Thinking Divergently and Finding a Flow: Does a Supportive Setting Matter?

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Abstract

In this study we investigated the role that student perception of support for creativity and openness in the school environment plays on creative self-efficacy, divergent thinking, and flow in learning. We explored models with cross-sectional data collected during the fall of the 2015–16 school year. We evaluated models' construct validity, direct effects of support for creativity and openness on divergent thinking and flow in learning, and indirect effects through creative self-efficacy. We found direct effects of support for creativity and support for openness on divergent thinking and flow in learning but no indirect effects through creative self-efficacy. Results suggest strategies that develop student openness may support student's achieving a state of flow in their learning and, perhaps, greater divergent thinking capacity.

1. Introduction

As a personal-level resource, creativity is a process of divergent thinking to find a novel idea or approach and a state of *flow* to act on that idea. Flow has been defined by the experiential situated immersion and enjoyment in learning (Csikszentmihalyi & Rathunde, 1993) as a balance of optimal challenge and adequate skill for the task. Similar to the latent versus achieved nature of divergent thinking, flow is characterized as a state of mind versus realized individual trait (Teng, 2011). Aspects of creative learning, such as divergent thinking and flow may play a pivotal role in the learning process (Beghetto, 2016), but may also be highly influenced by the opportunities provided in the learning environment. Research indicates that certain classroom environments and practices, such as a singular focus on transmission of knowledge and teacher-dominated convergent discussion, may be pervasive and undermine the growth of students' creative potential and self-efficacy (Beghetto, 2010; 2013). Whether a teacher can create the opportunity for students' unconventional ideas (e.g., *is there always only one right answer*) and uninterrupted states of flow while developing "structured disciplinary knowledge" may determine how students develop personal creative resources and the self-efficacy to use them (Beghetto, 2016, p. 10).

2. Research Questions

1. To what extent do the measures included in this model show construct validity?
2. To what extent are there direct effects of support for creativity and openness on divergent thinking and flow in learning?
3. In addition to these direct effects, to what extent are there indirect effects through creative self-efficacy?

3. Methods

Measures: Runco Evaluation of Setting and Climate (Runco, 2015), Creative Self-Efficacy (Beghetto, 2006), Flow in Learning (based on the work of Nakamura and Csikszentmihalyi (2014)), and divergent thinking tasks from the Runco Creativity Assessment Battery (Runco, 2011) to measure originality, flexibility, and fluency.

Participants: Students from eight large middle schools participating in this study from both fringe rural and urban locales in small and mid-size cities in the Pacific Northwest. Schools served more than 50% of students identified as economically disadvantaged families and comparatively high proportions of racial/ethnic minority students. We administered the items from a survey protocol to a sample of students (n = 1,048).

Planned Analysis. This study analyzes cross-sectional data using structural equation modeling. In M*plus* software (Muthen & Muthen, 2012), we used full information maximum likelihood with robust estimation to accommodate variables that violated assumptions of normality (Kline, 2016). We followed the two-step approach to testing fully latent structural regression models (Kline, 2016) and used Hu and Bentler's (1999) strict criteria for close fit with the fit. First, we ran a one-factor model in confirmatory factor analysis (CFA), followed by a four-factor model that combined the exogenous manifest items from the evaluation of creative settings measure under a single exogenous latent variable, and concluded with a five-factor model that separated the measure evaluated the setting into two factors. We examined residual correlations and modification indices to conduct local fit-testing of paths between all variables. In the full model there were eight manifest exogenous variables and 10 manifest endogenous variables for a total of 171 sample moments with 46 free parameters in the proposed model (df = 125).

