Factorial structure and internal consistency of the Russian version of Teachers Creativity Nurturing Behavior Scale (TCNB)

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Abstract

Creativity is valued as one of the key 21st-century skills. Though the importance of creativity and creativity nurturing is well-accepted yet it remains the unachieved standard for educational systems.Various factors contribute to fostering creative behavior but the role of a teacher is critical and crucial in nurturing the creative potential of the child. Thecurrent study aimsto adapt the Teachers Creativity Nurturing Behavior Scale (TCNB) in Russian and evaluate its psychometric properties. Factorial structure and internal consistency of the Russian TCNB were examined in the sample of 223 school teachers from 86 towns and rural areas of the Russian Federation and the Commonwealth of Independent States countries (88.8% females, M_{age} = 36.91, SD_{age} = 10.57). The teaching experience of participants varied from 1 to 43 years (M = 14.39, SD = 10.58). The factorial structure of the TCNB was assessed by exploratory factor analysis, and the internal consistency was estimated by the omega coefficient. Results showed that the four-factor structure was the most appropriate given the data. The value of internal consistency reliability variedfrom .62 to .83 for different factors, providing evidence of acceptable consistency of the scale. Overall, this study demonstrated preliminary evidence of the psychometrical characteristics of the Russian TCNB. The discrepancies between English and Russian versions of TCNB, limitations of the study, and future research perspectives are discussed.

Introduction

Historically, creativity was not considered as a special topic of systematic scientific research and as an important objectiveofschool education. The dominant association of creativity with mystical phenomena (Runco & Albert, 2010; Weiner, 2000), which is still persistent (e.g., Cropley, 2018),the association of creativity with intelligence (Galton, 1869/1892; Terman, 1925), and the primary interest of “young” psychological science in studying the basic psychological phenomena (Simonton, 2001) are few of the reasons which slowed down the emergence of the field of creativity research. Nevertheless, the second half of the twentieth century has given rise to the separate field of creativity research (Guilford, 1950; see also Glăveanu, 2019) what in turn raised the interest in the problem of nurturing creativity in education.

Many scholars emphasized on the role of creativityin education. For instance, J. P. Guilford stressedthat “creativity is the key to education in its fullest sense and to the solution of mankind’s most serious problems” (Guilford, 1967, p. 13). In a similar vein, E. P. Torrance argued that “the development of creative thinking” is crucial for achievingeducational purposes and “successful living” (Torrance, 1995, p. 43) which is resonated by A. Maslow who claimed that modern education prepares children for the realities of today’s world, whereas only creative education can prepare the young generation for the future (Maslow, 1971).Moreover, creativity cannot be considered a “worthless trinket” for education as long as it contributes to some extent to academic achievements (Ai, 1999; Gajda, Karwowski, & Beghetto, 2017; see also Sternberg, 2018) and to the development of other key competencies (Ahmadi & Besançon, 2017). Overall, it is not surprising that creativity is valued as one of the key 21st-century skills (e.g., Sharma, 2015).

Unfortunately, as has been discussed in the literature, there is a huge gap between accepting the importance of creativity andits nurturing in the classroom (Aljughaiman & Mowrer-Reynolds, 2005; Makel, 2009; Sternberg, 2015). As a result, creativity remains a highly desired but still unachieved standard for educational systems (Grigorenko, 2019). The logical question that arises is: How can school education enhance children’s creativity?To address this question, we need to first clarify the definition of creativity. By creativity, we understand an ability to create something original and useful in certain sociocultural context (Beghetto & Kaufman, 2014; Plucker, Beghetto, &

Dow, 2004; Stein, 1953).In the educational context, it may be appropriate to designate between various components and levels of creativity.

First, creativity incorporates both creative potential and creative performance (Runco, 2007; see Glăveanu, 2016 for objections to this dichotomy).Creative potential refers to an ability to generate original ideas, whereas creative performance may be defined as the actualized creative potential, resulting in certain creative achievements. Evidently, the development of creativity in the context of school education should be focused on enhancing creative potential. With this in mind, we should not forget that creative potential is not limited to cognitive capacity but also includes such components as personality and environment (Glăveanu, 2013; Lubart, 2017; Rhodes, 1961).

Second, it is fruitful to differentiate between various levels of creativity: mini-c (the creativity involved in learning), little-c (the creativity in everyday life), Pro-C (the creativity in the context of professional activities), and Big-C (genius, or the creativity associated with significant transformations in any cultural domain; Kaufman & Beghetto, 2009; see Runco, 2014 for objections).Often, teachers are not certain as to how to integrate creativity in the school curriculum because of lack of understanding about the meaning of creativity (e.g., Deroche, 1968). The conception of 4 C's helps to give a more detailed description of educational purposes concerning the development of creativity. More specifically, teachers are offered to focus not on abstract "creativity" but on stimulating children's mini-c creativity (i.e. gaining personally meaningful learning experience)in order to attain the level of little-c creativity (i.e. producing a product externally judged as original and useful; Kaufman, Beghetto, & Dilley, 2016). Thus, the enhancement of children's creative potential, focusing on stimulating mini-c creativity, can be regarded as a quiet realistic educational goal.

