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Translation and Validation of the Kaufman Domains of Creativity Scale on a Croatian Sample of Early Childhood and Preschool Education Students

Marijana Županić Benić[1]

The current literature describes creativity as a domain-specific phenomenon. According to Kaufman's five-factor model, creativity can manifest in the following distinctive domains: Self/Everyday, Scholarly, Performance, Mechanical/Scientific and Artistic. The purpose of the present study was to validate the Croatian version of the Kaufman Domains of Creativity Scale. The scale was administered to a sample of early childhood and preschool education students (N = 222). The results of the exploratory factor analysis showed that certain Self/Everyday tasks did not load on any of the scales, whereas some music-related tasks separated from other Performance tasks into a separate factor. These results could be explained by the characteristics of the convenience sample recruited for the study. The confirmatory factor analysis of the five-factor model and goodness-of-fit tests yielded results that are as satisfactory and consistent as previous validations. The Kaufman Domains of Creativity Scale is therefore considered to be a potentially feasible scale for assessing creativity as a domain-specific phenomenon. Additional research is needed to confirm the validity of the Croatian version of the scale with a representative random sample.

Keywords: creativity self-assessment, domains of creativity, factor analysis, Kaufman Domains of Creativity Scale, scale validation

1 Faculty of Teacher Education, University of Zagreb, Croatia; marijana.z.benic@gmail.com.

Prenos in potrditev Kaufmanove lestvice ustvarjalnih področij na hrvaškem vzorcu učencev v zgodnjem otroštvu in predšolskih otrok

Marijana Županić Benić

Sodobna literatura opisuje ustvarjalnost kot področno specifičen pojav. Po Kaufmanovem petfaktorskem modelu se lahko ustvarjalnost izrazi na naslednjih specifičnih področjih: osebnem/medosebnem, študijskem, izvedbenem, tehnično/znanstvenem in umetniškem. Cilj raziskave je bil potrditev hrvaške različice Kaufmanove lestvice ustvarjalnih področij, ki je bila uporabljena na vzorcu učencev v zgodnjem otroštvu in predšolskih otrok (N = 222). Rezultati eksploratorne faktorske analize so pokazali, da nekatere naloge osebnega/medosebnega področja niso bile prisotne na nobeni lestvici, medtem ko so se nekatere naloge v povezavi z glasbo ločile od preostalih nalog izvedbenega področja v ločen dejavnik. Tovrstne rezultate je mogoče pojasniti z značilnostmi slučajnega vzorca, uporabljenega v raziskavi. Rezultati konfirmatorne faktorske analize petfaktorskih modelov in testov skladnosti so enako zadovoljivi in konsistentni kot pri prejšnjih validacijah, zaradi česar se Kaufmanova lestvica ustvarjalnih področij uvršča med potencialno izvedljive lestvice za ocenjevanje ustvarjalnosti kot področno specifičnega pojava. Za potrditev veljavnosti hrvaške različice lestvice so potrebne dodatne raziskave z reprezentativnim naključnim vzorcem.

Ključne besede: samoocena ustvarjalnosti, ustvarjalna področja, faktorska analiza, Kaufmanova lestvica ustvarjalnih področij, potrditev veljavnosti lestvice

Introduction

Creativity is often associated with the arts because people can observe it and experience it immediately through artwork and performances. Although the term creativity is often used as a synonym for art, researchers frequently study creativity and its manifestation in multiple domains (Kaufman, 2012). Contemporary trends in education also recognise the importance of developing creativity through different approaches, including creativity-oriented pedagogy (Cheung & Mok, 2018), the development of divergent thinking (Guilford, 1956; Sternberg & Lubart, 1993) and the application of new, creative teaching strategies (Craft, 2003; Feldhusen, 1994; Zoglowek, 2018).

