

Examining Patterns of Specificity, Generality, and Interindividual Differences in Preschoolers'

Creativity

by

Violet Cieslik

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We acknowledge and respect the lək̓ʷəŋən peoples on whose traditional territory the university stands and the Songhees, Esquimalt and W̱SÁNEĆ peoples whose historical relationships with the land continue to this day.

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**Supervisory Committee**

Dr. Ulrich Mueller, Supervisor  
Department of Psychology

Dr. Paweena Sukhawathanakul, Departmental Member  
Department of Psychology

## Abstract

Creativity is a multifaceted construct that develops in a variety of different modalities. Previous research suggested that creativity is a domain-specific skill in school children and adults; however, the structure of creativity in preschoolers and whether it is domain-specific or domain-general is unclear. This study had three main goals, (1) to examine the overall structure of creativity, (2) determine whether preschool creativity is domain-specific or domain-general, and (3) address associations between preschoolers' leisure time activities (i.e., screen time and play), preschool environment, and creative ability. Eighty-three preschoolers between the ages of four and five years ( $M_{\text{age}} 4.40$  years) participated in this study. Creativity was measured with four performance-based measures: Torrance Test of Creative Thinking – Figural (TTCT-F), the Torrance Thinking Creatively in Action and Movement (TACM), the Alternative Use Task (AUT), and the Ball and Jar Task. Leisure activity was measured with an online parental questionnaire that included the SCREENS-Q (Klakk et al., 2020) and the Time Diary: Daily Activities Questionnaire (DAQ; Lehrer et al., 2014). Preschool environment was measured with the number of structured daily activities in the preschool schedule. Exploratory factor analysis (EFA) findings revealed four unique domains of creativity (verbal, non-verbal, motor/explorative, and figural) that were not correlated with each other, suggesting that preschool creativity is a domain-specific skill. Higher amounts of structured daily activities within the preschool environment were associated with lower scores of non-verbal creativity. These results shed light on the structure and validity of behavioural measures of creativity and contribute to the conceptualization and assessment of creativity in early childhood. Findings also reveal the importance of unstructured environments in preschool creativity.

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## **Examining Patterns of Specificity, Generality, and Interindividual Differences in Preschoolers' Creativity**

Creativity is a multifaceted construct that involves four domains related to abilities that reflect fluency (i.e., idea production), originality (i.e., unusual idea production), flexibility (i.e., production of ideas from different categories), and elaboration (i.e., ability to include details within an idea; Yildiz & Yildiz, 2021; Evans et al., 2021). This multifaceted nature of creativity facilitates the development of creative abilities in a variety of different modalities (e.g., behavioral, verbal, and figural; Said-Metwaly et al., 2017). The development of these creative modalities in children primarily occur in interactions with their social, cultural, and physical environments. These environments provide children with the opportunity to interact, explore, and develop skills required for cognitive processes later in life (i.e., self-regulation and problem-solving; Gong et al., 2020).

Previous research on creativity in school-aged children and adults has examined the question of whether creative abilities are specific to one modality (domain specific) or if they are transferable to other modalities (domain general; Hong & Milgram, 2010). Even though these questions have yet to be explored in preschoolers, the consensus in research on school-aged children and adults is that creativity is a domain-specific skill (Plucker & Zabelina, 2009). However, with the lack of research on preschoolers' creativity, it is unclear whether creativity can be categorized as a domain-specific or domain-general ability in preschool. Therefore, the three goals of this study were to examine (1) the structure of creative abilities in preschoolers, (2) whether creativity is a domain-specific or domain-general skill in preschool using four performance-based measures of creative ability: Torrance Test of Creative Thinking (TTCT), the Torrance Thinking Creatively in Action and Movement (TACM), the Alternative Use Task

(AUT), and the Ball and Jar task, and (3) the interindividual differences in preschoolers' creative ability using parent-report of preschoolers' leisure activities (i.e., Time Diary: Daily Activity Questionnaire (DAQ) and SCREENS-Q) and a measure of structure in preschool environment.

### **Defining Creativity**

Within creativity research a commonly asked question is how creativity should be defined. This is in part because of the multifaceted nature of creativity and its presence in almost everything we do. Thus, researchers studying creativity have struggled to capture the complex and multifaceted nature of creativity in a single definition. In a seminal paper Gilford (1950) defined creativity as a two-part process involving both divergent and convergent thought. Divergent thinking was described as the ability to search and come up with solutions to problems, whereas convergent thinking was the ability to find one logical solution that would succinctly solve the problem (Gilford, 1950). However, other renditions of the definition have emerged that add to the conceptualization of creativity. For example, Mendick (1962) proposed that creativity is composed of elements that when put together in new and unique ways create an optimal solution. Alternatively, Torrance (1977) suggested that the creative process was somewhat parallel to the scientific process, whereby one has a problem, comes up with a theory for the solution (i.e., hypothesis), tests out the solution, and then shares the results. Even though each of these three definitions are unique, they share one main element. That is, they all allude to the creative process and, in turn, creativity as the ability to produce and uncover unique solutions for ordinary events and problems (Said-Metwaly et al., 2017). Thus, for the purposes of this study, creativity will be discussed in terms of Gilford's (1950) definition of divergent and convergent thinking, with emphasis on divergent thinking and the overall creative process (i.e., the production of new ideas).

## **Is Creativity a Domain-Specific or Domain-General Skill?**

Whether creativity is a domain-general or specific skill has been a prevalent question in creativity research. This discussion has been stimulated by inconsistent findings that support both the specificity and generality of creativity. This evidence will be discussed in the next paragraphs, but first the definitions of both domain generality and specificity must be outlined. Domain generality is the ability to transfer knowledge and skills of performing one creative task (e.g., music) to another (e.g., writing); thus, when measured domain generality is shown through highly correlated creative scores across a variety of tasks in different domains (Baer, 2012). Domain specificity is having distinct creative abilities in different domains (e.g., drawing); thus, when measured domain-specific abilities primarily show as a lack of correlated creative scores across a variety of domains (Baer, 2012).

Historically, creativity was considered to be a domain-general ability that could be transferred to and from multiple tasks within everyday life. Plucker and Zabelina (2009) provide an example of this through the idea of a renaissance man who is multidisciplinary in nature and can create great works in various disciplines (e.g., Leonardo da Vinci). This example shows the generality of creative ability and, in turn, supports empirical research that has established creativity as a domain-general skill (Qian et al., 2019; Chen et al., 2006; Qian & Plucker 2018). However, in the past decade research in creativity has altered its course from being understood as domain-general to being understood as domain-specific. Plucker and Zabelina (2009) argue that this change is, in part, a result of Gardner's theory of multiple intelligences. That is, the application of creativity in everyday life requires a variety of creative abilities, much like there are a variety of intelligences (Plucker & Zabelina, 2009; Furnham, 2016; Plucker et al., 2020). This conceptualization of creativity is illustrated in the Amusement Park Theory (APT) of

creativity (Kaufman & Baer, 2004, 2005; Baer, & Kaufman, 2005, 2017) that describes creativity as a multi-faceted construct reliant on four hierarchical phases of (1) initial requirements, (2) general thematic areas, (3) domains, and (4) micro domains. Through these phases the APT argues that creativity consists of unique individual differences in cognition, motivation, personality, knowledge, interests, preferences, and abilities, that together exist on a continuum ranging from domain general to domain specific (Baer, & Kaufman, 2017). However, even with theoretical explanations of creativity being composed of both generality and specificity, there is still conflicting outcomes in empirical research that show creativity as both domain general and specific (Baer, 2018; Plucker, & Makel, 2010).

