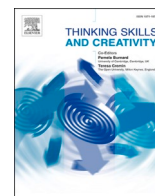


Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Thinking Skills and Creativity

journal homepage: www.elsevier.com/locate/tsc

Overexcitabilities and creative potential in the kindergarten context: The mediating role of children's playfulness

Wing Kai Fung^{a,*}, Kevin Kien Hoa Chung^b^a Department of Early Childhood, School of Education, Liverpool Hope University, United Kingdom.^b Department of Early Childhood Education, The Education University of Hong Kong, Hong Kong.

ARTICLE INFO

Keywords:

Overexcitabilities
Playfulness
Creative potential
Kindergarten context

ABSTRACT

This study examined the direct and indirect relationships of children's overexcitabilities with their playfulness and creative potential in the kindergarten context. Participants were parents and teachers of 140 Hong Kong Chinese kindergarten children (47.9% girls, mean age = 52.2 months). Parents reported their children's overexcitabilities (imaginational, psychomotor, sensual, intellectual, and emotional), and teachers rated children's playfulness (physical spontaneity, social spontaneity, cognitive spontaneity, manifest joy, and sense of humor) and creative potential (creative personality traits) as demonstrated in the classrooms. Hierarchical regression revealed that controlling for child age, gender, and parental education, children's social and cognitive spontaneity were significant correlates of their creative potential as perceived by the teachers. Moreover, results from the path analytic model showed that the positive relationship between intellectual overexcitability and creative potential was fully mediated by cognitive spontaneity. In contrast, the indirect relationship through social spontaneity was non-significant. The findings suggest that children's daily imaginative and inventive peer play in kindergarten may be conducive to their creative potential. Practically, results underscore the utility of creating a preschool play environment that embraces children's choice, autonomy, and originality while promoting peer interaction and collaboration, as such an approach may cultivate their creative potential.

1. Introduction

Overexcitabilities indicate one's innate heightened responsiveness to stimuli (Dabrowski, 1964), and these factors may impact children's creative potential directly by augmenting their perceptual experience (He, Wong & Chan, 2017) and indirectly by predisposing them to specific play behaviors (Fung & Chung, 2021). The playfulness of kindergarten children is reflected in their general style of play (Barnett, 1991), and this characteristic acts as an impetus to their creative potential (e.g., Lieberman, 1977; Luria, Baer & Kaufman, 2018). A growing body of evidence has revealed the interconnectedness among overexcitabilities, playfulness, and creative potential of kindergarten children (e.g., Fung & Chung, 2021; Fung, Chung & He, 2021), but the prior research depended on parental ratings only and examined their relationships within the household environment. As kindergarten offers children a different play context in terms of playmates, materials, and constraints, children may or may not display comparable play patterns in school and at

* Corresponding author at: Wing Kai Fung, Department of Early Childhood, School of Education, Liverpool Hope University, Hope Park, Liverpool, L16 9JD, United Kingdom.

E-mail address: fungw@hope.ac.uk (W.K. Fung).

<https://doi.org/10.1016/j.tsc.2022.101197>

Received 6 June 2022; Received in revised form 11 November 2022; Accepted 12 November 2022

Available online 15 November 2022

1871-1871/© 2022 The Author(s). Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

home (Berndt & Bulleit, 1985). Therefore, it is essential to examine whether and how children's inherent overexcitabilities would associate with their play characteristics and creative potential in the kindergarten environment. The present study aimed to fill this gap by investigating the direct and indirect relationships between parent-reported overexcitabilities and teacher-reported playfulness and creative potential in Hong Kong Chinese kindergarten children.

1.1. Creative potential in early childhood

Creativity has been broadly defined as generating novel and useful ideas in different domains (Amabile, 1996). Although creative ideas inevitably require the reintegration of prevailing resources and knowledge, works originating from creative ideas tend to be useful in some but not all situations or contexts (Runco & Jaeger, 2012), especially in early childhood. Generally, creativity in early childhood corresponds to the little-c (i.e., everyday creativity) that involves the expression of originality and appropriateness in everyday situations (Richards, 2007, 2019). Runco (2014) further proposed to avoid the term creativity and, instead, examine children's creative potential. Children's creative potential can relate to four factors: press (e.g., connectedness with the environment), person (e.g., traits/personality), process (e.g., thinking processes), and product (outcomes) (Rhodes, 1961). The operationalization of children's creative potential is diverse and challenging. Prior research has employed different assessment measures such as picture drawing production (Hui, Chow, Chan, Chui & Sam, 2015) or divergent and convergent thinking tasks (Lloyd & Howe, 2003). In the present study, the creative potential was assessed by informants' ratings of children's creative personality traits, an approach employed in prior research (e.g., Butcher & Niec, 2005; Fung et al., 2021).

The study of creative potential in kindergarten children is of vital importance. Ershadi and Winner (2020) have highlighted the U-shape development of creativity that children are likely to transition from the pre-conventional (kindergarten years), literal (middle childhood to early adolescence), to the post-conventional (late adolescence to early adulthood) stage. Specifically, kindergarten children are less restrictive or unconcern with the conventional representations in their creative products (e.g., drawing) (Gardner and Winner, 1982), while their creative potential tends to be static or drop during the primary and early secondary school years (Kim, 2011). Therefore, it is important to understand the factors driving kindergarten children's creative expression to nurture its positive development during middle childhood and help more adolescents and adults successfully transition to the post-conventional stage (Ershadi & Winner, 2020). The present study focused on two possible antecedents of children's creative potential: playfulness and overexcitabilities. Findings from this study may inform early childhood policy and practice on promoting children's early creative potential and pave their ways to achieve in 21st-century creative industries (Van Laar, Van Deursen & Van Dijk, 2022).

1.2. Playfulness in early childhood

Playfulness is generally defined as one's disposition to engage in playful situations, while such a characteristic is expressed throughout the lifespan (Pinchover, 2017). In early years, playfulness indicates a child's orientation to exhibit a distinctive pattern of play behaviors (Barnett, 1991; Lieberman, 1977) which is often shown by five indicators, namely physical spontaneity (motor coordination and activity level), social spontaneity (lead and engage in peer play), cognitive spontaneity (imagination, pretense, and originality), manifest joy (positive emotional expression), and sense of humor (enjoyment and production of humor) (Barnett, 2018). Playfulness has been suggested to govern children's approaches to various play situations and daily play behaviors (Barnett, 1991).