The ability to improve creativity through all subjects across the curriculum, not just the arts, has been demonstrated and discussed by numerous authors (Craft, 2003; Haylock, 1987; Robinson, 2015). However, schools often use outdated practices in teaching that have been reported to have a negative effect on creativity (Beghetto, 2005a, 2005b; Robinson, 2015). More importantly, teachers' dedication to lifelong learning and improvement of their own creativity is essential for developing their students' creativity through education (Darling-Hammond, 2000; Jennings & Greenberg, 2009; Sanders & Rivers, 1996). Teachers' perceptions of creativity determine how they define and understand creative thinking and creative behaviours, as well as the role of the classroom environment in supporting creative development (Maksić & Spasenović, 2018; Runco, 1999). Most teachers do not consider themselves to be creative (Pendergast et al., 2011), so they are unable to achieve one of the most important goals of contemporary education, which is to teach students how they can creatively solve problems on their own (Sekulić-Majurec, 2007).

Since creativity can manifest in almost every task, the phenomenon of creativity in the literature is often conceptualised and studied according to the *four P's:* "Person: Who is creative?; Process: How are we creative?; Product: What is creative?; Press or Place: Where are we creative?" (Kaufman, 2016, p. 16). Plucker et al. (2004) describe creativity as the production of something useful and novel as a result of the interaction between aptitude, process and environment. Another description of creativity in contemporary literature distinguishes between little-c creativity as creativity in daily life and big-C creativity as the result of genius that will be remembered for generations to come (Csikszenmihalyi, 1998; Simonton, 2013). As an extension of that definition, Kaufman and Beghetto (2009) proposed the concept of four C's that are consistent with creativity over different stages of life, which would make little-c the type of creativity that emerges during early childhood and is shaped by the

environment, i.e., parents and teachers through education.

Domain-specific factors that determine what creativity is can vary across fields and activities, so there is no universal agreement on the general definition of creativity, with numerous authors providing different definitions of creativity (Amabile, 1996; Beghetto, 2010; Csikszentmihalyi, 1996; Feist, 2004; Feldhusen & Goh, 1995; Gardner, 1993; Guilford, 1950; Ivcevic & Mayer, 2009; Kaufman & Sternberg, 2006; Runco, 2014; Sternberg & Lubart, 1999; Stein, 1953). For example, Guilford (1950) uses a structural intelligence model as a basis for defining creativity as a new and effective method for solving problems. Gardner (1993) conceives creativity as a process that is determined by personality, environmental support and multiple intelligences, so creativity is also a multidimensional concept that can manifest in different domains depending on a person's dominant type of intelligence. Stein (1953) explains creativity as a process of creating original and effective ideas or products that a group or society in general find applicable, useful and sustainable in practical situations during a certain period. Csikszentmihalyi (1996) defines creativity as a phenomenon determined by personal factors, domains and environmental support. For Fiest (2004), creativity is thinking or acting in a manner that produces an original and useful product, and creative expression is specific in different domains, such as psychology, physics, biology, mathematics, linguistics, music and aesthetics. Ivcevic and Mayer (2009) also emphasise the importance of original and practical products or ideas as results of creativity, but their classification of the domains of creativity includes the everyday domain (e.g., handcrafts, relationships), the artistic domain (e.g., visual arts, music) and the intellectual domain (e.g., science, technology). Based on these definitions, it is evident that researchers tend to agree with the standard definition, which states that creativity is a process that produces an original and effective product or idea (Runco & Jaeger, 2012; Stein, 1953). An example product of creativity according to the standard definition would be innovative solutions to problems that are not obvious and that have value in practical situations (Boden, 2004; Bruner, 1962; Feldhusen & Goh, 1995; Simonton, 2012; Sternberg & Lubart, 1999). However, there are multiple different classifications of domains in which creativity depends on the relative importance of domain-specific factors.