Several prior studies examining the patterns of results for domain specificity and generality show different results for self-report as compared to performance-based measures (Baer, 1991; Kaufman and Baer, 2004; Plucker & Zabelina, 2009). Plucker and Zabelina (2009) note this disparity could be due to the quantity of creative actions in self-report measures, compared to the quality of creative actions in performance-based measures. Specifically, quantity refers to how self-report measures assess overall general creative ability with no emphasis on specific creative domains; and quality refers to the task specific nature of performance-based measures that assess creativity in specific domains. Thus, Plucker and Zabelina (2009) argued that task specific measures (e.g., performance-based) that focus on categorizing creative abilities into different domains (e.g., flexibility, elaboration, fluency, and originality) show evidence of domain specificity; and measures that focus on creativity as a single construct (e.g., self-report) and provide only an overall score of creative ability (i.e., higher scores indicate higher creative ability and lower scores indicate lower creative ability) show evidence of domain generality (Plucker & Zabelina, 2009). Mainly, this argument boils

down to the claim that domain specificity vs. generality is influenced by the way in which creativity is measured (performance-based vs. self-report). Hence, evidence supporting either domain generality or domain specificity could be due to the type of method being used.

For example, Qian et al. (2019) and Qian and Plucker (2018) examined creative ability in undergraduate populations using the Creative Behavioural Inventory (CBI). The CBI is a well-known 90 item self-report checklist that rates adults' current and past creative achievements on a four-point scale (zero = never had a creative achievement and three = creative achievement more than five times) using six subscales (i.e., mathematics, science, music, fine arts, performing arts, literature) and provided an overall score of creative ability (Qian & Plucker, 2018). The results of these studies showed high correlations between each of the domains suggesting that creativity is a domain-general skill (Qian et al., 2019; Qian & Plucker, 2018). Yet different results are found in research employing performance-based assessments (Han & Marivn, 2002; Han, 2003; Baer, 1991). That is, research by Han and Marvin (2002), Baer (1991) and Hong and Milgram (2010) measured creative ability in different populations using several performance-based measures. Each study showed low correlations between each of the different performance-based creativity measures which, in turn, provided evidence for creativity as a domain-specific skill. Hence, the above studies illustrate method effects in that domain generality emerges in self-report measures (Qian et al., 2019; Qian & Plucker, 2018) and domain specificity in performance-based measures (Han & Marivn, 2002; Han, 2003; Baer, 1991).

Even though these patterns are present in school-aged and adult populations, few studies have been conducted to assess these patterns in preschoolers (Han & Marvin, 2002; Han, 2003). This gap in creativity assessment could be attributed to the fact that most research has only employed measures that assess one or two areas of creative expression; thus, whether

preschoolers' creative abilities are domain specific or general remains unknown. Particularly, as research has yet to examine changes in creative specificity or generality longitudinally, it is unclear if creativity develops as a domain-specific or domain-general skill, or if it varies based with age. Han (2003) suggests that the reason for this could be attributed to the predominant emphasis in creativity research on evaluating the predictive and concurrent validity of creativity measures as indicators of creative potential or performance. For example, research looking at variations in creativity amongst school-aged populations commonly employ a single creative measure to assess overall creative ability (Charles & Runco, 2001). This methodology is illustrated in a recent meta-analysis by Said-Metwaly et al. (2021) that addressed variation in overall divergent thinking from Grade 1 to Grade 12. Of the 41 articles included in the meta-analysis, only 12 (29%) studies used two measures of creative ability (i.e., verbal and figural); displaying evidence of most creativity research to employ one measure of creative ability and therefore only evaluate children's creativity in a single domain. This is concerning as employing one measure to evaluate overall creative ability provides a limited representation of distinctive creative domains present in school-aged populations. To address this shortcoming, future research should consider employing multiple measures of creative ability in different domains. Therefore, the next section will review common measures used in creativity research, including the four creativity measures chosen for this study.

### **Creativity Tests**

Two of the most common tests of creativity are the Wallach-Kogan Creativity Test (Wallach & Kogan, 1965) and TTCT (Torrance, 1966). These tests were foundational in influencing the development of creativity measures to capture the multifaceted nature of creative expression (i.e., motor, verbal, graphic, explorative). Hence, the measures that will be used

within this study are: TTCT-F (Torrance, 1966), TACM (Torrance, 1981), AUT (Wallach & Kogan, 1965), and the Ball and Jar Task (Evans et al., 2021). In this section I will describe in detail each of the four creativity tests and past research that has utilized each test. Next, I will provide an overview of research that has compared the construct validity of creativity tests. Finally, I will end by providing a rationale for how comparatively assessing the four chosen performance-based measures will help fill the gap in creativity research in preschool populations.

#### *Alternative Use Task (AUT)*

The Alternative Uses Task (AUT) was developed by Wallach and Kogan (1965) as one of the first measures of children's creativity. Within the AUT children are introduced to different household objects and then asked to explain how they could use the objects in alternative ways. The explanations given by children can either be provided in writing or verbally, depending on the developmental level of the studies participants. For example, Shah and Gustafsson (2020) evaluated creativity in children aged seven to eleven using written responses; while Evans et al. (2021) and Bia (2021) evaluated creativity in children aged four to six and three to five, using verbal responses, respectively. The results of all three studies displayed reliable and valid creativity scores when using the AUT as either a verbal or written task. Hence, the AUT will be used in this study as an indication of preschoolers' creativity in the verbal domain.

#### *Ball and Jar Task*

The Ball and Jar Task was recently developed by Evans et al. (2021) to assess the importance of including explorative behaviour when measuring children's creative problem-solving abilities. This task assesses three aspects of creativity: divergent thinking, convergent thinking, and exploration; however, for this study only divergent thinking will be used. Divergent thinking is measured in two creative domains, fluency and originality. The task is a

performance-based measure of creativity in the motor/explorative domain as it requires preschoolers to manipulate 12 items ( i.e., chopstick, spoon, ball of sticky clay, magnet, clip, popsicle stick, rubber band, pipe cleaner, spool, cork, knitting needle, and ball of yarn) with a goal of retrieving a 1.40-inch Styrofoam ball from a 9-inch-tall jar. The rationale for the development of this measure was that no available measure of creativity had assessed both divergent thinking and exploration as aspects of creative thinking. This was problematic as previous research has considered exploration as fundamental in understanding children’s creative development (Beghetto & Jaeger, 2022). Therefore, as the goal of this study is to examine whether creativity is a domain-specific or domain-general skill, the Ball and Jar task will be used as a performance-based measure to evaluate preschoolers’ creativity in the motor/explorative domain.

#### *Torrance Test of Creative Thinking (TTCT)*

The TTCT was developed by Torrance (1966) as one of the first measures of creativity and was pivotal in the advancement of creativity measurement (Kim, 2017). That is, it was the first measure of creativity that could assess creative ability in both adults and children in two domains (i.e., figural and verbal; Almeida et al., 2008). The two domains within the TTCT are measured using different modes of assessments and are named, the Torrance Test of Creative Thinking – Figural (TTCT-F) and the Torrance Test of Creative Thinking – Verbal (TTCT-V). The inclusion of these two parts enables the researcher to choose between either using the two parts together as a comprehensive measure of creativity, or separately as two different measures of creativity (Kim, 2017). Applications of the two TTCT parts are illustrated in works by Kim (2017) and Ulger (2015) who used both the TTCT-V and the TTCT-F, while Palmiero et al. (2010) and Yildiz and Yildiz (2021) only utilized the TTCT-F to measure children’s creativity.

As this study aims to compare measures of creativity that assess creative expression in different domains, the TTCT-F will be used as the measure of preschoolers' creative ability in the figural domain (i.e., drawing).

