

## Inverse Relationships between Cognitive and Personal-Meaning Characteristics in High-Achieving Students: The Splitting Effect of Developing Competence

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**Abstract:** *Relevance and Background.* Contemporary educational paradigms increasingly recognize competence not as a static accumulation of knowledge, but as a dynamic, integrative system encompassing cognitive, operational, axiological, and experiential components. However, the developmental trajectory of high-level competence may be accompanied by paradoxical effects, including cognitive asynchrony, structural dissociation, and inversion of psychological characteristics. These phenomena remain insufficiently understood, particularly in student populations undergoing intensive professional training. *Aim.* This study investigated the inverse relationships and splitting effects within the cognitive, semantic, and emotional dimensions of intellectual-personal resources among university students with varying levels of developing competence. *Methods.* The research employed a multi-phase sequential design with 418 engineering, economics, and IT students (aged 18–25 years,  $M=21.1$ ). Comprehensive psychodiagnostic assessment included measures of conceptual abilities (Problem Formulation, Ideal Computer, Cognitive Composition of Concept, Three-Word Generalization, Conceptual Synthesis), basic beliefs (World Assumptions Scale), cognitive position (World Construction), and emotional intelligence (Hall's EI Test, Lyusin's EmIn Test). Data analysis integrated cluster analysis, factor analysis (principal components method), and non-parametric statistics (Mann-Whitney U, Kruskal-Wallis H tests). *Results.* Distinct inversion effects were identified across all three research phases. In high-achieving student clusters (6.3% of sample), exceptional conceptual abilities coexisted with inverse relationships between semantic capabilities and beliefs in world benevolence, as well as between conceptual experience and self-worth perceptions (Factor 3: 24.2% variance). Cognitive position analysis revealed paradoxical associations: higher cognitive openness correlated negatively with questioning ability ( $U_{emp}=70.5$ ,  $p\leq 0.05$ ), while strategic planning and differentiated evaluation showed inverse relationships with cognitive position openness (Factor 3: 87.0% cumulative variance). Emotional intelligence assessment demonstrated splitting effects: highly developed semantic abilities were associated with underdeveloped emotional regulation ( $U_{emp}=479$ ,  $p\leq 0.05$ ), indicating verbal-emotional ambivalence. The findings substantiate the phenomenon of "resource splitting" wherein elevated cognitive competence does not ensure proportional development of emotional and personal-meaning characteristics. This dissociation manifests as inconsistent structural relationships, cognitive asynchrony, and multidimensional inversions that challenge linear models of competence development. The observed patterns align with theoretical frameworks positing that high intellectual achievement may paradoxically correlate with reduced integration across psychological subsystems. These effects likely reflect educational specialization processes that prioritize conceptual development while neglecting emotional and meaning-making capacities. *Conclusion.* Developing competence in high-achieving students is characterized by non-linear dynamics and structural inversions that require reconceptualization of educational practices. The splitting effect identified across cognitive, semantic, and emotional domains suggests that optimal competence development necessitates balanced attention to all resource components. Future research should investigate longitudinal trajectories and identify predictors of adaptive versus maladaptive splitting patterns.

**Keywords:** Developing Competence, Splitting Effect, Inversion Effect, Intellectual-Personal Resource, Conceptual Abilities, Emotional Intelligence, Basic Beliefs, Cognitive Asynchrony

### 1. Introduction

Societal expectations of modern young people as primary drivers of social development are substantially elevated. The capacity for self-improvement and competence development throughout professional formation constitutes a

critical determinant of youth success in modern conditions. Consequently, investigation of individual resources, conditions for competence development (including academic and professional achievement), and emerging

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characteristics that align or fail to align with societal and state requirements has become increasingly pertinent. A crucial research direction involves examining effects emerging within students' individual resources during competence formation. The significance of such investigations is underscored by the dual necessity of: (a) identifying characteristics of successfully developing competence that ensure effective academic, professional, and personal self-actualization; and (b) timely detection, prevention, and correction of undesirable effects, deformations, and contradictory manifestations arising during competence development.

Contemporary theoretical frameworks conceptualize competence not as a repository of knowledge, but as an integrated, evolving capacity enabling effective functioning in authentic, dynamic situations. Competence represents a distinctive organizational structure of knowledge, skills, values, and attitudes ensuring individual success across professional and personal domains (Nesterenko, 2024). Critical differentiation from "competency" as predetermined knowledge and skill requirements is essential, because competence embodies the actual qualitative level of their acquisition and implementation.

A growing body of research challenges the traditional separation of cognitive and socio-emotional development in gifted and high-achieving populations. Sternberg (2024) argues that socio-emotional development is not a separate concomitant of giftedness but an integral part of it, and that giftedness itself should be viewed as an interaction between the person, the task, and the situation rather than a purely internal property. This perspective aligns with the resource-integrative approach adopted in our study, wherein competence comprises cognitive, operational, axiological, and experiential components that are dynamically interrelated.