Classic developmental theories highlighted that children acquire different knowledge and skills through play (e.g., Piaget, 1976; Vygotsky, 1967). Research has examined how play promotes children's early development in areas like social competence (e.g., Fung & Cheng, 2017; Kalkusch et al., 2021), problem solving (Hollenstein, Thurnheer & Vogt, 2022), and school readiness (e.g., O'Sullivan & Ring, 2018). As children's playfulness characterizes their play behaviors that "transcend situations, contexts, tasks, and materials" (Barnett, 1991, p. 52), research has investigated how children's playfulness predicts their future cognitive and social-emotional development (e.g., Fink et al., 2020; Fung & Chung, 2022). This study extends the prior work to examine the link between playfulness and creative potential among kindergarten children.

1.3. Overexcitabilities in early childhood

Overexcitabilities reflect one's inherited tendencies to be exceptionally aroused by stimulations (Dabrowski, 1964). Dabrowski (1964) proposed five forms of overexcitability including imaginal (lively imaginations and extensive associations), psychomotor (energetic and restlessness), sensual (heightened sensory and esthetic experience), intellectual (curious and desire for mental activity), and emotional (intensified feelings). Chang and Kuo (2013) described overexcitabilities as the filters of one's sensory perception. All inward and outward stimulations are passed through these filters before subjecting to cognitive information processing (Chang & Kuo, 2013). When overexcitable people are exposed to internal or external stimuli that correspond to their overexcitabilities, they tend to show incomparable levels of emotional and behavioral responses (Piechowski, 1999).

These innate characteristics, in accordance with the Theory of Positive Disintegration (Dabrowski, 1964), may lead people to heightened internal arousal (Piechowski, 1999) and an augmented perception of reality (De Bondt, Maeyer, Donche & Van Petegem, 2019). Thus, people with high overexcitabilities may display exceptional levels of information processing and creative ideation that directly support their creative potential (He et al., 2017; Piechowski, 1999). Among the five different aspects, Dabrowski (1964) underlined imaginal, intellectual, and emotional overexcitabilities as the major contributors to creative potential. Nevertheless, strong overexcitabilities are not necessarily related to higher levels of creative expression (Chang & Kuo, 2013) as the accompanying intense emotional tensions have to be released through a proper outlet (Piechowski, 1999). In early childhood, play is an appropriate

channel for children to express and release these intense emotions (Ayling, Armstrong & Gordon, 2019) and, possibly, promote their positive disintegration and creative potential.

1.4. Overexcitabilities, playfulness, and creative potential

Other than a direct influence, overexcitabilities may indirectly impact children's creative potential by shaping their daily behaviors (Dabrowski, 1964; Piechowski, 1999). Specifically, overexcitabilities may predispose children to exhibit a particular style of play, while these play experiences enable the release of deep emotions and shape their creative potential (Fung & Chung, 2021). For instance, Fung and Chung (2021) demonstrated the relationships between kindergarten children's imaginal, psychomotor, and intellectual overexcitabilities with various aspects of parent-reported playfulness (e.g., cognitive, social, and physical spontaneity).

Evidence also supports that playfulness catalyses creative potential among adults (Bateson & Nettle, 2014) and children (Fung et al., 2021). For example, Trevas, Matsouka and Zachopoulou (2003) reported the positive relationships between playfulness, motor fluency, and motor flexibility in a sample of Greek preschool children. Play offers children a safe and engaging environment to stretch the boundary across the real and imaginary world in which they can generate new associations and experiment with novel ideas and solutions (Chávez-Eakle, Eakle & Cruz-Fuentes, 2012). Therefore, higher levels of playfulness may give these children increased opportunities for combining ideas and solving problems in unusual ways and these capacities are conducive to their creative potential (Bateson & Nettle, 2014; Luria et al., 2018). Although increasing evidence supported a theoretical framework connecting children's overexcitabilities, playfulness, and creative potential, very limited research has examined their interrelationships. A recent study has reported that, within the household context, children with increased levels of imaginal overexcitability tend to engage in more imaginative pretense, while the increased cognitive (object substitution, broad scanning) and affective (affect-laden imagination) play processes may promote their creative potential (Fung et al., 2021). Nonetheless, the results were solely based on the parental report without considering the multidimensional nature of overexcitabilities and playfulness.

Kindergarten is an important context that shapes children's early development. Due to the range of play materials, availability of playmates, and contextual limitations (e.g., time constraints, teacher's expectation) in kindergarten, children have higher needs to interact with play partners to conduct group play and the successful coordination of peer play is a major social goal for kindergarten children (Beaty, 2014). Consequently, children may display different play behaviors in school from home (Berndt & Bulleit, 1985), and a wider range of personal characteristics (e.g., emotional overexcitability, social spontaneity) may shape children's school play behaviors and creative potential. Therefore, the generalizability of the existing findings concerning overexcitabilities, playfulness, and creative potential in the household context remains an open question. A comprehensive examination by including multiple aspects of overexcitability and playfulness is necessary. The present study extended prior work (e.g., Fung & Chung, 2021; Fung et al., 2021) by investigating how children's parent-reported overexcitabilities would be associated with their teacher-reported playfulness and creative potential and exploring the possible mediating mechanism with consideration of the multidimensionality of these innate and behavioral characteristics.

1.5. The present study

This study investigated the direct and indirect relationships among kindergarten children's parent-reported overexcitabilities (imaginal, psychomotor, sensual, intellectual, and emotional), teacher-reported playfulness (physical spontaneity, social spontaneity, cognitive spontaneity, manifest joy, and sense of humor), and creative potential. Based on the literature reviewed (e.g., Fung & Chung, 2021; Fung et al., 2021; He et al., 2017), it was hypothesized that children's parent-reported imaginal, intellectual, and emotional overexcitabilities would be positively related to their teacher-reported creative potential. It was also expected that teacher-reported cognitive spontaneity, social spontaneity, and manifest joy would mediate the positive links between children's overexcitabilities and creative potential.

2. Method

2.1. Participants

Participants were parents and teachers of 140 Hong Kong Chinese kindergarten children (47.9% girls, mean age = 52.2 months) from a local kindergarten situated in the middle-socioeconomic stratum. Twenty-two teachers participated in the study. The number of children rated by each teacher ranged between five to nine, depending on the number of positive parental consent received in the classes. A majority of the teachers (>90%) possessed a bachelor's degree in early childhood education and were in-service teachers for more than one year. These figures aligned with the overall percentage of trained kindergarten teachers with a certificate or above in Hong Kong (i.e., 95.9%) between 2020 and 2021 (Education Bureau of HKSARG, 2022). The Hong Kong Kindergarten Education Curriculum Guide (Curriculum Development Council, 2017) endorses play-based learning as a core pedagogical approach. Therefore, teacher-training programs in Hong Kong generally equip pre-service teachers with solid theoretical knowledge of the importance of play (Fung & Cheng, 2012). The learning through play approach has been widely employed in Hong Kong kindergartens (Lau & Li, 2018). Parents reported their education level: (1) primary, (2) secondary, (3) college, (4) university, and (5) postgraduate. Among the parents, 44.2% completed university or above, 29.6% completed secondary school, and 26.2% completed college. 89.1% of the parental questionnaires were completed by mothers, whereas 30.0% of these mothers were less educated than their spouses.

