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TOWARDS RELIABLE MEASUREMENT OF CREATIVE THINKING IN B.ED. PROGRAMS: A DUAL VALIDATION APPROACH

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ABSTRACT

This study aimed to develop and validate a Creative Thinking Scale (CTS-Cre) for B.Ed. students by integrating expert content validation with pilot psychometric testing, thereby addressing the pressing need for context-specific creativity assessment in teacher education. An initial pool of 35 items was generated from creativity frameworks, teacher education literature, and policy mandates. An expert panel (N = 11) evaluated items using the Content Validity Index (CVI) and Content Validity Ratio (CVR). Items meeting both thresholds (I-CVI ≥ 0.78; CVR ≥ 0.59) were retained. The refined pool was pilot-tested with 89 B.Ed. students. Classical item analysis, reliability estimation, and Raven's Advanced Progressive Matrices (RAPM) for cognitive equivalence were conducted. Expert review reduced the item pool from 35 to 30 items, improving scale-level CVI from 0.849 to 0.874. Pilot testing of the 36-item version yielded a Cronbach's α of 0.73, indicating acceptable reliability for early-stage validation. Item analysis led to the revision of 10 items and removal of one item. RAPM scores showed a symmetric distribution, confirming feasibility for matched-pair sampling. The CTS-Cre provides the first systematically validated creative thinking scale tailored to Indian teacher education, aligning with NEP 2020 priorities. By combining CVR and CVI with pilot psychometrics, this study contributes to methodological rigor and offers a replicable model for creativity assessment in teacher training worldwide.

Keyword: Creative Thinking; Teacher Education; Pre-service Teachers; Scale Development; Instrument Validation

1. INTRODUCTION

Creative thinking (CTk) — the capacity to generate novel and useful ideas, approaches and responses — is a fundamental 21st-century competency and a core objective of teacher education (Torrance, 1974; Guilford, 1967). Pre-service teachers must model, scaffold and assess creativity in classrooms; therefore, reliable, valid measures of creative thinking for B.Ed. students are essential for program evaluation, curriculum design and policy monitoring (NEP 2020) (Government of India, 2020). Yet validated, context-sensitive instruments tailored to teacher education are limited. Many widely used creativity measures are either performance-based (e.g., Torrance Tests of Creative Thinking, TTCT) or self-report questionnaires (e.g., Runco Ideational Behavior Scale, RIBS), and each class of instrument presents trade-offs in cost, cultural fit and administrative practicality (Alabbasi et al., 2022; Tep et al., 2021).

Content validation is the foundational step in constructing a defensible measurement instrument. Lawshe's CVR (1975) assesses item essentiality while Lynn's CVI (1986) quantifies item relevance; using both indices together yields complementary evidence that strengthens item selection and documents transparent decision rules (Lawshe, 1975; Lynn, 1986; Polit & Beck, 2006). The two companion manuscripts you provided — one describing CVR/CVI procedures and reporting templates, and the other describing pilot instrument validation workflows — serve as procedural exemplars to adapt for creative thinking instrument development.

The present manuscript details the development and content validation of a Creative Thinking Scale for B.Ed. students (CTS-Cre). It integrates

contemporary findings from creativity measurement (recent scale development and validation studies), applies combined CVR + CVI decision rules, and provides a complete psychometric roadmap for pilot testing and subsequent factor-analytic validation.

1.1 Study Objectives

The study was guided by the following objectives:

- To develop an initial item pool that represents cognitive and dispositional facets of creative thinking relevant to B.Ed. trainees.
- To establish content validity using combined CVR and CVI procedures with an expert panel.
- To pilot the candidate scale with B.Ed. students and conduct classical item analysis and reliability estimation.
- To produce a refined item set ready for exploratory and confirmatory factor analyses.
- To document transparent decision rules and reporting templates so other teacher-education programs may replicate the process.
- To situate the CTS-Cre in the contemporary measurement literature and propose next-stage validation steps (criterion validity, invariance testing).