Several primary interpretations of competence can be identified: as a personality quality, as a personal disposition, and as an integrative characteristic of intellectual-personal resources. Bachynska, Semenyshena, and Sheychuk (2024) conceptualize competence as an integral personality quality encompassing knowledge, skills, experience, values, and attitudes that manifest holistically in action. Sokolova (2021) frames competence as readiness and capacity to apply knowledge, skills, and abilities in real situations with accountability for outcomes.

In our theoretical framework, competence represents a resource-integrative characteristic, a distinctive organizational structure and

readiness (capacity) for applying knowledge, skills, abilities, and fundamental capabilities that determine individual success (Kibalchenko & Eksakusto, 2024). This competence structure comprises several key components: cognitive (knowledge, erudition, understanding), operational (intentions and actions, skills, behavior, volition, motivation), and axiological (goals, values, attitudes, responsibility). An additional "experiential" component encompasses problem-solving, collaboration, and success experiences. Thus, throughout competence development, individuals progressively acquire capacity for goal identification, problem formulation, innovation, creative endeavor, decision-making accountability, meaningful and value-based engagement in activities (including cognitive activities), continuous knowledge updating, information mastery, and achievement of success (Kibalchenko & Eksakusto, 2024).

A fundamental aspect of competence investigation is its dynamic, developmental nature: content and competence levels evolve with individual development, societal change, and professional transformation (Nesterenko, 2024). Within Sternberg's conceptual framework of developing expertise, expertise and competence are conceptualized not as static outcomes but as developmental processes characterized by continuous cognitive and personal resource restructuring (Sternberg, 2024). High competence levels correlate with professional competitiveness, career advancement, and adaptive capacity (Škrinjarić, 2022). Critical significance attaches to the capacity for knowledge and skill transfer to novel situations, adapting across diverse academic, professional, and life contexts (Wong, 2020; Pevneva & Filimonchik, 2022).

The dynamic, developmental aspect of competence increasingly attracts scholarly attention across scientific domains. Analysis of contemporary trends in developing competence research reveals several primary dynamic models applied in psychology and education.

*First*, the "cubic" model is a multidimensional framework in which competence is assessed not along a single linear scale but across multiple interrelated dimensions forming a conditional "cube" (Nash & Larkin, 2012; Rodolfa et al., 2005). *Second*, the competence-oriented model is an educational framework in which the key outcome is not material mastery volume or learning duration but formation of specific competencies: autonomous action capacity, decision-making, situation navigation, and practical knowledge application (Zimnyaya, 2003; Khutorskoy, 2026; Fouad et al., 2009).

*Third*, the sustainability development model views competence as an integrative system encompassing systematic thinking, predictive capacity, criticality, responsibility, collaboration capacity, reflexivity, and value self-determination (Wilhelm, Förster, & Zimmermann, 2019). *Fourth*, the competence as cognitive disposition model considers competence not merely as skill aggregates but primarily as a system of stable cognitive dispositions, predispositions toward specific thinking and information processing modes. Competence relates less to knowledge possession than to capacity for organizing cognitive activity in particular ways (Koeppen et al., 2008; Leutner et al., 2015).

These models converge in departing from linear competence conceptualization as simple knowledge and skill accumulation. Across all approaches, competence is viewed as a multidimensional, dynamic, and evolving system whose formation accompanies changes in cognitive, behavioral, motivational-value, and reflexive components. Consequently, these models serve an important explanatory function in understanding nonlinearity and inversion mechanisms in competence development, enabling interpretation of temporary performance decrements, indicator inconsistencies, cognitive instability, and developmental asynchrony not as deficits but as natural stages of competence system complexification and reorganization.

Contemporary research (Kholodnaya, 2012, 2020, 2021; Shcheblanova, 2015; Ushakov, 2016) has identified several systematic patterns: with increasing IQ, a systematic decrease occurs in the strength of relationships between individual cognitive ability characteristics. Negative and non-linear relationships have been detected among gifted children's characteristics: as IQ increases, negative relationships emerge between individual cognitive ability characteristics. Children with high IQ levels frequently experience learning difficulties, manifesting various personal problems: emotional imbalance, heightened emotional susceptibility, excessive perfectionism, inflated self-esteem, unwillingness to confront obstacles, peer conflicts, and related challenges.

A recent meta-analysis by Ogurlu (2021), synthesising 81 effect sizes from 17 studies, provided systematic evidence that gifted individuals exhibit higher emotional intelligence than their non-gifted peers, but only when emotional intelligence is measured as an ability (e.g., MSCEIT) rather than as a trait (e.g., self-report questionnaires). This finding is particularly relevant to our study, as it

suggests that the discrepancy in emotional competence between high-achieving and typically-developing students may be obscured by the choice of measurement model. Notably, Ogurlu (2021) found that gifted individuals' advantage in emotional intelligence is modest ( $g = 0.120$ ,  $p = .023$ ) and emerges primarily in performance-based assessments of emotional knowledge, not in self-perceived emotional competence. This aligns with our Stage 3 finding of verbal-emotional ambivalence—where highly developed semantic abilities coexisted with underdeveloped emotional regulation—suggesting that high-achieving students may possess declarative knowledge about emotions without necessarily demonstrating effective emotional regulation in practice.