2.2. Procedure

Ethical approval was given by the concerned university (blinded for review). The principal of the participating kindergarten also provided consent. Informed consent and questionnaire forms were sent to the teachers and parents to invite their participation. Parents reported their educational level and their child’s age, gender, and overexcitabilities by completing a questionnaire, which could be finished in twenty minutes. Class teachers rated children’s playfulness and creative potential as exhibited in the kindergarten, and the questionnaire could be completed in ten minutes.

2.3. Measures

2.3.1. Parent-reported overexcitabilities

Children’s overexcitabilities were assessed by the Chinese version of Overexcitability Questionnaire–Two (OEQII; Falk, Lind, Miller, Piechowski & Silverman, 1999), which was previously employed in local and international research showing reliability and validity (Chang & Kuo, 2013; Fung & Chung, 2021). The adapted OEQII had five subscales with ten items each: imaginal (e.g., “My child’s pretend world is very real”), psychomotor (e.g., “My child enjoys a physically exhausting activity”), sensual (e.g., “My child feels music throughout the whole body”), intellectual (e.g., “My child observes and analyses everything”), and emotional (e.g., “My child has strong feelings of joy, anger, excitement, and despair”). Parents rated each item on a 5-point scale ranging from 1 (not like) to 5 (exactly like). The average scores of the five subscales represented children’s imaginal, psychomotor, sensual, intellectual, and emotional overexcitabilities.

2.3.2. Teacher-reported playfulness

Children’s playfulness was assessed by the Children’s Playfulness Scale (CPS; Barnett, 1991), which has been employed in research on kindergarten children (e.g., Fung & Chung, 2021; Trevlas et al., 2003). The CPS consisted of 23 items under five subscales: physical spontaneity (e.g., “The child is physically active during play), cognitive spontaneity (e.g., “The child uses unconventional objects in play”), social spontaneity (e.g., “The child initiates play with others”), manifest joy (e.g., “The child expresses enjoyment during play”), and sense of humor (e.g., “The child likes to clown around in play”). Teachers rated the items on a 5-point scale ranging from 1 (not like) to 5 (exactly like), and the average scores of the corresponding subscales represented children’s playfulness in the kindergarten context.

2.3.3. Teacher-reported creative potential

Children’s creative potential in the kindergarten context was assessed by the teachers’ ratings on Common Creative Attribute (Chan & Chan, 1999). The Common Creative Attribute (Chan & Chan, 1999) included eleven items extracted from prior research of teachers’ ratings on students’ creativity (e.g., imaginative, unique, and original), and the items were validated by local teachers. Teachers rated the items on a 7-point scale ranging from 1 (rarely) to 7 (extremely), and the average scores represented children’s teacher-reported creative potential.

2.4. Data analysis plan

Correlation analysis was first conducted to examine the relationships among the variables. Hierarchical regression analysis was then performed to investigate how different aspects of parent-reported overexcitability and teacher-reported playfulness would predict

Table 1
Descriptive statistics, reliabilities, and bivariate correlations of study variables.

Variables	Correlations										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1. Imaginational overexcitability	–										
2. Psychomotor overexcitability	.35***	–									
3. Sensual overexcitability	.44***	.16	–								
4. Intellectual overexcitability	.42***	.41***	.52***	–							
5. Emotional overexcitability	.40***	.47***	.36***	.57***	–						
6. Physical spontaneity	.16	.30***	.10	.34***	.08	–					
7. Social spontaneity	.01	.12	.05	.24**	.14	.63***	–				
8. Cognitive spontaneity	.06	.13	.07	.29***	.10	.63***	.80***	–			
9. Manifest joy	.11	.29***	.10	.32***	.11	.73***	.75***	.74***	–		
10. Sense of humor	.15	.20*	.14	.39***	.12	.66***	.63***	.67***	.65***	–	
11. Creative potential	.08	.18*	.04	.22**	.13	.54***	.70***	.72***	.59***	.48***	–
Descriptive statistics											
Mean	3.17	3.53	3.39	3.27	3.32	3.51	3.48	3.19	3.79	2.81	4.42
SD	0.68	0.63	0.50	0.59	0.51	0.89	0.86	0.80	0.87	0.87	1.08
Skewness	0.05	–0.35	0.07	–0.11	0.06	–0.19	–0.44	–0.28	–0.66	0.05	–0.60
Kurtosis	0.00	0.82	0.07	–0.02	–0.38	–0.82	0.03	–0.25	–0.13	–0.37	–0.05
Cronbach’s Alpha	0.84	0.81	0.74	0.84	0.70	0.84	0.84	0.75	0.90	0.82	0.92

* $p < .05$; ** $p < .01$; *** $p < .001$.

children's teacher-reported creative potential and to identify any potential mediators. To explore the plausible indirect relationships among the variables, the identified aspects of overexcitability and playfulness that were significant correlates of teacher-reported creative potential (as reflected in the correlation and hierarchical regression analyses) were subjected to the path analyses. Path models were estimated with the lavaan package (version 0.6–7) in R (version 3.6.1; R Core Team, 2022). Intraclass correlations were inspected to understand the possible impacts of the nested sampling structure (i.e., class teachers' ratings on children's playfulness and creative potential) on the outcome variables, and the values ranged between 0.099 (social spontaneity) and 0.293 (creative potential). To account for the multilevel nature of the data, the lavaan.survey package (Oberski, 2014) was also employed to correct the parameter estimates, standard errors, and chi-square-derived fit measures for the clustered sampling design. This approach was utilized in recent research (e.g., Jackson & Cunningham, 2017; Stühmann et al., 2020). Model fit was assessed by the Chi-square index (non-significant χ^2), comparative fit index ($CFI \geq 0.95$), non-normed fit index ($NNFI \geq 0.95$), root mean square error of approximation ($RMSEA \leq 0.06$), and standardized root mean square residual ($SRMR \leq 0.08$) (Hu & Bentler, 1999).

