 0.005, again within the limit of 0.01. Thus, these results supported cross-cultural validation of the CreMo scale by showing the measurement equality across six country groups, with invariance of factor structure, factor loadings, variances, and covariances.

Figure 4 presents standardized factor loadings, pattern coefficients, and interfactor correlations for the nine items of the CreMo scale with the three factors of "do new things," "learn new things," and "accomplish new things," which are significantly correlated.

Table 5:
Model fit: baseline models with different levels of constraints across multiple groups

Model	χ^2	df	χ^2/df	CFI	TLI	RMSEA	Model comparison	ΔCFI
Baseline model (six countries combined)	78.649	24	3.27	0.983	0.975	0.031		-
Model A: Factor structure equal (unconstrained)	302.208	144	2.10	0.955	0.932	0.065		-
Model B: Factor loadings constrained	354.602	174	2.04	0.948	0.936	0.063	B and A	0.007
Model C: Factor variances (and loadings) constrained	371.717	189	1.97	0.946	0.938	0.062	C and B	0.002
Model D: Factor covariances (and variance, loadings) constrained	398.139	204	1.95	0.941	0.938	0.062	D and C	0.005

Notes: RMSEA = the root mean square error of approximation; CFI = the comparative fit index; TLI = Tucker-Lewis index.

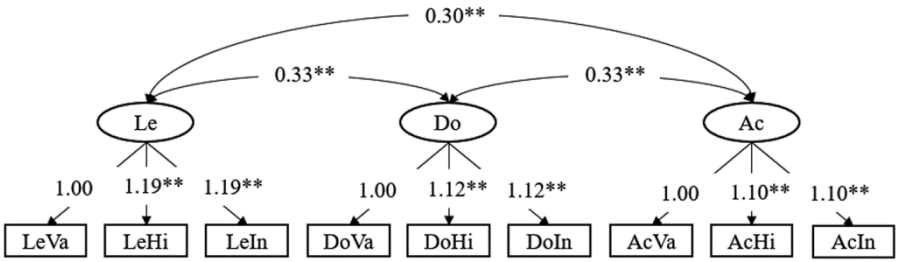

Figure 4:
Final three-factor model for CreMo in six country groups. χ^2=398.14, *df* =204, CFI=0.941, TLI=0.938, RMSEA=0.050

*Le = learn new things; Do = do new things, and Ac = accomplish new things; Va = value, Hi = high quality experience, and In = instrumental purpose. For instance, LeVa refers to the item combining "learn new things" and "value"; DoHi refers to the item combining "do new things" and "high-quality experience" and so on.

4 Discussions and implications

We conceptualized Creativity Motivation theory and developed the Creativity Motivation Scale as a measurement instrument. Moreover, we employed CFA to establish the theoretical structural validity and tested its cross-cultural validity as well as reliability of the CMS with data from six country groups.

There are three important results emerging from this study. First, the internal consistency of the nine items of CMS from all countries involved shows a great potential for future use of the scale. The consideration that the countries involved represent different languages and cultures constitutes an added value to the validity and reliability of the scale. Second, CFA results confirmed that the theoretically hypothesized three-factor CreMo model, consisting of three types of behavior disposition (do, learn, and accomplish new things), is statistically preferable to both a one-factor-model and a second-order model. Third, the CMS showed convincing evidence of measurement equivalence of factor structures, factor loadings, and factor variances and covariances across groups of college students across six culturally and geographically different countries (Chile, China, Kosovo, Russia, Saudi Arabia, and Turkey). With these results, we can have various cross-national studies and analyze different aspects of creativity motivation, which in turn would provide reliable results and conclusions. Overall, this study provides strong support for the universality of CMS by examining its reliability and validity across diverse cultural groups.

The findings from this study have several research and practical implications.

Firstly, the theory of creativity motivation can serve as a useful conceptual framework for research, in which all dispositions of do, learn, and accomplish new things, as well as all forces of instrumental purpose, high-quality experience, and value should be considered for an individual to be motivated to create. Three subscales of creativity motivation can and should be further investigated in the future. Secondly, due to the acceptable cross-country groups' invariance, researchers may consider the CMS as a valid tool to be

applied in the research field of creativity, especially for comparative studies across cultures and countries. Moreover, CMS has the potential to be used for the identification and diagnosis of personal motivation towards creating activities in multiple dimensions. This can provide information on different aspects of creativity motivation, whether already exceling or whether in need of development regarding to doing new things, learning new things, or accomplishing new things.

A limitation of the current study should be noted. The sample of the current study involves convenience sample of college students from six countries majoring in education. The research result from this sample could be limited in that it was not applied to a larger college student sample in other majors or non-college student sample.

CMS can be used in future studies to investigate the relationship between motivation elements and other creativity-related variables such as personal attributes, creative products, and environmental factors. Further validation of CMS can be tested in longitudinal designs to establish prediction validity and with multiple behavioral and objective measures.

In conclusion, the current study proposed the conceptual and theoretical framework of creativity motivation. In addition to this new conceptualization, we developed a creativity motivation scale and provided the evidence for its structural validity, cross-cultural validity, and reliability using CFA and MGCFA. We hope it will be used to help conduct future research and practice on developing creativity.