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4. Results

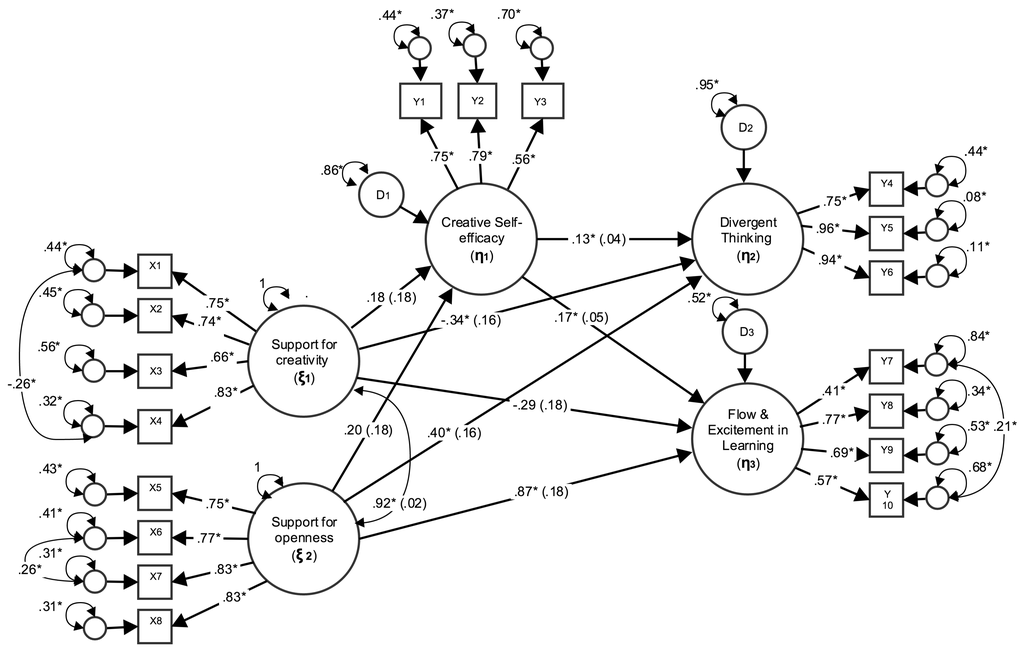

Figure 1. Structural regression model with standardized regression coefficients, standard errors, covariances, residual variances of manifest variables, and unstandardized residual variance of endogenous latent variables. * p < .05.

Table 1.

Statistics from Selected Goodness-of-Fit Indices for Two-Step Testing of a Structural Regression Model of Evaluation of Creative Setting at School, Creative Self-efficacy, Divergent Thinking, and Flow in Learning in Cross-sectional Measurement (n = 1,012)

Model	χ^2_M	df_M	χ^2_D	df_D	RMSEA	CFI	SRMR
Measurement model							
One factor	3,012.92*	135	—	—	.123 (.140–.149)	.552	.123
Four factor	327.60*	129	2,685.32*	6	.039 (.034–.044)	.969	.035
Five factor	271.36*	125	56.24*	4	.034 (.028–.039)	.977	.033
Five factor w/ correlated	195.45*	122	75.91*	3	.024 (.018–.030)	.989	.028
Structural model (not nested)							
Eight paths, indirect effects, sex	235.13*	139	—	—	.026 (.020–.032)	.985	.031
Seven paths and indirect paths only	195.45*	122	—	—	.024 (.018–.035)	.989	.028

**Note.* The chi-square tests were significant at the p < .01 alpha level. CFI = comparative fit index; SRMR = standardized root-mean-square residual; RMSEA = root mean square error of approximation.

Detailed results—

- Generally, there were high pattern coefficients across measures.
- Final nested five-factor model demonstrated close fit.
- As Kline (2016) recommends when residual correlations may be high for some items, we switched two indicators between the *support for creativity* and *support for openness* exogenous latent variables—language in the items fit the other factor better.
- We followed Kline's (2016) suggestions and correlated the residual variance between three pairs of items when we found distinct similarity in wording and concept within the pairs.
- In the first structural regression model, we included the effect of sex on divergent thinking and found a statistically significant regression coefficient (γ = -.22, S.E. = .03, p < .001) indicating that female students' scores were higher than their male peers
- Detailed in Figure 1, the standardized direct effect of support for creativity and support for openness to divergent thinking were statistically significant but in opposite directions.
- In this cross-sectional model, the indirect effects through creative self-efficacy were not significant (not a true test of mediation).
- Though the direct effect of support for *creativity* to flow in learning was not statistically significant, the direct effect of support for *openness* to flow in learning was statistically significant and large
- All indirect effects through creative self-efficacy were not significant.

Expression of the measurement equations for the indicators of endogenous variables (Y):

$$Y = \Lambda_Y \eta + \epsilon$$

$$\begin{bmatrix} Y_1 \\ Y_2 \\ Y_3 \\ Y_4 \\ Y_5 \\ Y_6 \\ Y_7 \\ Y_8 \\ Y_9 \\ Y_{10} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ \lambda_{Y21} & 0 & 0 \\ \lambda_{Y31} & 0 & 0 \\ 0 & 1 & 0 \\ 0 & \lambda_{Y52} & 0 \\ 0 & \lambda_{Y62} & 0 \\ 0 & 0 & 1 \\ 0 & 0 & \lambda_{Y83} \\ 0 & 0 & \lambda_{Y93} \\ 0 & 0 & \lambda_{Y103} \end{bmatrix} \begin{bmatrix} \eta_1 \\ \eta_2 \\ \eta_3 \end{bmatrix} + \begin{bmatrix} \epsilon_1 \\ \epsilon_2 \\ \epsilon_3 \\ \epsilon_4 \\ \epsilon_5 \\ \epsilon_6 \\ \epsilon_7 \\ \epsilon_8 \\ \epsilon_9 \\ \epsilon_{10} \end{bmatrix}$$

