



PRE-SERVICE TEACHERS' CONCEPTIONS OF "BEING GIFTED" AND "BEING TALENTED": A MULTIMODAL SEMIOTIC APPROACH

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Abstract

Teachers' conceptions of gifted and talented students significantly influence their nomination skills and teaching practices. However, research indicates that these conceptions are often incorrect or inconsistent, even among teachers who have completed coursework in gifted and talented education. This study aimed to explore pre-service teachers' conceptions of "being gifted" and "being talented" using a qualitative case study research design with 35 participants. Data were collected using a multimodal instrument that allowed participants to express their mental representations through various modes such as writing, drawing, and mathematical symbols. The collected data were then analyzed using a multimodal semiotic analysis protocol developed specifically for this purpose. The results revealed that participants predominantly associated "being gifted" with cognitive abilities such as high IQ, scientific inquiry, and mathematics, while "being talented" was linked to cognitive, affective, and psychomotor abilities, including high performance in arts and sports. The findings highlight the need for pre-service training programs that promote scientific conceptions of giftedness and talent, addressing stereotypes and lay misconceptions.

Keywords: gifted education, gifted students, multimodal analysis, talented students, teacher conception

Introduction

Gifted students are a special group with distinctive educational needs that span both cognitive and non-cognitive domains. Supporting these learners effectively requires not only academic enrichment but also attention to their socio-emotional development, motivation, and affective characteristics. These students benefit from specialized educational provisions tailored to their unique learning profiles (Davis et al., 2014; Subotnik et al., 2011). Teachers play a pivotal role in addressing these needs, as their conceptions of "giftedness" and "talent" significantly impact their nomination decisions and instructional strategies (Godor, 2019; Golle et al., 2023). Accurate conceptions are crucial for identifying gifted students early, fostering positive peer interactions, creating an inclusive classroom climate, and employing effective teaching practices (Baudson & Preckel, 2016; Missett et al., 2014). This underscores the importance of exploring teachers' conceptions to enhance teacher training and better support gifted and talented students.

In this vein, numerous studies have investigated teachers' knowledge, attitudes, and beliefs about giftedness, talent, and gifted/talented students, revealing significant misconceptions and inconsistencies. For example, Sumpter and Sternevik (2013) found that pre-service teachers often attribute giftedness to both cognitive and non-cognitive traits, such as high intelligence, creativity, and personality features. Similarly, Altıntaş and İlgun (2016) reported that teachers associate giftedness with creativity, academic performance, and congenital traits, but their perceptions are often shaped by stereotypes and myths. Heyder et al. (2018) developed

a knowledge test for assessing teachers' understanding of giftedness and found widespread misconceptions, even among experienced teachers, which could hinder effective teaching practices. These misconceptions often result in either idealized or negative attitudes towards gifted students, as demonstrated in studies by Troxclair (2013) and Baudson and Preckel (2016). According to Heyder et al. (2018), teachers' conceptions encompass both knowledge and attitudes, with the former influencing the latter. These studies imply that teachers' knowledge can originate from diverse sources, including scientific literature, personal experiences, and cultural representations in media, which may perpetuate stereotypes and myths. Voss et al. (2011) emphasized that teachers' conceptions should align with scientific pedagogical-psychological knowledge (PPK), encompassing knowledge about learners, learning processes, and instructional strategies. Such knowledge is critical for fostering professional competence in teaching diverse student populations, including gifted and talented learners.

"Gifted" and "Talented" Concepts in Theory

The concepts of giftedness and talent have been explored through various theoretical lenses, with four primary approaches dominating the discourse: domain-general definitions, domain-specific definitions, system models, and developmental models. The domain-general approach, grounded in early studies by Terman, equates giftedness with general intelligence, often measured by high IQ scores (Terman, 1925). This perspective views giftedness as a one-dimensional construct centered on cognitive ability. In contrast, the domain-specific approach, championed by Thurstone, challenges the idea of a single "g-factor" of intelligence (Thurstone, 1938). It emphasizes independent cognitive abilities, such as verbal comprehension, numerical aptitude, and spatial reasoning, allowing for a more diverse understanding of giftedness. Third, system models, such as Renzulli's Three-Ring Model, take a multidimensional approach by incorporating creativity, task commitment, and above-average ability as necessary components of giftedness (Renzulli, 2005). These models highlight that without all elements in balance, giftedness may not manifest. Lastly, developmental models, like Gagné's Differentiated Model of Giftedness and Talent (DMGT), distinguish between innate abilities (gifts) and cultivated skills (talents) (Gagné, 2013). Gagné emphasizes that talent emerges through the transformation of natural abilities into domain-specific expertise via systematic practice and environmental support. The developmental models collectively underlined the multifaceted nature of giftedness and talent, with distinctions between potential and performance, cognitive and non-cognitive traits, and innate versus developed abilities. The developmental models shed a light on the talent development processes and the internal and external factors affecting the transformation of genesis-based skills into talents in performance fields through appropriate educational provisions (Merello, 2024).