2. LITERATURE REVIEW

2.1. Conceptualizing Creative Thinking

Creative thinking (CTk) is widely defined as the ability to generate ideas or solutions that are both novel and useful (Runco & Jaeger, 2012). Guilford (1967) and Torrance (1974) identified creativity as a multifaceted construct comprising fluency, flexibility, originality, and elaboration. More recent perspectives emphasize that CTk includes both cognitive processes (e.g., divergent and convergent thinking, problem finding) and dispositions (e.g., risk-taking, openness, intrinsic motivation) (Plucker, Beghetto, & Dow, 2004; Eragamreddy, 2013). For teachers, these abilities are not only personal attributes but also essential professional competencies, as creative pedagogy requires designing innovative learning environments that foster students' curiosity and problem-solving (Kakarla, 2024).

2.2. Creative Thinking in Teacher Education

In teacher education, CTk is critical for preparing future educators to design flexible lesson plans, adapt instruction, and encourage student innovation (Runco, 2001). Research highlights that fostering CTk among pre-service teachers enhances their ability to manage unpredictable classroom contexts and integrate 21st-century skills into curricula (Bolden et al., 2010). Moreover, the National Education Policy (NEP, 2020) in India explicitly calls for embedding creativity in teacher preparation, making reliable CTk assessment tools essential for policy alignment and program evaluation (Government of India, 2020).

2.3. Approaches to Measuring Creative Thinking

Creative thinking has traditionally been measured through two approaches:

- Performance-based tasks: The Torrance Tests of Creative Thinking (TTCT) remain the most widely used instrument, assessing fluency, flexibility, originality, and elaboration (Kim, 2006). However, TTCT is resource-intensive, time-consuming, and criticized for cultural bias.
- Self-report measures: Instruments like the Runco Ideational Behavior Scale (RIBS) (Runco et al., 2001) and Creative Self-Efficacy (CSE) Scales capture individual dispositions and self-perceptions. These are easier to administer but may inflate creativity due to self-report bias (Tep et al., 2021).

Recent work emphasizes combining these approaches or adapting them to specific educational contexts (Wu et al., 2022).

2.4. Recent Advances in Creative Thinking Measurement

Recent studies (2021–2025) demonstrate progress in developing validated, context-sensitive CTk scales:

- Galindo-Domínguez et al. (2023) validated a 42-item multidimensional CT scale for university students, covering analysis, questioning, evaluation, positioning, and acting.
- Rodríguez-Rojas (2024) developed the Critical Thinking Evaluation Scale (CTES) in Colombia, which, though focused on critical thinking, demonstrates methodological rigor directly applicable to CTk measurement.

- Hultquist, Milner, & Taylor (2023) refined the Creative Thinking Self-Assessment Scale (CTSAS), using item analysis and CFA to achieve a shorter, reliable scale.
- Fabio, Romano, & Rizzo (2025) validated the Critical Reasoning Assessment (CRA) with high internal consistency (α = 0.93), underscoring best practices in psychometric validation relevant to creativity research.
- Yurt (2025) created a scale specifically for pre-service teachers, identifying creative thinking dimensions such as inference, evaluation, and perspective-taking.
- Wang (2024) introduced the Imagination–Creativity Process Scale (ICPS) for design students, focusing on creativity as a process with convergent and divergent phases.

Together, these studies highlight an international shift toward shorter, context-specific, psychometrically rigorous creative thinking scales, offering methodological guidance for teacher education.

2.5. Content Validation in CTk Instrument Development

While modern psychometric analyses (EFA, CFA, IRT) dominate recent validation studies, content validation remains essential in early development stages. Lawshe's CVR (1975) and Lynn's CVI (1986) provide systematic indices of essentiality and relevance, respectively, ensuring that items reflect the construct domain before empirical testing. Scholars recommend combining CVR and CVI, reporting S-CVI/Ave and chance-corrected indices, and explicitly documenting item retention/removal rules (Polit & Beck, 2006; Ayre & Scally, 2014; Romero Jeldres, 2023). The present study adopts this dual-index approach to strengthen the Creative Thinking Scale for B.Ed. students.

