



Identifying And Assessing The Creative Potential Of Pre-Service Teachers: A Four-Component Model And The Creative Potential Index (CPI)

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Abstract. Digital transformation and the rapid renewal of educational content require pre-service teachers who can generate original, pedagogically effective solutions in non-standard situations, making creative potential a central research direction in teacher education. Although Uzbekistan's national policy (Presidential Resolution No. PP-5188, 2021) prioritizes creativity development, no standardized system exists for identifying and assessing pre-service teachers' creative potential, and the two processes are frequently conflated. Objective: This study develops and substantiates a scientifically grounded criteria system and an integrative index model for identifying and assessing pre-service teachers' creative potential. Methods: A two-phase mixed conceptual-methodological design was used: a qualitative-theoretical phase (comparative-analytical synthesis of international and domestic literature, content analysis) and a quantitative-methodological phase (development of a weighted computational index with Delphi-based weighting and a psychometric validation protocol - Cronbach's α , Pearson's r , confirmatory factor analysis, t-test/ANOVA). Results: A four-component structure (motivational-value, cognitive, activity-practical, creative-instrumental) with indicators and a three-level (high/medium/low) rating scale was developed, together with the Creative Potential Index ($CPI = w_1 \cdot MV + w_2 \cdot CG + w_3 \cdot AP + w_4 \cdot CI$), illustrated through a worked calculation. Conclusion: The proposed model integrates the psychometric precision of the Guilford–Torrance–Tunik tradition with the holistic componential approach of domestic pedagogy, enabling quantifiable, statistically tractable, and pedagogically interpretable assessment, with direct applicability in teacher-training curricula.

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1. Introduction.

In the context of digital transformation, the rapid renewal of educational content, and the expansion of personalized learning trajectories, the quality indicators of continuous education systems are increasingly determined by the professional-creative readiness of teaching staff. Pre-service teachers are now expected not merely to master subject content but to generate rapid,

effective, and original solutions in non-standard pedagogical situations. Consequently, creative potential has become one of the central research directions in contemporary teacher education worldwide, reflected in international frameworks such as the OECD's inclusion of “creative thinking” among learners' key competencies, and in teacher-education standards in the United States, the United Kingdom, and Finland, which list creative and critical thinking among core teacher competencies.

In Uzbekistan, the establishment of the system of Presidential schools and the Fund for the Support of Gifted Youth under Presidential Resolution No. PP-5188 of 19 July 2021 confirms that developing creativity is a state-level policy priority [1]. Yet, while regulatory documents and educational standards designate creative-potential development as a goal, no unified, standardized system of criteria exists for its identification and assessment, leaving practice largely subjective and unsystematic. A further, more fundamental gap concerns terminology: the methodological distinction between identification - the diagnostic fixation of the existence and structural features of creative potential - and assessment - its quantitative-qualitative classification by developmental level - remains insufficiently clarified in the literature; the two processes are frequently treated as synonymous, which undermines the scientific grounding and reliability of diagnostic findings. Moreover, existing structural models are either narrowly componential and descriptive (the value-cognitive-activity triad proposed by Vershlovskiy and colleagues), expanded to a degree that complicates operationalization (the five-component model of Kolesnikova), or psychometrically rigorous but professionally decontextualized (the Guilford-Torrance-Tunik tradition, which develops cognitive-creative indicators without addressing their manifestation in teaching practice). No existing model integrates these traditions into a single, quantifiable index.

This study aims to develop and substantiate a holistic, scientifically grounded, and practically applicable system of criteria for identifying and assessing the creative potential of pre-service teachers. It addresses five research questions: (RQ1) How can creative potential be conceptually differentiated from the closely related constructs of creativity and creative ability? (RQ2) What component structure can integrate existing international and domestic models? (RQ3) What diagnostic instruments support the identification of creative potential? (RQ4) What indicators and levels support its assessment? (RQ5) How can the resulting components be mathematically integrated into a single, validated index?