Empirical evidence from diverse cultural contexts corroborates these patterns. Rocha et al. (2024), in a Portuguese sample, found that high-ability students exhibited significantly lower scores in emotional regulation compared to typically-developing peers, along with greater dissatisfaction in peer relationships and school experiences. Similarly, Kuan et al. (2021) documented that gifted learners at the higher education level frequently experience overexcitabilities (intellectual, emotional, imaginative, psychomotor, and sensory) that are linked to perfectionism, insomnia, anxiety, and depressive symptoms. These findings suggest that the cognitive-emotional dissociation observed in our sample is not culturally bound but reflects a general phenomenon in high-ability populations.

Non-linear relationships among conceptual, creative, and cognitive abilities have been demonstrated (Trifonova, 2015). Multidimensional (non-linear) creativity has been substantiated through splitting effects in high and low psychometric creativity indicators (Kholodnaya, 2020, 2021), reflection and areflection patterns (Kholodnaya, 2022), and asynchrony signs in students' emotional and social characteristic development (Kochetova & Klimakova, 2021). Kholodnaya (2021) concluded that both low integration of diverse cognitive abilities and excessive specialization indicate diminished intellectual and personal resources. Work with students, particularly first and second years, reveals (based on our experiential evidence) that educational processes exhibit, on one hand, situations approximating excessive specialization, and on the other, signs of uneven development (declining indicators in some domains alongside increasing indicators in others) within individual intellectual-personal resources

(cognitive, emotional, meaning-related, and other blocks).

The scarcity of research on high-ability students in higher education has been systematically documented by Nannings et al. (2025), who conducted a comprehensive systematic review of 118 studies. Their review identified 46 distinct social-emotional and educational needs, categorised into six domains: Self-Perception, Motivation, and Performance Expectations; Psychological Well-Being and Emotional Regulation; Social Integration and Acceptance; Curriculum Design and Instructional Strategies; Academic and Social Support Systems; and Teacher Training and Pedagogical Expertise. Critically, they found that emotional regulation and psychological well-being received significantly less attention in interventions compared to academic motivation, despite their known role in preventing burnout and fostering long-term engagement. This gap directly parallels our finding that high-achieving students in technical disciplines exhibit cognitive-emotional dissociation, underscoring the need for holistic approaches that integrate emotional development into competence-building curricula.

Accumulating evidence thus indicates that high intellectual and competence characteristic development is accompanied not only by individual indicator growth but also by complex restructuring of relationships among cognitive, personal, and metacognitive components. These findings establish theoretical foundations for investigating developing competence as a non-linear phenomenon accompanied by temporary deformations, resource restructuring, and changing structural interrelationships among competence components. Based on theoretical analysis, the following research hypothesis was advanced: among students with varying competence levels (professional-academic activity success), inversion effects will be detected within the structure of interrelationships among cognitive, meaning-related, and emotional components of intellectual-personal resources, manifesting as unevenness, inconsistency, and multidirectionality of diagnostic indicators of developing competence.

The aim is to study of inversion effects in diagnostic results across cognitive, meaning-related, and emotional blocks of students' intellectual-personal resources within the framework of developing competence.

## 2. Method

### 2.1. Participants

The total research sample comprised 418 engineering, economics, and IT students aged

18–25 years ( $M=21.1$  years; 174 males, 244 females). Participants were recruited from Southern Federal University, Russian Federation, and provided informed consent in accordance with institutional ethical guidelines.

### 2.2. Measures and Instruments

*Theoretical Methods:* Theoretical problem analysis; synthesis and systematization of theoretical and experimental research.

*Empirical Measures:* The following psychodiagnostic instruments were administered across sequential research phases:

- Problem Formulation (Kholodnaya, 2012): assesses capacity for problem identification and formulation.
- Ideal Computer (Demidova, Gelfman, & Kholodnaya, 2015): measures cognitive flexibility and metacognitive abilities.
- Cognitive Composition of Concept (Kholodnaya, 2012): semantic analysis of the concept "resource".
- Three-Word Generalization (Kholodnaya, 2012): assesses categorical generalization abilities.
- Conceptual Synthesis (Kholodnaya, 2012): measures conceptual integration capacities.
- World Assumptions Scale (WAS) (Janoff-Bulman, 1989) in O. Kravtsova's adaptation: assesses basic beliefs about world benevolence, meaningfulness, justice, and self-worth.
- World Construction (Savin, 2012): evaluates cognitive position characteristics.
- Emotional Intelligence Test (Hall, 1999): measures emotional awareness, management, empathy, and social skills.
- Emotional Intelligence Test (EmIn) (Lyusin, 2006): assesses intrapersonal and interpersonal emotional intelligence dimensions.

### 2.3. Procedure

The research was conducted across three sequential stages:

*Stage 1* ( $n=134$ ) examined relationships between conceptual structures and basic beliefs among 134 students (76 males, 58 females; age range 19–22 years,  $M=20.5$ ). Measures administered: Problem Formulation, Cognitive Composition of Concept, Conceptual Synthesis, and World Assumptions Scale. The results of this phase were partially reported in our earlier work (Kibalchenko, Eksakusto, & Chegodaeva, 2021).