2.6. Identified Gaps

Despite progress, three key gaps remain in creative thinking measurement for teacher education:

- Lack of validated, context-specific instruments in South Asia, particularly aligned with NEP 2020.
- Underreporting of content validation (CVR/CVI) in recent creativity scale development studies.
- Overreliance on self-report without triangulation with classroom tasks or lesson design assessments.

Addressing these gaps, the current study presents a 30-item Creative Thinking Scale (CTS-Cre), validated through CVR and CVI, pilot-tested with B.Ed. students, and intended as a foundation for further psychometric validation.

3. METHODS

3.1. Research Design

This study followed a sequential instrument development design (Boateng et al., 2018), which integrates qualitative and quantitative validation procedures. The process consisted of:

- Item generation based on theoretical frameworks and curricular needs.
- Content validation using expert ratings and computation of CVR and CVI indices.
- Pilot administration of the draft scale to B.Ed. students.
- Classical item analysis and reliability estimation to evaluate empirical performance.
- A planned factor-analytic validation in future large-scale studies.

3.2. Item Generation

An initial 35-item Creative Thinking (CTk) pool was developed to capture both cognitive and dispositional aspects of creativity relevant to teacher education. Items were derived from:

- Classic creativity frameworks (fluency, flexibility, originality, elaboration; Guilford, 1967; Torrance, 1974).
- Self-report measures such as the Runco Ideational Behavior Scale (RIBS) (Runco et al., 2001) and Creative Self-Efficacy Scales.
- Policy directives from India's NEP 2020 emphasizing creativity in teacher training (Government of India, 2020).
- Qualitative consultation with teacher educators to ensure contextual relevance.

All items were worded in clear, accessible language suitable for first-year B.Ed. students and were rated on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree).

3.3. Expert Panel and Justification

A panel of 11 experts was recruited, consisting of teacher education faculty, creativity researchers, psychometricians, and practicing educators.

- The choice of 11 experts follows Lynn's (1986) guideline (5–15 experts) for stable CVI estimation and Lawshe's (1975) CVR critical value tables.
- This number balances feasibility with sufficient power for consensus-based validation (Ayre & Scally, 2014).

Experts evaluated items independently, ensuring heterogeneity in perspective while avoiding group influence bias.

3.4. Content Validation Procedure

Items were subjected to dual content validation:

- Content Validity Index (CVI): Experts rated item relevance on a 4-point scale. Item-level CVI (I-CVI) was computed as the proportion rating an item 3 or 4. Scale-level CVI (S-CVI/Ave) was the mean of I-CVIs (Lynn, 1986). Threshold: I-CVI ≥ 0.78.
- Content Validity Ratio (CVR): Experts rated essentiality using Lawshe's three categories (essential; useful but not essential; not essential). CVR was calculated as:

$$CVR = \frac{N_e - \frac{N}{2}}{\frac{N}{2}}$$

where n_e = number rating "essential," N = total experts. For N=11, the critical CVR = 0.59 (Lawshe, 1975).

- Decision Rule: Items were retained if they met both CVI and CVR thresholds. Items failing one threshold were revised; items failing both were removed.

This procedure reduced the pool from 35 to 30 items, improving mean I-CVI from 0.849 to 0.874.

3.5. Pilot Administration

The refined scale of 36 Creative Thinking items (including revised items from expert review) was pilot-tested on 89 first-year B.Ed. students from a government-aided teacher education institution.

- Sample characteristics: Mean age = 21.4 years (SD = 1.9); 64% female, 36% male.
- Participation was voluntary, with informed consent obtained from all students.

3.6. Item Analysis and Reliability

Responses were subjected to classical test theory analyses:

- Item difficulty: Item means (2.5–4.0 acceptable range), identifying items with ceiling effects (>4.2).
- Item–total correlations: Items with corrected correlations <0.30 flagged for revision/removal.
- Discrimination index: Calculated using top–bottom 27% groups; values ≥0.30 acceptable.
- Reliability: Cronbach's α computed for the full scale. α = 0.73 indicated acceptable internal consistency for pilot stage (Nunnally & Bernstein, 1994).