Addressing RQ1 requires distinguishing creative potential from the closely related constructs of creativity and creative ability, a distinction that has received limited systematic attention in the pedagogical literature reviewed (Filimonyuk, Tryapitsina, Pisareva, Grebenkina, Ivanchenko, Mikhaylov, Martishina, Musurmanova and colleagues, among others). Creativity denotes primarily the process of generating a new product, whereas creative ability (creativity) refers to the individual-psychological trait - fluency, flexibility, and originality of thought - that enables this process. Creative potential is treated here as the broader, integral construct that subsumes both: it encompasses not only existing creative capacity but also the motivational, cognitive, and activity-based resources required to realize that capacity within professional-pedagogical practice. Accordingly, this study defines creative potential as the dynamic, integral complex of a person's capacities to produce original, non-standard, and pedagogically effective solutions in professional-pedagogical activity, to creatively re-process existing professional experience, and to implement new pedagogical ideas in practice.

The study's novelty lies in the Creative Potential Index (CPI) - an integrative-index model that combines the psychometric precision of the international Guilford-Torrance-Tunik tradition

with the holistic professional-componential approach of domestic pedagogy (Markova, Vershlovskiy), operationalized through expert-elicited (Delphi) weighting and a standardized three-level classification scale.

2. Methods.

Research design. This study followed a two-phase mixed conceptual-methodological design. Phase 1 (qualitative-theoretical) comprised a comparative-analytical synthesis of the international and domestic literature and a content analysis of existing structural models of creative potential, from which a four-component structure and its diagnostic criteria were derived. Phase 2 (quantitative-methodological) comprised the development of a computational integrative index - the Creative Potential Index (CPI) - together with its psychometric validation protocol. Three methodological approaches were identified in the literature: structural-componential (analysis by constituent parts), functional-activity (assessment through activity outcomes), and integrative-diagnostic (combining psychodiagnostic testing, pedagogical observation, and expert evaluation). The integrative-diagnostic approach was adopted as the principal methodological basis, as it alone captures the multidimensional - cognitive, motivational, and behavioral - nature of creative potential.

Sample and application context. The model is designed for application with pre-service teachers enrolled in pedagogical higher-education programs, to be administered at the start and end of an academic term as part of a longitudinal diagnostic cycle. For the subsequent pilot-validation stage, a sample of at least 100-150 pre-service teachers across two or more academic groups (control and experimental) is recommended, sufficient to support the internal-consistency and group-comparison procedures described in Section 2.5. To demonstrate the computational procedure transparently, this article reports a single illustrative case (Student N.); large-sample pilot validation constitutes the next stage of the broader research project and lies outside the scope of the present conceptual-methodological contribution.

Instruments. Five groups of diagnostic instruments were systematized for the identification stage: (a) psychodiagnostic tests based on the Guilford-Torrance-Tunik tradition, assessing verbal and non-verbal creativity through timed (10-15 min) associative-response tasks scored for fluency, flexibility, originality, and elaboration; (b) Likert-type questionnaires (20-30 items) measuring professional motivation, initiative, and independent thinking; (c) portfolio analysis of written assignments, lesson designs, and project outputs, enabling longitudinal tracking; (d) problem-situation tests presenting non-standard pedagogical scenarios (e.g., peer conflict, an unexpected question, technical failure) to assess analytical and solution-generation skills; and (e) expert observation during teaching practicum, involving at least three independent raters (methodologist, practicum supervisor, subject instructor) to strengthen objectivity. Because each instrument captures only a specific facet of creative potential, a triangulation principle was applied, combining multiple instruments to achieve convergent validity and compensate for single-method limitations (Table 3).

The Creative Potential Index (CPI). Building on the four-component structure (Section 3.2), component scores are integrated into a single index:

$$CPI = w_1 \cdot MV + w_2 \cdot CG + w_3 \cdot AP + w_4 \cdot CI, \quad \sum w_i = 1 \quad (1)$$

where MV, CG, AP, and CI denote the normalized (0–100) scores of the motivational-value, cognitive, activity-practical, and creative-instrumental components, respectively, and w_1 – w_4 are expert-elicited weight coefficients. Each component score is computed as:

$$K_i = (\Sigma B_i / (n \times 5)) \times 100 \quad (2)$$

where B_i is the score (1-5) obtained on sub-indicator i , and n is the number of sub-indicators within the component.

