MEASURING ADVANCED COGNITIVE SKILLS IN YOUNG ADULTS: DEVELOPMENT AND PSYCHOMETRIC VALIDATION OF THE POST-FORMAL THINKING SCALE FOR EMERGING ADULTS

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Abstract: The Post-Formal Thinking Scale for Emerging Adults (PFTSEA) is a novel self-report instrument developed to measure advanced cognitive skills associated with post-formal thought in individuals aged 18-26/29 years. The scale was created through a rigorous multi-stage process in accordance with established guidelines for psychological test construction and was adapted for the emerging adult population in Romania.

An initial item pool was generated based on theory and empirical research on post-formal thinking as conceptualized by Sinnott & Johnson (1997). This framework posits that cognitive capacities continue developing beyond Piaget's stage of formal operations to include skills like dialectical reasoning, multidimensional perspective taking, and systems thinking. Focus groups with emerging adults provided qualitative feedback to refine item wording and content.

A panel of five experts in scale development and post-formal thinking then evaluated items for relevance, clarity, and representativeness to establish content validity. Their feedback resulted in revisions to optimize the scale's content domain coverage.

The PFTSEA was then administered to a sample of 420 emerging adults in Romania along with validation measures. Exploratory factor analysis supported the retention of 16 items loading onto 4 interpretable factors representing key aspects of post-formal thought: Dialectical Thinking, Multidimensional Perspective Taking, Complexity, and Contextual Reasoning. Confirmatory factor analysis confirmed the robustness of this theoretical factor structure.

Reliability and validity analyses demonstrated strong psychometric properties. The internal consistency values for the subscales ranged from 0.82 to 0.87, while the overall scale demonstrated a high internal consistency with a Cronbach's alpha of 0.91. Moderate to strong correlations with related constructs provided evidence for convergent validity, while weaker correlations with unrelated variables supported discriminant validity.

In summary, the PFTSEA was developed through rigorous methodology to provide researchers and practitioners with a reliable and valid measure of advanced cognitive skills specific to emerging adulthood. Its strong psychometric properties support the potential for meaningful applications in assessing post-formal thought capacities.

UDC Classification: 159.92, **DOI**: https://doi.org/10.12955/pss.v4.396

Keywords: post-formal thinking, cognitive skills, emerging adults, developmental psychology

Introduction

The evaluation of the level of postformal thinking development in emerging adults is an important subject in developmental psychology. Emerging adults refer to individuals who are in the transitional phase between adolescence and adulthood, typically ranging from the late teens to the mid to late twenties (18-26/29 years). This period is characterized by significant changes and explorations in various aspects of life, such as education, career, relationships, and personal identity. Emerging adults are often navigating the challenges and opportunities of becoming more independent and establishing their own path in life (Arnett, 2000). It is a critical developmental stage where individuals are forming their values, beliefs, and goals for the future. Researchers and scholars often study emerging adults to better understand the unique experiences and needs of this population.

The concept of postformal thinking has been thoroughly studied by researchers (Commons & Ross, 2008; Blanchard-Fields, 2007), but its empirical evaluation remains challenging from both conceptual and methodological perspectives (Kallio, 2020). Thinking does not stop at the formal-operational level, but instead progresses through new stages of complexity based on the demands of the socio-cultural context (Blanchard-Fields, 2007). Emerging adults demonstrate a transition towards more flexible thinking, enabling them to address the complex challenges of the current era (Arnett, 2014).

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The development of rigorously evaluated instruments would provide valuable insights into the level of cognitive maturity within this age group (Kuhn et al., 2000). Analysing the characteristics of postformal thinking could determine whether they represent a distinct structure or an evolutionary stage (Riegel, 1973). Additionally, correlating the results with other contextual factors would allow for the identification of social influences on thinking maturity (Labouvie-Vief, 2015).

The purpose of this research was to evaluate the psychometric properties of a research instrument consisting of 16 items, used to measure postformal thinking in emerging adults, in accordance with the theory developed by Sinnott & Johnson (1997). The objectives of the study included assessing the reliability of the scale and determining its factorial structure.