*Stage 2* ( $n=180$ ) investigated interrelationships between cognitive position and basic beliefs among 180 students (83 males, 97 females; age range 18–25 years,  $M=21.5$ ). Measures administered: Ideal Computer, World Construction, and World Assumptions Scale.

Stage 3 (n=104) examined conceptual ability characteristics and their relationships with emotional intelligence among 104 Southern Federal University students (age range 18–20 years, M=19.4). Measures administered: Cognitive Composition of Concept, Three-Word Generalization, Problem Formulation, Hall Emotional Intelligence Test, and Lyusin EmIn Test. Factor analysis in this phase followed the approach described in our previous methodological studies (Kibalchenko & Shilova, 2021, 2022).

#### 2.4. Data Analysis

Statistical analyses were performed using IBM SPSS Statistics Subscription Trial for MacOS. Data processing employed:

- Cluster analysis (within-groups linkage method) for identifying homogeneous student groups.
- Factor analysis (principal components method) with varimax rotation for multidimensional relationship identification.
- Non-parametric statistics: Mann-Whitney U test for between-group comparisons; Kruskal-Wallis H test for multiple group comparisons.

### 3. Results

#### 3.1. Conceptual Structures and Basic Beliefs Interrelationships (Stage 1)

Cluster analysis identified five student groups characterized by distinct basic beliefs and semantic, categorical, and conceptual abilities (conceptual structures) (see Table 1).

**Table 1.** Descriptive Characteristics of Cluster Groups (Stage 1)

Cluster	Sample Proportion	Conceptual Structures Score	Basic Beliefs Score
1	29.3%	2.32	2.21
2	16.7%	3.20	2.90
3	31.4%	3.40	3.31
4	16.4%	4.40	4.39
5	6.3%	6.00	5.02

The smallest cluster (5th: 6.3% of sample) significantly differed from all other groups in conceptual structure formation level. These five clusters represented homogeneous student groups for determining interrelationship specificity between basic beliefs and conceptual structures: low, medium-low, medium, high, and outstanding indicators. These results reflect symmetrical level-based but asymmetric student distribution across clusters, consistent with previous research identifying very high conceptual structure results in small participant groups (Volkova, Kalugin, & Rusalov, 2022; Kholodnaya, 2012).

Statistical analysis revealed significant between-group differences across multiple characteristics: conceptual thinking ( $h_{emp}=57.08496$ ,  $p \leq 0.01$ ), belief in world benevolence ( $h_{emp}=21.89975$ ,  $p \leq 0.01$ ), justice and event randomness ( $h_{emp}=22.55463$ ,  $p \leq 0.01$ ), self-worth ( $h_{emp}=22.77368$ ,  $p \leq 0.01$ ), and basic beliefs overall ( $h_{emp}=53.5336$ ,  $p \leq 0.01$ ). Conceptual ability levels increased correspondingly with conceptual structure and basic belief development ( $h_{emp}=13.76415$ ,  $p \leq 0.01$ ).

Factor Analysis in Outstanding-Performance Group: Factor analysis in the outstanding conceptual structure/basic beliefs group revealed a cumulative variance of 100%, with

three factors accounting for 41.4%, 75.8%, and 100% respectively (KMO=0.93,  $p=0.015$ ).

*Factor 1* crystallized around indicators of world meaningfulness beliefs, mental representation of the "resource" concept, involuntary categorization, and an inverse categorical generalization indicator. These students utilized independently identified generic categories while demonstrating meaningful orientation toward the world and constructing their intellectual-personal resource image.

*Factor 2* comprised directly interrelated indicators of world benevolence beliefs and conceptual synthesis, inversely related to quantitative/qualitative cognitive composition of the "resource" concept. This group achieved the highest conceptual ability formation levels, reflecting maximum conceptual structure development.

*Factor 3* was constituted by multidirectional indicators of conceptual experience (stimulus "resource"), self-worth beliefs, event management capacity, and luck degree, reflecting signs of self-dissatisfaction and dissatisfaction with personal achievements.

These findings revealed both concordant patterns and contradictory effects (inversion effects). Students with high and outstanding indicators demonstrated capacity for

transcending standard conceptual frameworks while simultaneously exhibiting contradictory interrelationships between individual intellectual-personal resource characteristics. Specifically, semantic ability indicators showed contradiction with belief in world benevolence, and conceptual experience contradicted self-worth perceptions. These results reflect student representations of personal resources as distinctive and non-standard, potentially perceived as illogical only within conventional normative expectations. However, deep integration of cognitive and personal characteristics establishes a foundation for reflection, meaning-making regarding personal capacities, and their alignment with required standard orientations.

### 3.2. Cognitive Position and Basic Beliefs Interrelationships (Stage 2)

Cluster analysis identified four groups: Group 1 (n=50, 27%), Group 2 (n=21, 12%), Group 3 (n=39, 21%), and Group 4 (n=73, 40%). Mann-Whitney U tests revealed significant differences across groups on cognitive position openness, cognitive decentration, justification and elaboration, and basic beliefs.

