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# The Kaufman Domains of Creativity Scale: Turkish Validation and Relationship to Academic Major

ABSTRACT

One common self-assessment of creativity is the Kaufman Domains of Creativity Scale (K-DOCS). This article provides support for a Turkish translation of the instrument, offering exploratory and confirmatory factor analysis to determine whether the factors were consistent across cultures. The participants consisted of two groups. The first group consisted of 1,260 undergraduate students (912 females, 348 males) at a public university in Turkey and was utilized for the principal axis factoring analysis. Horn's parallel analysis, a robust statistical technique, was employed to determine the number of factors to be extracted from a scale. The second group consisted of 1,215 participants (885 females and 330 males) who were utilized for confirmatory factor analysis. Results supported a nine-factor solution as a better fit for this sample than the five-solution originally used by Kaufman. Of the original five factors, four factors were divided into two sub-factors, which were distinct although moderately correlated. Finally, we determined the relationship between K-DOCS factors and college major. We also found good evidence for the construct, discriminant, and convergent validity of the scale. Relationships between K-DOCS factors and college major were largely consistent with predictions, providing additional evidence for the construct validity of the scale.

*Keywords:* creativity, creativity domains, self-assessment, college major.

Self-assessments are not ideal outcome measures of creativity. They depend on a participants' insight, memory, honesty, and general ability to compare themselves to other people. If participants interpret some items in a different way than intended, for example, the responses may be inaccurate (Reynolds & Suzuki, 2012). Such measures are not a good substitute for measures of creative performance (e.g., Pretz & McCollum, 2014); however, they do offer opportunities to learn about people's beliefs, values, and perceptions about their own creativity and the construct itself (Kaufman, 2019). Self-assessments that ask for people's ratings of their own creativity can be used to gauge their accuracy on such estimations (e.g., Silvia, 2008). People who are more proficient at rating their creative strengths and weaknesses may be considered to have higher creative metacognition (Kaufman & Beghetto, 2013; Kaufman, Beghetto & Watson, 2016) and better equipped to develop their creativity.

Although some evaluation-based self-assessments are domain-general (e.g., Furnham, Miller, Batey & Johnson, 2011), many are domain-specific and ask questions about people's creativity in specific areas. One commonly used measure is the Kaufman Domains of Creativity Scale (K-DOCS; Kaufman, 2012), which represents an evolution of several earlier measures of creativity across different domains (e.g., Kaufman, 2006; Kaufman & Baer, 2004; Kaufman, Waterstreet, et al., 2009). The K-DOCS measures self-reported creativity across five domains: Everyday, Scholarly, Performance, Scientific, and Artistic. Everyday taps into interpersonal and intrapersonal creativity, as well as having a general creative lifestyle. Scholarly is related to intellectual and verbal/linguistic creativity. Performance encompasses kinesthetic activities, music, and creative writing. Scientific includes mathematical and mechanical creativity. Artistic creativity includes both art creation and appreciation.

The K-DOCS has demonstrated convergent and discriminant validity (McKay, Karwowski & Kaufman, 2017). It has been translated and used in empirical research in Chinese (Tu & Fan, 2015; Tu, Guo, Hatcher & Kaufman, in press), Czechoslovakian (Plháková, Dostál & Záskodná, 2015), the Hausa, Igbo, and Yoruba indigenous languages of Nigeria (Awofala & Fatade, 2015), and Turkish (Şahin, 2016). Although most of the translations have used the existing five factors without explicitly testing the structure, Şahin (2016) extracted a comparable five factors and provided evidence for this solution.

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There were four goals of the present study. First, although the K-DOCS has been translated into Turkish and used in empirical studies (e.g., Şahin, 2016; Şahin & Lee, 2016), the sample was approximately 500 gifted high school students and only 42 of the original 50 items were retained. We wanted to use a larger and slightly older sample to see whetherthere were any differences in factor loadings. Second, our goal was to build off of Sahin's work. His focus was on the construct validity of the scale and conducted exploratory and confirmatory factor analysis In addition to these analyses, we want to also study discriminant and convergent validity of the scale. Our third goal, given that gender differences are a frequently studied area in creativity with often inconsistent results (Abraham, 2016; Baer & Kaufman, 2008), was to explore gender differences on the K-DOCS.