In general, gifted students are typically characterized by exceptional cognitive abilities, such as creativity, academic achievement, problem-solving, and curiosity and non-cognitive abilities (Davis et al., 2014; Eysink et al., 2017). Non-cognitive attributes, including motivation, autonomy, and social adaptability, also play a significant role in distinguishing them from their peers (Heyder et al., 2018; Tourreix et al., 2023). Talented individuals, on the other hand, are often seen excelling in specific domains like sports, arts, or leadership, showcasing psychomotor skills and creative potential (Gagné, 2013). While the terms "gifted" and "talented" are often used interchangeably, these theoretical models suggest nuanced differences, which are essential for tailoring educational approaches to meet students' unique needs and understanding the talent development processes. In this context, Gagné's model posits that natural abilities (gifts) are transformed into talents in specific performance or occupational areas through a well-designed educational process that integrates internal and external factors, with teachers playing a critical role (Gagné, 2013).

Teachers' Conceptions

Teachers' conceptions of giftedness play a pivotal role in shaping their ability to identify and address the needs of gifted students (Bildiren, 2018; Golle et al., 2023; Şahin & Levent, 2015). These conceptions encompass both cognitive knowledge and affective beliefs, which influence their attitudes, classroom practices, and overall effectiveness in teaching gifted learners. Research highlights the importance of pedagogical–psychological knowledge (PPK) as a foundation for understanding the diverse cognitive and non-cognitive traits of gifted students, including motivation, creativity, and social-emotional needs (Heyder et al., 2018; Voss et al., 2011). Despite its significance, many teachers hold misconceptions about giftedness, often equating it solely with academic achievement or high IQ, while overlooking other attributes. These misconceptions are frequently rooted in stereotypes or inadequate or inappropriate training, which can lead to inconsistent practices in identifying and supporting gifted students. For example, Heyder et al. (2018) found that even experienced teachers often focus on academic traits while neglecting social or emotional factors. Similarly, societal stereotypes portray gifted students as either intellectually superior or socially maladjusted, further shaping teachers' beliefs and practices. Such narrow views can hinder inclusive practices and perpetuate inequities, as teachers may fail to recognize gifted students who do not conform to these stereotypes (Baudson, 2016; Carman, 2011). Troxclair (2013) highlighted that teachers' attitudes—whether positive or negative—significantly influence their strategies and interactions with gifted learners, affecting their ability to foster supportive classroom environments. While positive attitudes generally correlate with more effective teaching practices, misconceptions can lead to biases in student identification and instruction. Conflicting perspectives, such as the harmony hypothesis (which views gifted students as well-rounded) and the disharmony hypothesis (which highlights emotional or social challenges), further complicate teachers' conceptions and approaches (Baudson, 2016). Ultimately, personal experiences, cultural influences, and limited exposure to evidence-based training contribute to the persistence of these misconceptions, underscoring the need for comprehensive teacher education to address these gaps.

Multimodal Semiotic Approach to Examining Conceptions

Commonly used methods of exploring teachers' conceptions, such as interviews or questionnaires, often fail to capture the implicit, non-verbalized dimensions of their understanding. This study employs a multimodal semiotic approach (Jewitt et al., 2016), which integrates diverse modes of expression—written language, visual imagery, and mathematical symbolism—to provide a comprehensive view of teachers' mental representations. This approach is employed parallel to Karmiloff-Smith' (1992) Representational Redescription Theory, which posits that knowledge exists at both implicit and explicit levels, necessitating methods that go beyond verbal articulation. Multimodal analysis enables the study of ideational meaning (content and attributions), interpersonal meaning (attitudes and values), and textual meaning (coherence and structure) (Ayik, 2021). For example, teachers' use of visual or symbolic representations can reveal implicit biases or stereotypes that may not surface through verbal explanations. By analyzing teachers' multimodal expressions of “gifted” and “talented” constructs, this study aims to uncover hidden dimensions of their conceptions, providing insights into how these views can be refined through targeted training.

Theoretical Framework

This study is guided by Gagné's Differentiated Model of Giftedness and Talent (DMGT), which provides a robust theoretical foundation for distinguishing between natural abilities

(gifts) and systematically cultivated skills (talents). According to Gagné, giftedness represents innate aptitudes that span four domains: intellectual, creative, socio-affective, and sensorimotor (Gagné, 2013). These natural abilities exist as raw potential, which, when nurtured through environmental factors and deliberate practice, transform into talent, characterized by high-level performance in a specific domain, such as academics, arts, sports, or leadership. This framework underscores the importance of recognizing both the inherent potential and the developmental trajectory required to achieve excellence. In this study building on the DMGT, this study evaluates pre-service teachers' conceptions of "being gifted" and "being talented" by examining the following dimensions:

1. **Attributed Learning Skills:** Teachers' conceptions of giftedness often focus on cognitive abilities such as problem-solving, creativity, and academic performance. These skills are complemented by non-cognitive traits, including motivation, curiosity, and socio-emotional adaptability. This study explored which cognitive, affective, and psychomotor abilities participants attribute to gifted and talented students and how these attributions align with theoretical models like DMGT.