The next issue to consider is the factors that foster children's creative potential. Even though various factors contribute to fostering creative behavior at school (e.g., Ahmadi, Peter, Lubart, & Besançon, 2019; Barbot, Besançon, & Lubart, 2015), the teacher's role in nurturing creative behavior may be considered as a crucial one.In recent years, considerable research attention has been devoted to studying teachers' implicit theories of creativity (Andiliou & Murphy, 2010; Bereczki & Kárpáti, 2018; Mullet, Willerson, Lamb, & Kettler, 2016) and teachers' behaviors that foster creativity (Esquivel, 1995; Soh, 2017).

Obviously, accurate teachers' conceptions of creativity and the effective recognition of creativity in students are the first steps in its fostering. Numerous studies have consistently found that teacher's implicit theories of creativity are limited, vague, and different from theories held by creativity researchers (Aljughaiman & Mowrer-Reynolds, 2005; Andiliou & Murphy, 2010; Brandau et al., 2007; Mullet et al., 2016; Newton & Beverton, 2012). For instance, in contrast to many explicit conceptualizations of creativity (e.g., Lubart, 2017; Plucker et al., 2004; Rhodes, 1961), teachers often fail to acknowledge that creativity is a multifaceted construct (Lee& Seo, 2006; Mullet et al., 2016). Moreover, teachers' ratings of students' creativity frequently tend to be gender-biased, poorly related to measures of creative potential, and highly related to students' level of intelligence and academic achievements (Gralewski, 2019; Gralewski & Karwowski, 2013, 2018, 2019; Holland, 1959; Mayfield, 1979; Scott, 1999). Although teachers' conceptions of creativity are also art-biased(e.g., Andiliou & Murphy, 2010), the recent online study conducted in seven countries over the world (Patson, Cropley, Marrone, & Kaufman, 2018)showsthat the tendency to "art bias"in teachers was not so notable as expected, and there were significant differences in art bias by discipline, gender, and teachers' self-assessed creativity. Based on the results of the presented studies, we conclude that teachers lack the knowledge about creativity and, thus, have problems in recognizing creativity in children.

As for teachers' classroom behavior, numerous studies investigated teachers' creativity nurturing behavior.The most prominent models are Renzulli's Enrichment Triad Model (Renzulli, 1977), Treffinger's Enrichment Triad Model (Treffinger, 1991), Torrance's Incubation Model (Torrance, 1979), and Williams "Cube" Model (Williams, 1979). For example, Williams (1979)suggested an integrated model encompassing three dimensions: curriculum (subject matter content), teacher behavior (strategies of teaching), and pupil behaviors. The Williams Model suggested various strategies for enhancing creativity in a classroom, including stimulating tolerance for ambiguity, asking provocative questions, using the intuitive expression, teaching the creative reading skill, etc.Similarly, Torrance (1977) emphasized that "learning creatively takes place in the process of sensing problems or gaps in information, making guesses or hypotheses about these deficiencies, testing these guesses, revising, and retesting them, and communicating the results" (p. 24). Torrance (1995) also outlined 20 principles for nurturing creativity in the school curriculum. They include creating necessities for creative thinking, valuing and rewarding creative thinking, developing tolerance of new ideas, encouraging self-initiated learning, teaching how to test each idea systematically, just to name a few.More current studies proposed many specific models of integrating creativity in the classroom (e.g., pedagogy of connection, Dillon, 2006; 5-I training program, Gu, Dijksterhuis, & Ritter, 2019; a model of inventive ideation, Ross, 2006; Creative Reversal Act, Sak & Oz, 2010).

However, regardless of the amount of scientific evidence, there is still a gap between scientific knowledge about creativity and widely spread educational practices. The same situation is true of school education in Russia. The Ministry of Education and Science in the Russian Federation states that creativity development is an important goal of current school education (Federalnyj Zakon "Ob obrazovanii v Rossiyskoy Federatsii", 2012). However, very little is done in promoting creativity at school curriculum apart from some creative activities like music or art lessons. Moreover, the need for educational programs for teachers that help them to learn how to teach creatively is still not widely recognized in Russia.We also admit that the problem of creativity development is not limited to teachers' competencies in nurturing creative behavior of children, but also involves educational conditions provided by higher levels of school educational system.