Conceptualizing and Empirically Testing Post-Formal Thinking

In psychological research literature, the concept of postformal thinking appears repeatedly. Often referred to as relativistic or dialectical thinking, this concept describes characteristics of thinking that cannot be explained by the final stage of formal-operational thinking postulated by Piaget (1972). Empirical investigation of this type of thinking requires overcoming conceptual challenges, defining a widely accepted framework, and addressing the question of whether the newly investigated characteristics represent a distinct structure or stage of thinking. We align ourselves with those researchers who believe that the development of thinking does not stop at the formal-operational level and that the most advanced form of thinking cannot be adequately described through these structures. They argue that the existence of increasingly complex challenges and problems in modern life imposes new demands on thinking, which can only be addressed through further development (Basseches, 2005; Blanchard-Fields, 2007). The requirements of post-industrial/informational life have brought new age categories to the forefront, such as emerging adulthood, which best demonstrates the transition from formal thinking to a more complex and integrated approach to problems and situations.

We argue that the increasing complexity of challenges and problems in modern life imposes new demands on thinking, which can only be addressed through further development and highlighting the adaptive nature of cognitive development (Sinnott, 2009). The question at hand is how this adapted and complex form of thinking can be described. In 1975, P. K. Arlin postulated a shift in thinking from problem-solving to problem identification (Arlin, 1975). Other authors, such as Riegel (1973) and M. Basseches (1980, 2005), emphasized dialectical reasoning as a characteristic of postformal thinking, which refers to the ability to integrate opposites into more comprehensive systems. Labouvie-Vief (1980, 2015) highlighted the process of development that deviates from absolute and dichotomous thinking and recognizes the perspective-dependent nature of knowledge. In Kramer's 1983 meta-analysis, the characteristics of postformal thinking were synthesized into three traits: 1. Recognition of the relativistic and non-absolutist nature of knowledge, 2. Simultaneous acceptance of multiple incompatible knowledge systems about reality, and 3. The integrative component of knowledge. The diversity in defining these characteristics provides an initial indication of their critical importance, which has a decisive significance in the development of assessment tools. D. A. Kramer analysed these three characteristics in terms of how these structural changes in thinking can be theoretically understood and empirically verified (Kramer, 2000). The meta-analyses conducted by H. Marchand (2002), and subsequently by E. Kallio in 2011, encountered significant difficulties.

Despite these conceptual difficulties, postformal thinking has been empirically investigated in recent years. Empirical research has been marked by the question of whether the newly investigated characteristics represent a distinct structure or stage of thinking that is hierarchically related to formal-operational structures, or if these characteristics of thinking develop in parallel with Piaget's sequence of stages (Kallio & Marchand, 2012). We believe that purely abstract systems such as the Model of Hierarchical Complexity (Commons & Ross, 2008) are challenging to empirically test, and we emphasize the influence of intermediate variables on thinking, such as the development of autonomy and self, context, or social life.

Measurement Tools for Post-Formal Thinking

Sinnott & Johnson (1997) developed a measurement tool for postformal thinking called the “Complex Postformal Thought Questionnaire” (CPTQ). This questionnaire assesses abilities such as recognizing relativism, contradiction, paradox, and integrating opposing perspectives. Cartwright et al. (2009) utilized a tool called the “Postformal Thought Scale” to evaluate postformal thinking in middle-aged

and elderly adults. The scale includes items that measure tolerance for ambiguity, recognition of contradictions, and synthesis of contradictory information. The study does not verify the distinction between formal and postformal structures in any way, although it explicitly describes postformal thinking as a further development of formal-operational thinking.

Another measurement tool used in studies to operationalize postformal thinking was developed by Kramer, Kahlbaugh, & Goldston (1992). The Social Paradigm Beliefs Inventory (SPBI) includes three subscales to measure formal, relativistic, and dialectic thinking. This scale has been used in several studies that investigated the relationship between creativity and postformal thinking, revealing a negative correlation between creativity and formal thinking, and a positive correlation between creativity and postformal thinking (e.g., Wu & Chiou, 2008; Yang, Wan & Chiou, 2010).

Relationship Between Formal and Post-Formal Thinking

It is important to note that none of these studies explicitly investigated formal thinking as a prerequisite for postformal thinking. Blouin & McKelvie (2012) observed that categorizing participants into distinct groups of "formal thinkers" and "postformal thinkers" is not appropriate and that there are no significant differences between them in certain cognitive abilities. Asadi, Amiri, & Molavi (2014) investigated the developmental trend of postformal thinking from adolescence to adulthood and were unable to identify significant differences between formal, relativistic, and dialectic thinking.