Finally, although the K-DOCS has been validated with other creativity instruments, it has not been examined in conjunction with college major. Our fourth goal was thus to see if the scores on the five K-DOCS factors aligned with relevant majors (which have also been used as a proxy for interests; Gasser, Larson & Borgen, 2007). Specifically, we predicted that students in science (or science education) and math (or math education) would rate themselves higher on the Scientific K-DOCS factor than other majors. We also predicted that students majoring in arts (or arts education) would rate themselves higher on the Artistic and Performance K-DOCS factors than other majors. We lastly predicted that students in humanities (or humanities education) would rate themselves higher on the Scholarly K-DOCS factors than other majors.

## METHOD

### PARTICIPANTS

The participants consisted of two groups. The first group consisted of 1,260 undergraduate students (912 females, 348 males) at a public university in Turkey. Of this sample, 853 students were studying in several majors in the faculty of education while 407 students with different majors who were taking education classes with the goal of becoming teachers. This first group of students was utilized only for the exploratory factor analysis with the aim of examining data pattern in the participants' responses and factor structure of the scale.

Like the first group, the second group of participants was undergraduate students in the same university. There were 1,215 participants (885 females and 330 males), which included 847 students directly in the school of education. In addition, as with the first group, this sample included 368 students with different majors who were taking education classes with the goal of becoming teachers. This second group of students was used to provide evidence for the construct, discriminant and convergent validity of the scale.

### INSTRUMENT

The Kaufman Domains of Creativity Scale (K-DOCS; Kaufman, 2012) was employed in the current study to measure participants' creativity in five broad domains: Everyday (11 items), Scholarly (11 items), Performance (10 items), Scientific (9 items), and Artistic (9 items). Sample items included: "Writing a poem" (Performance), "Writing a computer program" (Scientific), "Writing a letter to the editor" (Scholarly), "Teaching someone how to do something" (Everyday), "Appreciating a beautiful painting" (Artistic). The participants were asked to compare themselves with other people of about their age and life experiences. They then indicated the degree to which they think are creative for each item on a 5-point Likert scale ranging from 1 (much less creative) to 5 (much more creative).

This scale was translated into Turkish by one of the researchers of the current study. Then, two Turkish-speaking experts in creativity examined the scale to establish its face validity. Based on their suggestions, three items were slightly re-worded for purposes of clarity. The final scale initially was administered to 30 students. All the students indicated that the scale items were understandable and clear to them.

### DATA ANALYSIS

Principal axis factoring with varimax rotation (Osborne, Costello & Kellow, 2008) was performed on the first group of participants to examine patterns in the data set. We used Horn's parallel analysis (Horn, 1965) to extract the number of factors. After that, items with factor loadings of less than .32 (Tabachnick & Fidell, 2007) in their respective factor were excluded from the final scale. With the remaining items, confirmatory factor analysis was carried to test the factor structure of the scale. A number of indices including chi-square/df test, comparative fit index (CFI), and root mean square error of approximation (RMSEA) were employed to assess the model fit.

In order to explore whether test items and factorial structure of the research instrument are equivalent across gender, a multi-group factor analysis was conducted on the second group of participants. Models

which test the relationships between observed variables and latent variables are measurement invariance tests. Three common models are unconstrained model (configural invariance), measurement weights model (metric invariance), and measurement intercepts model (scalar invariance). Configural invariance deals with whether the same confirmatory factor analysis is valid for each group and is examined by performing individual CFAs for each group. Metric invariance tests whether each group gives responses to the test items in the same manner. It is performed through constraining all factor loadings to be equal across groups. Scalar invariance deals with the degree to which observed scores are related to the latent scores. This is performed through constraining the intercepts of items in addition to factor loadings to be equal across groups (Milfont & Fischer, 2010).

In addition to examining factorial structure of the scale through PCA and CFA, its convergent and discriminant validity were examined by calculating the average variance extracted (AVE) for each dimension of the scale. AVE should be higher than 0.40 to establish the convergent value. In order to establish discriminant validity, the square root of AVE should be higher than inter-construct correlations (Nevitt & Hancock, 2001). The Cronbach's Alpha values were employed to determine the internal consistency.

After establishing the validity of the scale, descriptive statistics were calculated for each of its dimensions. In order to give more evidence for the construct validity of the scale, scores of participants in each major was calculated. In this analysis, a number of predictions were made. For example, it was predicted that artistic creativity scores of participants enrolled in music education and arts education majors would be higher than the students in other majors.