Weight coefficients are recommended to be elicited via the Delphi technique: a panel of 10-15 pedagogical experts independently rates each component's relative importance (1-10 scale); ratings are statistically summarized (mean, standard deviation) and anonymously returned for a second round; the process iterates until convergence, conventionally at Kendall's coefficient of concordance $W \geq 0.70$. Based on preliminary expert judgment, the following weights are recommended: MV = 0.20, CG = 0.25, AP = 0.30, CI = 0.25, with the activity-practical component weighted highest, reflecting the primacy of practical realization in professional creative potential. Weights may be re-elicited for specific institutional or disciplinary contexts.

Validation protocol and statistical procedures. Prior to full-scale application, the model requires psychometric verification: internal consistency via Cronbach's α ($\alpha \geq 0.70$ considered acceptable); inter-component association via Pearson's correlation coefficient; construct validity via confirmatory factor analysis (CFA); and external validity via correlation of CPI scores with independent expert ratings or practicum outcomes. Group-level comparisons (e.g., control vs. experimental, pre- vs. post-intervention) are supported through independent-samples t-tests, the Mann–Whitney U test, or ANOVA. These procedures constitute the model's built-in psychometric acceptability criteria; their full-sample empirical confirmation is scheduled for the subsequent, pilot-implementation stage of the research.

3. Results.

Comparative analysis of existing models. Table 1 summarizes a comparative analysis of five existing structural models against the proposed four-component model. Existing models cluster around two limitations: a narrow three-component base restricted to value–cognitive–activity dimensions, or an expanded multi-component structure that complicates practical measurement; psychometric models (Guilford, Torrance, Tunik) provide well-developed cognitive-creative indicators but omit professional-pedagogical context.

Table 1. Comparative analysis of existing models of creative potential

Model / Author(s)	Proposed Components	Key Feature / Limitation
Vershlovskiy et al.	Value, cognitive, activity components	Three-component baseline model; creative-instrumental aspects not separately addressed
Kolesnikova	Motivational-value, cognitive, communicative, emotional-expressive, creative-instrumental	Five-component expanded model; lacks operational measurement criteria
Tuzova	Stimulation of activity/independence, inner freedom, reflection	Focused on psychological-pedagogical conditions; no rating scale
Oskolkova	Motivational, informational, and processual stages	Process-stage model; no static component structure specified

Guilford, Torrance, Tunik	Fluency, flexibility, originality, elaboration	Psychometric-cognitive approach; professional-pedagogical context not addressed
Proposed model (CPI)	Motivational-value, cognitive, activity-practical, creative-instrumental + CPI	Four-component integrative model with a quantitative index and standardized three-level scale

Four-component structure of creative potential. Table 2 presents the four-component structure derived from the comparative analysis. The components are interdependent: the motivational-value component directs creative activity, the cognitive component supplies its knowledge base, the activity-practical component enables practical implementation, and the creative-instrumental component determines the originality and effectiveness of the final outcome.

Table 2. Four-component structure and indicators of pre-service teachers' creative potential

Component	Content	Key Indicators
Motivational-value (MV)	Internal need for, and value orientation toward, creative-professional activity	Interest in creativity; drive for professional self-actualization; achievement motivation
Cognitive (CG)	Knowledge system underlying creative pedagogical activity	Depth of psychological-pedagogical knowledge; awareness of creative-thinking strategies; problem-analysis ability
Activity-practical (AP)	Application of knowledge and skills in real pedagogical situations	Creative use of pedagogical tools; design/modeling skills; independent decision-making
Creative-instrumental (CI)	Generation of original ideas and their conversion into non-standard pedagogical solutions	Fluency and flexibility of thinking; number of original responses; ability to synthesize new ideas

Diagnostic instrumentation. Table 3 systematizes the diagnostic techniques identified for the identification stage, spanning psychodiagnostic, questionnaire-based, and observational instruments.