There are also other constructs that, although not explicitly using the term postformal thinking, exhibit some similarities with this concept. One such example is the Reflective Judgment Model developed by P. M. King & K. S. Kitchener (2004), which argues that cognitive development cannot be adequately described solely through deductive thinking, as Piaget assumed, and does not cease with the emergence of formal operations. The RJM presents a complex, stage-based model that extends beyond universal and cross-cultural stages, focusing instead on domain-specific development, heavily influenced by the interaction between the individual and the surrounding environment.

E. Kallio (2011) analysed various assessment tools for postformal thinking, highlighting both their strengths and limitations. The author emphasizes the need for more comprehensive measurements that consider the contextual and situational nature of postformal thinking.

We have reviewed some of the difficulties in conceptualizing postformal thinking and its empirical testing. It is undeniable that the various conceptions of postformal thinking can be empirically measured, but there is still a need for the development of new tools that can adapt to the theoretical clarifications in the field of developmental psychology. The term "postformal thinking" can be misleading, as it does not refer to more advanced thinking, but rather to different thinking or different aspects of thinking. So far, there is no concept that adequately describes postformal thinking and allows for its empirical investigation within Piaget's stage theory tradition. As early as 2001, Marchand suggested replacing the term "postformal thinking" with "adult cognition" or "adult thinking", as any scientific and epistemological theory must have conceptual clarity, economy, and simplicity (Marchand, 2002). Similarly, E. Kallio (2011) suggests redefining the broad research domain terminology as the investigation of adult thinking competence development. The term "postformal" was introduced to describe adult thinking in a more comprehensive and appropriate way than is possible with Piaget's formal operational stage.

As for us, we believe that a uniform and statistically grounded operationalization of postformal thinking is necessary. In the study of mature thinking, it may be worthwhile to consider the similarities with research on wisdom and epistemological understanding. Greene and Brown (2009) have proposed such an approach by developing the Wisdom Development Scale (WDS). This instrument measures wisdom as a manifestation of postformal thinking, including factors such as recognizing uncertainty, integrating perspectives, and self-reflection.

The instrument proposed in this research, although it includes the term "postformal" in its title, refers to a specific aspect of cognitive development that is not hierarchically derived from the formal stage but rather chronologically develops during the stage of emerging adulthood. It would be useful to investigate to what extent formal operations are necessary for dialectic-relativistic operations, as empirical findings support the hypothesis that these structures develop in parallel (Riegel, 1973). For example, several studies have found that measures of postformal thinking based on judgment, evaluation, and problem-

solving systematically increase from young adulthood to middle age, indicating growth in relativistic reasoning separate from formal operations (Sinnott, 2009; Commons & Ross, 2008). The two modes exhibit different developmental trajectories, with formal operations reaching mature forms in adolescence while postformal reasoning continues advancing during adulthood in response to life experiences (Labouvie-Vief, 2015). Formal operations, as described by Piaget, involve logical and abstract thinking, such as hypothetical-deductive reasoning and systematic problem-solving. These operations enable individuals to think scientifically and consider multiple possibilities.

Dialectic-relativistic operations, on the other hand, are related to a specific aspect of cognitive development that emerges chronologically during the stage of emerging adulthood. These operations likely involve the ability to consider multiple perspectives, tolerate ambiguity, and synthesize contradictory ideas.

While formal operations are necessary for advanced logical thinking, dialectic-relativistic operations seem to focus more on the complexities and nuances of real-world situations. They may allow individuals to navigate the uncertainties and relativistic nature of knowledge in various domains of life.

However, the exact relationship between these two types of operations requires further investigation. Empirical findings suggest that they might develop in parallel rather than sequentially, indicating that dialectic-relativistic thinking is not necessarily a higher stage than formal operations but a different aspect of cognitive development (Kallio & Marchand, 2012).

The development of postformal thinking in the stage of emerging maturity is important for several reasons. Firstly, it enables individuals to adapt to the complexity of adult life by approaching challenges in a nuanced and flexible manner, considering multiple perspectives and contexts (Labouvie-Vief, 2015). Secondly, it helps individuals overcome the dichotomous thinking specific to adolescence, allowing them to recognize and accept the ambiguity, uncertainty, and relativity of knowledge in various domains of life (Perry, 1970). Additionally, postformal thinking contributes to the development of a mature identity and fosters deeper and more authentic interpersonal relationships by integrating multiple perspectives and conflicting ideas (Hernandez & Iyengar, 2001). Moreover, the skills of postformal thinking, such as dialectic and relativistic reasoning, assist emerging adults in making more informed decisions and solving complex problems, considering the situational context and long-term implications (Blanchard-Fields, 2007). Lastly, postformal thinking is essential for continuous personal and professional development, enabling individuals to learn from experiences, reexamine their beliefs, and constantly update their knowledge (Kuhn, Cheney, & Weinstock, 2000).