2. **Utterances or Appearances:** Gifted and talented students are often identified through observable behaviors, such as exceptional academic performance, creative expression, or leadership abilities. This part is related to how teachers depict or show teacher in doing something.

3. **Occupational Fields:** Gagné's model emphasizes that talents manifest in specific domains or occupational fields, ranging from the arts and sciences to athletics and leadership. This study explored how pre-service teachers associate giftedness and talent with particular professional or academic pathways, reflecting their implicit beliefs about the long-term potential of gifted individuals.

4. **Attitudes Toward Giftedness and Talent:** Teachers' attitudes, shaped by their conceptions, significantly influence how they engage with gifted students in the classroom. This study examines how pre-service teachers articulate these behaviors and how their descriptions align with the harmony or disharmony hypotheses. The harmony hypothesis posits that gifted students excel in both cognitive and non-cognitive domains, while the disharmony hypothesis suggests they may face socio-emotional or behavioral challenges (Baudson, 2016). This study evaluated whether participants view gifted students as well-rounded and harmonious or socially and emotionally fragile, reflecting either positive or negative biases.

Aims and Research Questions

Despite the inclusion of coursework on gifted and talented education in many teacher preparation programs, persistent misconceptions among pre-service teachers remain a concern (Carman, 2011; Persson, 1998). These misconceptions often stem from culturally embedded stereotypes, a lack of exposure to scientific models, and limited real-world experience with gifted learners. Prior research exploring teacher conceptions has primarily relied on interviews, surveys, and metaphor-based tasks, methods that focus on linguistically articulated and explicit knowledge (Reis-Jorge et al., 2021). However, such approaches may not fully capture the nuanced, and sometimes implicit, understandings that shape how teachers perceive and respond to giftedness.

Drawing on Karmiloff-Smith's (1992) representational redescription theory, it is important to recognize that knowledge can exist across different levels of consciousness, including forms that are not readily accessible through verbal explanation. This has significant methodological implications: limiting research to linguistic modes risks overlooking critical aspects of pre-service teachers' mental representations. As Heyder et al. (2018) noted, pedagogical-psychological knowledge is multifaceted, and its expression may extend beyond

language. To address this limitation, the current study adopted a multimodal semiotic approach (Baldry & Thibault, 2010), enabling participants to express their ideas using a variety of semiotic resources, including language, visual imagery, and symbolic representations such as mathematical notation. This framework allowed for a richer and more holistic understanding of how giftedness and talent are conceptualized by future educators.

This study is also motivated by a second major gap in the literature: the interchangeable use of the terms “gifted” and “talented”, both in research and educational practice. While often conflated, these terms have distinct meanings in contemporary talent development theories. Gagné’s (2013) DMGT made a clear distinction between gifts—innate, natural aptitudes—and talents, which are developed systematically over time through learning, practice, and environmental support. The failure to distinguish between these concepts may contribute to confusion about the nature of ability, as well as about how educators should identify and nurture different forms of potential.

Against this backdrop, the present study explored pre-service teachers’ conceptions of “being gifted” and “being talented” using Gagné’s DMGT as a theoretical foundation. By combining this model with a multimodal methodological design, the study sought to generate insights into both the content of these conceptions and the forms through which they are expressed.

Based on this rationale, the study aimed to address the following research questions:

1. How do pre-service teachers conceptualize “being gifted” in terms of attributed learning skills, observable utterances, occupational fields, and attitudes?
2. How do pre-service teachers conceptualize “being talented” in terms of attributed learning skills, observable utterances, occupational fields, and attitudes?
3. What modes and semiotic resources do pre-service teachers utilize to express their conceptions of “being gifted” and “being talented”?

Research Methodology

Research Design

This study employed a qualitative case study design to investigate how pre-service mathematics teachers conceptualize the constructs of “being gifted” and “being talented.” A case study was chosen because it allows for an in-depth, context-sensitive exploration of a bounded phenomenon—in this case, the participants’ multimodal representations of giftedness and talent within their pre-service training context (Yin, 2018). The study is theoretically grounded in social semiotics and the principles of multimodality, which view communication as occurring through the orchestration of multiple semiotic modes, each offering distinct affordances for meaning-making (Jewitt et al., 2016; Kress, 2010). This framework supports the belief that individuals express and externalize knowledge not only through language but also through visuals, symbols, and spatial design. Multimodal inquiry was thus used to capture a fuller spectrum of participants' conceptions—both explicit and implicit.

Participants

The study sample consisted of 35 pre-service mathematics teachers enrolled in the final year of their undergraduate program at the Faculty of Education at a public university in Turkey. Among the participants, 57% were male and 43% female. All participants were preparing to become middle school mathematics teachers and had completed a year-long school internship as part of their teacher training. Participants had completed two relevant courses prior to this

study: Educational Psychology and Mathematics Education for Gifted/Talented Students. While the Educational Psychology course did not include content on giftedness, the latter course introduced various theoretical models of giftedness and talent (e.g., domain-general, domain-specific, system, and developmental models). However, the course predominantly emphasized cognitive attributes and observable classroom behaviors such as learning speed, analytical thinking, and academic creativity. Limited attention was given to affective or socio-emotional traits. Participants had completed this course one term prior to the data collection phase.