In order to make a statistical comparison among majors, we classified majors into six major clusters: Primary/Secondary Education, Humanities/Humanities Education, Social Science/Social Science Education, Science/Science Education, Math/Math Education, and Arts/Arts Education. Then, we conducted ANOVA tests to determine the differences among these clusters in each factor of the research instrument. We again made a number of predictions. For example, we estimated that the students in the math and science major clusters had higher scores than students in other major clusters in the scientific factor of the scale. We also conducted two-way ANOVA test to identify difference among major clusters after controlling for the effects of gender.

## RESULTS

Principal axis factoring resulted in 12 factors with eigenvalues more than 1. Nevertheless, as shown in Table 1, 95$^{th}$ percentile value of 1.22 was higher than the raw data (eigenvalue) of 1.96 in the 10$^{th}$ factor. Thus, Horn's parallel analysis suggested 9 factors.

Factor loadings in the principal axis factoring with 9-factor solution are presented in Table 2. Three items written in italic had either low factor loadings or cross-loadings. Thus, they were removed from further analysis, resulting in a final scale with 47 items.

As expected, all of the items in the scholarly creativity loaded on the same factor. However, items in the other dimensions of creativity loaded on two factors. For example, seven of the self everyday creativity items loaded on factor 4 (which we called *Everyday-Interpersonal*) three on factor 8 (which we called *Everyday-Intrapersonal*). The names of the new factors were presented in Table 3.

TABLE 1. Results of Parallel Analysis

| Root | Raw data (Eigen value) | Random data | |
|---|---|---|---|
| | | Mean | 95th percentile |
| 1 | 9.51 | 1.41 | 1.45 |
| 2 | 3.90 | 1.37 | 1.40 |
| 3 | 3.42 | 1.34 | 1.37 |
| 4 | 2.44 | 1.32 | 1.34 |
| 5 | 1.99 | 1.29 | 1.32 |
| 6 | 1.56 | 1.27 | 1.29 |
| 7 | 1.44 | 1.25 | 1.27 |
| 8 | 1.27 | 1.24 | 1.25 |
| 9 | 1.24 | 1.22 | 1.23 |
| 10 | 1.06 | 1.20 | 1.22 |

TABLE 2. Results of Exploratory Factor Analysis

| | Factor | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |
| SE1 Finding something fun to do when I have no money | .058 | .080 | .054 | .194 | .058 | .096 | .142 | .118 | .052 |
| SE2 Helping other people cope with a difficult situation | .057 | .107 | .055 | **.484** | −.008 | .087 | .018 | .090 | −.019 |
| SE3 Teaching someone how to do something | .012 | .155 | .053 | **.442** | −.028 | .108 | .045 | .092 | .029 |
| SE4 Maintaining a good balance between my work and my personal life | .057 | .119 | −.025 | .214 | .040 | .084 | −.007 | **.412** | .042 |
| SE5 Understanding how to make myself happy | −.017 | .023 | −.023 | .114 | .069 | .072 | .042 | **.645** | .005 |
| SE6 Being able to work through my personal problems in a healthy way | .083 | .114 | .002 | .195 | −.004 | −.017 | .033 | **.746** | .030 |
| SE7 Thinking of new ways to help people | .116 | .183 | .060 | **.486** | .025 | .029 | .011 | .157 | .019 |
| SE8 Choosing the best solution to a problem | .098 | .241 | .043 | **.370** | .006 | −.005 | .005 | .288 | .122 |
| SE9 Planning a trip or event with friends that meets everyone's needs | .070 | .159 | .011 | **.412** | .175 | .065 | .075 | .075 | .012 |
| SE10 Mediating a dispute or argument between two friends | −.007 | .107 | .023 | **.598** | .135 | .033 | .033 | −.042 | −.032 |
| SE11 Getting people to feel relaxed and at ease | −.030 | .119 | .036 | **.606** | .086 | .108 | .082 | .077 | .013 |
| S1 Writing a non-fiction article for a newspaper, newsletter, or magazine | .141 | **.669** | .187 | .021 | .150 | −.055 | .102 | .017 | −.102 |
| S2 Writing a letter to the editor | .115 | **.691** | .150 | .042 | .216 | −.033 | .085 | .029 | −.090 |
| S3 Researching a topic using many different types of sources that may not be readily apparent | .104 | **.562** | .002 | .175 | .030 | .086 | .128 | .086 | .019 |
| S4 Debating a controversial topic from my own perspective | .040 | **.456** | .050 | .344 | −.004 | .092 | .107 | .099 | −.006 |
| S5 Responding to an issue in a context-appropriate way | .003 | **.425** | .046 | .408 | −.004 | .096 | .016 | .102 | .058 |
| S6 Gathering the best possible assortment of articles or papers to support a specific point of view | .042 | **.547** | .080 | .203 | .017 | .119 | .049 | .033 | .025 |
| S7 Arguing a side in a debate that I do not personally agree with | .093 | .255 | .044 | .171 | .100 | −.026 | .015 | −.085 | .005 |
| S8 Analyzing the themes in a good book | .015 | **.545** | .027 | .243 | .004 | .163 | .030 | .050 | .035 |
| S9 Figuring out how to integrate critiques and suggestions while revising a work | .016 | **.492** | .076 | .263 | −.052 | .225 | .037 | .123 | .106 |