*Torrance test of Thinking Creatively in Action and Movement (TACM)*

The TACM was developed by Torrance (1981) to measure children's non-verbal creativity through movement-oriented tasks. The main intent for developing the TCAM relates to early stages of childhood when children find new and unique ways of moving through their environments (Zachopoulou et al., 2009). Hence, the TCAM is used to evaluate children aged three to eight in three domains of creativity: fluency, originality, and imagination (Torrance, 1981). It is important to evaluate children's creativity through movement because movement is engrained in how children express themselves (Cheung, 2010). That is, children use movement in their expression and communication of emotions, ideas, responses, and artistic creations (e.g., art and dance; Frith et al., 2019). Thus, in the TCAM creativity is demonstrated through a child's ability to generate new and unique movements in response to different movement-based tasks. For example, Bijvoet-van den Berg and Hoicka (2014) and Gong et al. (2020) used the TCAM to test preschoolers' creative abilities in samples of 24 and 300 participants, respectively. Bijvoet-van den Berg and Hoicka (2014) used the TCAM to test the validity of a new measure of non-verbal creativity called the Unusual Box test, while Gong et al. (2020) used the TCAM to assess the effects of a one-year intervention of regular museum visits on preschoolers' movement creativity. Results of both studies showed that the TCAM was a reliable measure of preschoolers' creativity.

However, the importance of movement in creativity notwithstanding, only few studies have evaluated the importance of movement in children's creativity, and even fewer have been done

with preschoolers (Zachopoulou et al., 2009). Zachopoulou et al. (2009) noted two gaps in creativity research (1) the lack of research on children's creativity in the non-verbal domain and (2) the lack of research comparing verbal and non-verbal creativity, especially in preschoolers. Hence, as this study aims to assess and compare preschoolers' creativity using performance-based measures that evaluate creativity across multiple domains (i.e., verbal, non-verbal, figural, and motor/explorative), it is anticipated that it will fill several gaps in current creativity research.

#### *Construct Validity of Four Creativity Tests*

A shortcoming of existent research on creativity is that relations between measures of creativity are unclear; hence, most of the creativity measures reviewed above have only been administered and evaluated individually. Specifically, Said-Metwaly et al. (2018) examined the construct validity of the TTCT-F using a meta-confirmatory factor analysis, where 26 studies that all utilized TTCT-F were identified. Results showed that the TTCT-F was a valid measure for assessing creativity level as well as creative style (Said-Metwaly et al., 2018). Additionally, Zachopoulou et al. (2009) analyzed the construct validity of the TCAM and found acceptable internal consistencies for the TCAM in its evaluation of preschoolers' creativity. Conversely, the construct validity of both the AUT and the Ball and Jar task have not been examined. Even though the AUT was one of the first available measures of creativity (Wallach & Kogan, 1965), it is surprising that few studies have examined its construct validity (Wallbrown et al., 1975; Cropley & Maslany, 1969). The lack of research on the construct validity of the Ball and Jar Task is due to its recent development (Evans et al., 2021). Hence, the individual construct validity of most creativity measures used in this study have been evaluated, but a comprehensive assessment comparing these measures has yet to be done. Specifically, no research has looked at

the interrelations of these tasks in preschool populations. Instead, previous research has focused on school-aged children, adolescents, and adults (Bijvoet-van den Berg & Hoicka, 2014).

### **Contextual Factors in the Development of Creativity**

Within preschool populations creativity can manifest in a variety of locales that are visibly demonstrated through imagination and play (Gong et al., 2020). Thus, most definitions of creativity in developmental psychology focus on the presentation of divergent thinking to produce new and unique ways to play, create, and solve problems. This divergent thinking typically starts in early childhood when children are heavily involved in the exploration of new environments (e.g., preschool), objects, and social relationships (Yildiz & Yildiz, 2021; Shah & Gustafsson, 2020). In turn, this exploration leads children to develop creative abilities in a variety of different areas (e.g., drawing, writing, dancing, etc.; Evans et al., 2021; Russ, 2018). The development of these abilities results from both the neuroplasticity of the developing brain and the constant exploration and play that accompanies early childhood (Gong et al., 2020). Hence, the development of creativity in early childhood acts as a primary facilitator for the development of other skills such as self-regulation, problem solving, emotional stability, and socialization (Gong et al., 2020).

The importance of environmental influences, specifically leisure time activities and school environments, have also been invoked to explain interindividual differences in creative ability. Research on elementary school children shows that increased time spent in leisure activities (i.e., play, outdoors, organized sports, etc.) and learning in informal classroom settings, are associated with increased creative abilities (Shah & Gustafsson, 2020; Román et al., 2018); however, few studies have examined these associations in preschool populations (Bijvoet-van den Berg & Hoicka, 2014). This gap in research is problematic for two reasons. The first is the formative

nature of preschool years in the development of creativity, and the second is the importance of considering the interindividual differences (i.e., leisure time activities) that accompany early childhood. Therefore, this section will outline previous research on the antecedents of preschool creativity and provide context for the third goal of this study: examining the associations between preschoolers' total time spent playing, non-educational and educational screen time, structured and unstructured preschool environment, on preschoolers' overall creative ability across four domains (i.e., verbal, non-verbal, graphical, and motor/explorative).

### *Creativity and Leisure Activities*

Previous research looking at the interindividual differences in creativity has primarily focused on associations between the type of leisure activities (i.e., play, outdoors, organized sports, etc.) that children and adolescents engage in and overall creative ability (Shah & Gustafsson, 2020; Román et al., 2018); however, limited research has addressed these associations in preschool populations (Bijvoet-van den Berg & Hoicka, 2014). Therefore, this section will look at previous research on associations of (1) physical activity (PA), (2) leisure activities, and (3) environments on children's creative abilities, and, in turn, address the gaps in creativity research on how leisure time activities are linked to creativity in preschool populations.

### *Physical Activity and Creativity*

Extensive research assessing the associations between PA and children's cognitive performance has found that increased amounts of PA positively affect children's cognitive processes (Román et al., 2018). Yet, a lesser amount of research in this area has focused on the effects of PA on specific cognitive abilities, such as creativity, especially in preschool populations. Studies that have looked at this relationship have done so experimentally through interventions focusing on implementation of PA activity programs in school environments. For

example, Garaigordobil (2006) and Zachopoulou et al. (2006) used play-based interventions to promote different types of creativity in ten-to-eleven-year-olds and preschoolers, respectively. Garaigordobil (2006) used a once-a-week intervention consisting of activities centering around play, cooperation, and creativity, to promote verbal and figural creativity; while Zachopoulou et al. (2006) used an intervention of two sessions of 30- to 45-minutes per week designed to foster creativity through activities of movement. Creativity was measured pre- and post-intervention in both studies, with Garaigordobil (2006) measuring creativity with the TTCT-V, TTCT-F, and Creation of a Painting (open theme), and Zachopoulou et al. (2006) measuring creativity with the TCAM. Results of both studies showed that the intervention significantly increased verbal, figural, and motor creativity in preschoolers and school-aged children (Garaigordobil, 2006; Zachopoulou et al., 2006). The results of these intervention studies are important as they demonstrate that increasing PA for preschoolers and school-aged children has a positive effect on several creative domains.

#### *Leisure Activities, Environments, and Creativity*

Participating in PA and leisure activities during preschool years is usually categorized as unstructured play or free play. This play is described as the time, at home or in school, when preschoolers explore and choose their own activities and modes of play (Lehrer et al., 2014). Considering the positive effects of PA interventions mentioned above, leisure time activity interventions that are based on unstructured play, free play, and PA, could be more beneficial in facilitating preschoolers' creative abilities than interventions consisting of only PA. This suggestion is supported by studies by Runco et al. (2022) and Lehrer et al. (2014) that looked at the effects of natural play environments (i.e., outside of school) on the creative potential of children ( $M_{age} = 6$  years, 9 months) and adolescents ( $M_{age} = 14.98$ ), respectively. The results of

both studies showed that unstructured environments positively affected creative ability (Runco et al., 2022; Lehrer et al., 2014). Specifically, Lehrer et al. (2014) found that playing with commercial toys and watching others play were positively associated with scores of fluency and originality on the TCAM; while Runco et al. (2022) found that creative potential was highest in adolescents during unstructured time spent at home. These results demonstrate the importance of the type of environment for creative ability.