3. Results

3.1. Preliminary analyses

Table 1 shows the descriptive statistics, Cronbach's alphas, and bivariate correlations of the study variables. The data was complete without missing values. The skewness and kurtosis of all variables fell within the range of plus and minus one. Parent-reported psychomotor and intellectual overexcitabilities were significantly related to various aspects of playfulness as reported by the teachers ($r = 0.20$ to 0.39 , $p < .01$). Similarly, psychomotor ($r = 0.18$, $p < .05$) and intellectual ($r = 0.22$, $p < .01$) overexcitabilities were positively correlated with teacher-reported creative potential. Furthermore, different aspects of playfulness were positively associated with creative potential ($r = 0.48$ to 0.72 , $p < .001$). Given the previous research revealing the links of child age, gender, and parental education with children's creative potential (e.g., He, 2018; He et al., 2017), these variables were controlled for further analysis.

3.2. Hierarchical regression model predicting creative potential

Hierarchical regression analysis was performed to investigate how children's overexcitabilities and playfulness would collectively predict their creative potential, with demographic variables entered in step 1, children's overexcitabilities entered in step 2, and various aspects of playfulness included in step 3. Table 2 shows the standardized regression coefficients of the individual predictors of the final model with all three steps considered. Step 1 of the regression model reveals that child gender and age significantly predicted 8% of the variance in teacher-reported creative potential. In step 2, overexcitabilities explained an extra 8% of the variance of creative potential, but none of the individual factors appeared as a significant predictor in the final model with playfulness considered. In step 3, various aspects of playfulness additionally explained 45% of the variance of creative potential. Specifically, teachers' ratings on children's social spontaneity ($\beta = 0.28$, $SE = 0.14$, $p < .05$) and cognitive spontaneity ($\beta = 0.49$, $SE = 0.14$, $p < .001$) emerged as the significant predictors. Considering the positive correlations of psychomotor and intellectual overexcitabilities with creative potential (Table 1) and their non-significant associations after taking playfulness into account (Table 2), social and cognitive spontaneity may have fully mediated the relationships between overexcitabilities and creative potential. Therefore, these factors were included in path analyses to examine their indirect relationships further.

Table 2

Hierarchical regression predicting creative potential from child age and gender, parental education, overexcitabilities, and playfulness.

Steps/independent variables	Creative potential ^b		Total R^2	ΔR^2	ΔF	p
	Final β	SE				
Step 1	–	–	.08	.08	2.93	.023
Child gender (boy = 0, girl = 1)	.12	.13				.049
Child age	.13	.01				.029
Maternal education	.10	.07				.115
Paternal education	–0.12	.07				.069
Step 2	–	–	.16	.08	2.30	.049
Imaginational overexcitability ^a	–0.01	.11				.933
Psychomotor overexcitability ^a	.09	.12				.187
Sensual overexcitability ^a	–0.04	.15				.551
Intellectual overexcitability ^a	.01	.16				.973
Emotional overexcitability ^a	.01	.16				.891
Step 3	–	–	.61	.45	29.26	<.001
Physical spontaneity ^b	.11	.11				.243
Social spontaneity ^b	.28	.14				.012
Cognitive spontaneity ^b	.49	.14				<.001
Manifest joy ^b	–0.04	.13				.740
Sense of humor ^b	–0.09	.11				.291

Note: ^a Children's overexcitabilities were reported by parents.

^b Children's playfulness and creative potential were reported by teachers.

3.3. Path analyses predicting creative potential

Fig. 1 shows the parameter estimates and model fit statistics for the path model of psychomotor overexcitability, social spontaneity, cognitive spontaneity, and creative potential, which fits well to the data $\chi^2 (df = 8, N = 140) = 10.95, p = .204, CFI = 0.99, NNFI = 0.97, RMSEA = 0.05$ (90% CI: 0.00, 0.11), $SRMR = 0.05, R^2_{\text{Social spontaneity}} = 0.01, R^2_{\text{Cognitive spontaneity}} = 0.02, R^2_{\text{Creative potential}} = 0.59$. Children’s social and cognitive spontaneity were significantly correlated ($r = 0.80, p < .001$). Moreover, the paths from social ($\beta = 0.29, SE = 0.08, p < .001$) and cognitive spontaneity ($\beta = 0.47, SE = 0.16, p < .001$) to creative potential were both significant. Nevertheless, the paths from psychomotor overexcitability to social spontaneity ($\beta = 0.12, SE = 0.11, p = .142$), cognitive spontaneity ($\beta = 0.13, SE = 0.11, p = .115$), and creative potential ($\beta = 0.10, SE = 0.12, p = .160$) were all non-significant.

Fig. 2 shows the parameter estimates and model fit statistics for the path model of intellectual overexcitability, social spontaneity, cognitive spontaneity, and creative potential, which fits the data well $\chi^2 (df = 8, N = 140) = 9.42, p = .309, CFI = 0.99, NNFI = 0.99, RMSEA = 0.04$ (90% CI: 0.00, 0.10), $SRMR = 0.05, R^2_{\text{Social spontaneity}} = 0.06, R^2_{\text{Cognitive spontaneity}} = 0.08, R^2_{\text{Creative potential}} = 0.58$. The paths from intellectual overexcitability to social ($\beta = 0.24, SE = 0.15, p < .05$) and cognitive ($\beta = 0.29, SE = 0.14, p < .01$) spontaneity were significant, but the one to creative potential was non-significant ($\beta = 0.01, SE = 0.14, p = .870$). The paths from social ($\beta = 0.30, SE = 0.07, p < .001$) and cognitive ($\beta = 0.47, SE = 0.16, p < .001$) spontaneity to creative potential were both significant. The indirect path from intellectual overexcitability to creative potential as mediated through cognitive spontaneity was significant (indirect effect: $\beta = 0.14, SE = 0.09, p < .01$), but the indirect path via social spontaneity was non-significant (indirect effect: $\beta = 0.07, SE = 0.07, p = .063$).

4. Discussion

This study examined the associations among kindergarten children’s overexcitabilities, playfulness, and creative potential as reported by parents and teachers and explored the mechanisms that potentially explain their interrelationships. The results reveal the interconnectedness among children’s social spontaneity, cognitive spontaneity, and creative potential in the kindergarten context. Moreover, the findings highlight how cognitive spontaneity may bridge the link between children’s intellectual overexcitability and their creative potential. Importantly, the present findings have expanded the existing studies (e.g., Fung & Chung, 2021; Fung et al., 2021) by demonstrating how children’s parent-reported innate characteristics of overexcitabilities would be translated into their play patterns and creative potential in kindergarten context, with multiple aspects of overexcitability and playfulness taken in account.