TABLE 2 (Continued)

| | Factor | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| S10 Being able to offer constructive feedback based on my own reading of a paper | .040 | **.447** | .077 | .292 | −.023 | .199 | .004 | .146 | .116 |
| S11 Coming up with a new way to think about an old debate | .048 | .323 | .105 | .282 | −.024 | .099 | .058 | .107 | .060 |
| P1 Writing a poem | .066 | .209 | **.715** | .071 | .058 | .065 | .050 | −.044 | .003 |
| P2 Making up lyrics to a funny song | .071 | .074 | **.796** | .071 | .245 | .107 | .089 | .003 | −.018 |
| P3 Making up rhymes | −.031 | .097 | **.763** | .118 | .138 | .122 | .090 | −.005 | .044 |
| P4 Composing an original song | .144 | .117 | **.722** | .081 | .274 | .044 | .065 | .022 | −.040 |
| P5 Learning how to play a musical instrument | .112 | .007 | .161 | .040 | **.671** | .142 | .072 | .025 | .038 |
| P6 Shooting a fun video to air on YouTube | .147 | .059 | .275 | .105 | **.478** | .123 | .060 | .000 | −.007 |
| P7 Singing in harmony | −.072 | .012 | .303 | .155 | **.453** | .166 | .034 | .053 | .080 |
| P8 Spontaneously creating lyrics to a rap song | .237 | .069 | **.501** | .002 | .361 | −.024 | .055 | −.022 | −.054 |
| P9 Playing music in public | .163 | .094 | .132 | .002 | **.772** | .069 | .055 | .031 | .044 |
| P10 Acting in a play | .122 | .153 | .225 | .150 | **.454** | .121 | .109 | .077 | .002 |
| MS1 Carving something out of wood or similar material | **.391** | .117 | .080 | .030 | .197 | .122 | .334 | .042 | −.008 |
| MS2 Figuring out how to fix a frozen or buggy computer | **.632** | .031 | .080 | .097 | .065 | .047 | .018 | .026 | −.005 |
| MS3 Writing a computer program | **.664** | .089 | .155 | −.039 | .107 | −.033 | .008 | .061 | .070 |
| MS4 Solving math puzzles | **.400** | −.021 | .021 | .041 | .041 | −.002 | .129 | .083 | **.708** |
| MS5 Taking apart machines and figuring out how they work | **.754** | .036 | .001 | .092 | .007 | .020 | .114 | .017 | .158 |
| MS6 Building something mechanical (like a robot) | **.777** | .112 | .072 | .035 | .139 | −.024 | .129 | .006 | .123 |
| MS7 Helping to carry out or design a scientific experiment | **.504** | .222 | −.034 | .113 | .116 | .062 | .182 | .031 | .325 |
| MS8 Solving an algebraic or geometric proof | **.414** | .044 | −.056 | .040 | .084 | −.020 | .124 | .058 | .661 |
| MS9 Constructing something out of metal, stone, or similar material | **.513** | .150 | .061 | .098 | .070 | .081 | .453 | .062 | .163 |
| A1 Drawing a picture of something I've never actually seen (like an alien) | .247 | .163 | .224 | .057 | .125 | .132 | **.651** | .003 | .017 |
| A2 Sketching a person or object | .147 | .150 | .093 | .100 | .083 | .212 | **.714** | .014 | .027 |
| A3 Doodling/Drawing random or geometric designs | .021 | .023 | −.001 | .134 | −.007 | .259 | **.569** | .016 | .276 |
| A4 Making a scrapbook page out of my photographs | −.162 | .027 | .018 | .209 | .085 | **.538** | .137 | .045 | .158 |
| A5 Taking a well-composed photograph using an interesting angle or approach | .080 | .052 | .113 | .199 | .148 | **.531** | .140 | .099 | .080 |
| A6 Making a sculpture or piece of pottery | .263 | .089 | .076 | .074 | .148 | **.386** | **.408** | .063 | −.074 |