Table 3. Diagnostic instruments for identifying pre-service teachers' creative potential

Technique	Author(s)	Key Indicators	Rating
Readiness for creative activity	A.N.Luk	Curiosity, self-confidence, persistence, independence, abstract thinking	High/Medium/Low
Creative activity assessment	Rozhkov, Tyunnikov, Alishev, Volovich	Level of motivation for creative activity	High/Medium/Low

Verbal & non-verbal creativity	Guilford, Torrance, Tunik (adapted)	Fluency, flexibility, originality, elaboration	Individual composite score
Professional-creative readiness scale	Lisovskaya	Cognitive, practical, and activity components	High/Above-average/Basic/Below-basic
Self-assessment of creative-activity organization	Makarova & Grigorieva	Activity component	High/Medium/Low

Assessment indicators and three-level scale. For each component, indicators and descriptors were developed for three developmental levels - high, medium, low (Table 4). The high level reflects stable, independent, and creative readiness across all four components; the medium level, present in the majority of pre-service teachers, reflects basic manifestations requiring external methodological support; the low level indicates an insufficiently formed creative disposition requiring intensive, individualized development.

Table 4. Assessment indicators and developmental levels of creative potential

Component	Indicators	High (4-5)	Medium (2-3)	Low (1)
Motivational-value	Interest in creative activity; need for professional self-actualization	Stable, intrinsically motivated interest	Unstable interest; needs external incentive	Little or no interest in creative activity
Cognitive	Psychological-pedagogical knowledge; awareness of creative-thinking strategies	Systematic, deep, independently applied knowledge	Knowledge present but unsystematic; applied partially	Superficial knowledge; not applied in practice
Activity-practical	Creative use of pedagogical tools; independent decision-making	Independent, effective solutions in non-standard situations	Completes tasks with guidance	Struggles even in standard situations
Creative-instrumental	Fluency, flexibility, originality of thinking	Many original, practically applicable ideas	Ideas present, few original	Ideas mostly standard, repetitive

CPI computation: illustrative case. Table 5 presents a worked example (Student N.), in which each component score was computed from four sub-indicators (1–5 scale) using Equation (2).

Table 5. CPI computation: illustrative case (Student N.)

Component	ΣBi	n	$Ki = (\Sigma Bi / (n \times 5)) \times 100$	Weight (wi)
Motivational-value (MV)	16	4	80.0	0.20
Cognitive (CG)	13	4	65.0	0.25
Activity-practical (AP)	14	4	70.0	0.30
Creative-instrumental (CI)	12	4	60.0	0.25

Applying Equation (1) with the recommended weights: $CPI = 0.20 \times 80.0 + 0.25 \times 65.0 + 0.30 \times 70.0 + 0.25 \times 60.0 = 16.00 + 16.25 + 21.00 + 15.00 = 68.25$

Classification of developmental level. According to the classification scale (Table 6), CPI = 68.25 corresponds to the medium level. The component profile shows the strongest score in the motivational-value component (80.0) and the weakest in the creative-instrumental component (60.0), indicating a differentiated rather than uniform profile and pointing to a targeted developmental need (e.g., brainstorming and metaphorical-design tasks to strengthen idea generation).

Table 6. CPI-based classification scale

CPI value	Level	Pedagogical description
75.0-100.0	High	Stable creative orientation; well-developed capacity for independent, original pedagogical solutions
50.0-74.9	Medium	Basic manifestations of creative potential present but unstable; requires additional stimulation and methodological support
0-49.9	Low	Insufficiently formed disposition and skills for creative activity; requires targeted pedagogical intervention

4. Discussion.

The proposed model directly addresses the methodological gap identified between two dominant traditions in creative-potential research. The psychometric tradition founded by Guilford (1967) and operationalized in the Torrance (1974) and Tunik (1998) instruments offers rigorously validated indicators of fluency, flexibility, originality, and elaboration, but was not designed to capture the professional-pedagogical context in which pre-service teachers' creativity is enacted. Conversely, the componential tradition represented by Markova's (1996) conception of professional creative activity and by Vershlovskiy's holistic view of teachers' creative-personal development offers rich contextual description but has not been operationalized into a quantifiable, statistically tractable index. By integrating a psychometrically grounded creative-instrumental component with a professionally contextualized motivational-value, cognitive, and activity-practical structure, the CPI model bridges these two traditions.