4.1. Relationships between overexcitabilities and creative potential

As expected, children’s intellectual overexcitability was positively correlated with their teacher-rated creative potential (Table 1). However, neither imaginal nor emotional overexcitability was significantly related to creative potential. Children’s imagination and pretense often involve cognitive processes of symbolic representation and broad association (Russ, 2003; Russ & Wallace, 2013). The capacities to imagine and pretend are considered indicators of early cognitive development (Vygotsky, 1967). Therefore, it is plausible that children overexcited to fantasy and imaginary ideas may have advanced cognitive functions and a higher tendency to manipulate concepts and ideas, which was reflected in their intellectual overexcitability. Indeed, research suggests that the relationship of cognitive spontaneity with intellectual overexcitability appears stronger than imaginal overexcitability (Fung & Chung, 2021). Given the close tie between cognitive spontaneity and creative potential, intellectual overexcitability may have

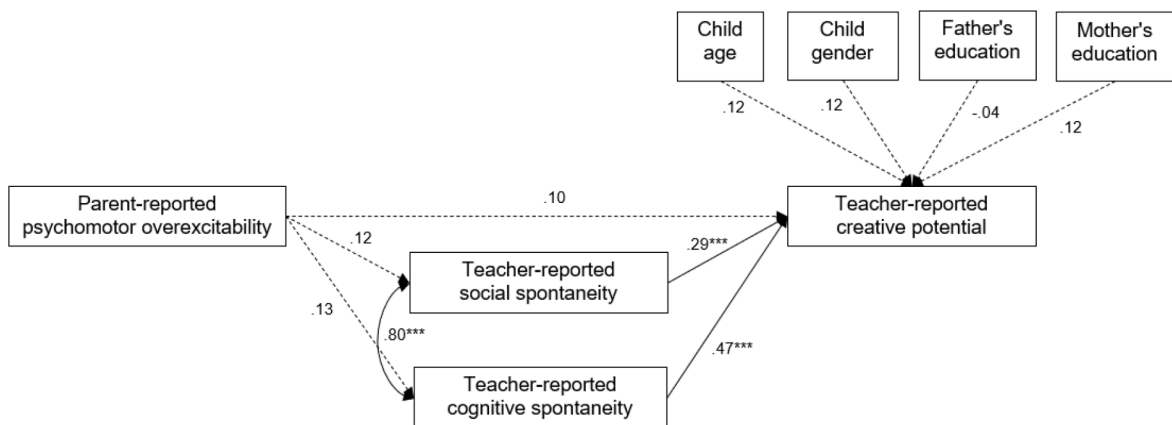


Fig. 1. Path model for predicting children’s teacher-reported creative potential from parent-reported psychomotor overexcitability, teacher-reported social spontaneity and cognitive spontaneity controlling for child age, child gender, and parental education levels. Standardized coefficients are reported. Solid paths are statistically significant. Dashed paths are non-significant. * $p < .05$; ** $p < .01$; *** $p < .001$. Fit indices: $\chi^2 (df = 8, N = 140) = 10.95, p = .204, CFI = 0.99, NNFI = 0.97, RMSEA = 0.05$ (90% CI: 0.00, 0.11), $SRMR = 0.05, R^2_{\text{Teacher-reported social spontaneity}} = 0.01, R^2_{\text{Teacher-reported cognitive spontaneity}} = 0.02, R^2_{\text{Teacher-reported creative potential}} = 0.59$.

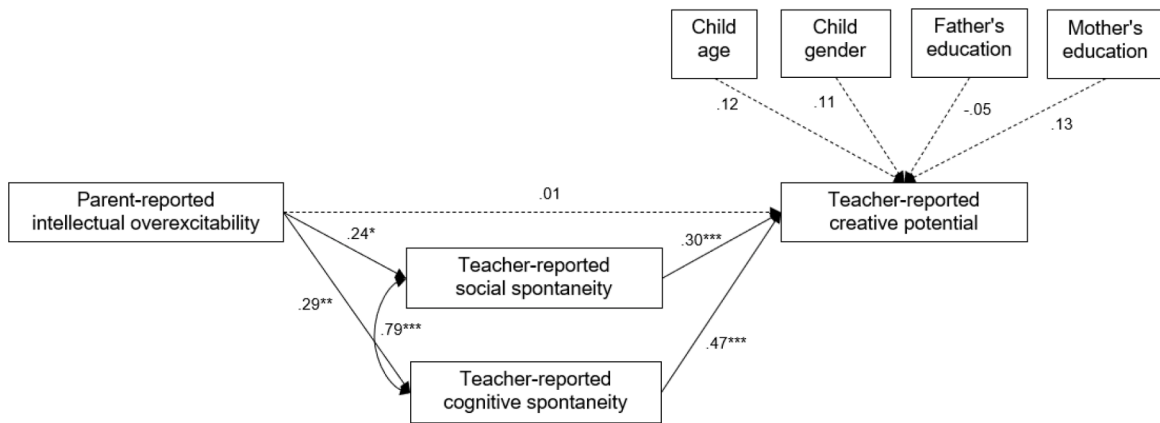


Fig. 2. Path model for predicting children’s teacher-reported creative potential from parent-reported intellectual overexcitability, teacher-reported social spontaneity and cognitive spontaneity controlling for child age, child gender, and parental education levels. Standardized coefficients are reported. Solid paths are statistically significant. Dashed paths are non-significant. * $p < .05$; ** $p < .01$; *** $p < .001$. Fit indices: $\chi^2 (df = 8, N = 140) = 9.42, p = .309, CFI = 0.99, NNFI = 0.99, RMSEA = 0.04$ (90% CI: 0.00, 0.10), SRMR = 0.05, $R^2_{Teacher-reported social spontaneity} = 0.06, R^2_{Teacher-reported cognitive spontaneity} = 0.08, R^2_{Teacher-reported creative potential} = 0.58$.

overshadowed the predictive power of imaginal overexcitability on creative potential. The present results also aligned with recent findings (Fung & Chung, 2021) and suggested that the role of emotional overexcitability in kindergarten children’s creative potential may be small. The positive impact of emotional overexcitability may be more salient in late childhood or early adolescence (e.g., He et al., 2017), when these children are more capable of resolving their internal conflicts and tensions (Piechowski, 1999) through the development of effective emotion regulation.

Separately, although psychomotor overexcitability emerged as a significant correlate of teacher-reported creative potential (Table 1), it was neither directly nor indirectly related to creative potential with social and cognitive spontaneity considered in the path model (Fig. 1). To further explore the possibility that psychomotor overexcitability might be indirectly related to creative potential through physical spontaneity, an additional path model was estimated, which revealed poor model fit: $\chi^2 (df = 4, N = 140) = 8.76, p = .067, CFI = 0.92, NNFI = 0.79, RMSEA = 0.10$ (90% CI: 0.00, 0.18), SRMR = 0.04. Nevertheless, given that teacher rating on children’s creative potential was employed in this study, the present results did not preclude the possibility that psychomotor overexcitability may predispose children to increased physical play experience and subsequently impacted their motor creativity (Milic, 2014; Trevlas et al., 2003). Future research may further examine this plausible indirect relationship.