The essential step in helping teachers to learn the principles of creative pedagogy is to design educational programs that allow measuring teachers' creativity nurturing behavior and developing it through training sessions. Evidently, the development of creativity nurturing behavior is not possible without its measurement. Thus, this study is concerned with an adaptation of a psychometric instrument targeted at measuring teachers' creativity nurturing behavior. As a target measure, we have chosen a recently developed Teacher's Creativity Nurturing Behavior (TCNB; Sharma & Sharma, 2018) which demonstrated acceptable psychometric properties in the original study.

Teachers Creativity Nurturing Behavior: Description of the Scale

TCNB is a newly developed self-report scale that assesses the teacher's involvement in nurturing the creative potential and creative behavior in schoolchildren. The development of the TCNBis based on the existing literature on fostering creative behavior in the classroom (e.g., Cropley, 1997). More concretely, Cropley (1997) defined creativity fostering teachers as those who have socially integrative style of teaching, stimulate gaining of knowledge as a basement for divergent thinking, encourage independence in learning and flexible thinking, delay premature judgment of students' ideas, promote students' self-evaluation, take students' questions seriously, offer opportunities to work in wide array of conditions, and help students to learn from failures. In other words,the

creativity nurturing behavior of teachers should be regarded as a constellation of various pedagogical skills. From a theoretical point of view, it means that the target construct is probably better described as multifaceted.Thus, items for the TCNB scale were selected with the aim to encompass these diverse aspects of creativity nurturing behavior.

The study of Sharma and Sharma (2018) demonstrated thatTCNB has a four-factor structure, including such factors as inquisitiveness, abstraction,critical thinking, and motivation. Inquisitiveness is defined as an ability to encourage students to question in order to understand concepts and thoughts. Abstraction refers to the ability to provide an opportunity for students to explore their ideas. Critical thinking can be defined as an ability to stimulate objective analysis and evaluation of an issue to form a judgment. Motivation is understood as an ability to boost the morale of the students and encourage learning from failures.Empirical data obtained on the sample of Indian teachers were consistent with the notion of the multifaceted view of creativity nurturing behavior in a classroom. At the same time, factor correlations varied from 0.39 to 0.66. The latter indicates that these factors are highly related and cannot be considered as totally independent. As a final note, compound reliability for the results obtained with TCNB was found to be good (0.82).

The Present Study

The aim of this study is twofold. The first is to translate the original items of TCNB from English to Russian. The second is to evaluate the psychometric properties of the Russian version of TCNB on a relevant sample of school teachers. The investigated psychometric properties are limited to factorial structure and internal consistency. This focus isconditioned by the fact that the presented data is a part of the international collaboration project on TCNB, which is more focused on studying cross-cultural differences.Therefore, we estimated factorial structure and internal consistency as a first step of evaluating the psychometric characteristics of the Russian TCNB. Other psychometric properties, including construct validity and test-retest reliability, should be investigated and presented in further studies.

Method

Sample

Two hundred and thirty-two school teacherswere recruited for the present study via one of the popular social network in the Russian Federation (VKontakte). The data collection was carried out by posting the announcement about the study in several online groups for school teachers.Informed consent was obtained from all participants.The data of nine participants were excluded due to either careless responding or no pedagogical experience (reported 0 years of teaching experience). The final sample consisted of 223 teachersfrom 86 towns and rural areas of the Russian Federation and the Commonwealth of Independent States countries (88.8% females, M_{age} = 36.91, SD_{age} = 10.57).The teaching experience of participants varied from 1 to 43 years (M = 14.39, SD = 10.58).In our sample, there were teachers of different school subjects: natural-scientific subjects (e.g., physics, chemistry, biology, etc.), humanitarian subjects (e.g., history, social science, languages, etc.), math, information technology, and physical education. The educational qualifications of teachers varied widely: secondary specialized education (6.73%), graduate (18.83%), postgraduate (69.51%) and doctoral (4.48%). Participants were not compensated for their participation in the study.

Measures

Teacher's Creativity Nurturing Behavior(TCNB)is a 15-item self-report measure (1 = *totally disagree* to 6 = *totally agree*)that assesses teacher's engagement in organizing educational context that facilitatescreative potential and creative behavior in schoolchildren (Sharma & Sharma, 2018).According to the results of prior research,TCNBhas a four-factor structure: (1) Inquisitiveness (e.g., "I question the students' ideas, to ponder them to explore it further"), (2) Abstraction (e.g., "The students have opportunity to share their ideas and suggestions during the class"), (3) Critical Thinking (e.g., "To develop critical thinking, I enquire students about their idea"), and (4) Motivation ("I encourage students to learn the basics of the topic").In previous research, total scores demonstrated good reliability varying from .72 to .80 (Cronbach's alpha; Sharma & Sharma, 2018).

Translation

Two researchers (native speakers in Russian) independently translated the original measure from English to Russian. Then both translated versions were compared and synthesized into one version. Further, a qualified translator back-translated it to English, and another two researchers (native speakers in English) checked the back-translated version for language adequacy. After that, we conducted a pilot test of the final Russian version on 10 respondents (MA and PhD students) to assess the clarity of items and instructions.As a result of the pilot test, no changes were made in the translation of the questionnaire.