#### *Overall Effects of Leisure Activities on Creativity in Preschoolers'*

When the results of Runco et al. (2022) and Lehrer et al. (2014) are taken alongside the intervention results of Garaigordobil (2006) and Zachopoulou et al. (2006), they show the importance of PA, unstructured and structured leisure activities (i.e., play), and environmental factors for preschoolers', children's, and adolescents' creative ability. Hence, these results illustrate that conducting a nuanced assessment of the types of leisure activities and environments (i.e., unstructured and structured) preschoolers engage in is important to establish specific antecedents of preschool creativity. Also, as few studies have looked at the associations between screen time and preschoolers' subsequent creative abilities, this study will include a measure of daily screen time that reflects screens used for educational and non-educational purposes.

#### **Rationale for the Current Study**

This study aims to fill the gap in creativity research through examining whether four tests of creative ability measure the same ability in a preschool population (i.e., TACM, AUT, and the Ball and Jar Task, TTCT-F). Each of these tests assesses creative expression in different areas (i.e., figural, verbal, non-verbal, and motor/explorative tasks). The relation among creativity tests will be assessed using a two-pronged approach. First, construct validity of the four performance-

based measures will be assessed with an Exploratory Factor Analysis (EFA). Second correlations between latent factors extracted from the EFA representing distinct creative domains will be evaluated. The pattern of correlations will provide us with information on whether preschoolers' creativity is domain-general (i.e., high inter-task correlations) or domain-specific (i.e., lack of correlations). Finally, given the limited research on interindividual differences in preschoolers' creativity, an exploratory goal of this study was to examine associations between a parent-report of preschoolers' leisure activities (i.e., Time Diary: Daily Activity Questionnaire (DAQ) and SCREENS-Q), the amount of structure in a preschoolers' environment, and latent creativity factors.

## Methods

### *Participants*

83 children aged four to five ( $M_{\text{age}} 4.40$  years) currently enrolled in preschools located in Victoria, British Columbia (BC) were recruited for this study. Of the 83 children participating in the study, only 70 parents completed the online questionnaire that was sent out after the testing sessions. Of the preschoolers' participating in the study there were 30 males and 53 females. Almost half of the participants were Caucasian (55%), while the rest were Hispanic (1%), East Asian (20%), Asian (20%), Hawaiian (1%), and African-Canadian (3%). The inclusion criteria for the sample consisted of children of any race, ethnicity, or gender whose first language was English, and who did not have any pre-existing developmental or learning disabilities.

### *Materials*

The materials used for this study consisted of one online Survey Monkey survey, four performance-based creativity measures, and preschool schedules. The survey was sent to the parents of consenting preschools and included (1) a consent form, (2) demographic questions, (3) SCREENS-Q, and (4) the DAQ. The four assessments of creative ability, AUT, TTCT-F, Ball and Jar Task, and TCAM, were physically administered to participants in a preschool setting. Preschool schedules of daily activities were collected from preschool directors.

### *Demographic Questionnaire*

Demographic questions included four items in which parents used a checkbox to mark the corresponding answer: the child's gender, age, ethnicity, and the highest level of parental education.

### *SCREENS-Q*

The SCREENS-Q was recently developed by Klakk et al. (2020) as a parent report measure of 19 questions and 92 items assessing screen-based leisure time activities in multiple areas of children's lives (i.e., individual, home, interpersonal, school, neighborhood, and community). Even though the questionnaire was developed for children aged six to ten, the items within the questionnaire have been assessed and were deemed appropriate for this study's sample of children aged four to five. The six domains of screen-based leisure activities assessed within the questionnaire are: screen media environment (7 questions – 39 items), child's screen media use (3 questions – 16 items), context of screen media use (2 questions – 2 items), early exposure (1 question – 4 items), parental perception of child's media use behavior (1 question – 16 items), and parental media use (3 questions – 15 items). For the purposes of this study only the domain of children's screen media was used to measure preschoolers' weekly educational and non-educational screen use. The questionnaire was shown to have good test-retest reliability ranging from 0.67 to 0.90.

### *Time Diary: Daily Activities Questionnaire (DAQ)*

The DAQ was developed by Lehrer et al. (2014) as a measure of children's out-of-school activities. The questionnaire includes 19 items that relate to the type of out-of-school activities, play locations of these activities, and the social context of play. The items for type of out-of-school activities included, (1) total play, (2) active physical play, (3) pretend play, (4) creative play, (5) construction play, (6) rough and tumble play, (7) play with commercial toys, (8) video games, (9) music/singing play, (10) board games and puzzles, (11) watching others play, (12) other play, and (13) total choice. Parents rated each of these items on a five-point Likert scale where zero = none, one = less than 30 minutes, two = between 31 and 60 minutes, three =

between 61 and 90 minutes, four = between 91 and 120 minutes, and five = more than 120 minutes. For this study the area of before-school play was excluded as there are inconsistencies in the time-of-day preschoolers' attend preschool. However, before removing the entire section one item from the before-school play section, pet play, was added to the type of out-of-school play. Additionally, after each type of out-of-school play item parents were then asked to report the location of each out-of-school play item, (1) inside the home, (2) in the back or front yard, (3) on the street sidewalk or alley, (4) at the park, and (5) other. In the social context of play section parents were asked to report using the same Likert scale as the type of out-of-school play, who the child played with, (1) play with siblings, (2) play with parents, (3) play alone, and (4) play with friends. At the end of the questionnaire there is a question that asks whether the answers provided represent a typical day for the child. The questionnaire is meant to be completed in the evening after the child goes to bed to ensure all activities are accounted for throughout the day. For the purposes of this study only the dimension of total play was used to measure outside-of-school leisure activities.

### *Preschool Environment*

Preschool environment was measured using daily preschool schedules provided by preschool directors. The schedules of daily activities were coded in terms of the number of unstructured and structured activities that were performed daily at the preschool. The scale used to evaluate structured and unstructured activities was adopted from a study by Määttä et al. (2019) that looked at the number of structured activities present in Finnish preschools. Preschool structure was evaluated using a Likert scale ranging from 1 = no structure, 2 = one structured activity, 3 = two structured activities, 4 = three or more structured activities, and 5 = completely structured.

### *Alternative Use Task (AUT)*

The AUT was first developed by Wallach and Kogan (1965) to measure children's figural and verbal creativity; however, a newer version of the AUT adopted by Bai et al. (2021) was used for this study. The task required children to think of as many unusual uses for six ordinary household objects (i.e., a hand towel, a brick, a fishnet, a basket, a broom, and a spoon). One by one children were presented with six pictures of the objects in a randomized sequence. While looking at the picture children had to verbally generate as many different and unusual uses for the household objects. Within the task, creativity was measured in two domains: fluency and originality. Fluency reflects the total number of distinct uses the child generated for a single object (e.g., one point-one answer, for a maximum of ten answers). Uses were considered distinct if the actions or the outcomes of the actions differed (e.g., "using a basket to carry food" and "using a basket to carry toys"). Originality reflects scored through comparing all the answers and then giving one point if the answer was only given by 5% of participants, and two points if the answer was only given by 1% of participants (e.g., one point was given if only a few children had the same answer, but two points were given if no other children had the same answer). Fluency and originality scores for each object were averaged for the analyses.

### *Torrance test of Thinking Creatively in Action and Movement (TACM)*

The TACM was developed by Torrance (1981) to measure children's non-verbal creativity. The test uses four activities to measure creativity in two domains, fluency and originality. The four activities were, (1) "*how many ways...can you walk or run across the room,*" (2) "*can you move like...*" where children are asked to preform six imitative actions, two role actions (e.g., driving a car) and four animals/objects actions (e.g., tree or fish), (3) "*what other ways can you put this paper cup in the garbage,*" and (4) "*what might be...*" where

children find new and unique ways of playing with a paper cup (Zachopoulou et al., 2009). The fluency and originality domains are scored through the first, third, and fourth task. Fluency is scored as the number of different responses the child gives in the three tasks and originality is scored by calculating the most frequent responses given in the entire sample. Fluency and originality scores from the first, third, and fourth tasks were averaged for the analyses.