Procedure

Research design

The aim of the study was to propose for examination a variant of evaluating postformal thinking in emerging adults in Romania, based on the concept that postformal thinking represents a distinct aspect of cognitive development that begins to emerge during the stage of emerging adulthood, as individuals move beyond the dichotomous thinking characteristic of adolescence. The reliability and construct validity were calculated for the adapted Romanian version of the Post-Formal Thinking Scale for Emerging Adults (PFTSEA).

The study focused on adapting the PFTSEA to the Romanian context and assessing its psychometric properties in a sample of Romanian emerging adults aged 18-26. The adaptation process aimed to ensure that the scale effectively captures the postformal thinking capacities of this specific population while considering cultural and linguistic factors.

Research participants

A total of 420 young individuals between the ages of 18 and 26 (M=22.2±2.5) were randomly selected for the study from the emerging adult population in Romania. Out of these, 268 were students in various academic fields, while the remaining participants were high school graduates.

Measures

1. The Post-Formal Thinking Scale for Emerging Adults (PFTSEA) consists of 16 items, with a five-point Likert scale response format. The scoring range is from 16 to 80 points. All items are directly scored, with higher scores indicating higher levels of post-formal thinking skills.

2. The Critical Thinking Disposition Scale (CTDS; Sosu, 2013) is a tool that measures one's disposition towards critical thinking. This scale consists of 11 items and assesses two underlying factors: critical openness and reflective skepticism.
3. Post-Formal Thought Scale (PTF; Cartwright et.al., 2009). The scale contains 10 items and 3 factors - Multiple Elements, Subjective Choice, and Underlying Complexity.
4. Openness (IPIP - The International Personality Item Pool). The scale contains 30 items and evaluates a personality trait that refers to a person's willingness to experience new things, explore different ideas, and embrace change.
Data analysis was performed with SPSS Statistics 26 and IBM® SPSS® Amos.

Results

The test-retest reliability

The findings of the study demonstrate a satisfactory test-retest reliability (0.78) over a two-week period, providing support for the use of the PFTSEA (Post-Formal Thinking Scale for Emerging Adults) as a tool to monitor cognitive maturation during the transition to postformal thinking in emerging adults.
The study was carried out online, with participants recruited from various universities in Romania. Data collection occurred during the fall semester of 2023, spanning approximately two months.
Participants were invited to complete the PFTSEA through a secure online survey platform. To ensure confidentiality and enable matching of test-retest responses, each participant was provided with a unique access code. The initial administration of the PFTSEA was followed by a second administration two weeks later, allowing for the assessment of test-retest reliability.
The online format of data collection offered several advantages, including the ability to reach a diverse sample of emerging adults from various regions of Romania, the convenience of remote participation, and the efficiency of automated data recording. However, the researchers implemented several measures to ensure data quality, such as including attention check items and monitoring response patterns for potential inconsistencies.
Overall, the online administration of the PFTSEA demonstrated its feasibility and reliability in a digital research context, supporting its potential for wider use in assessing postformal thinking development among Romanian emerging adults.
Principal Components Analysis

The KMO measure of sample adequacy of 0.942 was higher than the recommended value of 0.60, and the results of the Bartlett's test were significant (chi-square = 296.52, $P < .001$), indicating the suitability of the data for conducting principal component analysis.

The results from Principal Components Analysis (PCA) with oblimin rotation provide substantial insights into the structure of the data set comprised of 16 items, especially with the reduction into four distinct factors accounting for a significant portion of the variance (Table 1). The items strongly loading on each factor indicate a good alignment with the thematic labels assigned to each factor. Factor 1 - Dialectical Thinking: Items 1 (.755), 5 (.728), 9 (.645), 13 (.733) all load significantly on this factor, suggesting they measure aspects related to dialectical thinking effectively. Factor 2 - Multiple Perspectives: Items 2 (.723), 6 (.685), 10 (.644), 14 (.704) demonstrate strong loadings, reinforcing that this factor captures elements of considering multiple perspectives. Factor 3 - Complexity: Items 3 (.625), 7 (.685), 11 (.703), 15 (.655) are well represented under this factor, indicating that these items are collectively assessing the complexity aspect of the construct. Factor 4 - Contextual Reasoning: Items 4 (.585), 8 (.658), 12 (.732), 16 (.744) load significantly on this factor, highlighting their role in assessing contextual reasoning skills.