Group 1 (50 students, 27%) exhibited stable indeterminate cognitive position with fewer categorical questions ( $U_{krit}=393$ ,  $U_{emp}=160$ ,  $p \leq 0.05$ ) and more factual questions ( $U_{krit}=693$ ,  $U_{emp}=1225$ ,  $p \leq 0.05$ ). They demonstrated cognitive potential actualization ( $U_{krit}=393$ ,  $U_{emp}=308$ ,  $p \leq 0.05$ ) and decentration. They evidenced less belief in human goodness but significantly greater belief in world justice ( $U_{krit}=1225$ ,  $U_{emp}=343.5$ ,  $p \leq 0.05$ ). Notably, this group exhibited result inversion: higher "justification" scores ( $U_{emp}=308$ ,  $p \leq 0.05$ ) despite absent open cognitive position students.

Group 2 (21 students, 12%) demonstrated indeterminate cognitive position with individual open cognitive position signs: significantly more categorical questions ( $U_{emp}=70.5$ ,  $p \leq 0.05$ ), representing another inversion indicator in cognitive position. However, in non-standard situations, they proved less effective and demonstrated greater belief in human goodness ( $U_{emp}=79$ ,  $p \leq 0.05$ ).

Group 3 (39 students, 21%) similarly exhibited indeterminate cognitive position with increasing cognitive orientation toward the world through open cognitive position indicator growth. However, these students significantly less frequently compared subjective achievement evaluations with objective feedback ( $U_{emp}=186.5$ ), demonstrated weaker self-worth beliefs ( $U_{emp}=245.5$ ), and lower perceived control capacity ( $U_{emp}=223$ ).

Group 4 (73 students, 40%) was characterized by predominance of

heterogeneous cognitive positions (indeterminate, closed, open) in greater quantity than other groups. They formulated fewer subjectivized questions ( $U_{emp}=109$ ) and more categorical questions ( $U_{emp}=115$ ), initiating significantly more questions overall ( $U_{emp}=93$ ). Despite low world justice beliefs, they maintained self-worth and self-control beliefs.

Factor analysis across groups revealed inversion signs in each factor structure ( $KMO=0.81$ ,  $p=0.02$ ).

*Group 1* (cumulative variance: 83.5%): predominantly indeterminate cognitive position with activation of latent decentration capacities in critical/indeterminate situations; higher planning tendency correlated with higher decentration.

*Group 2* (cumulative variance: 97.6%): inverse relationship between objectification, categoricalness, and cognitive position openness, and question formulation, paraphrasing, and summarizing capacities. This suggests a more creative, less consciously processed world perception mode.

*Group 3* (cumulative variance: 87.0%): inverse relationship between self-control, objectification, justification, and elaboration/decentration. Their world interest appeared driven not by self-development motivation but by self-control desire relative to events. Strategic planning, differentiated evaluation, and conscious decision-making showed inverse relationships with categorical questions and cognitive position openness.

*Group 4* (cumulative variance: 79.2%): predominantly indeterminate-with-open-tendency and open cognitive positions. Justification, elaboration, and decentration showed direct relationships. Inversion signs emerged: cognitive position level increases correlated with impulsivity in question formulation and increased belief in worldly randomness.

### 3.3. Conceptual Abilities and Emotional Intelligence Interrelationships (Stage 2)

Cluster analysis identified three relatively homogeneous groups: Group 1 (N=23, 22%), Group 2 (N=69, 66%), Group 3 (N=12, 12%), reflecting normal distribution tendencies.

Mann-Whitney U tests revealed significant differences ( $0.000 \leq p \leq 0.01$ ) in overall emotional intelligence between Groups 1 and 2 ( $U_{emp}=4$ ,  $p \leq 0.000$ ), Groups 1 and 3 ( $U_{emp}=0$ ,  $p \leq 0.000$ ), and Groups 2 and 3 ( $U_{emp}=1$ ,  $p \leq 0.000$ ). Conceptual abilities were significantly higher in Group 1 compared to Group 2 ( $U_{emp}=479$ ,  $p \leq 0.05$ ) and Group 3 ( $U_{emp}=69$ ,  $p \leq 0.01$ ).

Factor analysis revealed the following interrelationships ( $KMO=0.78$ ,  $p=0.03$ ).

*Group 1* (cumulative variance: 25.938%, 45.738%, 64.835%, 81.736%): inverse relationships emerged between the emotional-regulatory triad (emotional flexibility, voluntary emotion management, integrative emotional intelligence) and conceptual structures (categorical, conceptual, conceptual abilities), contrasting with a block comprising understanding others' emotions, empathy, support readiness, and high-level semantic abilities.

*Group 2* (cumulative variance: 23.197%, 42.534%, 57.862%, 69.931%): predominantly harmonious interrelationships emerged; however, medium-level emotional awareness and high-level semantic abilities demonstrated inverse relationships, indicating verbal-emotional ambivalence.

*Group 3* (cumulative variance: 37.411%, 60.934%, 76.815%): predominantly multidirectional combinations of underdeveloped emotional and conceptual characteristics, accompanied by developed semantic and sufficiently developed categorical abilities.