#### *Torrance Test of Creative Thinking-Figural (TTCT-F)*

The TTCT-F was developed by Torrance (1966) to measure children's creativity in a drawing task (i.e., the figural domain of creativity). The task is approximately 10 minutes, and it requires children to complete three different drawing activities: picture completion, picture construction and repeated figures of lines (Form A). These activities are then assessed in five creative domains: fluency, originality, elaboration, abstractness of titles, and resistance to premature closure. However, for this study only fluency and originality were measured. Fluency is assessed through the number of figural drawings a child can complete. Originality is assessed by statistical infrequency by identifying the number of unique drawings a child produces when compared to other children's drawings. Fluency and originality scores from the three drawing activities were averaged for the analyses.

#### *Ball and Jar Task*

The Ball and Jar Task was recently developed by Evans et al. (2020) as a measure of children's motor and explorative creativity. It measures how divergent, convergent, and explorative behaviours work both separately and together to predict a child's success on the creative task. To complete the task children are given 12 items (i.e., chopstick, spoon, ball of sticky clay, magnet, clip, popsicle stick, rubber band, pipe cleaner, spool, cork, knitting needle, and ball of yarn) to manipulate what the goal of retrieving one 1.40-inch Styrofoam ball out of a

9-inch-tall Jar. The goal of the retrieval is for children to use the provided materials without using their hands to retrieve or tip the ball out of the jar. Divergent behaviours are measured in the number of actions (i.e., fluency) and unique manipulations (i.e., originality) the child generates. Originality is scored through comparing all the answers and then giving one point if the answer was only given by 5% of participants and two points if the answer was only given by 1% of participants (e.g., one point was given if only a few children had the same answer, but two points were given if no other children had the same answer).

### ***Procedure***

Preschools in Victoria, BC were invited to participate in the study through email and social media platforms (e.g., Facebook and Instagram). These invitations included a small description of the study, an explanation of requirements, a consent form for the preschool, and next steps for contacting parents should the preschool agree to participate. Once the preschool agreed to participate, daily schedules were collected from the preschool directors and parents of children attending the preschool were contacted via email. Emails consisted of a description of the study and a link to the online parental consent form. After parental and preschool consent were collected, testing sessions were scheduled with the preschool and parents were notified to confirm their child's availability for the session. The session took place in an open available room within the preschool that had a table and the assessment materials. Children whose parents consented were then invited to complete the session with the researcher. Prior to beginning the session child assent was gathered by giving an age-appropriate explanation of the tasks and requirements of the session. After child assent was received children were individually assessed in one testing session of 45 minutes. The four performance-based measures used in the session were counterbalanced to minimize practice and fatigue effects. For example, the TCAM was

administered first, followed by the TTCT-F, Ball and Jar Task, and the AUT. Counterbalancing also ensured that each session had a movement-based task (i.e., TCAM, Ball and Jar Task) followed by a sedentary task (i.e., TTCT-F and AUT). At the end of the sessions, children were given a sticker. In the evening following the session parents were sent a confirmation email with a link to complete the online survey. The study was approved by the Research Ethics Board at the University of Victoria (UVic REB).

### *Analytic Approach*

Three analyses were conducted to examine preschoolers' creativity. The first analysis was an EFA to evaluate the structure of creativity in preschoolers. An EFA rather than principal component analysis was chosen as this approach assumes the observed measures of creativity are based on underlying factors. Additionally, EFA deals only with shared variance, whereas principal component analysis splits variance into common variance, unique variance, and error variance and assumes that all communalities are initially 1. The second analysis was performed to determine the specificity or generality of preschoolers' creativity by looking at the correlations between latent creative domains. Previous research in school aged and adult populations has identified creativity to be domain specific; however, research has yet to determine if the same patterns exist in preschool populations (Han & Marivn, 2002; Han, 2003; Baer, 1991). Finally, to examine the interindividual differences in preschoolers' creativity, a second-order SEM path analysis of total amount of time spent playing, weekly screen time (i.e., educational and non-educational), and preschool environment on the latent creativity domains was performed.

The SEM analyses were carried out using the R package lavaan (Rosseel, 2012). Four recommendations for assessing model parameters and goodness-of-fit were selected (Hu & Bentler, 1999): (a) comparative fit index (CFI) values  $\geq 0.95$ , (b) the Tucker-Lewis index (TLI)

$\geq 0.95$ , (c) the standardized root mean square residual (SRMR)  $\leq 0.08$ , and (d) the 90% confidence interval (CI) accompanying root mean square error of approximation (RMSEA)  $\leq 0.05$ . Models inside of these parameters were considered to have good model fit.

## Results

### *Descriptive Analyses*

Descriptive statistics and assumptions of the data were completed in SPSS. Table 1 presents descriptive statistics for all study variables including mean, standard deviation, skewness, and kurtosis. Table 2 illustrates the correlation matrix for all study variables. Significant positive correlations were found between fluency and originality scores of each creativity measure; AUT-originality and all fluency and originality scores, except for Ball and Jar-fluency; total play and AUT-fluency; TCAM-fluency and weekly non-educational screentime. Conversely significant negative correlations were found between preschool environment, AUT-originality, TCAM-fluency, and total play.

**Table 1**  
*Descriptive Statistics for all Study Variables*

	N	Mean	SD	Skewness		Kurtosis	
				statistic	Std. Error	statistic	Std. Error
Torrance Test of Creative Thinking – Fluency	83	.64	.72	.96	.26	-.07	.52
Torrance Test of Creative Thinking – Originality	83	1.46	1.60	.90	.26	-.28	.52
Torrance Test of Creative Thinking in Action and Movement – Fluency	83	5.36	2.45	.58	.26	.78	.52
Torrance Test of Creative Thinking in Action and Movement – Originality	83	5.96	3.63	.88	.26	1.11	.52
Ball and Jar Task – Fluency	83	19.57	9.94	1.17	.26	1.60	.52
Ball and Jar Task – Originality	83	3.55	3.98	1.35	.26	1.61	.52
Alternative Use Task – Fluency	83	12.04	4.72	.66	.26	1.09	.52
Alternative Use Task – Originality	83	4.96	4.23	1.34	.26	1.50	.52
Total play	64	4.44	1.25	-.44	.30	-.00	.59
Weekly Educational Screentime	65	1.23	.62	3.27	.30	11.41	.59
Weekly Non-educational Screentime	67	2.08	.83	5.65	.29	39.55	.58
Preschool Environment	83	2.71	1.21	-.11	.26	-1.62	.52

*Note.* The varied N relates to the number of parents who completed the online survey. 70 parents completed the survey, however some only filled out the demographic information and therefore didn't complete the other survey sections.

**Table 2**  
*Correlation Matrix of Study Variables*

Variables	Alternative Use Task - Fluency	Alternative Use Task - Originality	Ball and Jar- Fluency	Ball and Jar- Originality	Torrance Test of Creative Thinking in Action and Movement – Fluency	Torrance Test of Creative Thinking in Action and Movement – Originality	Torrance Test of Creative Thinking – Fluency	Torrance Test of Creative Thinking – Originality	Preschool Environment	Total play	Weekly Non-educational Screentime	Weekly Educational Screentime
Alternative Use Task -Fluency	1											
Alternative Use Task - Originality	.268*	1										
Ball and Jar-Fluency	0.079	0.054	1									
Ball and Jar- Originality	0.214	.225*	.673**	1								
Torrance Test of Creative Thinking in Action and Movement – Fluency	0.166	.293**	-0.013	0.085	1							
Torrance Test of Creative Thinking in Action and Movement – Originality	0.116	.246*	0.008	0.063	.896**	1						
Torrance Test of Creative Thinking – Fluency	0.017	.395**	0.083	0.197	0.119	0.137	1					
Torrance Test of Creative Thinking – Originality	0.004	.313**	0.094	0.208	.217*	0.212	.900**	1				
Preschool Environment	-0.129	-.248*	0.058	-0.18	-.242*	-0.117	0.057	0.054	1			
Total play	.385**	0.244	-0.065	0.163	0.149	0.079	-0.005	-0.029	-.314*	1		
Weekly Non-educational Screentime	-0.116	0.008	-0.043	-0.059	.275*	0.191	0.035	-0.029	-0.102	-0.05	1	
Weekly Educational Screentime	-0.061	0.124	0.164	0.205	0.058	0.059	-0.089	-0.096	0.015	-0.036	0.076	1

*Note.* Significant correlations are displayed as \*  $p < .05$ , \*\*  $p < .01$ .