Kaufman (2012) developed the Kaufman Domains of Creativity Scale (K-DOCS) and proposed a five-factor model of creativity dimensions based on the results of validation analysis. The dimensions are Self/Everyday, Scholarly, Performance, Mechanical/Scientific and Artistic. Each dimension of creativity is associated with tasks that people can encounter and solve in creative ways. The Self/Everyday domain consists of all tasks that people can encounter in

daily life, such as finding the best solution to a problem or helping other people in a creative way. The Scholarly domain includes activities that involve analysing and discussing topics or conducting other activities related to academia, such as providing constructive feedback on a scientific paper. Activities in the Performance domain can be performed in front of an audience or shared with an audience, such as playing an instrument, writing a poem, dancing and other forms of public performance. The Mechanical/Scientific domain includes activities that require interest in and knowledge of STEM disciplines, such as computer programming, building something mechanical, etc. Finally, activities such as sketching people or objects and making a sculpture belong to the Artistic domain.

Previous validations of the K-DOCS instrument have been conducted on samples from different cultural backgrounds, and goodness-of-fit tests support the five-factor model of creativity domains, which is also a good indicator of the instrument's potential for cross-cultural applications (Awofala & Fatade, 2015; McKay, Karwowski, & Kaufman, 2017). The purpose of the present study was to validate the Croatian version of the K-DOCS. Two aims were addressed: (a) to identify the optimal number of factors and perform an exploratory factor analysis using this information, and (b) to examine the five-factor model's goodness-of-fit based on the responses obtained from a convenience sample of Croatian students.

Method

Participants

A convenience sampling strategy was used to recruit 222 students enrolled in the Early Childhood and Preschool Education programme at the Faculty of Teacher Education, University of Zagreb. The majority of the participants, 215 (96.85%), were female. The age of the participants ranged from 19 to 33 years, but 196 (88.29%) of them were between 19 and 22 years of age. Prior to attending university, most of the participants had graduated from a grammar school or a vocational school, 143 (64.41%) and 75 (33.78%) of the participants, respectively. Only four of the participants (1.80%) had graduated from an art school. In addition to mandatory education, 88 (39.64%) of the participants had attended after-school additional art education programmes.

Instrument

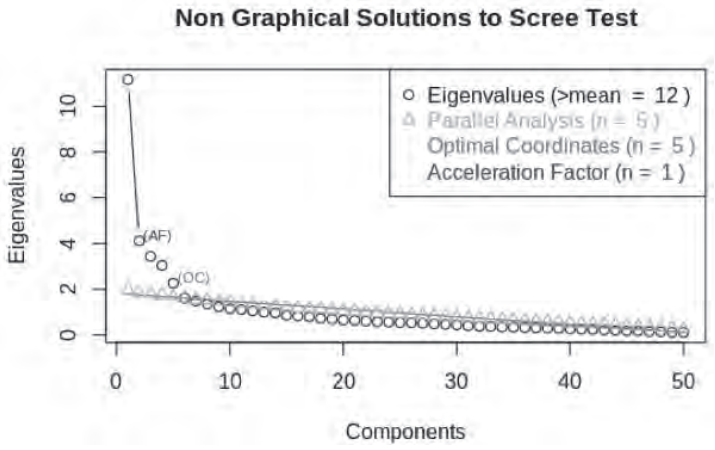
The Kaufman Domains of Creativity Scale (K-DOCS) (Kaufman, 2012) was translated into Croatian and administered along with a demographic questionnaire to the participants. The K-DOCS consists of 50 items that measure the respondents' self-reported ability to creatively perform certain tasks from the five domains of creativity: Self/Everyday (e.g., "Teaching someone how to do something"), Scholarly (e.g., "Debating a controversial topic from my own perspective"), Performance (e.g., "Playing music in public"), Mechanical/scientific (e.g., "Taking apart machines and figuring out how they work"), and Artistic (e.g., "Coming up with my own interpretation of a classic work of art") (Kaufman, 2012). Respondents are asked to compare their ability to creatively perform a task to other people of similar age and experience, and their responses are registered on a 5-point Likert scale, as follows: 1 = much less creative, 2 = less creative, 3 = neither more nor less creative, 4 = more creative, and 5 = much more creative. The respondents are instructed to estimate their creativity on tasks they have never performed based on their experiences with similar tasks.