Procedure

The data collection was carried out online via Google Forms. Prior to the start, all participants completed the informed consent form. After that, they provided demographic information and some details about their qualifications and professional carrier. Finally, the participants were offered to complete the TCNB and answer some questions concerning their pedagogical style and opinion on the role of creativity in the school curriculum. Importantly, we included the instructed response item among TCNB items to control for careless responding. The latter is considered a strong contaminating factor in web-based research (e.g., see Meade & Craig, 2012).

Data Analysis

The factorial structure of the TCNB was assessed by exploratory factor analysis (EFA) whereas the internal consistency reliability was estimated by the omega coefficient (McDonald, 1999). All statistical analysis was performed with *psych* (Revelle, 2018), *GPArotation*(Bernaards & Jennrich, 2005), *MVN*(Korkmaz, Goksuluk,& Zararsiz, 2014), and *semTools* packages (Jorgensen, Pornprasertmanit, Schoemann,& Rosseel, 2019) developed for R software (R Core Team, 2018). The raw data and R-code of the analysis are available in the Open Science Framework repository, https://osf.io/vcwt9.

We investigated the dimensionality of TCNB by means of EFA because the *factorial* structure of TCNB can hardly be considered as solidly established. To our knowledge, Sharma and Sharma's (2018) article represents the only

published work that provided evidence for TCNB's factorial structure. The authors performed the analysis in two steps. At the first step, Sharma and Sharma identified that a *four-component* solution suggested by principal component analysis (PCA) with varimax rotation showed the best fit to data. In the second step, they proceeded with confirmatory factor analysis (CFA) and concluded that their data supported the adequacy of the *four-factor* structure.

In fact, such an approach to statistical analysis contains certain limitations. Firstly and primarily, aprincipal component model is not the same as a common factor model (e.g., Thompson, 2004; Fabrigar & Wegener, 2012). One of the major differences is that PCA is a formative model (i.e. components are "caused" by their indicators) whereas EFA is a reflective one (i.e. latent variables "influence" their indicators; Borsboom, 2006). For this reason, PCA is not an appropriate statistical tool for investigating the underlying latent structure of any measure. Even though both PCA and EFA often produce similar solutions, PCA does not distinguish between common variance and unique variance and, therefore, is prone to overestimate the variance explained. Moreover,anorthogonal rotation procedure also does not seem to be the optimal option for the first analysis of any scale because it is not known in advance how much variance would be shared by latent variables.Secondly, we have to draw attention to the problem in CFA analysis conducted by Sharma and Sharma. More concretely, fit indices of the final CFA model with correlated errors showed only "moderate"rather than "good" fit (Sharma & Sharma, 2018). In sum, the prior evidence favoring the four-factor structure is not strong. Therefore, in the context of our study, it seems more reasonable to apply EFA than CFA to explore this issue in more detail.

The descriptive statistics for each item and correlations between items are presented in Table 1.Data were carefully inspected visually and statistically in order to check the assumptions of EFA and choose the most appropriate estimation method. The results of the Kaiser-Meyer-Olkintest (.87) and Bartlett's sphericity test ($\chi^2(105) = 1102.82$, $p < .001$) both clearly indicated the suitability of EFA. No missing values were present. One influential multivariate outlier was detected (Mahalanobis $D^2 = 71.99$) and removed from the data. This manipulation resulted in significantly reduced values of skewness and kurtosis for several items. However, the assumption of multivariate normality did not hold for our data (kurtosis > 7, critical ratio > 5; Bentler, 2005; West, Finch, & Curran, 1995). The latter was also verified by Mardia's test of multivariate normality. Considering all this, including ordinal measurement scale of TCNB, an EFA was conducted on the polychoric correlation matrix using the ordinary least squares (OLS) method with promax rotation (Forero, Maydeu-Olivares, &Gallardo-Pujol, 2009; Holgado–Tello, Chacón–Moscoso, Barbero–García, & Vila–Abad, 2010; Lee, Zhang, & Edwards, 2012).

The internal consistencyreliability was estimated by the omega coefficient due to some methodological concerns. The more widely spread statistics such as Cronbach's alpha is of limited value because of several limitations which were intensively discussed in the psychometric literature (e.g., Dunn, Baguley,& Brunsden, 2014; McNeish, 2018; Sijtsma, 2009). Specifically, the notion of tau-equivalence, which is crucial for interpreting the value of Cronbach's alpha as the reliability estimate, can be rarely satisfied. Thus, in most but not all cases, the application of congeneric estimates of reliability (e.g., omega coefficient) is more justified (Graham, 2006; Teo & Fan, 2013; Trizano-Hermosilla & Alvarado, 2016). Given the nature of the data being categorical, we computedthe omega coefficient based on the polychoric correlation matrix (Gadermann, Guhn, & Zumbo, 2012) and estimated its confidence intervals with a bias-corrected and accelerated bootstrap method (Kelley & Pornprasertmanit, 2016).