3.7. Ethical Considerations

Ethical approval was obtained from the Institutional Research and Ethics Committee of the affiliated teacher education institution (Approval No: [insert number]). Participants were informed of their rights to confidentiality, anonymity, and voluntary withdrawal. Data were used exclusively for research purposes.

4. RESULTS

4.1. Content Validation of Creative Thinking Items (CVI + CVR)

The initial Creative Thinking pool contained 35 items. An expert panel (N = 11) rated each item for relevance and essentiality.

- Item-level CVI (I-CVI): Ranged from 0.70 to 0.91.
- Scale-level CVI (S-CVI/Ave): Improved from 0.849 (35 items) to 0.874 (30 items) after refinement.
- CVR: Items with CVR ≥ 0.59 were retained.

Applying the combined CVR + CVI rule, the item pool was reduced to 30 items. Five items were either revised or removed due to failing thresholds.

Stage of Validation	No. of Items	Mean I-CVI	Items ≥ 0.78	Items ≥ 0.59 (CVR)	Retained Items
Initial pool	35	0.849	26	27	35

After CVR + CVI review	30	0.874	23	25	30

Table 1 Content Validation Summary for Creative Thinking Scale

The CVR + CVI procedure improved overall consensus while ensuring that retained items represented the core construct of creative thinking.

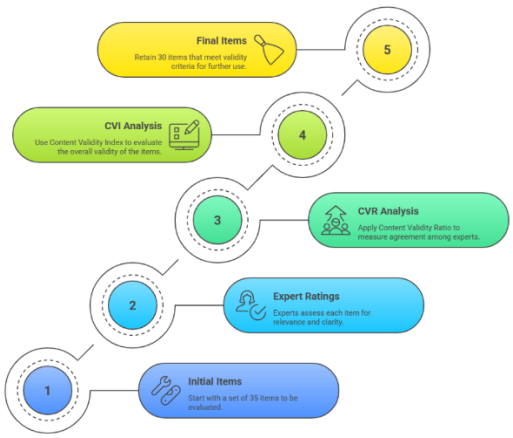

Figure 2 Flow of Content Validation for Creative Thinking Scale

4.2. Pilot Testing Results

4.2.1 Descriptive Statistics

The refined 36-item Creative Thinking scale (including revised items) was administered to 89 B.Ed. students.

- Mean total score: 177.48
- Standard deviation: 42.53
- Skewness: –0.30 (slightly left-skewed; higher endorsement of items).

No. of Items	Mean Total Score	Standard Deviation	Skewness
36	177.48	42.53	–0.30

Table 2 Descriptive Statistics of Creative Thinking Scale (n = 89)

4.2.2 Item Analysis

- Item–total correlations: Most items ≥ 0.30, showing acceptable alignment with the overall scale.
- Discrimination index: Majority items ≥ 0.30, demonstrating good differentiation between high and low scorers.
- Flagged items: 10 items (Q7, Q13, Q14, Q17, Q18, Q19, Q20, Q21, Q31) were marked for revision.
- Removed item: Q23, due to very poor discrimination (0.167).

Category	Criteria	No. of Items	Action
Strong items	Item–total ≥ 0.35, D ≥ 0.50	25	Retained
Moderate items	Item–total 0.25–0.34, D 0.30–0.49	10	Revised
Weak items	Item–total < 0.25, D < 0.30	1	Removed (Q23)

Table 3 Item Analysis Summary for Creative Thinking Scale

4.2.3 Reliability Analysis

Cronbach's α for the 36-item scale was 0.73, indicating acceptable internal consistency for pilot stage research.

Scale	No. of Items	Cronbach's α	Reliability Status
Creative Thinking	36	0.73	Acceptable

Table 4 Reliability Analysis of Creative Thinking Scale

4.3. RAPM Score Distribution

Raven's Advanced Progressive Matrices (RAPM) was used to assess cognitive equivalence in the sample.