Procedure

The data were collected during the spring semester of the 2022–2023 academic year. Prior to data collection, participants were informed of the study's purpose, their rights to voluntary participation, and the confidentiality of their responses. Written informed consent was obtained from all participants.

Each participant received two blank A4 sheets and a set of colored pencils. They were instructed as follows:

"You have two blank sheets of paper. On the first sheet, please express what you understand by the concept of 'being gifted,' and on the second, your understanding of 'being talented.' You are free to use writing, drawing, symbols, or any combination of these to communicate your thoughts. There are no right or wrong answers—please feel comfortable expressing your ideas in whatever way feels most natural to you"

The activity was designed to be open-ended in order to encourage the natural expression of both verbal and non-verbal ideas. Participants were given one hour to complete their responses and were encouraged to engage freely with the task. Afterward, participants attended a brief debriefing session, where ethical procedures were reiterated, and questions were addressed.

Data Collection

The primary data collection instrument was a multimodal, semi-structured task designed to elicit participants' conceptions using three primary semiotic modes: written language (LM), visual imagery (VIM), and mathematical symbolism (MSM). This instrument was developed based on the theoretical principles of social semiotics (Kress, 2010) and multimodal text analysis (Baldry & Thibault, 2010). Each mode offers distinct possibilities for expressing knowledge:

- Written Language Mode (LM): Offers explicit, verbalized conceptual understanding.
- Visual Imagery Mode (VIM): Facilitates metaphorical, symbolic, or emotional representation.
- Mathematical Symbolism Mode (MSM): Enables abstract reasoning and disciplinary-specific expression in mathematics and other sciences.

By allowing participants to draw upon these different modes, the instrument provided an opportunity to externalize implicit mental representations and express complex, layered meanings that may not emerge through commonly used verbal data collection methods.

Data Analysis

To examine how pre-service teachers conceptualize the constructs of "being gifted" and "being talented," the participants' written and visual responses were analyzed using a structured approach grounded in multimodal semiotic analysis. This analytical method allows researchers

to interpret how meaning is constructed through the combination of multiple communicative modes, including language, images, symbols, and layout. Each participant produced two static multimodal texts—one for “being gifted” and one for “being talented.” These texts incorporated three primary semiotic modes: written language (LM), visual imagery (VIM), and mathematical symbolism (MSM). This multimodal design was informed by the framework of Baldry and Thibault (2010), who argued that each mode provides distinct affordances for meaning-making within an externalized conception. Written language tends to convey abstract and analytical thoughts; visual imagery captures metaphorical and emotional ideas; and mathematical or symbolic notations allow for precise, discipline-specific expression. The simultaneous use/orchestration of these modes enabled participants to articulate both explicit and implicit understandings of the target concepts.

To guide the analysis of these complex texts, the study employed a Multimodal Semiotic Analysis Protocol (MSAP), which was developed specifically for this research. The MSAP is based on the principles of Systemic Functional Theory (SFT) (Halliday & Matthiessen, 2014), a linguistic model that views communication as fulfilling three broad and interrelated metafunctions:

1. Ideational Meaning: This aspect of the analysis focused on the content and subject matter of the participants' representations. Specifically, it examined:

- The types of learning skill domains attributed to gifted or talented individuals (e.g., cognitive, affective, psychomotor).
- Observable actions or utterances, such as behaviors, symbols, or language that suggest how gifted or talented individuals might act or perform.
- Associated occupational fields, including careers or domains (e.g., science, music, sports) implied in the representation.

2. Interpersonal Meaning: This dimension explored the attitudes, emotions, and values expressed in the participants' texts. These were categorized as:

- Attitudes: Positive, neutral, or negative orientations toward giftedness or talent.
- Values: The degree of importance attributed to giftedness or talent (significant, neutral, or insignificant).
- Graduation: The intensity or strength of these attitudes and values, which was operationalized by the number of modes used in expressing them (e.g., use of both image and text may reflect stronger emotional investment).

3. Textual Meaning: This metafunction dealt with the structural and compositional aspects of the multimodal texts. It evaluated how well the different semiotic modes (e.g., text and imagery) were integrated, whether the representation was coherent, and whether the design elements supported the intended meanings. It also considered layout, spatial organization, and the interplay between modes.

Although the primary analysis was qualitative, the use of the MSAP enabled researchers to systematically code and categorize the data, which were then summarized using descriptive statistics (frequencies and distributions) to identify patterns across participants (See Table 1). This helped in visualizing the overall trends in how participants conceived of the two constructs.