4.2. Indirect relationships among overexcitabilities, playfulness, and creative potential

Notably, the path analysis (Fig. 2) highlighted cognitive spontaneity as an important correlate of children’s creative potential. The positive correlation between intellectual overexcitability and creative potential (Table 1) was fully mediated by cognitive spontaneity. The significant indirect relationship among intellectual overexcitability, cognitive spontaneity, and creative potential pointed to the likelihood that children who are fond of manipulating concepts and ideas may engage in more group imaginative play with their peers in kindergarten, which may, in turn, influence their creative potential as perceived by teachers. These results concurred with recent evidence revealing the relationship of cognitive processes within the imaginative play with creative potential in the home context (Fung et al., 2021). Particularly, children showing high cognitive spontaneity are more likely to pretend and integrate unconventional materials into their play. These processes often involve free associations, symbolic representation, and object substitution, which may promote their creative potential (Bodrova & Leong, 2018; Fung & Chung, 2021).

In addition to cognitive spontaneity, teachers regarded children’s social spontaneity as another predictor of their creative potential. Although the indirect relationship among intellectual overexcitability, social spontaneity, and creative potential did not reach statistical significance (at a trend level of $p = .063$), this finding underscored the social aspect of play in the kindergarten context (Fung & Chung, 2022). To effectively communicate and implement imaginative play ideas in a group setting, children with high cognitive spontaneity need to negotiate the play directions with their peers skilfully. These interactive processes, which allow exchanges of creative ideation, may be perceived as social spontaneity by the teachers. In contrast, social spontaneity may be less readily observed in the home context, particularly among children who choose solitary pretense to show their cognitive spontaneity. The present results demonstrated the importance of taking multiple aspects of overexcitability and playfulness into account when examining their influences on children’s creative potential, particularly in the kindergarten context. The small amount of variances of cognitive (8%) and social spontaneity (6%) explained by intellectual overexcitability emphasized how contextual constraints might impact children’s manifestation of their innate tendencies in the kindergarten context. Children may have altered their pattern of play behaviors to fulfill various kindergarten rules and limitations (e.g., daily class schedule, availability of materials, teacher’s direction). That said, children’s cognitive and social spontaneity explained a significant portion of the variance of their creative potential as perceived by teachers (58%). This finding and prior results based on parental ratings (Fung et al., 2021) revealed the connectedness between

children's playfulness and creative potential in both household and kindergarten contexts.

Unexpectedly, the present results showed that children's manifest joy was unrelated to their creative potential. This finding is in line with previous evidence showing the weak association of the affective play process with creative potential (Fung et al., 2021; Russ & Wallace, 2013). Together, this pattern of relationships suggested that children's cognitive spontaneity outweighed their manifest joy in shaping teachers' perception of creative potential. Positive emotions are inarguably the proper indicators of children's enthusiasm in play, but their exuberance can also be reflected by certain negative emotional expressions like anger and hostility that are specifically related to a play theme, character, or scenario (Fung & Chung, 2021). Although both positive and negative emotions were suggested as facilitating children's affect-laden ideation and creative thinking processes (Russ & Wallace, 2013), the dimension of manifest joy may not adequately capture children's expression of intense play-aroused negative emotions. Thus, the nature of the measurement may affect the present results. Equally possible, the teachers may perceive these negative emotions as less adaptive in the kindergarten context (Fung et al., 2021), and the unfavorable perceptions may have complicated the relationship between manifest joy and creative potential. However, caution should be taken in interpreting results as children's manifest joy may support their creative ideation and expression in other domains (e.g., drawing, storytelling), and future work can explore these possibilities.

4.3. Limitations

The present study has at least three limitations. First, although this study involved ratings from parents and teachers, informant reports of children's overexcitabilities, playfulness, and creative potential may be subjected to biases such as social desirability (Krumpal, 2013). Relatedly, the high correlations between some teacher-reported variables (e.g., social spontaneity, cognitive spontaneity, creative potential) may be attributed to common method variance (Podsakoff, MacKenzie, Lee & Podsakoff, 2003). Further work may investigate the relationships between these variables by employing behavioral measures (e.g., Test of Playfulness scale; Bundy, Nelson, Metzger & Bingaman, 2001) and alternative assessments of creative potential (e.g., thinking processes, creative product; Rhodes, 1961). For example, researchers may employ the Torrance Thinking Creatively in Action and Movement Test (TCAM) (Torrance, 1981) or the Test for Creative Thinking – Drawing Production (TCT-DP) (Urban & Jellen, 1996) to assess kindergarten children's creative potential. Second, the present sample size is small, which may have influenced the statistical significance of path coefficients. Moreover, all participants were recruited from the same kindergarten. Future research with an increased sample size recruited from more diverse socioeconomic backgrounds and kindergartens may better inform if a different aspect of playfulness (e.g., social spontaneity) can explain the association between overexcitabilities and creative potential of kindergarten children. Lastly, the present results were based on correlational data, and the path models were intended to explore the potential mechanisms only. Therefore, no causal inference can be made based on the present findings. Longitudinal studies are necessary to investigate the directionality of relationships further.

4.4. Conclusions and implications

Despite its limitations, the present study contributed to the literature by demonstrating how children's innate (overexcitabilities) and behavioral (playfulness) characteristics would indirectly relate to their creative potential in kindergarten. Practically, the results also point to the utility of encouraging children's cognitive and social spontaneity in peer play situations, as the relevant play processes may contribute to children's creativity development. For example, instead of structured play materials, teachers may promote children's ingenuity and imagination by providing them with "loose parts" (p.556) (Canning, 2010). Adults may also show their play supportiveness (e.g., endorsement of children's play choices and eagerness to offer play support) and provide children with additional group play opportunities. These factors may facilitate children's playfulness (Fung & Chung, 2022) and, in turn, promote their creative potential.

Data availability statement

Research data are not shared.

Compliance with ethical standards

This manuscript was prepared in accord with the ethical standards of the American Psychological Association

Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent

Informed consent was obtained from all participants included in the study.

Funding

This work was supported by the Education University of Hong Kong.

CRedit authorship contribution statement

Wing Kai Fung: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. **Kevin Kien Hoa Chung:** Conceptualization, Funding acquisition, Writing – review & editing.

Declaration of Competing Interest

None.

Data availability

The authors do not have permission to share data.