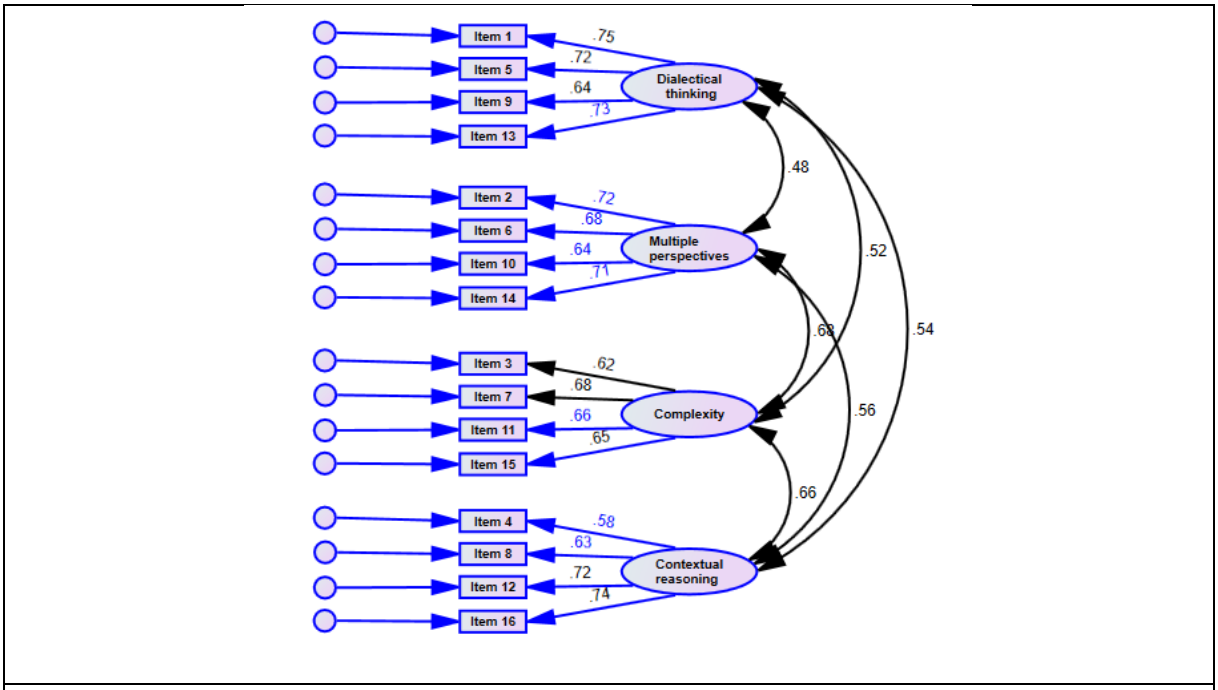
Table 1. Item Means, Standard Deviation and Factor loadings for the Post-Formal Thinking Scale for Emerging Adults (PFTSEA)

Item English/Romanian	Factor 1 Dialectical thinking	Factor 2 Multiple perspectives	Factor 3 complexity	Factor 4 Contextual reasoning
Subscale mean/SD	2.9±1.27	2.7±1.03	2.5±1.1	3.1±1.4
Subscale Variance	18.6%	23.15%	12.3%	14.7%