Cronbach's alpha coefficients reported by Kaufman (2012) were above .80 for all five scales on the total sample. The alpha coefficients for the present sample were .78, .89, .87, .87 and .83 for the Self/Everyday, Scholarly, Performance, Mechanical/Scientific and Artistic scales, respectively. The values of Cronbach's alpha coefficients in the present study indicate good internal consistency and are consistent with the coefficients reported in previous studies (Awofala & Fatade, 2015; Kaufman, 2012).

Results and Discussion

The K-DOCS (Kaufman, 2012) instrument was translated and administered in a cultural setting that is different from the one in which the instrument was constructed and validated, so an exploratory factor analysis was first conducted to compare the factors and item loadings with the results of studies conducted with participants from different backgrounds. The scree plot shown in Figure 1 indicates that five factors are expected to be optimal, which is consistent with Kaufman's (2012) choice for creating the original five-factor model of creativity domains, and with the results reported by Awofala and Fatade (2015).

Figure 1
Scree plot



The results of the exploratory factor analysis with varimax rotation are shown in Table 1. The items "Finding something fun to do when I have no money", "Helping other people cope with a difficult situation" and "Mediating a dispute or argument between two friends" did not load on any of the five factors. This outcome could be attributed to the characteristics of the convenience sample, which consisted mostly of female participants between 19 and 22 years of age. Kaufman (2012) conducted the exploratory factor analysis of the K-DOCS on a sample that also consisted mostly of female participants, but the participants of that study were between 18 and 66 years of age. In a subsequent confirmatory analysis, the instrument was administered to an international sample of adults between the ages of 18 and 73, as well as a sample of adults between 26 and 46 years of age from Poland, with male and female participants equally represented in the two samples (McKay et al., 2017). Awofala and Fatade (2015) administered the survey to a sample of students in Nigeria, but the sample had an equal representation of male and female participants and comprised students between 16 and 33 years of age and engaged in different fields of study. Since the present sample consisted mainly of young female adults with similar interests and backgrounds, it is possible that the outcome of the analysis was influenced by experiences with everyday tasks and attitudes towards those tasks that are typical for that demographic group.

Table 1

Exploratory factor analysis results

Item	1	2	3	4	5
Finding something fun to do when I have no money	-				
Helping other people cope with a difficult situation	-				
Teaching someone how to do something	.41				
Maintaining a good balance between my work and my personal life	.42				
Understanding how to make myself happy	.46				
Being able to work through my personal problems in a healthy way	.69				
Thinking of new ways to help people	.48				
Choosing the best solution to a problem	.58				
Planning a trip or event with friends that meets everyone's needs	.43				
Mediating a dispute or argument between two friends	-				
Getting people to feel relaxed and at ease	.40				
Writing a nonfiction article for a newspaper, newsletter or magazine		.65			
Writing a letter to the editor		.67			
Researching a topic using many different types of sources that may not be readily apparent		.57			
Debating a controversial topic from my own perspective		.71			
Responding to an issue in a context-appropriate way		.46			
Gathering the best possible assortment of articles or papers to support a specific point of view		.48			
Arguing a side in a debate that I do not personally agree with		.69			
Analysing the themes in a good book		.59			
Figuring out how to integrate critiques and suggestions while revising a work		.61			
Being able to offer constructive feedback based on my own reading of a paper		.61			
Coming up with a new way to think about an old debate		.55			
Writing a poem			.61		
Making up lyrics to a funny song			.75		
Making up rhymes			.76		
Composing an original song			.79		
Learning how to play a musical instrument	.48		.44		
Shooting a fun video to air on YouTube			.49		
Singing in harmony			.42		
Spontaneously creating lyrics to a rap song			.75		