#### **4. Discussion**

The findings across three sequential research stages provide compelling evidence for the phenomenon of splitting and inversion effects in the structural organization of intellectual-personal resources among university students. These results substantiate our hypothesis that developing competence in high-achieving students is characterized by non-linear, multidirectional relationships among cognitive, meaning-related, and emotional components. The observed patterns demand careful theoretical interpretation and carry significant implications for educational practice.

The concept of splitting as applied to intellectual-personal resources requires theoretical elaboration. Drawing on Kholodnaya's (2020, 2021, 2022) framework, splitting refers to the dissociation of resource components whereby high development in one domain coexists with underdevelopment or paradoxical organization in another. Our findings extend this conceptualization by demonstrating that splitting manifests not merely as uneven development but as systematically inverse relationships, such that advancement in cognitive capacities may paradoxically correlate with diminished emotional or meaning-making resources. This phenomenon aligns with contemporary understanding of intellectual development as a multidimensional, non-linear process (Ushakov

& Grigoriev, 2016; Shcheblanova, 2015). The negative correlations observed between high-level conceptual abilities and basic beliefs about world benevolence (Stage 1), between cognitive openness and question-formulation capacity (Phase 2), and between semantic abilities and emotional awareness (Stage 3) collectively suggest that excellence in specific cognitive domains may occur at the expense of integrative psychological functioning.

A critical interpretation of our findings concerns the role of educational specialization in producing splitting effects. The disproportionate emphasis on conceptual skill development within engineering, economics, and IT curricula, while neglecting emotional and meaning-making capacities, may inadvertently generate structural imbalances in intellectual-personal resources. This interpretation is consistent with Kholodnaya's (2021) observation that both low integration of diverse cognitive abilities and excessive specialization indicate diminished intellectual and personal resources. Our Stage 1 finding that only 6.3% of students achieved outstanding conceptual structure levels while simultaneously exhibiting dissatisfaction with personal achievements suggests that educational environments may foster competence without commensurate personal meaning development. Similarly, Stage 2 results indicate that students with stronger cognitive openness may paradoxically demonstrate reduced capacity for question formulation, potentially reflecting an educational context that values answers over inquiry. The Stage 3 finding of verbal-emotional ambivalence (Group 2) is particularly noteworthy: students with well-developed semantic abilities nevertheless demonstrated underdeveloped emotional awareness. This pattern suggests that specialized training in technical domains may promote analytical capacities while neglecting the emotional competencies essential for effective interpersonal functioning and well-being (Kochetova & Klimakova, 2021).

Rather than interpreting inversion effects as deficits, they may be understood as developmental indicators, manifestations of the complex, non-linear reorganization characteristic of high-level competence development (Nesterenko, 2024; Škrinjarić, 2022). From this perspective, the temporary contradictions and structural disjunctions observed across our phases represent natural features of developing expertise (Sternberg, 2000), wherein resource restructuring yields transient patterns of asynchrony. The inverse relationships identified in Factor 3 (Stage 1),

between conceptual experience and self-worth beliefs, exemplify such developmental tension. Students capable of sophisticated conceptualization simultaneously exhibited self-dissatisfaction, suggesting that advanced cognitive capacities enable critical self-appraisal that temporarily destabilizes positive self-regard. Such patterns, while potentially concerning from a well-being perspective, may also represent productive disequilibrium (Piaget, 1970) that motivates further development. Similarly, Stage 2 Group 1 results, showing higher justification scores despite absent open cognitive position, suggest latent capacities activated by non-standard situations. This pattern aligns with dynamic systems perspectives (Thelen & Smith, 1994) wherein developmental capacities may exist in latent form, emerging only under appropriate contextual conditions.

Empirical evidence from a neighbouring post-Soviet context corroborates the link between perfectionism and academic outcomes. Kassymbekova et al. (2024), in a study of 261 Kazakhstani university students, found that perfectionism subscales exhibited differential associations with academic performance. Excessively high personal standards showed the strongest positive correlation with grade point average ( $r = 0.51$ ), followed by worry about mistakes and doubts about actions ( $r = 0.45$ ). However, students' self-evaluations were consistently lower than their objective academic achievements (mean self-assessment: 77.75 vs. actual GPA: 83.9 on a 100-point scale), indicating subjective dissatisfaction despite high performance—a pattern reminiscent of our Stage 1 finding that outstanding conceptual abilities coexisted with self-dissatisfaction and inverse relationships between conceptual experience and self-worth perceptions. This suggests that perfectionist strivings may drive academic excellence while simultaneously undermining psychological well-being, a dynamic consistent with the splitting effect we observed.

The concept of “productive tension” has been recently operationalized by Liu et al. (2026) in a study of Chinese university students. They found that high-achieving students exhibited a cognitive-emotional configuration where negative affects such as self-doubt and learning anxiety functioned as significant positive drivers of academic success within the Confucian-heritage cultural context. This parallels our finding that outstanding conceptual abilities coexist with self-dissatisfaction and inverse relationships between semantic capabilities and beliefs in world benevolence (Factor 3, Stage 1). Such patterns suggest that the inversion effects we observed may reflect a

culturally embedded mechanism wherein critical self-appraisal and emotional tension catalyze cognitive development, rather than merely indicating maladjustment.