I 1. I can understand how two opposing ideas both can be partially true (*Pot înțelege cum două idei opuse pot fi parțial adevărate*).	.755			
I 5. I consider multiple sides of an issue, even if they conflict with each other (*Iau în considerare mai multe perspective ale unei probleme, chiar dacă sunt contradictorii*).	.728			
I 9. When analysing problems, I look for compromises that include some aspect of both conflicting perspectives (*Când analizez probleme, caut soluții de compromis care să includă aspecte din ambele perspective conflictuale*).	.645			
I 13. Contradictions do not discourage me but inspire me to find a synthesis of opposing views (*Contradicțiile nu mă descurajează, ci mă inspiră să găsesc o sinteză a opiniilor opuse.)*	.733			
I 2. I try to understand other people's points of view, even if I disagree with them (*Încerc să înțeleg punctele de vedere ale altor persoane, chiar dacă nu sunt de acord cu ele*).		.723		
I 6. Considering different perspectives helps me have a more nuanced understanding of issues (*Luând în considerare diverse perspective, îmi dezvolt o înțelegere mai profundă a problemelor*).		.685		
I 10. I recognize that no single perspective can capture the whole truth (*Recunosc că o singură perspectivă nu poate cuprinde întreagul adevăr*).		.644		
I 14. Exploring different perspectives often leads me to refine or change my own views (*Explorarea diferitelor perspective mă determină adesea să îmi rafinez sau să îmi schimb propriile opinii*).		.714		
I 3. I see how elements within a situation can influence each other in indirect ways (*Văd cum elementele dintr-o situație se pot influența reciproc în mod indirect*).			.625	
I 7. I can recognize patterns and interdependencies in systems with many interacting parts (*Pot recunoaște modele și interdependențe în sisteme cu mai multe părți care interacționează*).			.685	
I 11. I think about how small events and factors might combine to create larger scale effects (*Mă gândesc cum evenimentele și factorii mici pot combina pentru a crea efecte la o scară mai mare*).			.663	
I 15. Analysing root causes allows me to better understand complexity beyond surface issues (*Analizarea cauzelor profunde îmi permite să înțeleg mai bine complexitatea dincolo de aspectele superficiale*)			.655	
I 4. The context of a situation influences how I interpret information (*Contextul unei situații influențează modul în care interpretez informațiile*).				.685
I 8. I can apply knowledge and skills to a variety of new situations (*Pot aplica cunoștințe și abilități într-o varietate de situații noi*).				.638
I 12. Considering different contexts helps me identify limitations or cultural biases in theories (*Luând în considerare diferite contexte, pot identifica limitările sau prejudecățile culturale din teorii*).				.722
I 16. Changing contexts may require adapting or revisiting solutions and perspectives (*Schimbarea contextelor poate necesita adaptarea sau reevaluarea soluțiilor și a perspectivelor*).				.744

Exploratory Factor Analysis

Figure 1. Structural equation modelling results



Source: Authors

Table 2 displays the intercorrelations between factors. Following the factorial analysis, four factors emerged as a result.

1. Dialectical thinking refers to the ability to understand how two opposing ideas can be partially true: considering multiple perspectives of an issue, even if they are contradictory. Individuals with dialectical thinking skills are adept at analysing problems and seeking compromise solutions that incorporate aspects from both conflicting viewpoints. Rather than being discouraged by contradictions, they are inspired to find a synthesis of opposing opinions.

2. Multiple perspectives refers to the willingness and ability to understand other people's points of view, despite disagreement: considering different perspectives to gain a more nuanced understanding of complex issues. Individuals who value multiple perspectives recognize that no single viewpoint can capture the whole truth. Exploring diverse perspectives often leads to the refinement or even a change of one's own opinions.

3. Complexity refers to the recognition of how elements in a situation can indirectly influence each other: the ability to identify patterns and interdependencies in systems with many interacting parts. Individuals who understand complexity think beyond superficial aspects and consider how small events and factors can combine to create effects on a larger scale. They also analyse deep-rooted causes for a deeper understanding of complex phenomena.

4. Contextual reasoning entails recognizing that the context of a situation influences how information is interpreted: applying knowledge and skills to a variety of new situations. Considering different contexts allows individuals to identify limitations or cultural biases in theories. Those with strong contextual reasoning skills understand that changing contexts may require adaptation or re-evaluation of solutions and perspectives. They can navigate and make informed decisions based on the specific circumstances at hand.

Confirmatory Factor Analysis

The hypothesized four-factor PFTSEA model demonstrated good fit: $\chi 2(98) = 112.21$, $p = .153$, CFI=.985, TLI=.981, RMSEA=.028, SRMR=.047. All items loaded significantly on their factors (Table 1).

Reliability

Internal consistency was strong for each PFTSEA subscale ($\alpha > 0.80$) and the full scale ($\alpha = 0.91$) (Table 2).

Discriminant Validity

Inter-factor correlations (Table 2) supported discriminant validity as factors were moderately related but distinct.