Item	1	2	3	4	5
Playing music in public	.40		.48		
Acting in a play			.38		
Carving something out of wood or similar material					.50
Figuring out how to fix a frozen or buggy computer				.60	
Writing a computer program				.72	
Solving math puzzles				.54	
Taking apart machines and figuring out how they work				.78	
Building something mechanical (like a robot)				.81	
Helping to carry out or design a scientific experiment				.68	
Solving an algebraic or geometric proof				.70	
Constructing something out of metal, stone or similar material				.46	.48
Drawing a picture of something I've never actually seen (like an alien)					.58
Sketching a person or object					.64
Doodling/drawing random or geometric designs					.73
Making a scrapbook page out of my photographs					.53
Taking a well-composed photograph using an interesting angle or approach					.47
Making a sculpture or piece of pottery					.59
Appreciating a beautiful painting					.58
Coming up with my own interpretation of a classic work of art					.49
Enjoying an art museum					.44

Note. 1 = Self/Everyday; 2 = Scholarly; 3 = Performance; 4 = Mechanical/Scientific; 5 = Artistic. Adapted from Kaufman, 2012.

The items "Learning how to play a musical instrument" and "Playing music in public" loaded on two factors: the Performance and Self/Everyday domains. In order to better understand this outcome, the analysis was repeated with six factors, and the aforementioned items loaded on the sixth factor along with the item "Singing in harmony". The separation of these items into a new factor could be explained by the characteristics of the sample, as the majority of the participants had extensive experience in the arts. Approximately 40% (n = 88) of the participants had some form of additional, after-school art education, such as music, dancing and folklore as a combination of the two. Therefore, participants with experience in the arts and public art performances could be less likely to generalise their abilities to different types of arts than the general population. In other words, the participants of the present study do not, for instance, generalise their ability to play a musical instrument to acting in a play or the other way around. In addition to previous experiences in the arts, the

participants are enrolled in the study programme Early Childhood and Preschool Education as part of their initial teacher education. Many of their courses are associated with the arts (i.e., singing, dancing, music) in order to prepare them for performing these activities with children. As a result of their previous experiences in the arts and participation in the arts through initial teacher education, they understand the nuances of different artforms better than the general population, as well as their own abilities in different art forms, so they assess their creativity accordingly.

It is also interesting to note that the items "Carving something out of wood or similar material" and "Constructing something out of metal, stone or similar material" loaded with higher coefficients on the Artistic domain than on the Mechanical/Scientific domain. This result is not unusual, as creating something in both cases can imply both a mechanical approach to reproducing a blueprint or a creative approach to making something new from the imagination. Since most of the participants were either involved in the arts through after-school programmes or required to participate in arts activities through their study programme at college, it is possible that they interpreted the tasks as artistic and creative rather than mechanical. These two items are the only items on the Mechanical/Scientific scale that describe tasks focused on creating something with physical materials instead of working on abstract tasks such as "Solving math puzzles" or "Writing a computer program".

Items that describe abstract tasks in fields of mathematics and computer science are less likely to be considered creative by participants who focus on arts in their education and do not have a strong enough background in fields such as mathematics or computer science to be creative in those types of tasks. On the other hand, carving and constructing something material can instead be considered artistic, as the participants would be working with tangible materials to create a physical product, much like a sculpture or a puppet that they are required to create as part of their initial education. It is also important to consider how the neglect of divergent thinking in education can contribute to these perceptions. Haylock (1987) demonstrated the ability to develop divergent thinking through mathematics, and several authors have elaborated on the feasibility of integrating the arts and STEM disciplines to promote creativity across the curriculum (Conradty & Bogner, 2018; Henriksen, 2014). However, due to the current teaching practices in education, students often associate creativity with the arts and are not familiar with the ability to produce multiple correct solutions or use different methods to solve a problem in STEM disciplines.