Results

Determining the Number of Factors

The first step was to identify the number of factors to retain. We employed the following methods to determine the optimal number of factors to extract: (a) Cattell's screen test for eigenvalues obtained from the reduced correlation matrix, (b) Horn's parallel analysiswith PCA extraction based on polychorics (mean rule; Cho, Lee, & Bandalos, 2009; Garrido, Abad, & Ponsoda, 2013) and (c)exploratory graph analysis (EGA; Golino & Epskamp, 2017). Visual inspection of the scree plot suggested either one or two factors solution with eigenvalues of 5.67 and 1.42, respectively.The parallel analysis resulted in two components whereas EGA detected four factors. Interestingly, Kaiser-Guttman rule (eigenvalues-greater-than-one), on which the study of Sharma and Sharma (2018) relied heavily, suggested three or four factors (the 4th eigenvalue was 0.99). Due to the inconsistency of the results obtained by various methods, we decided to proceed with analyses and comparison of one-, two-, three-, and four-factor solutions.

One Factor Solution

Table 2 presents factor loadings and communalityvalues for a one-factor solution. During the analysis, it appeared that frequency tables, computed when polychoric correlations are used, contained 105 cells with zeros. Mair (2018) wrote that "if there are many 0's, the results may become unstable…" (p. 21). In such cases, a default option in the *psych* package usually applies a continuity correction that replaces zero values by 0.5. However, Savalei (2011) found thatwhen a number of categories is greater than three, the treatment of zeros — either correcting them or not — does not essentially change the results.All TCNB's items have a 6-point response scale and, therefore, here and elsewhere we present results without adjustments for continuity.

One-factor solution explained 35.2% of the variance. All items had factor loadings greater than .35 with communalities ranging from low (.12) to moderate (.56).In addition, we assessed the essential unidimensionality by chi-square GLS (generalized least squares)because it seems to be most relevant and accurate option for the design of our study (n = 100, h^2 = .20, skew = 2.50; see Slocum-Gore & Zumbo, 2011).As a result, chi-square test provided evidence against the model with one general factor, $\chi^2(105) = 417.87$, $p < .001$.

From our point of view, the one-factor solution does not show a good fit to the data because a substantial amount of variance remains unexplained as indicated by very low communalities of some items. Hence, apart from the major factor, there might be minor factors that jointly influence small sets of variables and further improve the model.

Two Factor Solution

Pattern coefficients and communality valuesfor the two-factor solution are given in Table 2.Although structure coefficients were omitted from the table, we nevertheless inspected them to gain fuller information about the model.In general, structure and pattern coefficients were not in conflict with each other. The two-factor solution resulted in 42.3% of the explained variance. Items 1–8, 10–11 and 13 predominantly loaded on the first factor while the second factor included Items 9 and 14–15. It appeared that Item 12 had low loadings on both factors. Hence, we did not consider it in the final interpretation. If the second factor can be labeled as Abstraction and Critical Thinking, the interpretation of the first factor is more difficult. Specifically, the first factor combines items from all originally hypothesized factors — Abstraction, Critical Thinking, Inquisitiveness, and Motivation — and,

thus, only an umbrella term “Creativity Nurturing Behavior” seems applicable.Probably, such confusion arises from the fact that two factors are highly correlated (r = .62).

Despite the improvement in fit compared to the one-factor model,we have to admit that the two-factor solution is difficult to interpret on theoretical grounds. Thus, it is still highly probable that the extraction of more factors will not only improve the general model fit but also yield a more sensibleinterpretation.

Three Factor Solution

Pattern coefficients and communalities for the three-factor solution are presented in Table 2.There was no contradiction betweenthe structure and pattern matrix. The three-factor solution explained 50.6% of the variance.As expected, there was one major factor and two minor factors. Again, the first factor (“major”) formed a mixed scale that incorporated a heterogeneous set of items whereas two other factors constituted highly specific scales. Particularly, the pool of items attributed by Sharma and Sharma (2018) to the Abstraction factor was allocated between two minor factors. With regard to items’ content, the second factor can be labeled as Abstraction-Individual (Items 9, 14–15) while the third factor can be named as Abstraction-Group (Items 5, 8). Finally, all factorswere highly correlated ($.51 < r < .65$).

In sum, the three-factor solutionreduced the number of items loaded on the first factor.At the same time,this major factor still remains immune to clear and reasonable interpretation. Although the second and third factorscorrespond to Abstraction-Individual and Abstraction-Group, an inconsistency lies in the fact that theAbstraction-Individual factor includes Item 9 that characterizes critical thinking rather than an abstraction. Therefore, we proceeded with our analysis of the four-factor solution.