References

Amabile, T. M. (1983). The social psychology of creativity: A componential conceptualization. *Journal of Personality and Social Psychology*, *45*(2), 357–376.

Amabile, T. M. (1990). Within you, without you: The social psychology of creativity, and beyond. *Theories of Creativity*, 245.

Amabile, T. M. (1993). Motivational synergy: Toward new conceptualizations of intrinsic and extrinsic motivation in the workplace. *Human Resource Management Review*, *3*(3), 185–201.

Byrne, B. M. (2004). Testing for multigroup invariance using AMOS graphics: A road less traveled. *Structural Equation Modeling*, *11*(2), 272–300.

Collins, M. A., & Amabile, T. M. (1999). Motivation and creativity. *Handbook of Creativity.*

Csikszentmihalyi, M., & Wolfe, R. (2014). New Conceptions and Research Approaches to Creativity: Implications of a Systems Perspective for Creativity in Education. In *The Systems Model of Creativity* (pp. 161–184).

Dollinger, S. J., Burke, P. A., & Gump, N. W. (2007). Creativity and Values. *Creativity Research Journal*, *19*(2–3), 91–103.

Feist, G. J. (2010). The Function of Personality in Creativity. *The Cambridge Handbook of Creativity*, 113–130.

Garver, M. S., & Mentzer, J. T. (1999). Logistics research methods: employing structural equation modeling to test for construct validity. *Journal of Business Logistics*, *20*(1), 33–57.

Guilford, J. P. (1950). Creativity. *The American Psychologist*, *5*(9), 444–54.

Harter, S., & Jackson, B. K. (1992). Trait vs. nontrait conceptualizations of intrinsic/extrinsic motivational orientation. *Motivation and Emotion*, *16*(3), 209–230.

Hennessey, B. A. (2000). Intrinsic and Extrinsic Motivation. *Intrinsic and Extrinsic Motivation*, 55–78.

Hennessey, B. A. (2010). The Creativity-Motivation Connection. In *The Cambridge Handbook of Creativity* (pp. 342–365).

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, *6*(1), 1–55.

Johnson, W., & Bouchard, T. J. (2005). The structure of human intelligence: It is verbal, perceptual, and image rotation (VPR), not fluid and crystallized. *Intelligence*, *33*(4), 393–416.

Kaufman, J. C., Plucker, J. A., & Baer, J. (2008). *Essentials of psychological assessment series. Essentials of creativity assessment.* Hoboken, NJ, US: John Wiley & Sons Inc.

Klassen, R. M., Bong, M., Usher, E. L., Chong, W. H., Huan, V. S., Wong, I. Y. F., & Georgiou, T. (2009). Exploring the validity of a teachers' self-efficacy scale in five countries. *Contemporary Educational Psychology*, *34*(1), 67–76.

Kozbelt, A., Beghetto, R. A., & Runco, M. A. (2010). Chapter 2 Theories of creativity. In *The Cambridge handbook of creativity* (pp. 20–48).

Kreitler, S., & Casakin, H. (2009). Motivation for creativity in design students. *Creativity Research Journal*, *21*(2–3), 282–293.

MacCallum, R. C., Browne, M. W., & Sugawara, H. M. (1996). Power analysis and determination of sample size for covariance structure modeling. *Psychological Methods*, *1*(2), 130–149.

Marsh, H. W., & Hocevar, D. (1985). Application of Confirmatory Factor Analysis to the Study of Self-Concept. First- and Higher Order Factor Models and Their Invariance Across Groups. *Psychological Bulletin*, *97*(3), 562–582.

Plucker, J. A., Beghetto, R. A., & Dow, G. T. (2004). Why isn't creativity more important to educational psychologists? Potentials, pitfalls, and future directions in creativity research. *Educational Psychologist*, *39*(2), 83–96.

Puccio, G., & Cabra, J. (2010). Organizational creativity: a systems approach. In J. C. Kaufman & R. J. Sternberg (Eds.), *The Cambridge handbook of creativity* (pp. 145-173). New York, NY, US: Cambridge University Press.

Raftery, A. E. (1995). Bayesian model selection in social research. *Sociological Methodology*, *25*, 111–163.

Rhodes, M. (1961). An Analysis of Creativity. *The Phi Delta Kappan*, *42*(7), 305–310.

Rosseel, Y. (2012). lavaan : An R Package for Structural Equation. *Journal of Statistical Software*, *48*(2), 1–36.

Runco, M. A. (2004). Creativity. *Annual Review of Psychology*, *55*, 657–687.

Runco, M. A. (2005). Motivation, competence, and creativity. In *Handbook of competence and motivation* (pp. 609–623).

Sosu, E. M. (2013). The development and psychometric validation of a Critical Thinking Disposition Scale. *Thinking Skills and Creativity*, *9*, 107–119.

Tierney, P. (2015). An identity perspective on creative action in organizations. In C. E. Shalley, M. A. Hitt, J. Zhou, C. E. Shalley (Ed), M. A. Hitt (Ed), & J. Zhou (Ed) (Eds.), *The Oxford handbook of creativity, innovation, and entrepreneurship.* (pp. 79–92). New York, NY, US: Oxford University Press.