Compared with conventional descriptive assessment, the CPI-based model offers three principal advantages, summarized in Table 7: it converts qualitative description into a quantifiable 0-100 index amenable to statistical analysis (correlation, t-test, ANOVA, factor analysis); it differentiates component contributions through expert-substantiated weighting rather than treating

them as equal or ignoring their relative importance; and it enables precise localization of individual strengths and weaknesses at the component level, rather than an undifferentiated global description.

Table 7. Comparison of the CPI-based model and conventional descriptive assessment

Criterion	Conventional descriptive assessment	Proposed CPI-based model
Output format	Qualitative description (narrative)	Quantitative index (0-100) + qualitative description
Weighting of components	Not considered, or treated as equal	Differentiated via expert-substantiated weights
Longitudinal comparability	Limited; largely subjective	Full statistical comparability on a common scale
Suitability for statistical analysis	Low	High - supports t-test, correlation, factor analysis
Localization of strengths/weaknesses	General description, not localized	Precisely localized via individual component scores

The model's practical significance lies in its direct applicability within teacher-education programs. It is recommended for integration as a diagnostic module within courses such as “Pedagogical Mastery,” for use in constructing a longitudinal “creative-potential profile” during teaching practicum, and as a supplementary criterion in the comprehensive assessment of professional readiness at thesis defense. A five-stage implementation algorithm - preparation, identification, assessment, computation, and interpretation - supports its practical deployment (Table 8).

Table 8. Five-stage algorithm for implementing the identification and assessment model

Stage	Name	Content
I	Preparation	Diagnostic instruments selected and adapted; expert panel formed; sample defined
II	Identification	Instruments from Table 3 applied in combination; initial diagnostic profile compiled
III	Assessment	Each component rated (1–5) per Table 4 indicators, combining expert and self-assessment
IV	Computation	Component scores (K_i) computed; overall CPI derived via Equation (1)
V	Interpretation & decision	Level determined via Table 6; individualized or group developmental program designed

The proposed model also responds to the international policy gap noted in the Introduction: while frameworks such as the OECD's key-competency assessments and the teacher-education standards of the United States, the United Kingdom, and Finland formally recognize creative and critical thinking as core teacher competencies, none specifies a standardized quantitative

methodology for their measurement. By operationalizing creative potential as a computable index with an explicit psychometric validation protocol, the CPI model offers one concrete response to this broader methodological gap, while remaining adaptable to the professional-pedagogical context of a specific national teacher-education system.

Several limitations should be acknowledged. First, the accuracy of the weight coefficients depends on the composition and expertise of the Delphi panel; periodic re-elicitation is advisable. Second, self-report indicators - particularly within the motivational-value component - carry a risk of subjectivity, which the model mitigates, but does not eliminate, through triangulating expert and self-assessment. Third, the model is primarily designed for cross-sectional assessment; establishing its full predictive validity requires longitudinal research. Finally, the psychometric properties reported here ($\alpha \geq 0.70$, $W \geq 0.70$ thresholds) represent the model's built-in design criteria rather than confirmed large-sample statistics; full empirical validation - including actual Cronbach's α , Pearson correlations, and confirmatory factor analysis on a representative sample - constitutes the necessary next stage of this research program.

5. Conclusion.

This study distinguished, both conceptually and methodologically, the identification and assessment of pre-service teachers' creative potential, defining creative potential as a dynamic, integral system of personal resources oriented toward professional-pedagogical activity, distinct from creativity and creative ability. Building on a comparative analysis of international and domestic models, a four-component structure - motivational-value, cognitive, activity-practical, and creative-instrumental - was substantiated, together with corresponding indicators and a three-level assessment scale. The principal scientific novelty of the study is the Creative Potential Index (CPI), an integrative-mathematical model that combines these four components through expert-elicited weighting into a single, statistically tractable measure, illustrated through a worked computational example. A five-stage implementation algorithm renders the model directly applicable within pedagogical higher-education institutions. It is recommended that the model be piloted on representative samples to empirically confirm its psychometric properties and be integrated into teacher-education curricula as a standardized diagnostic and monitoring instrument.

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