TABLE 2 (Continued)

| | Factor | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |
| A7 Appreciating a beautiful painting | −.052 | .072 | .026 | .154 | .022 | **.554** | .166 | −.014 | .031 |
| A8 Coming up with my own interpretation of a classic work of art | .167 | .198 | .203 | .028 | .158 | **.526** | .084 | .026 | −.130 |
| A9 Enjoying an art museum | .087 | .238 | .053 | .017 | .177 | **.612** | .099 | .058 | −.146 |

*Notes.* Factor 1: Mechanical/Scientific; Factor 2: Scholarly; Factor 3: Performance-Literary. Factor 4: Everyday/Interpersonal; Factor 5: Performance-Music; Factor 6: Artistic-Drawing. Factor 7: Artistic-Activity; Factor 8: Everyday/Intrapersonal; Factor 9: Mathematics. Factor loadings above .35 are presented in bold.

Correlations among variables are presented in Table 4. We hypothesized that the highest correlations would be the sub-dimensions of the originally proposed 5 factors (e.g., Artistic-Drawing and Artistic-Activity). Except for the relationship between Everyday-Interpersonal and Everyday-Intrapersonal ($r = .33$, $p < .05$), our hypothesis was supported. For example, Mathematical variable was found to yield a higher correlation with the mechanical/scientific variable ($r = .54$, $p < .01$) than did the other variables. Similar findings were found for Performance (Literary and Music) and Artistic (Drawing and Activity) pairs. Unexpectedly, Everyday-Interpersonal and Everyday-Intrapersonal variables were found to have a higher correlation with the Scholarly factor than between themselves.

Although parallel analysis suggested a 9-factor solution, correlation analysis showed that the sub-dimensions of the originally proposed 5 factors are closely related. Thus, we examined the discriminant validity of 9 dimensions. Average Variance Extracted (AVE) values were calculated. The square root of AVE is presented in the diagonal of Table 2. In order to establish discriminant validity, this value should be higher than inter-construct correlations (Nevitt & Hancock, 2001). All of the AVE values were found to be higher than inter-construct correlations, suggesting that these nine dimensions were distinct. In addition, since all of the AVE values were found to be more than .40, we were able to establish the convergent validity of each dimension.

Based on all of the analyses carried out so far revealed that the scale consisted of distinct but related 9 dimensions. Thus, we decided to test the 9-factor model as well as 5-factor model in the confirmatory factor analysis. The fit indices for the hypothesized nine-factor model with 47 items for the full-sample data were as follows: CFI = .80, RMSEA = .057, and $\chi^2/df = 5.12$. Among these indices the RMSEA value indicated a very good fit. $\chi^2/df$ value were very close to the threshold value of 5. Nevertheless, CFI value was relatively far from the threshold value of .90. Table 5 shows fit indices values for both five-factor model and nine-factor model. It suggested that 9-factor model provided a better fit with the data.

We also calculated the Raykov's reliability scores (composite reliability) to provide evidence for the reliability of the 9-dimension scale. Composite 'reliability scores were found to be 75 for Everyday-Interpersonal,

TABLE 3. Dimensions of the Scale

| **Factors** | **Number of items** | **Mean (SD)** | **Cronbach's alpha** |
|---|---|---|---|
| Everyday-Interpersonal | 7 | 3.71 (.59) | .73 |
| Everyday-Intrapersonal | 3 | 3.67 (.80) | .66 |
| Scholarly | 9 | 3.10 (.68) | .84 |
| Performance-Literary | 5 | 2.50 (1.06) | .87 |
| Performance-Music | 5 | 2.77 (.95) | .77 |
| Mechanical/Scientific | 7 | 2.42 (.90) | .84 |
| Mathematical | 2 | 2.78 (1.28) | .83 |
| Artistic-Drawing | 5 | 3.62 (.82) | .74 |
| Artistic-Activity | 4 | 3.00 (.66) | .76 |