Across all three phases, consistent patterns emerged suggesting systematic inversion phenomena. First, cognitive-emotional dissociation was evident: students with advanced conceptual and semantic abilities frequently demonstrated underdeveloped emotional intelligence, consistent with findings on emotional giftedness asynchrony (Kochetova & Klimakova, 2021). Second, meaning-cognition tension appeared: higher cognitive capacities correlated with more complex, sometimes contradictory meaning-making patterns, echoing research on basic belief complexity in high-IQ populations (Volkova, Kalugin, & Rusalov, 2022). Third, structural disintegration was observed: factor structures in high-performing groups consistently revealed inverse relationships absent in lower-performing groups, supporting the resource splitting hypothesis. These patterns suggest that the development of expertise may follow a less-is-more trajectory (Bereiter & Scardamalia, 1993), wherein simplification of certain resource components enables focused advancement in others. However, such specialization carries costs, including reduced integrative functioning and potential vulnerability to stress or interpersonal difficulties.

One potential mechanism underlying the observed splitting effects may involve dissociation as an adaptive cognitive style. Cristofanelli et al. (2023) demonstrated that in healthy adolescents, increased emotional dysregulation was associated with higher levels of non-pathological dissociation, which in turn predicted enhanced processing speed and even higher intelligence quotient scores. They proposed that a dissociative cognitive style – involving focused attention and compartmentalisation of emotional distress – can paradoxically boost cognitive performance under certain conditions. Translating this to our findings, high-achieving students who exhibit cognitive-emotional dissociation may be employing a similar non-pathological dissociative strategy: they effectively “compartmentalise” emotional concerns to preserve cognitive resources for complex conceptual tasks. This interpretation offers a novel explanation for the inverse relationships we observed between semantic abilities and emotional awareness (Stage 3) and between conceptual experience and self-worth perceptions (Stage 1)

Our findings carry significant implications for higher education. *First*, the identification of splitting effects underscores the importance of holistic development approaches that attend equally to cognitive, emotional, and meaning-making dimensions. Currently, technical curricula may inadvertently promote cognitive excellence at the expense of personal resource development. *Second*, the detection of inversion effects in high-performing students suggests that educational interventions should address psychological integration alongside skill development. Programs incorporating emotional intelligence training, reflective practice, and meaning-making opportunities may help students integrate diverse resource components. *Third*, the pattern of latent capacities activated by non-standard situations (Stage 2, Group 1) suggests that educational environments should incorporate authentic, challenging contexts that reveal and develop hidden resources. Problem-based learning, interdisciplinary projects, and real-world engagement may promote capacity activation and integration.

Several limitations warrant acknowledgment. The cross-sectional design prevents conclusions about developmental trajectories; longitudinal research is needed to determine whether splitting effects resolve or persist over time. The sample, while substantial, comprised primarily technical students; extension to humanities and social science disciplines would clarify domain-specificity of observed patterns. Additionally, the measures employed, while psychometrically validated in Russian contexts, may not fully capture the complexity of constructs like cognitive position or conceptual abilities. Future research should investigate longitudinal trajectories of splitting effects across undergraduate and postgraduate education, predictors of adaptive versus maladaptive inversion patterns, interventions designed to promote resource integration, and cultural and institutional factors moderating splitting phenomena.

The systematic review by Nannings et al. (2025) identified a critical gap in teacher-focused interventions: only one out of 118 reviewed studies addressed teacher training for supporting high-ability students in higher education, despite instructional approaches for gifted learners being one of the most frequently identified educational needs. This gap resonates with our observation that educational specialisation in technical disciplines may inadvertently promote cognitive excellence at the expense of personal resource development. The relative absence of faculty development

programmes targeting the socio-emotional needs of high-achieving students suggests that universities may be overlooking a crucial leverage point for mitigating the splitting effects we identified. Future research should investigate the effectiveness of teacher training programmes in fostering integrated cognitive-emotional competence development, particularly in STEM and technical fields where the emphasis on conceptual skills may be most pronounced.

## 5. Conclusion

This investigation provides robust evidence for splitting and inversion effects in the structure of intellectual-personal resources among university students with varying levels of developing competence. Across three sequential research stages, consistent patterns of dissociation emerged wherein advanced cognitive capacities coexisted with underdeveloped emotional and meaning-making characteristics. These findings challenge linear models of competence development and support conceptualization of expertise as a non-linear, multidimensional process characterized by temporary asynchrony and structural reorganization.

The theoretical significance of these findings lies in their extension of the "splitting effect" (Kholodnaya, 2020, 2021, 2022) to the domain of developing competence in higher education. Our results suggest that resource splitting is not merely an academic phenomenon but systematically manifests in actual student populations, particularly among those achieving high or outstanding competency levels.

Practically, these findings underscore the importance of holistic educational approaches that simultaneously develop cognitive, emotional, and meaning-making capacities. Educational institutions bear responsibility not only for skill development but also for fostering integrated, resilient, and personally meaningful competence. The identification of inversion effects opens promising avenues for research on resource integration, resilience factors, and competence development interventions.