Four Factor Solution

The last model that we considered was the four-factor model (see Table 2). No apparent discrepancy between values of structure and pattern coefficients was found. The four-factor solution resulted in 52.5% of the explained variance. After careful consideration of this model, we concluded that the four-factor model provideda better balance between fit to empirical data and adequate theoretical interpretation thanall other models.

In fact, it is not surprising thatthe extraction of an additional factor led to an improved model fit with all communalities higher than 0.28. The more parameters are estimated, the better fit of a model to sample data will be expected (Thompson, 2004).However, even though the four-factor solution is indeed more sophisticated than all other models, the loss in parsimony can be partially compensated by enhanced interpretability of the results.

Our main concern was related to the interpretation of the first “major” factor. Previously tested models failed to differentiate between various dimensions of creativity nurturing behavior, and itcomplicated the interpretation of the first factor. In the four-factor model, the first factor had moderate to high loadings on Items 2–4, 6–7 and 11. The highest pattern coefficient was for Item 2 (“I give students the opportunity to share their ideas and thoughts”) which conceptually relates to inquisitiveness. The other item closely linked to inquisitiveness was Item 4 (“I give heed to every student’s query”), however, it had much weaker loading. Moreover, we think that the wordings of Item 3 (“To develop critical thinking, I inquire students about their idea”) and Item 6 (“The students have opportunity to

share their ideas and suggestions during the class”) also make them tightlyrelated to the domain of inquisitiveness. Considering Items 7 and 11, we think that their inclusion has a negative effect on a theoretical consistency of the factor because they are theoretically more associated with motivational aspects than with inquisitiveness. The latter idea is consistent with the presence of moderate cross-loadings on these items from the third factor that encompasses the most items associated with motivation (see Table 2). Overall, despite certain difficulties in interpretation, we believe that the “core” items of the first factor constitutethe Inquisitiveness factor. The reliability of this factor was estimated to be good (ω_t = .80, 95% CI [.73, .85]).

Next, three “minor” factors should be briefly described. The second factor had loadings on Items 5 and 8 and made up the Abstraction-Group factor. Items 9–10 and 12–13 formed the third factor of Motivation because three out of four items were clearly focused on motivational aspects of creativity nurturing behavior. In contrast to previous models, Items 14 and 15 were finally separated from Item 9 (“I provide opportunity to students to evaluate and judge themselves”) and constituted the Abstraction-Individual factor.Reliability estimates for three factors were the following: ω_t = .83 (95% CI [.78, .87]; for Abstraction-Group), ω_t = .62 (95% CI [.49, .69]; for Motivation with Item 9 eliminated), and ω_t = .77 (95% CI [.70, .82]; for Abstraction-Individual). All coefficients corresponded to an acceptable level of reliability for exploratory analysis.

In addition, we decided to explore the model with a second-order factor. The rationale for considering this model is that all models with multiple factors revealed high associations between latent variables. The model with four factors was no exception. Indeed, correlations between the factors varied from .38 to .65.The factor correlation matrix from the four-factor solution was used as an input into the second-order EFA. As in previous cases, the estimation method was ordinary least squares (OLS). Factor loadings of each factor on the second-order factor were the following: .760 for Inquisitiveness, .745 for Abstraction-Group, .847 for Motivation, and .562 for Abstraction-Individual. In order to identify the second-order factor in terms of measured variables, we multiplied the pattern matrix of the four-factor model by the pattern matrix of the model with the second-order factor (Gorsuch, 1983). Thus, factor loadings of 15 items on the second-order factor were produced. All factor loadings except one were higher than .40 and varied from .35 to .68. This suggests that the general second-order factor can be defined broadly as Creativity Nurturing Behavior.Its reliabilitywas found to be quite satisfactory (ω_{L2}= .79). Yet, we have to acknowledge that the proposed interpretation of the second-order factor relies solely on theoretical premises and not on direct evidence of construct validity.

Discussion

The present study was conducted in order to translate TCNB to Russian and investigate its factorial structure and internal consistency. The results of our study slightlydiffer from those obtained by Sharma and Sharma (2018) on the sample of Indian teachers. Even though we arrived at a similar conclusion about the appropriate number of factors to describe various dimensions of TCNB, these factors were defined differently. For instance, the originally proposed Abstraction factor was split into two factors: Abstraction-Individual and Abstraction-Group.A probable explanation is that this differentiation between Abstraction-Individual and Abstraction-Group appeared as a mere difference in preferred pedagogical methods. That is, teachers could perceive items from the Abstraction-Group factor as simply indicating “organizing group work” rather than “group work as a way of exploring and sharing ideas”. However, both factors shared a substantial amount of variance which does not allow us to consider them as distinct dimensions. Further, we failed to isolate Critical Thinking as a separate dimension of TCNB. We suppose it could happen due to not clear wordings of original items targeted to critical thinking because some items

included a mix of critical thinking and inquisitiveness (e.g., Item 3) whereas other integrated critical thinking and motivation (e.g., Item 10). Therefore, additional work aimed at revising the Russian version of TCNB is required. Based on the results of our study, some items should beeither revised (items about critical thinking) or even dropped. For example, Item 1 performed very poorly compared to other items and might be considered as the first candidate for exclusion from the Russian TCNB scale.