The results of the confirmatory factor analysis are shown in Table 2. The five-factor model developed by Kaufman (2012) was used. Overall, the

coefficients are moderate and strong, greater than .40, with the exception of the item "Mediating a dispute or argument between two friends" in the Self/Everyday domain, which is .25. This is an expected outcome given the factor loadings on the Self/Everyday scale observed in the exploratory factor analysis, in which the aforementioned item failed to load.

Table 2

Confirmatory factor analysis results

Items	1	2	3	4	5
Finding something fun to do when I have no money	.51				
Helping other people cope with a difficult situation	.41				
Teaching someone how to do something	.57				
Maintaining a good balance between my work and my personal life	.45				
Understanding how to make myself happy	.46				
Being able to work through my personal problems in a healthy way	.59				
Thinking of new ways to help people	.64				
Choosing the best solution to a problem	.68				
Planning a trip or event with friends that meets everyone's needs	.51				
Mediating a dispute or argument between two friends	.25				
Getting people to feel relaxed and at ease	.48				
Writing a nonfiction article for a newspaper, newsletter or magazine		.75			
Writing a letter to the editor		.75			
Researching a topic using many different types of sources that may not be readily apparent		.66			
Debating a controversial topic from my own perspective		.71			
Responding to an issue in a context-appropriate way		.52			
Gathering the best possible assortment of articles or papers to support a specific point of view		.56			
Arguing a side in a debate that I do not personally agree with		.66			
Analysing the themes in a good book		.62			
Figuring out how to integrate critiques and suggestions while revising a work		.64			
Being able to offer constructive feedback based on my own reading of a paper		.67			
Coming up with a new way to think about an old debate		.64			
Writing a poem			.66		
Making up lyrics to a funny song			.83		

Item	1	2	3	4	5
Making up rhymes			.83		
Composing an original song			.81		
Learning how to play a musical instrument			.40		
Shooting a fun video to air on YouTube			.55		
Singing in harmony			.40		
Spontaneously creating lyrics to a rap song			.72		
Playing music in public			.43		
Acting in a play			.47		
Carving something out of wood or similar material				.42	
Figuring out how to fix a frozen or buggy computer				.63	
Writing a computer program				.69	
Solving math puzzles				.53	
Taking apart machines and figuring out how they work				.82	
Building something mechanical (like a robot)				.84	
Helping to carry out or design a scientific experiment				.76	
Solving an algebraic or geometric proof				.71	
Constructing something out of metal, stone or similar material				.57	
Drawing a picture of something I've never actually seen (like an alien)					.58
Sketching a person or object					.63
Doodling/drawing random or geometric designs					.73
Making a scrapbook page out of my photographs					.52
Taking a well-composed photograph using an interesting angle or approach					.60
Making a sculpture or piece of pottery					.62
Appreciating a beautiful painting					.63
Coming up with my own interpretation of a classic work of art					.59
Enjoying an art museum					.41

Note. 1 = Self/Everyday; 2 = Scholarly; 3 = Performance; 4 = Mechanical/Scientific; 5 = Artistic. Adapted from Kaufman, 2012.

The goodness-of-fit was assessed using the chi-square test, as well as the following goodness-of-fit indices: the comparative fit index (CFI), the Tucker-Lewis index (TLI), the root mean-square error of approximation (RMSEA) and the standardised root mean-square residual (SRMR). The results of the assessment from the Croatian sample are shown in Table 3 along with the results reported by previous K-DOCS validation studies for reference.

Table 3
Goodness-of-fit comparisons between samples

Sample	χ^2	df	CFI	TLI	RMSEA	SRMR
Croatian	2404.33	1165	.72	.71	.07	.09
Polish (McKay et al., 2017)	3822.58	1165	.77	.76	.07	.07
Nigerian (Awofala & Fatade, 2015)	1273.41	306	.95	.95	.04	n/a
International (McKay et al., 2017)	5214.57	1165	.80	.79	.07	.06

Note. CFI = comparative fit index; TLI = Tucker-Lewis index, RMSEA = root mean square error of approximation; SRMR = standardised root mean residual.