Expression of the measurement equations for the indicators of exogenous variables (X):

$$X = \Lambda_X \xi + \delta$$

$$\begin{bmatrix} X_1 \\ X_2 \\ X_3 \\ X_4 \\ X_5 \\ X_6 \\ X_7 \\ X_8 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ \lambda_{X21} & 0 \\ \lambda_{X31} & 0 \\ \lambda_{X41} & 0 \\ 0 & 1 \\ 0 & \lambda_{X62} \\ 0 & \lambda_{X72} \\ 0 & \lambda_{X82} \end{bmatrix} \begin{bmatrix} \xi_1 \\ \xi_2 \end{bmatrix} + \begin{bmatrix} \delta_1 \\ \delta_2 \\ \delta_3 \\ \delta_4 \\ \delta_5 \\ \delta_6 \\ \delta_7 \\ \delta_8 \end{bmatrix}$$

Covariance matrix of exogenous factors:

$$\Phi = \begin{bmatrix} \phi_{11} & \square \\ \phi_{21} & \phi_{22} \end{bmatrix}$$

Covariance matrix of error terms of X indicators:

$$\Theta_\delta = \begin{bmatrix} \theta_{\delta_{11}} & \square & \square & \square & \square & \square & \square & \square \\ 0 & \theta_{\delta_{22}} & \square & \square & \square & \square & \square & \square \\ 0 & 0 & \theta_{\delta_{33}} & \square & \square & \square & \square & \square \\ 0 & 0 & 0 & \theta_{\delta_{44}} & \square & \square & \square & \square \\ 0 & 0 & 0 & 0 & \theta_{\delta_{55}} & \square & \square & \square \\ 0 & 0 & 0 & 0 & 0 & \theta_{\delta_{66}} & \square & \square \\ 0 & 0 & 0 & 0 & 0 & 0 & \theta_{\delta_{77}} & \square \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & \theta_{\delta_{88}} \end{bmatrix}$$

Covariance matrix of error terms of Y indicators:

$$\Theta_\epsilon = \begin{bmatrix} \theta_{\epsilon_{11}} & \square & \square & \square & \square & \square & \square & \square & \square & \square \\ 0 & \theta_{\epsilon_{22}} & \square & \square & \square & \square & \square & \square & \square & \square \\ 0 & 0 & \theta_{\epsilon_{33}} & \square & \square & \square & \square & \square & \square & \square \\ 0 & 0 & 0 & \theta_{\epsilon_{44}} & \square & \square & \square & \square & \square & \square \\ 0 & 0 & 0 & 0 & \theta_{\epsilon_{55}} & \square & \square & \square & \square & \square \\ 0 & 0 & 0 & 0 & 0 & \theta_{\epsilon_{66}} & \square & \square & \square & \square \\ 0 & 0 & 0 & 0 & 0 & 0 & \theta_{\epsilon_{77}} & \square & \square & \square \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & \theta_{\epsilon_{88}} & \square & \square \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \theta_{\epsilon_{99}} & \square \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \theta_{\epsilon_{1010}} \end{bmatrix}$$

Figure 2. Matrix algebra expression of measurement equations.

Expression for structural part of the SR model:

$$Y = \Gamma \xi + \beta Y + \zeta$$

$$\begin{bmatrix} \eta_1 \\ \eta_2 \\ \eta_3 \end{bmatrix} = \begin{bmatrix} \gamma_{11} & \gamma_{12} \\ \gamma_{21} & \gamma_{22} \\ \gamma_{31} & \gamma_{32} \end{bmatrix} \begin{bmatrix} \xi_1 \\ \xi_2 \end{bmatrix} + \begin{bmatrix} 0 & 0 & 0 \\ \beta_{21} & 0 & 0 \\ \beta_{31} & 0 & 0 \end{bmatrix} \begin{bmatrix} \eta_1 \\ \eta_2 \\ \eta_3 \end{bmatrix} + \begin{bmatrix} \zeta_1 \\ \zeta_2 \\ \zeta_3 \end{bmatrix}$$

Covariance matrix for the disturbances of endogenous factors:

$$\Psi = \begin{bmatrix} \varphi_{11} & \square & \square \\ 0 & \varphi_{22} & \square \\ 0 & 0 & \varphi_{33} \end{bmatrix}$$

Figure 3. Expression for structural part of latent structural regression model.

5. Conclusions

- The results of the measurement model demonstrate structural validity of the individual measures.
- Creative self-efficacy had a weak association with divergent thinking and flow in learning and did not explain any of the shared variance between support for creativity or openness and divergent thinking or flow.
- The higher students rated the support for creativity in their school, the lower they scored in divergent thinking. It is possible that middle school students who had developed divergent thinking skills, a proxy for personal-level creative potential, were more discerning and critical of the support for creativity in the school setting.
- A more positive evaluation of the school's support for openness related to higher divergent thinking scores and higher ratings of a student's flow in learning—a connection between openness and flexible thinking?
- As the largest coefficient, support for openness may lead to more regular states of flow in learning.
- These results indicate that how students' evaluate the support in school does matter in relation to their divergent thinking and flow in learning.
- If educators seek to enhance students' flow state in learning, increasing the support for students to be open to new ideas and ways of learning may prove effective. Creative self-efficacy may only play a small role.