TABLE 4. Correlations among Variables

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| 1. Everyday (*Everyday-Interpersonal*) | (.50) | | | | | | | | |
| 2. Everyday (*Everyday-Intrapersonal*) | .33** | (.53) | | | | | | | |
| 3. Scholarly | .49** | .27** | (.55) | | | | | | |
| 4. Performance (*Performance-Literary*) | .20** | .03 | .30** | (.70) | | | | | |
| 5. Performance (*Performance-Music*) | .24** | .13** | .27** | .52** | (.58) | | | | |
| 6. Mechanical/Scientific (*Mechanical/Scientific*) | .20** | .14** | .29** | .25** | .32** | (.55) | | | |
| 7. Mechanical/Scientific (*Mathematical*) | .13** | .13** | .09** | .05 | .14** | .54** | (.59) | | |
| 8. Artistic (*Artistic-Drawing*) | .30** | .18** | .36** | .26** | .36** | .18** | .04 | (.53) | |
| 9. Artistic (*Artistic-Activity*) | .23** | .14** | .33** | .29** | .33** | .44** | .27** | .48** | (.68) |

**p < .01.

70 for Everyday-Intrapersonal, 86 for Scholarly, 90 for Performance-Literary, 80 for Performance-Music, 86 for Mechanical/Scientific, 82 for Mathematical, 80 for Artistic-Drawing, and 79 for Artistic-Activity. These findings showed the overall consistency of the scale.

Table 6 shows fit indices values for three invariance types. No substantial difference was found in $\chi^2/df$ and RMSEA indices among the three models. In addition, CFI values for unconstrained model and measurement weights model were close, which suggested that males and females respond to the scale items in the same manner. However, CFI difference between the metric invariance and scalar invariance was more than .01, which prevented cross-gender comparison of scores. Thus, we did not compare creativity scores of males and females separately.

In order to compare the participants' scores from different majors (except for physical education), we clustered 21 majors into six larger major clusters: Primary/Secondary Education, Humanities/Humanities Education, Social Science/Social Science Education, Science/Science Education, Math/Math Education and Arts/Arts Education. Table 7 shows the number of students in each major by gender. Math major cluster had the highest number of students.

Then, we compared the scores in major clusters after controlling for the effects of gender. To do so, we conducted two-way ANOVA test for each factor in which gender served as a control variable (See Table 8). Consistent with our predictions, no significant difference existed among majors in Everyday-Interpersonal, Everyday-Intrapersonal and Scholarly factors. As expected, students majoring in the arts received higher scores than the other students on the Performance-Literary, Performance-Music, Artistic-Drawing, and Artistic-Activity factors. Moreover, students majoring in mathematics received statistically higher scores than the other students in Mechanical/Scientific and Mathematics factors.

## DISCUSSION

The main purpose of the current study was to examine the validity and reliability of the Kaufman Domains of Creativity Scale (K-DOCS) with a Turkish sample. In contrast to our predictions, exploratory factor analysis supported a 9-factor solution. Although some indices did not fully support the model's fit in confirmatory factor analysis, items seemed to have high factor loadings in their respective factor. In addition, we were able to provide good evidence for the discriminant and convergent validity of the scale. Furthermore, the results of multi-group invariance analysis supported measurement invariance across gender. Most importantly, in comparing K-DOCS scores across different majors, we found a general pattern than

TABLE 5. Fit Indices Values for Two Models

| Model | CFI | RMSEA | $\chi^2/df$ |
|---|---|---|---|
| Five-factor Model | .70 | .069 | 7.04 |
| Nine-factor Model | .80 | .057 | 5.12 |

TABLE 6. Fit Indices of Three Nested Models of Multi-group Confirmatory Factor Analysis

| Model (Invariance Type) | $\chi^2/df$ | RMSEA (90% CI) | CFI |
|---|---|---|---|
| Unconstrained Model (Configural Invariance) | 3.186 | .042 (.041–.044) | .790 |
| Measurement Weights Model (Metric Invariance) | 3.147 | .042 (.041–.043) | .790 |
| Measurement Intercepts Model (Scalar Invariance) | 3.262 | .043 (.042–.044) | .773 |

supports the construct validity of our scale. Based on these findings, we believe that the Turkish scale can be used to measure self-reported creativity across different domains in Turkish-speaking populations.