Table 1
Text Analysis Protocol

		Ideational Meaning			Interpersonal Meaning			Textual Meaning
Modes	LM	Learning Skill Domain	Appearance	Occupational field	Feeling	Value	Graduation	Modes
	VIM							
	MSM							

Trustworthiness

To ensure the reliability and validity of the data analysis tool, a systematic procedure was implemented. The Multimodal Semiotic Analysis Protocol (MSAP) for analyzing functional meanings was developed based on theoretical and empirical research in gifted/talented education and multimodal semiotic analysis mentioned above, establishing the tool's validity. Reliability was tested using intra-rater and inter-rater reliability procedures suggested by Rui and Feldman (2012). For intra-rater reliability, the same researcher analyzed two texts twice, with a one-week interval, to assess consistency. For inter-rater reliability, two experienced researchers independently analyzed the same two texts, comparing their categorical codes for similarity and consistency. Cohen's Kappa test was employed to measure agreement between codes. The reliability scores for both procedures are presented in Table 2.

Table 2
Kappa Results of Intra-rater and Inter-rater Reliability

	Ideational Meaning			Interpersonal Meaning			Textual Meaning
	Learning Skill Domain	Appearance	Occupational Field	Feeling	Value	Graduation	Modes
Intra-rater Reliability							
Text 1	.775	.729	.626	.715	.763	.919	.875
Text 2	.759	.816	.841	.875	.863	.929	.915
Inter-rater Reliability							
Text 1	.685	.629	.676	.763	.669	.836	.835
Text 2	.719	.716	.741	.675	.663	.843	.875

This study's methodology was designed to enable a deep and multifaceted exploration of pre-service teachers' conceptions of giftedness and talent. By integrating a multimodal data collection instrument, a theoretically grounded analysis framework, and rigorous reliability procedures, the research ensured both conceptual depth and methodological rigor. This approach provided the necessary tools to uncover both the explicit and implicit dimensions of participants' conceptions—laying the foundation for a rich and meaningful interpretation of the findings presented in the next section.

Research Results

Of the 35 participants, 33 created multimodal texts to express their conceptions of "being gifted" and "being talented," while 2 created monomodal texts (only language mode). The analysis focused on three areas: (1) characterizations and attributions related to learning skills, utterances, and occupational fields (ideational meaning); (2) teachers' attitudes toward the terms (interpersonal meaning); and (3) the compositional richness of their texts (textual meaning).

Ideational Meaning

1. *Attributed Skills*

Figure 1 below shows the attributed learning skill domain for the term "being gifted". 28 participants with LM, and 29 participants with VIM, related "being gifted" with only the cognitive learning skill domain. With LM, 4 participants related the construct with both cognitive and affective learning skill domains. Furthermore, most of the participants deployed the three modes, and the main learning skill domain attributed to "being gifted" is the cognitive learning domain. The psychomotor learning skill domain was not attributed and related to "being gifted". This data shows that the majority of the participants equate "being gifted" with intellectual skills.

Figure 1

Attributed Skills to the "Gifted" Construct in Modes

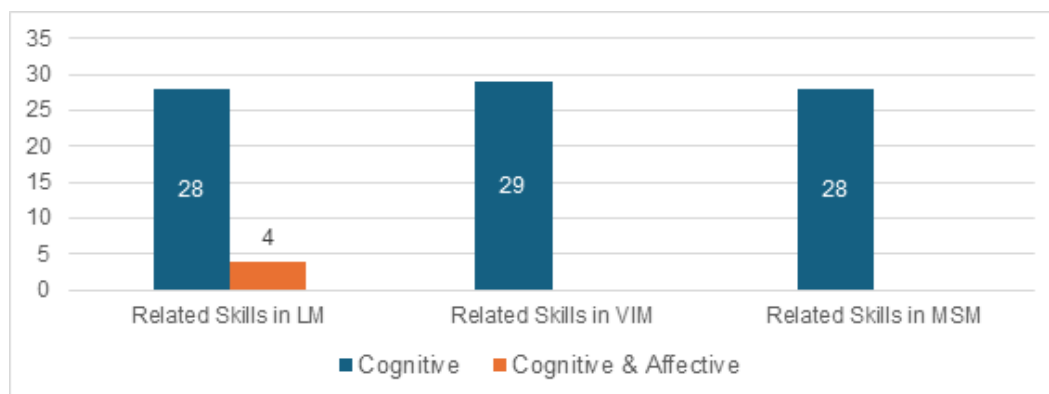
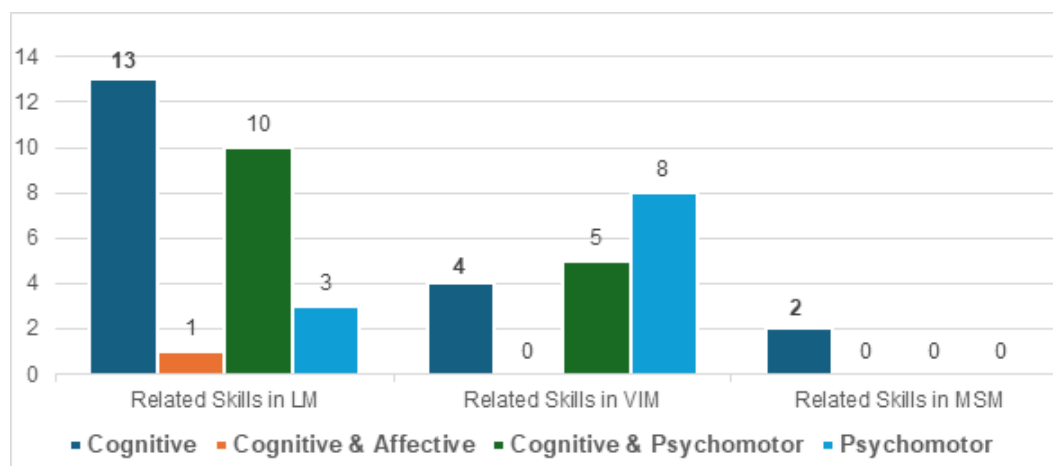