### *EFA for the Structure of Preschoolers' Creativity*

Factorability of the data was assessed in terms of correlations, Bartlett's statistic, and Kaiser-Meyer-Olkin (KMO). Enough correlations exceeded the .30 threshold indicating evidence of sufficient communality to justify factorability (Tabachnick & Fidell, 2001). Additionally, a significant Bartlett's statistic,  $\chi^2 = 353.17$  ( $df = 28$ ,  $p < .001$ ), confirming that linear combinations exist (Pett et al., 2003), and a KMO test value (0.54) suggesting an adequate degree of common variance (Hair et al., 2018), indicated sufficient correlation between the items to proceed with the analysis.

An EFA with an oblique (Promax) rotation of 8 observed variables and a minimum criterion of no factor loading under 0.30 was conducted. Parallel Analysis using eigenvalues, scree plot, and cumulative percentages were used to determine the number of extracted factors. Eigenvalues and scree plot indicated a four-factor solution (fourth eigenvalue = 1.01), whereas cumulative percentages lower than 75% indicated a three-factor solution (third factor = 74.1%). Hence, two initial unrotated EFA factor extractions were considered. The four-factor solution accounted for 13.6%, and the three-factor solution accounted for 19.8% of the variance. Rotations for the three-and-four-factor rotations were completed. The three-factor rotation produced an ultra-Heywood case solution that was unable to produce a reliable model for the data (Cooperman & Waller, 2022); therefore, we did not continue to interpret the three-factor solution. Conversely the four-factor solution better fit the data ( $\chi^2 = 353.17$ ; RMSEA = .01, TLI = . 0.93, mean item complexity = 1.10).

Table 3 displays the factor loadings after performing the oblique (promax) rotation. Factor loadings criteria of greater than .71 are regarded as excellent, greater than .63 as very good, greater than .55 as good, and greater than .45 as fair (Comrey & Lee, 1992). Factor 1

accounted for 24% of the variance (eigenvalue = 2.68) and consisted of two items with factor loadings above .93 and was referred to as figural creativity. Factor 2 accounted for 23% of the variance (eigenvalue = 1.71), consisted of two items with factor loadings above .94, and was referred to as non-verbal creativity. Factor 3 accounted for 17% of the variance (eigenvalue = 1.50), consisted of two items with factor loadings above .80, and was referred to as motor/explorative creativity. Factor 4 accounted for .01% of the variance (eigenvalue = 1.01), consisted of two items with factor loadings above .52, and was referred to as verbal creativity. The four extracted factors indicate the presence of four distinct domains of non-verbal, verbal, figural, and motor/explorative creative ability in preschoolers.

**Table 3**

*Rotated factor loading matrix from exploratory factor analysis with oblique (Promax) rotation, Eigenvalues, cumulative percentage, and communalities (N = 83)*

Variables	Factor loading				Communality
	1	2	3	4	
<b>Figural Creativity</b>					
Torrance Test of Creative Thinking – Fluency	1.00				1.00
Torrance Test of Creative Thinking – Originality	.93				1.00
<b>Non-Verbal Creativity</b>					
Torrance Test of Creative Thinking in Action and Movement – Fluency		.94			1.00
Torrance Test of Creative Thinking in Action and Movement – Originality		.95			1.00
<b>Motor/Explorative Creativity</b>					
Ball and Jar Task – Fluency			.84		1.00
Ball and Jar Task – Originality			.80		1.10
<b>Verbal Creativity</b>					
Alternative Use Task – Fluency				.52	1.10
Alternative Use Task – Originality				.55	1.04
Eigenvalues	2.68	1.71	1.50	1.01	
% of Variance	24	23	17	.01	

*Note.* Factor loadings below .30 are excluded. Factor 1 = figural. Factor 2 = non-verbal. Factor 3 = explorative/motor. Factor 4 = verbal.

### *Specificity or Generality of Preschoolers' Creativity*

To determine preschool specificity or generality, the four latent factors extracted from the EFA analysis were correlated. This was done by extracting latent factor scores as regression weights. Table 4 illustrates the correlations between the four latent factors of creativity. Significant correlations were found between verbal creativity and the three subsequent creative domains: non-verbal, figural, and motor/explorative. These results are comparable to significant correlations found between AUT originality and all fluency and originality scores, except for fluency in the Ball-and-Jar task, displayed in Table 2. Suggesting that verbal creativity could play an important role in preschoolers overall creative ability. However, as the four latent factors of creativity were not consistently associated with one another, results suggest that creativity may be a domain specific skill in preschoolers.

**Table 4**  
*Correlation Matrix of Latent Creativity Variables*

Variables	Verbal Creativity	Figural Creativity	Non-Verbal Creativity	Motor/Explorative Creativity
Verbal Creativity	1			
Figural Creativity	.396**	1		
Non-Verbal Creativity	.486**	.193	1	
Motor/Explorative Creativity	.286*	.216	.080	1

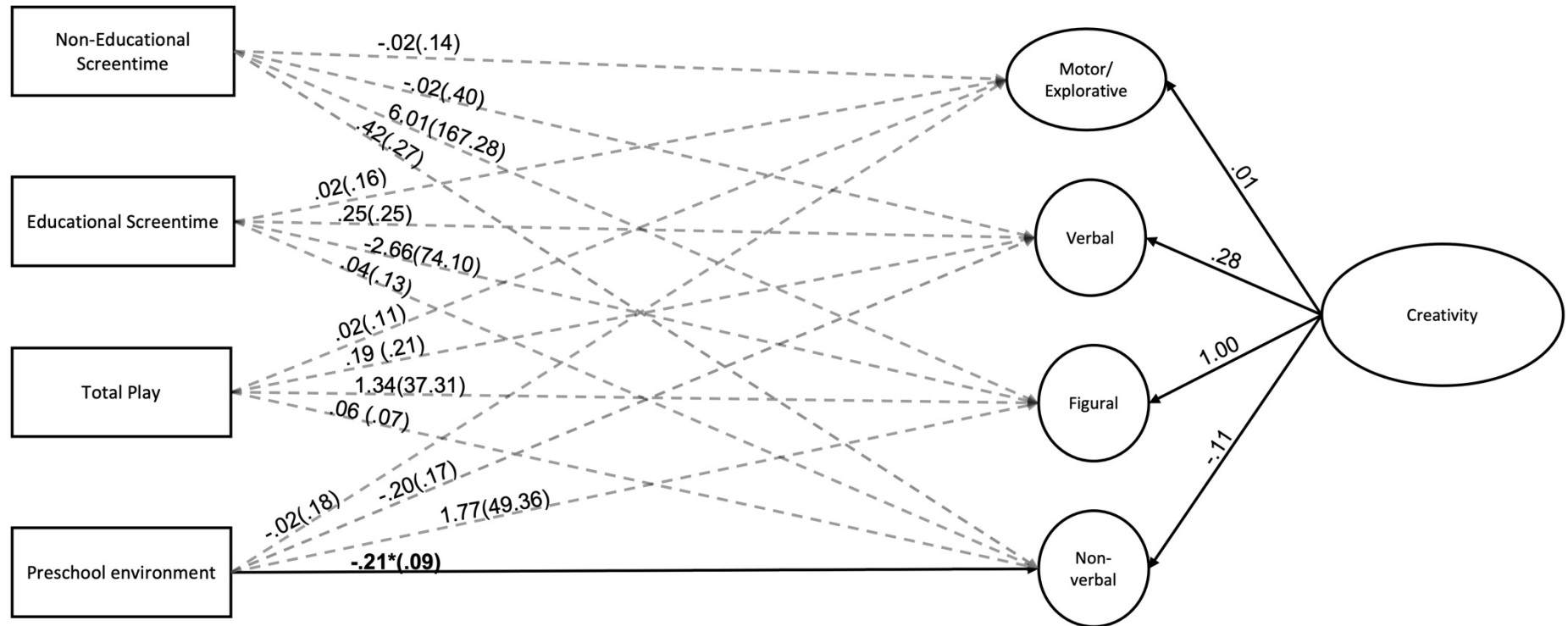
*Note.* Significant correlations are displayed as \*  $p < .05$ , \*\*  $p < .01$ .