References

- Amabile, T. M. (1996). *Creativity in context: Update to the social psychology of creativity* (1st ed.). Routledge. <https://doi.org/10.4324/9780429501234>
- Ayling, P., Armstrong, H., & Gordon, C. L. (2019). *Becoming and being a play therapist: Play therapy in practice*. Taylor & Francis Group. <https://doi.org/10.4324/9780203711224>
- Barnett, L. A. (1991). The playful child: Measurement of a disposition to play. *Play & Culture*, 4(1), 51–74.
- Barnett, L. A. (2018). The education of playful boys: Class clowns in the classroom. *Frontiers in Psychology*, 9, 232. <https://doi.org/10.3389/fpsyg.2018.00232>. –232.
- Bateson, P., & Nettle, D. (2014). Playfulness, ideas, and creativity: A survey. *Creativity Research Journal*, 26(2), 219–222. <https://doi.org/10.1080/10400419.2014.901091>
- Beatty, J. J. (2014). *Observing development of the young child* (8th edition). Upper Saddle River: Prentice Hall.
- Berndt, T. J., & Bulleit, T. N. (1985). Effects of sibling relationships on preschoolers' behavior at home and at school. *Developmental Psychology*, 21(5), 761–767. <https://doi.org/10.1037/0012-1649.21.5.761>
- Bodrova, E., & Leong, D. J. (2018). Tools of the Mind: The Vygotskian-based early childhood program. *Journal of Cognitive Education and Psychology*, 17(3), 223–237. <https://doi.org/10.1891/1945-8959.17.3.223>
- Bundy, A. C., Nelson, L., Metzger, M., & Bingaman, K. (2001). Validity and reliability of a test of playfulness. *OTJR (Thorofare, N.J.)*, 21(4), 276–292. <https://doi.org/10.1177/153944920102100405>
- Butcher, J. L., & Niec, L. N. (2005). Disruptive behaviors and creativity in childhood: The importance of affect regulation. *Creativity Research Journal*, 17(2), 181–193. <https://doi.org/10.1080/10400419.2005.9651478>
- Canning, N. (2010). The influence of the outdoor environment: Den-making in three different contexts. *European Early Childhood Education Research Journal*, 18(4), 555–566. <https://doi.org/10.1080/1350293X.2010.525961>
- Chan, D. W., & Chan, L. K. (1999). Implicit theories of creativity: Teachers' perception of student characteristics in Hong Kong. *Creativity Research Journal*, 12(3), 185–195. https://doi.org/10.1207/s15326934crj1203_3
- Chang, H., & Kuo, C. (2013). Overexcitabilities: Empirical studies and application. *Learning and Individual Differences*, 23, 53–63. <https://doi.org/10.1016/j.lindif.2012.10.010>
- Chávez-Eakle, R. A., Eakle, A. J., & Cruz-Fuentes, C. (2012). The multiple relations between creativity and personality. *Creativity Research Journal*, 24(1), 76–82. <https://doi.org/10.1080/10400419.2012.649233>
- Curriculum Development Council. (2017). *Kindergarten education curriculum guide: Joyful learning through play, balanced development all the way*. https://www.edb.gov.hk/attachment/en/curriculum-development/major-level-of-edu/preprimary/ENG_KGECG_2017.pdf.
- Dabrowski, K. (1964). *Positive disintegration*. Little Brown.
- De Bondt, N., Maeyer, S. D., Donche, V., & Van Petegem, P. (2019). A rationale for including overexcitability in talent research beyond the FFM-personality dimensions. *High Ability Studies*, 1–26. <https://doi.org/10.1080/13598139.2019.1668753>
- Education Bureau of HKSARG (2022). *Figures and statistics – Kindergarten education*. <https://www.edb.gov.hk/en/about-edb/publications-stat/figures/index.html>.
- Ershadi, M., & Winner, E. (2020). Children's creativity. In M. M. Runco & S. Pritzker (Eds.), *Encyclopedia of creativity*, (3rd edition), vol. 1 (pp. 144–148). Elsevier, Academic Press.
- Falk, R. F., Lind, S., Miller, N. B., Piechowski, M. M., & Silverman, L. K. (1999). *The overexcitability questionnaire—two (OEQ II): Manual, scoring system, and questionnaire*. Institute for the Study of Advanced Development.
- Fink, E., Mareva, S., & Gibson, J. L. (2020). Dispositional playfulness in young children: A cross-sectional and longitudinal examination of the psychometric properties of a new child self-reported playfulness scale and associations with social behaviour. *Infant and Child Development*, 29(4). <https://doi.org/10.1002/icd.2181>
- Fung, C. K. H., & Cheng, D. P. W. (2012). Consensus or dissensus? Stakeholders' views on the role of play in learning. *Early Years*, 32, 17–33. <https://doi.org/10.1080/09575146.2011.599794>
- Fung, W. K., & Chung, K. K. H. (2021). Associations between overexcitabilities and playfulness of kindergarten children. *Thinking Skills and Creativity*, 40, Article 100834. <https://doi.org/10.1016/j.tsc.2021.100834>
- Fung, W. K., & Chung, K. K. H. (2022). Parental play supportiveness and kindergartners' peer problems: Children's playfulness as a potential mediator. *Social Development*, 31(4), 1126–1137. <https://doi.org/10.1111/sode.12603>
- Fung, W. K., Chung, K. K. H., & He, M. W. (2021). Association between children's imaginal overexcitability and parent-reported creative potential: Cognitive and affective play processes as potential mediators. *The Journal of Creative Behavior*, 55(4), 962–969. <https://doi.org/10.1002/jobc.501>
- Fung, W., & Cheng, R. W. (2017). Effect of school pretend play on preschoolers' social competence in peer interactions: Gender as a potential moderator. *Early Childhood Education Journal*, 45(1), 35–42. <https://doi.org/10.1007/s10643-015-0760-z>
- Gardner, H., & Winner, E. (1982). First intimations of artistry. In S. Strauss. (Ed.), *U-Shaped development*. Academic Press.
- He, W. (2018). A 4-year longitudinal study of the sex-creativity relationship in childhood, adolescence, and emerging adulthood: Findings of mean and variability analyses. *Frontiers in Psychology*, 9, 2331. <https://doi.org/10.3389/fpsyg.2018.02331>. –2331.
- He, W., Wong, W., & Chan, M. (2017). Overexcitabilities as important psychological attributes of creativity: A Dabrowskian perspective. *Thinking Skills and Creativity*, 25, 27–35. <https://doi.org/10.1016/j.tsc.2017.06.006>