To begin with, unlike other studies which supported 5-factor solution (Kaufman, 2012; Şahin, 2016) the results of the exploratory factor analysis supported the 9-factor solution. However, our result is consistent with other studies which supported three (Kaufman & Baer, 2004), four (Kaufman, Waterstreet, et al., 2009) and seven (Kaufman, Cole & Baer, 2009) factors of creativity.

It is important to note that other studies relied on a scree plot and eigenvalues to extract the number of factors. Here, we used a robust and advance statistical analysis technique, Horn's parallel analysis, which resulted in 9-the factor solution. It is important to note that a 5-factor solution mirroring the original K-DOCS was found; however, the 9-factor model provided a better fit to the data in the confirmatory factor analysis. Our results do not mean that the originally 5-factor model is incorrect or a poor interpretation. Rather, it shows that 4 of the 5 factors may have two related but distinct sub-dimensions.

The predicted associations between college major and scores on K-DOCS factors were partially found. Both science and math majors rated themselves higher on the Mechanical/Scientific and Mathematics factors and the arts majors rated themselves on Performance-Literary, Performance-Music, Artistic-Drawing, and

TABLE 7. The Number of Students by Gender in Each Major and Major Cluster

| Major cluster | Major | Female | Male | Total |
|---|---|---|---|---|
| Primary/Secondary Ed | Primary School Ed | 71 | 17 | 88 |
| | Early Childhood Ed | 115 | 6 | 121 |
| | Total | 186 | 23 | 209 |
| Humanities/Humanities Ed | English Language Teaching | 1 | 4 | 5 |
| | History | 58 | 31 | 89 |
| | Geography | 12 | 14 | 26 |
| | Turkish Language Teaching | 75 | 45 | 120 |
| | Total | 146 | 94 | 240 |
| Social Science/Social Science Ed | Social Science Education | 37 | 27 | 64 |
| | Counseling | 17 | 5 | 22 |
| | Sociology | 13 | 1 | 14 |
| | Nursing | 5 | 1 | 6 |
| | Total | 72 | 34 | 106 |
| Science/Science Ed | Computer Education | 26 | 20 | 46 |
| | Science Education | 49 | 4 | 53 |
| | Biology | 73 | 14 | 87 |
| | Chemistry | 26 | 5 | 31 |
| | Physics | 2 | 3 | 5 |
| | Total | 176 | 46 | 222 |
| Math/Math Ed | Secondary Math Education | 27 | 12 | 39 |
| | Primary Math Education | 112 | 35 | 147 |
| | Mathematics | 68 | 42 | 110 |
| | Total | 207 | 89 | 296 |
| Arts/Arts Ed | Music Education | 16 | 17 | 33 |
| | Arts Education | 5 | 0 | 5 |
| | Turkish Linguistics and Literature | 74 | 20 | 94 |
| | Total | 95 | 37 | 132 |

TABLE 8. Differences by Major Cluster Using Mean Factor Scores

| Factor | Pr/Sec education | Humanities | Social science | Science | Math | Arts |
|---|---|---|---|---|---|---|
| Everyday-Interpersonal | 3.72 (.59) | 3.73 (.57) | 3.67 (.70) | 3.82 (.58)[e] | 3.66 (.60) | 4.00 (.44) |
| Everyday-Intrapersonal | 3.58 (.65) | 3.64 (.59) | 3.66 (.61) | 3.78 (.55) | 3.68 (.58) | 3.68 (.61) |
| Scholarly | 3.01 (.88) | 3.25 (.80) | 3.23 (.70) | 3.15 (.68) | 3.00 (.88) | 3.26 (.78) |
| Performance-Literary | 2.65 (1.04) | 2.65 (.99) | 2.66 (.88) | 2.48 (1.03) | 2.39 (1.03) | 3.25 (.88)[a,b,c,d,e] |
| Performance-Music | 2.80 (1.02) | 2.67 (.97) | 2.75 (.99) | 2.87 (.99) | 2.68 (1.01) | 3.96 (.40)[a,b,c,d,e] |
| Mechanical/Scientific | 2.25 (.99) | 2.16 (1.05) | 2.22 (.97) | 2.74 (.98)[a,b,c,f] | 2.70 (.99)[a,b,c,f] | 2.30 (1.14) |
| Mathematics | 2.71 (.97)[b,c,f] | 1.93 (1.12) | 2.16 (.95) | 3.14 (.79)[a,b,c,f] | 3.84 (.98)[a,b,c,d,f] | 2.05 (1.22) |
| Artistic-Drawing | 3.61 (.60) | 3.62 (.57) | 3.65 (.52) | 3.60 (.64) | 3.41 (.57) | 4.04 (.49)[a,b,c,d,e] |
| Artistic-Activity | 3.11 (.62) | 2.76 (.98) | 2.80 (.89) | 3.15 (.66) | 3.14 (.78) | 3.63 (.49)[a,b,c,d,e] |