### *Interindividual Differences in Creative Ability*

A second-order SEM path analysis with maximum likelihood (ML) estimation was performed to examine the interindividual differences in preschoolers' creativity. Specifically, we looked at the predictive validity of daily time spent playing, weekly educational and non-educational screentime, and preschool environment on creativity in four latent domains (non-verbal, figural, verbal, motor/explorative) that together represent preschoolers' overall creative ability. The second-order SEM model is illustrated in Figure 1 with standardized estimates and errors. Table 5 shows that preschool environment was a significant negative predictor of non-verbal creativity ( $\beta = -.21, p = .03$ ). This indicates that higher amounts of structured activities within preschool environments could have a negative effect on preschoolers' non-verbal creativity and, in turn, their ability to produce new and original ways of non-verbal expression (e.g., locomotion, body language, facial expressions etc.).

**Figure 1**

Second-order Structural SEM model ( $N = 62$ ) displaying 4 observed variables regressed onto four latent factors of creativity that each load onto one latent construct of creativity.



*Note.* Standardized estimates and standard errors for structural regression paths between preschool environment, non-educational screentime, educational screentime, and total play predicting non-verbal, verbal, figural, and motor/explorative creativity are reported. Factor loadings for the four latent creativity domains that together reflect one latent construct of creativity are reported. Pairwise comparison was used to account for missing data in the parental questionnaire, resulting in an  $N$  of 62.

**Table 5**

*Structural Regression Path Coefficients for Preschool Environment, Non-Educational Screentime, Educational Screentime, and Total Play Predicting Non-Verbal, Verbal, Figural, and Motor/Explorative Creativity (N=62)*

Variables	Estimate	Std.Err	z-value	P(> z )	Std.all
<b>Non-Verbal Creativity</b>					
Preschool Environment	-0.21	0.09	-2.20	0.03	-0.24
Total Play	0.06	0.07	0.76	0.45	0.07
Non-Educational Screentime	0.42	0.27	1.58	0.12	0.15
Educational Screentime	0.04	0.13	0.27	0.79	0.02
<b>Verbal Creativity</b>					
Preschool Environment	-0.20	0.17	-1.74	0.08	-0.30
Total Play	0.19	0.21	0.93	0.35	0.21
Non-Educational Screentime	-0.02	0.40	-0.06	0.95	-0.01
Educational Screentime	0.25	0.25	1.00	0.32	0.13
<b>Motor/Explorative Creativity</b>					
Preschool Environment	-0.02	0.18	-0.14	0.89	-0.03
Total Play	0.02	0.11	0.14	0.89	0.02
Non-Educational Screentime	-0.02	0.14	-0.13	0.89	-0.01
Educational Screentime	0.02	0.16	0.14	0.89	0.01
<b>Figural Creativity</b>					
Preschool Environment	1.77	49.36	0.04	0.97	0.05
Total Play	1.34	37.31	0.04	0.97	0.04
Non-Educational Screentime	6.01	167.28	0.04	0.97	0.05
Educational Screentime	-2.66	74.10	-0.04	0.97	-0.04

*Note.* Estimates are structural regression path coefficients extracted from a SEM model where preschool environment, non-educational screentime, educational screentime, and total play predicting non-verbal, verbal, figural, and motor/explorative creativity. Fit indices 1: ( $X^2(32) = 33.480$ , CFI = 0.99, TLI = 0.99, RMSEA = 0.03 [90% CI = [.00, .09]], SRMR = 0.08, estimator=ML).

## Discussion

Extant research shows that creativity is multifaceted and can be operationalized in several ways (Yildiz & Yildiz, 2021; Evans et al., 2021). This study operationalized creativity through scores of fluency and originality, and as the process of divergent thinking that encompasses the creation of new and unique ways to think, move, create, and problem solve (Said-Metwaly et al., 2017). This study was the first to comprehensively examine the question of domain generality or specificity in a preschool population. Hence, the three main goals of the study were (1) to examine the construct validity of four performance-based measures of creativity in preschool populations (i.e., TTCT-F, TCAM, AUT, Ball and Jar task), (2) evaluate whether preschoolers' creativity is domain-specific or domain-general using four performance-based measures, and (3) outline associations between preschoolers' creativity, preschool environment (i.e., unstructured and structured play), and parental reports of preschoolers' leisure activities measured with the DAQ and SCREENS-Q. Therefore, in the following paragraphs I discuss the main findings of the current study, outline limitations of this study, and make suggestions for future research.

Correlational analysis showed significant positive associations between AUT-originality and all other fluency and originality scores, except for fluency in the Ball-and-Jar task. Suggesting that the number of verbal responses relates to increases in the number of non-verbal and figural responses and the originality of non-verbal, figural, and motor/explorative responses in preschoolers. Additionally, total play and AUT-fluency were positively correlated which showed evidence for a unique relationship between the amount of time preschoolers spend playing and the number of creative responses they produce. Positive correlations found between TCAM-fluency scores and weekly non-educational screentime indicate that non-educational screen time could promote the production of ideas in the non-verbal domain. Alternatively,

significant negative correlations were found between preschool environment, AUT-originality, TCAM-fluency, and total play. This shows evidence for negative relationships between increased structure in preschool and the number of verbal responses, the production of unique non-verbal responses, and the amount of time preschoolers' spend playing at home.

Acknowledging these correlations helps us to understand the variability in preschoolers' creativity in the context of other variables and sets the stage for the three main goals of the current study

An exploratory analysis was employed to examine the construct validity of the four creativity measures and the overall structure of preschool creativity. A good model fit for the structure of creativity was found and four unique factors of creativity were extracted. Each factor related to a unique creative modality that was assessed by different performance-based measure. The factors were composed of fluency and originality scores representing four distinct creative domains: (1) verbal creativity measured by the AUT; (2) non-verbal creativity measured by the TCAM; (3) figural creativity measured by the TTCT-F; and (4) motor/exploratory creativity in the Ball and Jar task. These results are consistent with existing literature on the construct validity of the TTCT-F (Said-Metwaly et al., 2018) and the TCAM (Zachopoulou et al., 2009) and add to the limited research on construct validity of the Ball and Jar task (Evans et al., 2021) and the AUT (Wallach & Kogan, 1965). Hence, this study moves beyond assessing individual construct validity and provides a comprehensive assessment of the four performance-based measures of creative ability in preschoolers'.