Figure 2 shows different results compared to Figure 1, showing greater variety in the learning skill domains associated with "being talented" and differences in the modes used to construct meaning. For LM, 13 participants associated "being talented" with cognitive and psychomotor skills, 10 with only cognitive skills, 3 with only psychomotor skills, and 1 with cognitive and affective skills. VIM linked "being talented" to cognitive skills for 8 participants, to cognitive and psychomotor skills for 5 participants, and to only cognitive skills for 4 participants. MSM was rarely used, with only 2 participants associating "being talented" with the cognitive learning skill domain. In comparison to "being gifted," which participants primarily associated with cognitive learning skill domains, "being talented" was related to all three domains—cognitive, psychomotor, and affective—with greater emphasis on psychomotor skills. Additionally, MSM was used less frequently to express conceptions of "being talented."

Figure 2
Attributed Skills to the "Talented" Construct in Modes



2. Utterance

For “being gifted,” LM featured the greatest variety of utterances, with “high IQ” (18) as the dominant theme, reflecting a domain-general view equating giftedness with intelligence (See Figure 3). Other frequent utterances included creativity (7), problem-solving (6), high learning speed (6), divergent thinking (4), and academic success (3). In VIM, the most observed portrayals included a “thinking kid” (14), calculating (9), brain structure (6), and a “working brain” (4) (See Figure 4). In MSM, “calculating” (14) and arithmetic (6) were the most common, with calculating linked to solving mathematical or scientific problems and arithmetic referring to basic operations (See Figure 4). Less frequent utterances included discovery, curiosity, reasoning, and reading, while artistic skills and social interactions were rarely mentioned. For “being talented,” LM predominantly expressed “high performance” or “success in any field” (16), followed by creativity (5). Other utterances included precocity, playing sports, performing arts, and abstract thinking. In VIM, participants often depicted “playing a musical instrument” (8), “painting” (8), and “playing a sports game” (6), with less frequent references to singing, dancing, or “thinking kid” (3 each). MSM included only two cases of “calculating” attributed to “being talented.” In summary, “being gifted” is primarily associated with cognitive abilities such as problem-solving and academic success, while “being talented” is linked to performance in arts or sports. The variety and choice of semiotic resources across modes reveal distinct mental representations of these constructs. This finding contradicts perspectives that view “gifted” and “talented” as interchangeable terms, emphasizing the nuanced differences in how participants internalize and express these concepts. Figure 5 shows the occupational fields attributed to “gifted” and “talented”. The data shows that “gifted” and “talented” terms are attributed to different professional fields, in which fields related to science are opted for “gifted” and fields related to arts and sports are generally attributed to “talented.”