[a]The mean difference is higher than Education at the 0.01 level. [b]The mean difference is higher than Humanities at the 0.01 level. [c]The mean difference is higher than Social Science at the 0.01 level. [d]The mean difference is higher than Science at the 0.01 level. [e]The mean difference is higher than Math at the 0.01 level. [f]The mean difference is higher than Arts at the 0.01 level.

Artistic-Activity factors. Additional, unpredicted associations were also found. Primary/secondary education majors rated themselves higher than non-science/math majors on Mathematics, and science majors rated themselves higher than science majors on Everyday-Interpersonal (which may be more of a comment on how math students perceive their creative in other domains).

## LIMITATIONS AND FUTURE DIRECTIONS

The findings regarding the relationship between majors and scales scores should be interpreted with caution. There could easily be a reciprocal relationship between major choice and perceived creative ability. Some students might major in the arts because they see themselves as more creative in that area; others might major in the arts and thereby participate in many artistic activities and come to see themselves as more creative. In addition, of course, students may have wildly inaccurate views of their own creativity (Kaufman & Beghetto, 2013) or a poor understanding of the construct of creativity itself (Baas, Koch, Nijstad & De Dreu, 2015). Further, unlike many other self-report instruments (see Kaufman, 2019), the K-DOCS does not ask for frequency of participation in these creative activities or attempt to provide an objective framework for responses. Some participants may report higher scores because of self-driven or narcissistic reasons (Goncalo, Flynn & Kim, 2010); others may be responding based on social desirability.

Further, a large percentage of the population were education students. Although this sampling is interesting because of the insights it yields for future teachers, it may also have potentially skewed the results. Given that students majoring solely in education did not vary greatly across the different factors of the K-DOCS from those students majoring in a domain of education (i.e., arts education) or a non-education major, these concerns may be muted. However, a study with a larger distribution of majors that better distinguishes between subjects (i.e., not needing to include arts education majors along with arts majors; see Kaufman, Pumaccahua & Holt, 2013), would be a natural next step. It is also important to note that back-translation process was not implemented, which was one of the main limitations of our study. In addition, the sample was predominantly female and derived from a single university.

Additional work—both on the K-DOCS and on self-report measures of creativity in general – is needed. Notably, no objective measure of creativity was included in this study. Although other studies (e.g., McKay et al., 2017) have validated the K-DOCS with measures that were not self-report, more evidence is needed (particularly for the Turkish version). Ideally, a future study might examine the K-DOCS and college major along with objective, domain-specific measures of creativity, such as the actual creation of products to be rated by experts (e.g., Amabile, 1996). In addition to offering better evidence of the validity of the K-DOCS (or, perhaps, of the absence of such validity), such a study could examine the accuracy of self-ratings across different majors and content areas.

It is also important to reiterate that the K-DOCS is not designed to be a proxy measure of objective creativity. It offers insight into how people view their own creativity and, likely, how much they value it. It helps assess people's accuracy in their opinions about their creativity. But it is not specifically designed to replace an objective measure (Kaufman, 2019).

# CONCLUSIONS

With these caveats, we believe that the Turkish K-DOCS does show support for the five-factor solution of the original K-DOCS (Kaufman, 2012). Further, it demonstrates evidence of discriminant, construct, and (limited) convergent validity. In addition, and more intriguingly, it suggests that a 9-factor solution may an even better fit. Given that several past investigations have primarily found the 5-factor solution (or a variant thereof), it is premature to assume that the 9-factor solution is generalizable or the best way to interpret the scale. However, it raises possibilities for future work. It is possible that a future revised and updated scale may expand to reflect more categories of domains, and the model presented in this paper may be a solid starting point.

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