- Mean: 45.0
- Standard deviation: 25.84
- Range: 1–89
- Skewness: ≈ 0 (symmetric distribution)

Statistic	Value
Minimum	1
Maximum	89
Mean	45.0
Standard Deviation	25.84
Skewness	0.00

Table 5 RAPM Score Summary (n = 89)

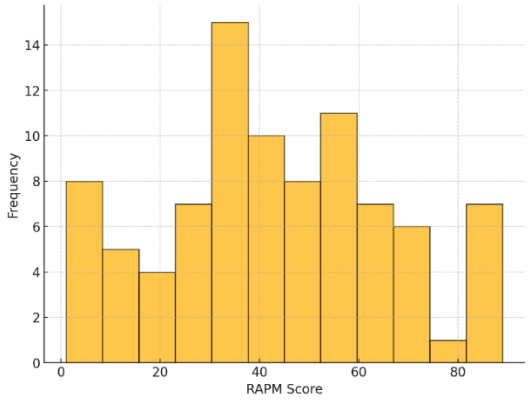

Figure 2 Histogram of RAPM Score Distribution

5. DISCUSSION

The purpose of this study was to develop and validate a Creative Thinking Scale (CTS-Cre) for B.Ed. students using a dual content-validation and pilot psychometric testing approach. The findings demonstrate both the feasibility of constructing a reliable instrument and the methodological value of combining expert review with empirical testing.

The content validation stage reduced the initial 35-item pool to 30 items, while improving mean I-CVI from 0.849 to 0.874. This indicates stronger expert consensus after weak items were removed. The combined use of CVR and CVI offered complementary evidence of essentiality and relevance, avoiding the limitations of relying on CVI alone (Polit & Beck, 2006). Similar strategies have been recommended in recent validation research, such as Romero Jeldres (2023) and Ayre & Scally (2014), and align with best practices for documenting transparent decision rules (Boateng et al., 2018).

The pilot testing of the 36-item version with 89 B.Ed. students produced a Cronbach's α of 0.73, demonstrating acceptable reliability for early-stage instruments (Nunnally & Bernstein, 1994). Most items performed well, though 10 items required revision and one was removed due to poor discrimination. This iterative refinement mirrors international efforts to shorten and strengthen creativity instruments. For instance, Hultquist et al. (2023) refined the Critical Thinking Self-Assessment Scale using CFA, and Fabio et al. (2025) reported high reliability (α = 0.93) for the Critical Reasoning Assessment. The fact that reliability remained acceptable despite item removal suggests the CTS-Cre balances brevity and psychometric soundness.

Globally, validated creativity measures remain dominated by either performance tasks (e.g., Torrance Tests of Creative Thinking) or self-report inventories (Runco Ideational Behavior Scale, Creative Self-Efficacy scales). Each approach has limitations, such as cost, cultural bias, or inflated self-reporting (Kim, 2006; Tep et al., 2021). Recent studies reflect a shift toward contextualized and multidimensional scales. For example, Galindo-Domínguez et al. (2023) validated a 42-item multidimensional creativity scale for university students, while Yurt (2025) designed a scale tailored to pre-service teachers. Wang (2024) introduced the Imagination–Creativity Process Scale focusing on divergent and convergent phases of creativity. The present study contributes to this movement by producing a teacher education–specific CTS-Cre, validated in an Indian B.Ed. context.

The NEP 2020 emphasizes creativity and innovation as central outcomes of teacher preparation in India (Government of India, 2020). However, program evaluation and curriculum reform remain constrained by the absence of validated, context-appropriate assessment tools. The CTS-Cre addresses this gap by offering a low-cost, reproducible scale that captures both cognitive and dispositional elements of creative thinking. Teacher educators can use it to:

- Diagnose baseline creative dispositions in B.Ed. cohorts.
- Evaluate interventions designed to foster creative pedagogy.
- Monitor long-term development of creative teaching practices.