As indicated previously, all first-order factors were closely correlated which led us to the suggestion that a higher-order factor can be extracted. Indeed, the second-order factor model was investigated, and the hypothesis about the general factor found support. The logical question to be raised is: what do these results mean? We believe that from theoretical point of view, such results imply that teachers' creativity nurturing behavior is a set of highly interrelated components and if teachers demonstrate a high level on one of them (e.g., motivating children to learn), they tend to show the same high level on the others (e.g., stimulating curiosity, critical evaluation, and self-initiated learning). The current goals of education in the Russian Federation as well as in other countries are focused on developing a multidimensional array of characteristics that goes far beyond a simplistic strategy towards "knowledge acquisition".It is quite difficult, if not impossible, to reach these high goalswithout creating a rich and stimulating environment. The rich and stimulating environment that will develop children's creative potential by emphasizing both the significance of studying the basics as well as learning skills of critical and creative thinking. The latter poses many challenges for ordinary school teachers as they are expected to integrate and manifest versatile competencies.For this reason, the Russian TCNB has been designed specifically to capture those diverse dimensions that are necessary for nurturing creative behavior in school children and enable Russian researchers to measure them with a short scale.

In conclusion, this study provides preliminary evidence for psychometriccharacteristics of the Russian TCNB as a measure of teachers' creativity nurturing behavior. However, given certain limitations of our study, our findings should not be overinterpreted. First, our study certainly lacks any information about convergent and discriminant validity. Investigation of both convergent and discriminant validity constitutes an essential step in establishing the construct validity of any psychometric instrument. Currently, only evidence about the factorial structure and internal consistency exist. It follows that establishing construct validity as well as test-retest reliability is the next essential step in validating the TCNB.Second, our sample was predominantly female and, thus, we could not inspect whether the Russian TCNB demonstrates gender invariance. It is not excluded that male and female teachers may show different patterns of creativity nurturing behavior.Future studies will have to explore further the validity and reliability of results obtained with the Russian TCNB. Moreover, additional research for the assessment of the cross-cultural validity of TCNB is also warranted in order to resolve the issue of itsfactorial structure.

Declarations

Funding

There was no funding used for this study.

Ethical Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later

amendments or comparable ethical standards.

Informed Consent

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

Conflict of Interest

On behalf of all authors, the corresponding author states that there is no conflict of interest.

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Tables

Table 1

Descriptive statistics and correlations

Item	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. I keep track of the progress in the students' ideas	4.41	1.16	—														
2. I give students the opportunity to share their ideas and thoughts	5.67	0.64	.46	—													
3. To develop critical thinking, I inquire students about their idea	5.00	1.02	.50	.61	—												
4. I give heed to every student's query	5.18	0.90	.29	.44	.45	—											
5. I regularly give group assignments as part of the pedagogy	4.19	1.39	.44	.31	.43	.33	—										
6. The students have opportunity to share their ideas and suggestions during the class	5.10	0.95	.31	.58	.42	.44	.45	—									
7. The students are motivated to apply their learning in different situations	5.27	0.92	.48	.56	.53	.38	.34	.58	—								
8. The students are expected to work cooperatively in group	4.74	1.18	.34	.32	.37	.26	.63	.36	.39	—							
9. I provide opportunity to students to evaluate and judge themselves	3.82	1.33	.30	.09	.35	.30	.28	.16	.23	.30	—						
10. I motivate students to apply the teachings in different contexts	5.09	0.96	.45	.39	.47	.35	.38	.49	.57	.34	.40	—					
11. I am open to listening to the distressed students	5.47	0.79	.32	.47	.34	.41	.29	.50	.45	.29	.20	.46	—				
12. I encourage students to learn the basics of the topic	5.32	0.81	.30	.13	.34	.27	.18	.17	.21	.13	.28	.32	.33	—			
13. I reinforce the students' behaviour to apply their learning in different contexts	5.52	0.66	.38	.46	.38	.26	.27	.47	.65	.36	.27	.57	.35	.39	—		
14. Before sharing my viewpoint on the student's idea, I urge them to explore it further	4.43	1.14	.35	.26	.37	.33	.23	.20	.33	.21	.29	.20	.07	.24	.28	—	
15. I don't react immediately to the suggestions of the students rather give them time	4.40	1.06	.19	.19	.29	.26	.11	.17	.18	.14	.28	.26	.13	.20	.17	.53	—

Note. All correlations are polychoric correlation coefficients without correction for continuity.