As mentioned above, the four-factor solution representing four distinct creative domains suggests that preschoolers' creativity is multifaceted construct present in several different modalities. Research outlines that the development of these creative abilities results from

preschoolers' fascination with inquiry and exploration (Yildiz & Yildiz, 2021; Shah & Gustafsson, 2020). Even with acknowledging the importance of creativity in preschool, there is a lack of consensus on whether creativity develops as a domain-specific or general skill (Plucker & Zabelina, 2009). This is primarily due to inconsistencies in the operationalization of creativity (Said-Metwaly et al., 2017). For example, research in school-age and adult populations that employ self-report show evidence for domain generality (Qian et al., 2019; Qian & Plucker, 2018), whereas research employing performance-based measures show evidence for domain specificity (Han & Marivn, 2002). Nevertheless, there has also been a case for research to employ a battery of performance-based measures instead of one measure aimed at assessing overall creative ability (e.g., a combined score from both the TTCT-F and TTCT-V) to determine the specificity or generality of creativity (Han, 2003; Baer, 1991). Baer (1991) first employed this technique in four studies each of which involved a different population (i.e., eighth grade, fourth grade, and second grade students as well as adults). In each study a battery of five performance-based creativity measures were administered and non-significant associations between measures indicated domain specificity in school-aged and adult populations. Similarly, Han (2003) found evidence for domain specificity in second grade children ( $N = 109$ ) through non-significant correlations between three performance-based measures of creativity. Applying this criterion to the current study, a correlational analysis using scores from the four extracted latent factors of creativity showed evidence for domain specificity in preschool. However, an interesting finding was that the latent factor of verbal creativity was significantly correlated with the three other extracted creativity factors (i.e., non-verbal, figural, motor/explorative). This finding suggests that verbal creativity could contribute to creative abilities in other domains and play an important role in preschoolers' overall creative ability. Nevertheless, as this study was

the first to use a battery of creativity measures to examine preschoolers' creativity, results are consistent with research in school-aged and adult populations and provide initial evidence for domain specificity in preschool.

The third goal of the study was to examine interindividual differences in preschoolers' creativity. Specifically, we assessed whether the total amount of time preschoolers participated in daily play, weekly non-educational screen time, weekly educational screen time, and preschool environment, predicted creativity in any of the four domains. Results showed that only preschool environment significantly negatively predicted non-verbal creativity. Thus, no associations were found between parental reports of preschoolers' time spent playing, weekly educational and non-educational screen time, and creativity. To better understand these results, it is important to contextualize them using prior research. Research in school-aged populations has shown that increased structure in preschool environments significantly and negatively predicts verbal and non-verbal creativity. For example, comparing creativity in children ( $N = 211$ ) attending alternative (i.e., Montessori) and traditional schools, Besançon and Lubart (2007) found that children in alternative and less structured school environments had higher creative performance scores when compared to children in traditional schools. Extending these findings to a preschool population, the current study also showed a significant negative relation between the amount of environmental structure and creativity. However, the cross-sectional nature of this study requires research to further examine directionality of this association in the context of preschool. If future research provides evidence that structured activity in preschool affects creativity, then preschools should consider limiting the number of structured activities they have in their daily schedules to foster preschoolers' creativity, specifically in the non-verbal domain.

Conversely, the lack of associations between time spent playing and preschoolers' creativity was unanticipated. Specifically, research has found that time spent participating in unstructured home and leisure environments increases overall creativity in school-aged populations (Shah & Gustafsson, 2020). For example, studies by Lehrer et al. (2014) and Runco et al. (2022) found that unstructured play environments were positively associated with school-aged children's fluency and originality scores on the TCAM and adolescents' overall creative potential, respectively. As these studies illustrate associations between creativity and unstructured home and leisure environments in school-aged children, it is unclear why the current study did not find similar associations.

Overall, the results of the current study showed that the four domains of creativity were not significantly related to one another; therefore, providing evidence for creativity as a domain-specific skill in preschoolers. These results were in line with extant research in school-aged and adult populations displaying creativity as domain-specific skill (Han & Marvin, 2002; Baer, 1991; Hong & Milgram, 2010; Baer, 2012). Identifying creativity in preschool as domain-specific sets the stage for future research to uncover more about the development of creativity. That is, looking at the development of creativity across time could illustrate the within-and-between person differences in creativity as a domain-specific skill. Existing research has established that creativity changes with age and that there are specific peaks and slumps in creative abilities from school-age to adulthood (Said-Metwaly et al., 2021; Lau & Cheung, 2010; Jastrzebska & Limont, 2017; Kim, 2011); however, limited research has examined the developmental trends in the structure of creativity beginning in preschool (Bai et al., 2023). Moreover, as research shows associations between creativity and intelligence (Furnham, 2016), cognition (Bornstein, 2021), social-emotional skills (Gong et al., 2020) it is important to

establish ways to facilitate preschoolers' creativity. Results relating to the interindividual difference in preschool creativity showed that increased structure in preschool environments can negatively predict non-verbal. Taken together the results of this study outline (1) the multifaceted nature of creativity, (2) that like in school-aged children and adults, creativity in preschool may be domain-specific skill, and (3) preschool environment is an important antecedent of preschoolers' non-verbal creativity. However, as with any study limitations and implications for future research must be considered.

### **Limitations and Suggestions for Future Research**

Firstly, as this sample consisted of only 83 preschoolers and their parents in Victoria, BC, the power of the study was reduced. Future studies should include larger samples from a wider geographical region that are more reflective of Canadian preschoolers. Even though the preschools that participated were randomly chosen, the majority of participants were from middle to high SES households. Nevertheless, the sample was relatively diverse, as just over half (55%) the participants were Caucasian and the rest were from ethnically diverse backgrounds. The second set of limitations relates to the study design. That is, the cross-sectional nature of this study limits its ability to (1) evaluate the developmental trajectory of preschoolers' creativity, and (2) establish a causal link and directionality for the effects of total play, screen time, and preschool structure on creativity. Therefore, future research should consider employing a similar battery of creativity measures across time, to examine changes in creativity longitudinally. For instance, following a cohort of preschoolers into and throughout elementary school would allow for a greater understanding of how creativity develops in relation to environmental changes, specifically the standardization of school environments. The last set of limitations relates to the measures used within the study. Firstly, fatigue effects were evident in data from the online

parental survey through incomplete survey data. Future research should consider implementing a simpler survey design with a reduced number of questions. Second, floor effects were evident in the TTCT-F as preschoolers had a difficult time understanding and following instructions. This was especially evident with the first activity (picture completion) as many preschoolers did not use the provided stimulus resulting in their drawing not being scored. Since there were several instances of TTCT-F incompleteness, future research should consider employing or developing an alternate measure to assess the figural domain of creativity.

### **Conclusion**

In conclusion, this was the first study to examine the structure of preschool creativity in terms of domain specificity and generality. The three goals were to examine (1) the construct validity of four performance-based measures of creative ability, (2) preschool creativity as a domain-specific or domain-general skill, and (3) the effects of four potential antecedents of creativity. Construct validity of the four performance-based measures was established through the extraction of a four-factor solution representing four distinct domains of creative ability (i.e., verbal, non-verbal, graphical, motor/exploratory). These results add to existing literature as it is the first study to provide a comprehensive assessment of four commonly used measures of creativity in preschool populations. Moreover, the study also established that the different domains of creativity (verbal, non-verbal, figural, motor/exploratory) were not significantly correlated, suggesting that creativity in preschoolers is a domain-specific skill. As this study was also the first to address the question of domain specificity and generality in preschool, it complements research showing domain specificity in school-aged and adult populations. Furthermore, the study illustrates important associations between the antecedents of time spent playing, screen time, and school environment on preschoolers' creativity. Results showed that

the amount of structure present in preschool was negatively associated with non-verbal creativity; however, no associations were found between time spent playing, weekly non-educational and educational screen time, and preschoolers' creativity. Looking at these results in the context of extant research, it is evident that more research must be done to understand interindividual differences in creativity, especially the relationships between type of leisure activity and preschoolers' overall creativity. As this is the first study to address the dimensionality of preschool creativity using a battery of performance-based measures, it provides a preliminary investigation into the development of creativity in preschoolers.

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