- Hollenstein, L., Thurnheer, S., & Vogt, F. (2022). Problem solving and digital transformation: Acquiring skills through pretend play in kindergarten. *Education Sciences*, 12(2), 92. <https://doi.org/10.3390/educsci12020092>. –
- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1), 1–55. <https://doi.org/10.1080/10705519909540118>
- Hui, A. N. N., Chow, B. W. Y., Chan, A. Y. T., Chui, B. H. T., & Sam, C. T. (2015). Creativity in Hong Kong classrooms: Transition from a seriously formal pedagogy to informally playful learning. *Education 3-13*, 43(4), 393–403. <https://doi.org/10.1080/03004279.2015.1020652>
- Jackson, S. L., & Cunningham, S. A. (2017). The stability of children's weight status over time, and the role of television, physical activity, and diet in elementary school. *Preventive Medicine*, 100, 229–234. <https://doi.org/10.1016/j.ypmed.2017.04.026>
- Kalkusch, I., Jaggy, A.-K., Burkhardt Bossi, C., Weiss, B., Sticca, F., & Perren, S. (2021). Promoting social pretend play in preschool age: Is providing roleplay material enough? *Early Education and Development*, 32(8), 1136–1152. <https://doi.org/10.1080/10409289.2020.1830248>
- Kim, K. H. (2011). The creativity crisis: The decrease in creative thinking scores on the Torrance Tests of Creative Thinking. *Creativity Research Journal*, 23(4), 285–295. <https://doi.org/10.1080/10400419.2011.627805>
- Krumpal, I. (2013). Determinants of social desirability bias in sensitive surveys: A literature review. *Quality & Quantity*, 47(4), 2025–2047. <https://doi.org/10.1007/s11135-011-9640-9>
- Lau, M. M., & Li, H. (2018). Is whole-day kindergarten better than half-day kindergarten? A mixed methods study of Chinese educators' perceptions. *Children and Youth Services Review*, 93, 365–377. <https://doi.org/10.1016/j.childyouth.2018.07.007>
- Lieberman, J. N. (1977). *Playfulness: Its relationship to imagination and creativity*. Academic Press.
- Lloyd, B., & Howe, N. (2003). Solitary play and convergent and divergent thinking skills in preschool children. *Early Childhood Research Quarterly*, 18(1), 22–41. [https://doi.org/10.1016/S0885-2006\(03\)00004-8](https://doi.org/10.1016/S0885-2006(03)00004-8)
- Luria, S. R., Baer, J., & Kaufman, J. C. (2018). *Creativity and humor*. Elsevier Science & Technology.
- Milic, N. S. (2014). The influence of motor experience on motor creativity of preschool children. *Kinesiology*, 46(S1), 81. <https://doi.org/10.26582/k>
- Oberski, D. (2014). lavaan.survey: An R package for complex survey analysis of structural equation models. *Journal of Statistical Software*, 57, 1–27. <https://doi.org/10.18637/jss.v057.i01>
- O'Sullivan, L., & Ring, E. (2018). Play as learning: Implications for educators and parents from findings of a national evaluation of school readiness in Ireland. *International Journal of Play*, 7(3), 266–289. <https://doi.org/10.1080/21594937.2018.1532720>
- Piaget, J. (1976). *The child and reality*. Penguin Books.
- Piechowski, M. (1999). Overexcitabilities. *Encyclopedia of Creativity*, 325–334. <https://www.positivedisintegration.com/Piechowski1999.pdf>.
- Piechowski, S. (2017). The relation between teachers' and children's playfulness: A pilot study. *Frontiers in Psychology*, 8, 2214. <https://doi.org/10.3389/fpsyg.2017.02214>. –2214.
- Podsakoff, P. M., MacKenzie, S. B., Lee, J., & Podsakoff, N. P. (2003). Common method biases in behavioral research. *Journal of Applied Psychology*, 88(5), 879–903. <https://doi.org/10.1037/0021-9010.88.5.879>
- R Core Team. (2022). *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing, 2022 <https://www.R-project.org/Assessed>, 26 May 2022.
- Rhodes, M. (1961). An analysis of creativity. *The Phi Delta Kappan*, 42, 305–310.
- Richards, R. (2007). Everyday creativity: Our hidden potential. In R. Richards (Ed.), *Everyday creativity and new views of human nature: Psychological, social, and spiritual perspectives* (pp. 25–54). American Psychological Association. <https://doi.org/10.1037/11595-000>.
- Richards, R. (2019). Everyday creativity: Process and way of life - Four key issues. In J. Kaufman, & R. Sternberg (Eds.), *The cambridge handbook of creativity* (pp. 189–215). Cambridge University Press. <https://doi.org/10.1017/9781316979839>.
- Runco, M. A. (2014). Big C, Little c' Creativity as a false dichotomy: Reality is not categorical. *Creativity Research Journal*, 26(1), 131–132. <https://doi.org/10.1080/10400419.2014.873676>
- Runco, M. A., & Jaeger, G. J. (2012). The standard definition of creativity. *Creativity Research Journal*, 24(1), 92–96. <https://doi.org/10.1080/10400419.2012.650092>
- Russ, S. W. (2003). Play and creativity: Developmental issues. *Scandinavian Journal of Educational Research*, 47(3), 291–303. <https://doi.org/10.1080/003138303088594>
- Russ, S. W., & Wallace, C. E. (2013). Pretend play and creative processes. *American Journal of Play*, 6(1), 136–148.
- Stühmann, L. M., Paprott, R., Heidemann, C., Ziese, T., Hansen, S., Zahn, D., et al. (2020). Psychometric properties of a nationwide survey for adults with and without diabetes: The "disease knowledge and information needs - diabetes mellitus (2017)" survey. *BMC Public Health*, 20(1), 192. <https://doi.org/10.1186/s12889-020-8296-6>
- Torrance, E. P. (1981). *Thinking creatively in action and movement*. Scholastic Testing Service.
- Trevas, E., Matsouka, O., & Zachopoulou, E. (2003). Relationship between playfulness and motor creativity in preschool children. *Early Child Development and Care*, 173(5), 535–543. <https://doi.org/10.1080/0300443032000070482>
- Urban, K. K., & Jellen, H. G. (1996). *Test for creative thinking - drawing production (TCT-DP)*. Swets & Zeitlinger.
- Van Laar, E., Van Deursen, J. A. M., & Van Dijk, A. G. M. (2022). Developing policy aimed at 21st-century digital skills for the creative industries: An interview study with founders and managing directors. *Journal of Education and Work*, 35(2), 195–209. <https://doi.org/10.1080/13639080.2022.2036710>
- Vygotsky, L. (1967). Play and its role in the mental development of the child. *Soviet Psychology*, 5(3), 6–18.