Table 2

Results of exploratory factor analysis

Item	One-factor		Two-factor			Three-factor				Four-factor				
	F1	h^2	F1	F2	h^2	F1	F2	F3	h^2	F1	F2	F3	F4	h^2
1. I keep track of the progress in the students' ideas	.626	.39	**.459**	.228	.39	.334	.211	.179	.39	.257	.179	.182	.148	.39
2. I give students the opportunity to share their ideas and thoughts	.679	.46	**.764**	-.094	.50	**.812**	-.077	-.061	.53	**1.125**	-.090	-.381	.130	.85
3. To develop critical thinking, I inquire students about their idea	.723	.52	**.515**	.284	.53	**.438**	.280	.103	.52	**.447**	.115	.065	.268	.53
4. I give heed to every student's query	.576	.33	**.418**	.217	.33	.383	.223	.041	.33	.378	.058	.053	.223	.34
5. I regularly give group assignments as part of the pedagogy	.571	.33	**.522**	.072	.32	-.165	-.109	**1.145**	1.00	-.054	**1.154**	-.165	-.106	1.00
6. The students have opportunity to share their ideas and suggestions during the class	.676	.46	**.849**	-.199	.55	**.781**	-.196	.095	.54	**.669**	.115	.044	-.105	.54
7. The students are motivated to apply their learning in different situations	.753	.57	**.798**	-.041	.59	**.854**	-.024	-.071	.63	**.604**	-.057	.297	-.026	.61
8. The students are expected to work cooperatively in group	.544	.30	**.505**	.060	.30	.127	-.021	**.581**	.43	.095	**.586**	.050	-.050	.43
9. I provide opportunity to students to evaluate and judge themselves	.430	.18	.105	**.439**	.26	-.020	**.426**	.169	.27	-.255	.163	**.502**	.199	.36
10. I motivate	.702	.49	**.654**	.074	.49	**.627**	.087	.030	.50	.214	.001	**.684**	-.119	.62

students to apply the teachings in different contexts														
11. I am open to listening to the distressed students	.577	.33	**.723**	-.174	.40	**.731**	-.158	-.013	.41	**.477**	-.012	.294	-.174	.40
12. I encourage students to learn the basics of the topic	.408	.17	.204	.275	.19	.237	.295	-.061	.20	-.055	-.088	**.552**	.098	.28
13. I reinforce the students' behaviour to apply their learning in different contexts	.659	.43	**.650**	.024	.44	**.717**	.047	-.095	.48	.357	-.120	**.557**	-.081	.53
14. Before sharing my viewpoint on the student's idea, I urge them to explore it further	.445	.20	-.156	**.835**	.56	-.140	**.838**	-.034	.55	.046	-.022	-.051	**.833**	.67
15. I don't react immediately to the suggestions of the students rather give them time	.351	.12	-.170	**.711**	.38	-.110	**.747**	-.119	.41	-.006	-.104	.097	**.615**	.39

Note. All factor loadings are rotated factor pattern coefficients. For solutions with multiple factors, pattern coefficients higher than .39 are bolded.

Appendix

Russian version of Creativity Nurturing Behavior Scale for Teachers

Инструкция: Ответьте, пожалуйста, наприведённыениже утверждения, отметив степень своего согласия с каждым утверждениемпо шкале от 1 до 6, где 1 = *полностью не согласен(-на)*, а 6 = *полностью согласен(-на)*.

1. Я отслеживаю то, как развиваются предложенные моими учениками идеи ___
2. Я предоставляю ученикам возможность высказывать свои идеи и мысли ___

3. Чтобы развивать навык критического мышления у учеников, я расспрашиваю их о высказанных ими идеях ___
4. Я внимательно отношусь к каждому вопросу, заданному моими учениками ___
5. В ходе своей педагогической деятельности я регулярно предлагаю ученикам групповые задания ___
6. У меня на уроке ученики всегда имеют возможность поделиться своими мыслями и предложениями ___
7. Ученики поощряются в стремлении применять свои знания в различных ситуациях ___
8. От учеников ожидается готовность вести совместную работу в группе ___
9. Я предоставляю ученикам возможность самостоятельно выставить себе оценки ___
10. Я мотивирую учеников к использованию приобретённых ими знаний за рамками изученной темы ___
11. Я готов(-а) выслушать учеников, которые чем-то расстроены___
12. Я стимулирую учеников к изучению базовых основ изучаемой темы ___
13. Я поощряю попытки своих учеников применять полученные знания в жизни ___
14. Прежде чем высказать собственное мнение на идею ученика, я побуждаю проработать её более тщательно ___
15. Вместо того чтобы сразу откликаться на то, что предлагают ученики, я даю им время подумать ___