Table 2. Cronbach Alpha and Intercorrelations Between Factors in Confirmatory Sample

Subscale	α Cronbach	Dialectical thinking	Multiple perspectives	Complexity	Contextual reasoning
Dialectical thinking	0.84	-			
Multiple perspectives	0.87	0.48	-		
Complexity	0.83	0.52	0.68	-	
Contextual reasoning	0.82	0.54	0.56	0.66	-
PFTSEA	0.91	0.72	0.76	0.82	0.81

Source: Authors

Convergent and Discriminant Validity

The results presented in *Table 3* provide evidence for the convergent and discriminant validity of the Post-Formal Thinking Scales for Emerging Adults (PFTSEA) and its subscales.

Convergent validity is demonstrated by the moderate to high correlations between the PFTSEA and its subscales with the Post-Formal Thought Scale (PTS) and its factors. The PFTSEA total score shows a strong correlation of 0.74 with the PTS, indicating a high degree of convergence between the two measures of postformal thinking. The subscales of the PFTSEA also exhibit substantial correlations with the PTS, ranging from 0.66 to 0.74. Moreover, the PFTSEA subscales demonstrate moderate to high correlations with the specific factors of the PTS, such as Multiple Elements (0.58 to 0.74), Subjective Choice (0.46 to 0.52), and Underlying Complexity (0.65 to 0.76). These findings suggest that the PFTSEA and its subscales are measuring constructs closely related to postformal thinking as assessed by the PTS.

Further evidence of convergent validity is provided by the moderate to high correlations between the PFTSEA and its subscales with the Critical Thinking Disposition Scale (CTDS) subscales of Critical Openness and Reflective Skepticism. The PFTSEA total score correlates 0.64 with Critical Openness and 0.58 with Reflective Skepticism, indicating a substantial relationship between postformal thinking and critical thinking dispositions. The PFTSEA subscales also show moderate correlations with the CTDS subscales, ranging from 0.38 to 0.56.

Discriminant validity is supported by the lower correlations between the PFTSEA and its subscales with the Openness scale from the International Personality Item Pool (IPIP). The correlations range from 0.17 to 0.36, suggesting that while there is some association between postformal thinking and the personality trait of Openness, the PFTSEA is measuring a distinct construct.

Overall, the pattern of correlations in *Table 3* provides strong support for the convergent and discriminant validity of the PFTSEA. The high correlations with the PTS and its factors demonstrate that the PFTSEA is effectively capturing the construct of postformal thinking. The moderate correlations with the CTDS subscales indicate that postformal thinking is related to, but distinct from, critical thinking dispositions. The lower correlations with the IPIP Openness scale suggest that the PFTSEA is not merely measuring a general personality trait, but rather a specific cognitive developmental construct.

Table 3. Convergent and Discriminant Validity

PFTSEA Subscales	**Critical openness (CTDS)**	**Reflective skepticism (CTDS)**	**PTS**	**Multiple Elements (PTS)**	**Subjective Choice (PTS)**	**Underlying Complexity (PTS)**	**Openness (IPIP)**
Dialectical thinking	0.54	0.48	0.66	0.58	0.47	0.72	0.23
Multiple perspectives	0.56	0.44	0.72	0.74	0.52	0.76	0.26
Complexity	0.48	0.54	0.74	0.66	0.51	0.72	0.32
Contextual reasoning	0.46	0.38	0.68	0.62	0.46	0.65	0.17
PFTSEA	0.64	0.58	0.74	0.65	0.54	0.66	0.36

PFTSEA – Post-Formal Thinking in Emerging Adults, PTS – Post-Formal Thought Scale, CTDS - Critical Thinking Disposition Scale, IPIP - International Personality Item Pool

Source: Authors

Discussions

This study aimed to evaluate the psychometric properties of an assessment questionnaire for postformal thinking skills in emerging adults (18-26/29 years). The scale was developed based on J.D. Sinnott's perspective on postformal thinking, which focuses on the idea that individuals can move beyond formal operational thinking, typically associated with adolescence, towards a higher level of cognitive development. Postformal thinking is characterized by an individual's ability to engage in complex, nuanced, and context-dependent reasoning.

According to Sinnott, postformal thinking goes beyond black-and-white thinking, involves the capacity to hold multiple perspectives, tolerate ambiguity, and appreciate the complexity of real-world problems. Postformal thinkers can synthesize information from various sources, consider multiple factors and variables, and make more holistic and flexible decisions. This type of thinking is often found in adults who have accumulated life experience and encountered diverse situations that require them to think beyond the constraints of formal operational thinking. Postformal thinkers are open to new ideas, question assumptions, and seek creative and innovative solutions to problems. Overall, Sinnott's conception of postformal thinking emphasizes the importance of ongoing cognitive development beyond adolescence and highlights the value of flexible, nuanced, and context-sensitive thinking in navigating the complexities of the world.