Lower results of the chi-square test are associated with better goodness-of-fit, $\chi^2(1165) = 2404.33$, $p < .001$. CFI and TLI indicate better goodness-of-fit as their value approaches 1.00, whereas RMSEA and SRMR approach 0.00 as goodness-of-fit improves. The goodness-of-fit of the five-factor model observed in the present study is comparable to the results reported by McKay et al. (2017), with better goodness-of-fit according to the results of the chi-square test and lower goodness-of-fit according to CFI and TLI. Awofala and Fatade (2015) reported better goodness-of-fit than any other study validating the K-DOCS. The five-factor model shows consistent goodness-of-fit estimates when the scale is administered to participants with different demographic characteristics, so it is possible to suggest that creativity could be defined as a domain-specific phenomenon that can be applied in the following domains: Self/Everyday, Scholarly, Performance, Mechanical/Scientific and Artistic (Kaufman, 2012).

The characteristics of the sample can affect the results of the factor analysis, so the results of the exploratory factor analysis in the present study showed that the Scholarly domain accounted for the greatest proportion of total variance (.25), followed by the Performance domain (.21). Kaufman (2012) found that the Self/Everyday domain had the highest variance, whereas Awofala and Fatade (2015) reported that the Mechanical/Scientific domain accounted for most of the variance, possibly because students from mathematical and technical disciplines were well represented in their sample. Given the age of the participants in the present study, as well as their experience with additional after-school art education, their formal secondary school education backgrounds and the activities they have to complete as part of their initial teacher education, it is possible that their previous experiences in the Scholarly and Performance domains gave them greater confidence in their creative abilities in these domains as opposed to other domains. According to Kaufman (2012), such variations are expected because "if the K-DOCS is a valid instrument,

then specific populations should score higher on different domains (i.e., scientists should score higher on Mechanical/Scientific)" (p. 304). The results of this and previous studies confirm that sample characteristics can influence scores, which supports the validity of the scale, but more validations are necessary to establish the correlation between the self-reported assessment of creativity and objective tasks that measure creativity.

In the present study, the participants were asked to self-assess their ability to perform tasks, but correlating an objective measurement of creativity on performing a certain task with self-reported values could further improve the validity of this study. The Croatian version of the scale should also be validated in a future study, but with a random sample that is representative of the general population. Although the results of the confirmatory factor analysis are consistent with previous studies and lend support to the K-DOCS as a valid instrument for measuring the five domains of creativity, the findings of the exploratory analysis can be generalised only as far as the sampling strategy permits.

Conclusion

The purpose of the present study was to validate the Croatian version of the K-DOCS instrument, a scale for measuring creativity in five different domains, on a sample of 222 Croatian early childhood and preschool education students. The participants considered themselves to be less creative in tasks that were associated with abstract thinking in the fields of mathematics and computer science than in tasks associated with other fields. In terms of practical implications for teacher education, it is important to consider how students can be encouraged to develop a creative approach in all fields so that they can one day encourage their students to develop creative thinking in those fields as well. The results of the exploratory factor analysis were mostly consistent with previous studies, but some variations were observed, which could be attributed to the characteristics of the convenience sample. The results of the confirmatory factor analysis were consistent with previous validation studies, so the Croatian version of the K-DOCS is a potentially feasible scale for assessing creativity as a domain-specific phenomenon. The five-factor model proved to be a good fit in this study and previous studies, but further research to validate the Croatian version of the scale with a random sample is necessary given the inconsistencies with previous results that were observed in this sample.

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Biographical note

Marijana Županić Benić, PhD, is an Assistant Professor at the Department of Art at the Faculty of Teacher Education University of Zagreb. Her areas of scientific interest are the visual art teaching methodology, arts based research, creativity, competences of teachers and educators, puppetry and performing arts, various pedagogical directions and approaches in encouraging and developing visual arts among children.