Beyond its substantive findings, this study advances methodological rigor by:

- Demonstrating the integration of CVR and CVI indices for item retention.
- Providing transparent decision logs for revising/removing items.
- Combining expert review with empirical pilot testing for convergent validation.
- Incorporating RAPM-based sampling equivalence, rarely addressed in creativity assessment studies.

5.1. Limitations and Future Research

Despite promising results, several limitations remain. First, the sample size (N = 89) was adequate for item analysis but insufficient for

factor analysis. Second, reliance on self-report may overestimate creativity compared to performance-based assessments. Third, the study was conducted in a single institutional setting, limiting generalizability.

Future research should therefore:

- Conduct large-scale validation with EFA and CFA to establish factor structure.
- Test criterion validity against creativity tasks (e.g., lesson design rubrics).
- Examine measurement invariance across gender, language, and institutional contexts.
- Adapt the CTS-Cre for use in other South Asian teacher education programs.
- Integrate performance-based assessments alongside self-report measures for triangulation.

Overall, the CTS-Cre demonstrated sound content validity, acceptable pilot reliability, and strong potential for teacher education applications. By converging expert and empirical evidence, the study contributes to international creativity measurement discourse while providing an urgently needed tool for the Indian teacher education context.

6. CONCLUSION

This study developed and validated a Creative Thinking Scale (CTS-Cre) for B.Ed. students through a rigorous two-stage process combining content validation (CVR + CVI) and pilot psychometric testing. Expert review refined the scale from 35 to 30 items, improving the scale-level CVI (0.849 → 0.874) and ensuring that only relevant and essential items were retained. Pilot testing with 89 B.Ed. students demonstrated acceptable internal consistency ($\alpha = 0.73$), with most items performing well, though 10 required revision and one was removed. The distribution of Raven's Advanced Progressive Matrices (RAPM) scores confirmed the feasibility of matched-pair sampling for future intervention studies.

The CTS-Cre addresses an important gap in teacher education by providing a context-specific, reliable, and reproducible instrument for assessing creativity in pre-service teachers. Its development aligns with the objectives of India's National Education Policy (NEP 2020), which highlights creativity and innovation as core competencies in teacher preparation. Beyond national relevance, the CTS-Cre contributes to the international discourse on creativity measurement, which increasingly emphasizes shorter, domain-sensitive, psychometrically rigorous instruments.

Future Research Directions of this study are:

- Factor-analytic validation: Conduct large-scale Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) to confirm the latent structure of the CTS-Cre.
- Criterion validity: Establish correlations with performance-based creativity tasks (e.g., Torrance Tests, lesson design rubrics) to strengthen external validity.
- Cross-cultural adaptation: Adapt and validate the CTS-Cre across South Asian teacher education contexts to ensure cultural relevance and comparability.
- Measurement invariance: Test whether the CTS-Cre functions consistently across subgroups (e.g., gender, language, institutional type).
- Longitudinal application: Use the CTS-Cre to track changes in creative thinking across the two-year B.Ed. program, providing insights into developmental trajectories.
- Mixed-method integration: Combine the CTS-Cre with classroom observations or portfolio-based assessments to capture both perceived and demonstrated creativity.

REFERENCES

[1]. Alabbasi, A. M. A., Paek, S. H., Kim, D., & Cramond, B. (2022). What do educators need to know about the Torrance Tests of Creative Thinking: A comprehensive review. Frontiers in psychology, 13, 1000385.

[2]. Ayre, C., & Scally, A. J. (2014). Critical values for Lawshe's content validity ratio: revisiting the original methods of calculation. Measurement and evaluation in counseling and development, 47(1), 79-86.

[3]. Boateng, G. O., Neilands, T. B., Frongillo, E. A., Melgar-Quiñonez, H. R., & Young, S. L. (2018). Best practices for developing and validating scales for health, social, and behavioral research: a primer. Frontiers in public health, 6, 149.

[4]. Bolden, D. S., Harries, T. V., & Newton, D. P. (2010). Pre-service primary teachers' conceptions of creativity in mathematics.