The present study analysed data from 420 young individuals between the ages of 18 and 26 ($M=22.2\pm2.5$, 53% female) who were randomly selected for the study from the emerging adult population in Romania. Out of these, 268 were students in various academic fields, while the remaining participants were high school graduates. The four-factor structure was tested using confirmatory factor analysis. The model demonstrated a good fit and proposed the instrument for further validation on diverse populations within the emerging adult category. Principal Components Analysis revealed a four-factor structure accounting for 68.8% of the variance. The factors aligned well with the intended theoretical dimensions of dialectical thinking, multiple perspectives, complexity, and contextual reasoning. All items loaded strongly on their primary factor. Confirmatory factor analysis provided further evidence for the validity of the 4-factor PFTSEA model. Fit indices (CFI = .985, TLI = .981, RMSEA = .028, SRMR = .047) indicated good model fit. All items significantly loaded on their specified factors, with standardized loadings ranging from .62 to .76. Reliability analysis found strong internal consistency for each PFTSEA subscale ($\alpha > 0.80$) and the full scale ($\alpha = 0.91$). Inter-correlations between factors provided support for discriminant validity, as the factors were moderately related but distinct.

Additional analyses demonstrated convergent validity through significant correlations (from .58 to .74) between the PFTSEA and other established measures of advanced thinking (PTS and CTDS). Finding lower correlations (from .17 to .36) between the PFTSEA, and a personality measure of Openness (IPIP) helps demonstrate that the PFTSEA is capturing something distinct from general personality traits.

Overall, the combination of exploratory and confirmatory factor analyses provides robust evidence for the factorial validity and reliability of the PFTSEA as an instrument assessing postformal thinking skills in emerging adults. The four dimensions align with the theoretical framework and demonstrate sound psychometric properties. Further research is warranted to confirm the factor structure in additional samples. Implications for assessing and promoting postformal thinking development are discussed.

Limitations of Study

Firstly, it would be recommended to have a more representative sample in terms of education level, background and socio-economic conditions. This would allow generalization of the results to a wider spectrum of individuals and contexts. Second, given that the study was largely conducted in an academic setting, responses may have been influenced by social desirability, which could affect the validity of the results. Third, the structure of the four factors identified should be explored and validated in further studies. This would provide a more detailed understanding of the components of postformal thought. It would be beneficial to examine the construct validity of the scale by correlating the results with several scales measuring postformal thinking skills. This would help confirm the validity and consistency of the measurements used in the study. Also, using self-report data for assessing is an important limitation.

Conclusion

The transition to postformal thinking typically occurs during the period of emerging adulthood (between 18 and 25-29 years old). During this stage, individuals begin to surpass the limitations of formal thinking, which focuses on abstract logic and hypothetical-deductive reasoning. Postformal thinking involves a more relativistic and contextual approach to knowledge, recognizing that truth can be subjective and that multiple perspectives can be valid depending on the context. This transition also involves the development of dialectical thinking, allowing individuals to reconcile seemingly contradictory ideas or perspectives by seeking synthesis and compromise.

As postformal thinking develops, emerging adults become more capable of analysing complex problems, considering a multitude of contextual factors, and applying knowledge flexibly. However, the transition to postformal thinking is not a uniform process and can be influenced by individual, educational, and cultural factors.

The existence of valid instruments that measure the level of development of relativistic-dialectical thinking is beneficial in educational, counselling, and therapeutic settings. This study contributes the development and initial validation of the PFTSEA as a new measure tailored to assess postformal thinking in emerging adults based on a multidimensional theoretical model. This instrument can help monitor the development of postformal thinking skills in this population. Longitudinal studies utilizing tools like the PFTSEA are important to better understand the nature and pace of the transition to maturity, as well as the factors that influence it.

In conclusion, this study provides robust initial validation for the PFTSEA as a psychometrically sound instrument for assessing postformal thinking skills in emerging adults based on exploratory and confirmatory factor analyses. The PFTSEA demonstrates a coherent four-factor structure along with strong reliability and validity evidence. Further research with diverse samples may help confirm the factor structure and refine the instrument.

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