Figure 3
Utterances of "Gifted" and "Talented" Students in LM Mode

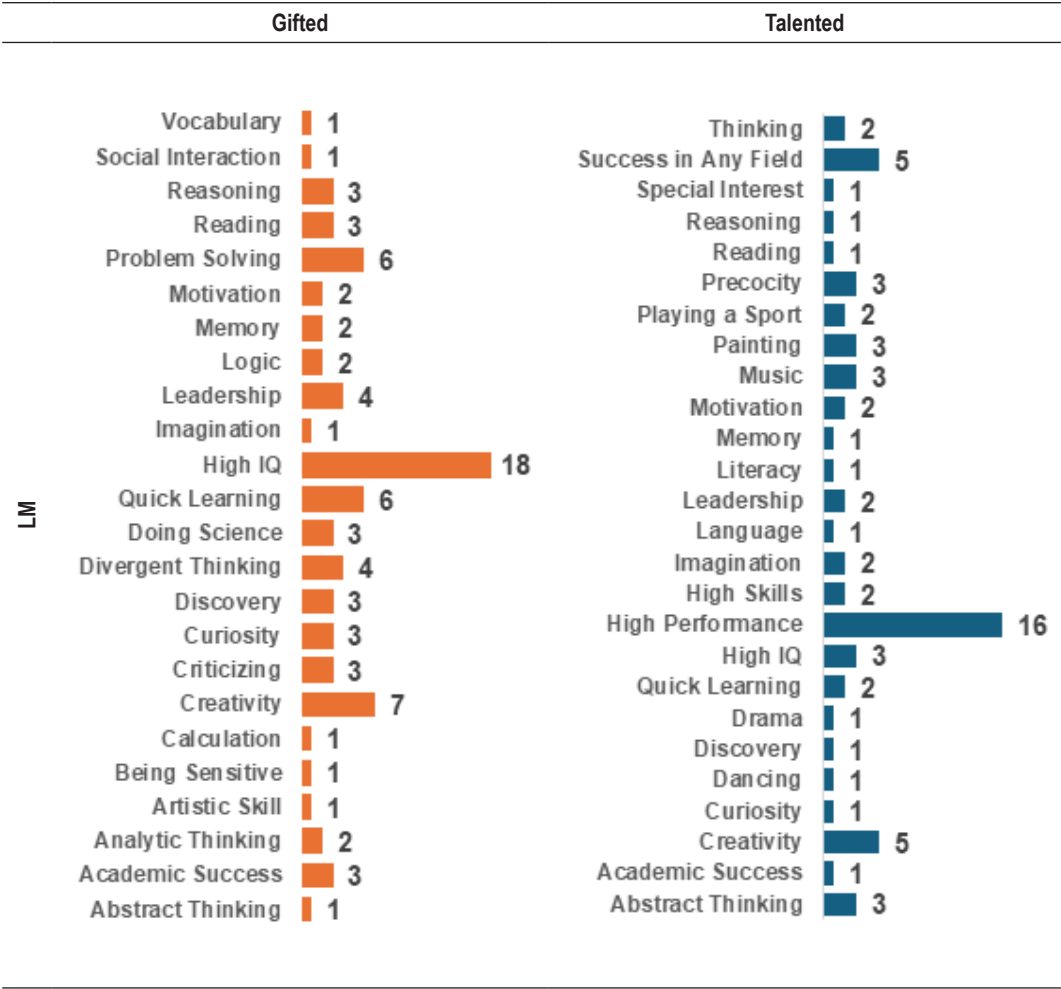
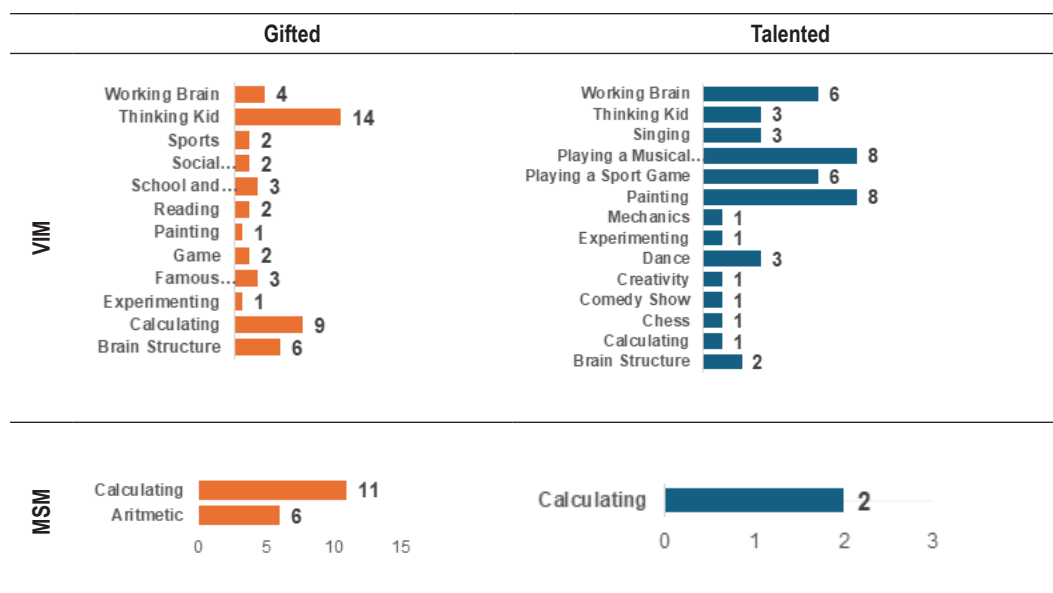
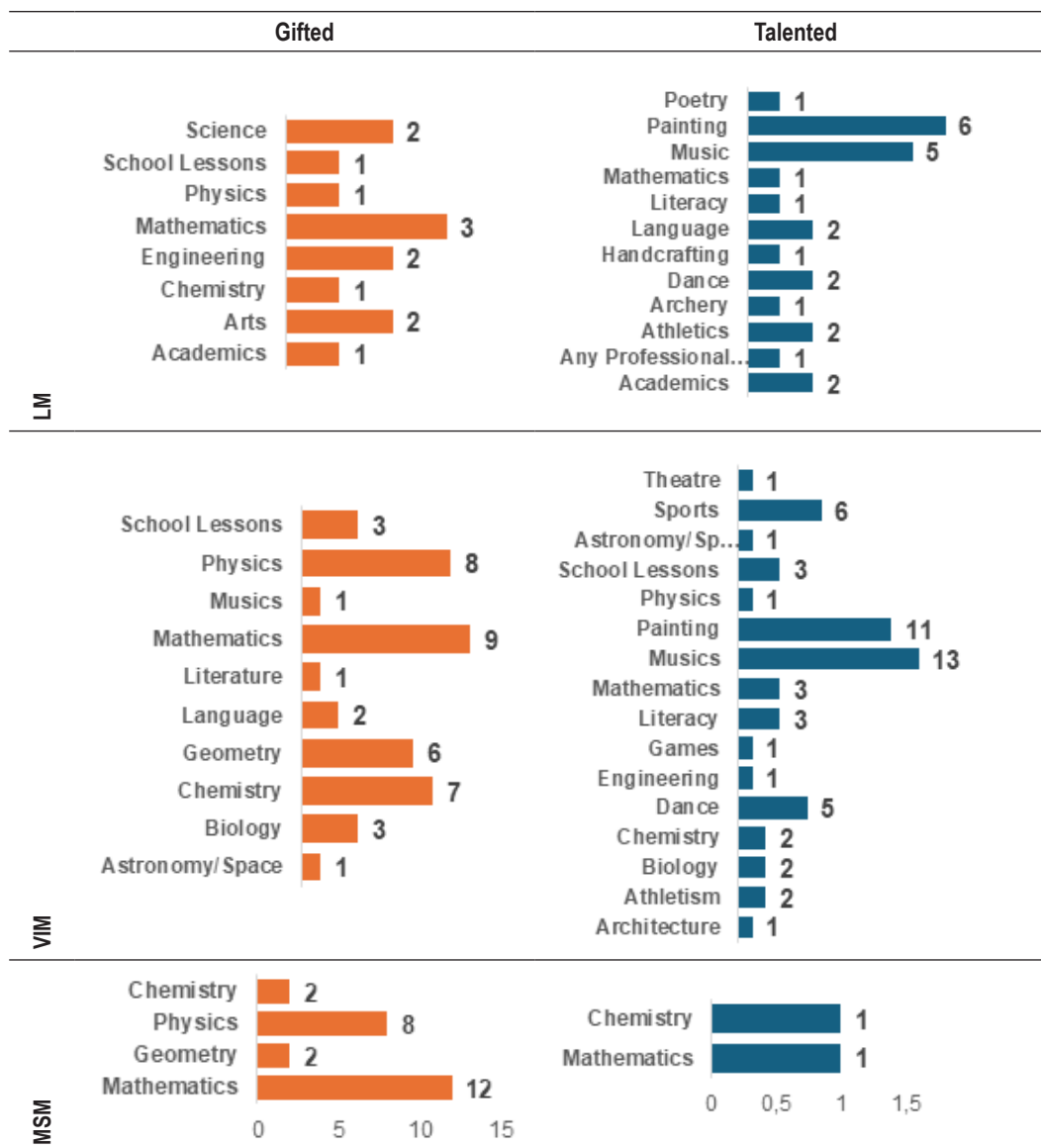