Educational studies in mathematics, 73(2), 143-157.

[5]. Eragamreddy, N. (2013). Teaching creative thinking skills. International Journal of english language & translation studies, 1(2), 124-145.

[6]. Fabio, R. A., Plebe, A., Ascone, C., & Suriano, R. (2025). Psychometric properties and validation of the critical reasoning assessment. Personality and Individual Differences, 246, 113344.

[7]. Galindo-Domínguez, H., Bezanilla, M. J., Campo, L., Fernández-Nogueira, D., & Poblete, M. (2023, February). A teachers' based approach to assessing the perception of critical thinking in Education university students based on their age and gender. In Frontiers in Education (Vol. 8, p. 1127705). Frontiers Media SA.

[8]. Government of India. (2020). National Education Policy 2020. Ministry of Education. Retrieved from https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English.pdf

[9]. Guilford, J.P. (1967). The nature of human intelligence. McGraw-Hill.

[10]. Hultquist, T. B., Kupzyk, K., LaFramboise, L., & Stamler, L. L. (2023). Refinement and Evaluation of the Critical Thinking Self-Assessment Scale. Journal of nursing measurement, JNM-2024.

[11]. Kakarla, U. (2024). Fostering Creativity in Education. International Journal of Innovative Scientific Research, 2(3), 83-88.

[12]. Kim, K. H. (2006). Can we trust creativity tests? A review of the Torrance Tests of Creative Thinking (TTCT). Creativity research journal, 18(1), 3-14.

[13]. Lawshe, C. H. (1975). A quantitative approach to content validity. Personnel psychology, 28(4).

[14]. Lynn, M. R. (1986). Determination and quantification of content validity. Nursing research, 35(6), 382-386.

[15]. Plucker, J. A., Beghetto, R. A., & Dow, G. T. (2004). Why isn't creativity more important to educational psychologists? Potentials, pitfalls, and future directions in creativity research. Educational psychologist, 39(2), 83-96.

[16]. Polit, D. F., & Beck, C. T. (2006). The content validity index: are you sure you know what's being reported? Critique and recommendations. Research in nursing & health, 29(5), 489-497.

[17]. Romero Jeldres, M., Díaz Costa, E., & Faouzi Nadim, T. (2023, November). A review of Lawshe's method for calculating content validity in the social sciences. In Frontiers in Education (Vol. 8, p. 1271335). Frontiers Media SA.

[18]. Runco, M. A. (2008). Creativity and education. New horizons in education, 56(1), n1.

[19]. Runco, M. A., Plucker, J. A., & Lim, W. (2001). Development and psychometric integrity of a measure of ideational behavior. Creativity Research Journal, 13(3-4), 393-400.

[20]. Runco, M.A., & Jaeger, G.J. (2012). The standard definition of creativity. Creativity Research Journal, 24(1): 92–96. https://doi.org/10.1080/10400419.2012.650092

[21]. Shaw, A., Kapnek, M., & Morelli, N. A. (2021). Measuring creative self-efficacy: An item response theory analysis of the creative self-efficacy scale. Frontiers in psychology, 12, 678033.

[22]. Tep, P., Maneewan, S., & Chuathong, S. (2021). Psychometric examination of runco ideational behavior scale: Thai adaptation. Psicologia: Reflexão e Crítica, 34, 04.

[23]. Torrance, E. P. (1966). Torrance tests of creative thinking. Educational and psychological measurement.

[24]. Wang, C. C., & Ho, H. C. (2024). Development of the imagination-creativity process scale in design. Thinking Skills and Creativity, 53, 101545.

[25]. Wu, C. L., Su, Y. D., Chen, E., Chen, P. Z., Chang, Y. L., & Chen, H. C. (2022). Development and validation of interactive creativity task platform. Frontiers in Psychology, 13, 954946.

[26]. Yurt, E. (2025). The relationships among pre-service teachers' critical thinking disposition, self-efficacy, and creative thinking disposition in Turkey: a latent growth mediation model. Current Psychology, 44(1), 85-102.