In conclusion, developing competence in high-achieving students is characterized by complex, paradoxical relationships among cognitive, semantic, and emotional resources. Understanding and addressing these effects will be essential for fostering sustainable, fulfilling, and effective competence development in contemporary higher education contexts.

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could be construed as potential conflicts of interest.

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### Highlights:

- The "splitting effect" of developing competence manifests as inverse relationships between cognitive, semantic, and emotional

resource components in high-achieving students.

- Exceptional conceptual abilities coexist with underdeveloped emotional regulation and self-worth dissatisfaction, revealing cognitive-emotional dissociation.
- Educational specialization in technical disciplines may inadvertently promote cognitive excellence at the expense of personal-meaning and emotional development.
- Inversion effects are systematic and multidimensional, challenging linear models of competence development and supporting a non-linear, dynamic systems perspective.
- Holistic educational approaches that balance cognitive, emotional, and meaning-making capacities are essential for sustainable competence development.

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## Развивающаяся компетентность студентов: эффекты инверсии

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**Резюме.** *Актуальность.* В современных образовательных парадигмах компетентность всё чаще рассматривается не как статичный набор знаний, а как динамическая интегративная система, включающая когнитивные, операциональные, аксиологические и опытные компоненты. Однако траектория развития компетентности высокого уровня может сопровождаться парадоксальными эффектами, такими как когнитивная асинхрония, структурная диссоциация и инверсия психологических характеристик. Эти феномены остаются недостаточно изученными, особенно в студенческих популяциях, проходящих интенсивную профессиональную подготовку. *Цель.* Исследование было направлено на изучение обратных взаимосвязей и эффектов расщепления в когнитивном, семантическом и эмоциональном измерениях интеллектуально-личностного ресурса у студентов вузов с разным уровнем развивающейся компетентности.

*Методы.* Исследование выполнено в многоэтапном последовательном дизайне с участием 418 студентов инженерных, экономических и IT-специальностей в возрасте от 18 до 25 лет (средний возраст 21,1 года). Комплексная психодиагностическая оценка включала методики изучения понятийных способностей (формулировка проблем, идеальный компьютер, когнитивный состав концепта, обобщение трёх слов, понятийный синтез), базовых убеждений (шкала базовых убеждений), познавательной позиции (конструирование мира) и эмоционального интеллекта (тест Холла, опросник ЭМИн Д. В. Люсина). Для обработки данных использовались кластерный анализ, факторный анализ (метод главных компонент) и непараметрические статистические критерии (U-критерий Манна–Уитни, H-критерий Краскела–Уоллиса). *Результаты.* На всех трёх этапах исследования были выявлены отчётливые эффекты инверсии. В группах студентов с высокими достижениями (6.3 % выборки) исключительные понятийные способности сосуществовали с обратными взаимосвязями между семантическими способностями и убеждениями в благосклонности мира, а также между понятийным опытом и представлениями о собственной ценности (Фактор 3: 24.2 % дисперсии). Анализ познавательной позиции обнаружил парадоксальные ассоциации: более высокая открытость познавательной позиции отрицательно коррелировала со способностью формулировать вопросы ( $U_{\text{emp}}=70.5$ ,  $p \leq 0.05$ ), тогда как стратегическое планирование и дифференцированная оценка показали обратные связи с открытостью познавательной позиции (Фактор 3: 87,0 % кумулятивной дисперсии). Оценка эмоционального интеллекта продемонстрировала эффекты расщепления: высокоразвитые семантические способности сочетались с недостаточной эмоциональной регуляцией ( $U_{\text{emp}}=479$ ,  $p \leq 0.05$ ), что указывает на вербально-эмоциональную амбивалентность.

Полученные данные подтверждают феномен «расщепления ресурса», при котором повышенная когнитивная компетентность не обеспечивает пропорционального развития эмоциональных и личностно-смысловых характеристик. Эта диссоциация проявляется в противоречивых структурных взаимосвязях, когнитивной асинхронии и многомерных инверсиях, которые ставят под сомнение линейные модели развития компетентности. Наблюдаемые паттерны согласуются с теоретическими подходами, постулирующими, что высокие интеллектуальные достижения могут парадоксально коррелировать со сниженной интеграцией между психологическими подсистемами. Эти эффекты, вероятно, отражают процессы образовательной специализации, которые делают акцент на развитии понятийных способностей в ущерб эмоциональным и смыслообразующим компетенциям. *Заключение.* Развивающаяся компетентность у высокоуспевающих студентов характеризуется нелинейной динамикой и структурными инверсиями, что требует пересмотра образовательных практик. Эффект расщепления, выявленный в когнитивной, семантической и эмоциональной сферах, свидетельствует о том, что оптимальное развитие компетентности требует сбалансированного внимания ко всем компонентам ресурса. В будущих исследованиях целесообразно изучить лонгитюдные траектории и выявить предикторы адаптивных и дезадаптивных паттернов расщепления.

**Ключевые слова:** развивающаяся компетентность, эффект расщепления, эффект инверсии, интеллектуально-личностный ресурс, понятийные способности, эмоциональный интеллект, базовые убеждения, когнитивная асинхрония

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