Figure 4
Utterances of "Gifted" and "Talented" Students in VM and MSM Modes



Participants generally depicted the positive aspects of being gifted and talented (See Table 3). Therefore, they generally embrace positive feelings and values toward being gifted and talented. The use of multiple modes in the expression of attitudes refers to the feeling or given value being expressed, for example, through LM and VIM. These findings imply that multimodal expression of conceptions enables not only the content (ideational meaning) but also the attitudes toward the circumstance under question.

Figure 5*Associated Occupational Fields to "Being Gifted" and "Being Talented" in Modes***Table 3***Attitudes of Participants Toward "Being Gifted" and "Being Talented"*

	Feeling				Values		Graduation		
	Positive	Neutral	Negative	Significant	Neutral	Insignificant	1M	2M	3M
Gifted	28	6	1	28	7	-	4	15	16
Talented	31	4	0	27	8	-	6	28	1

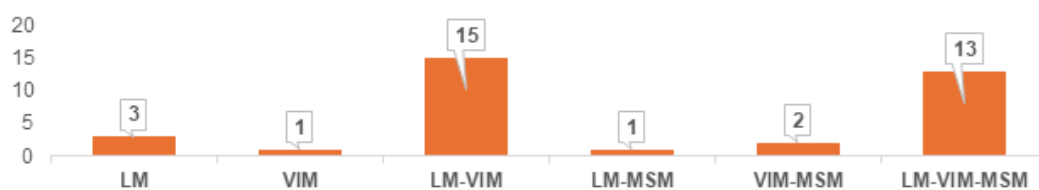
Textual Meaning

Figures 6 and 7 below demonstrate which modal or compositional choices are made for the expression of views about gifted and talent constructs. This is the semiotic features and structures of the texts and how the semiotic choices are deployed and used for their expressions of the concepts under question.

1. Use of Modes/ Mode Structure in the Expressions

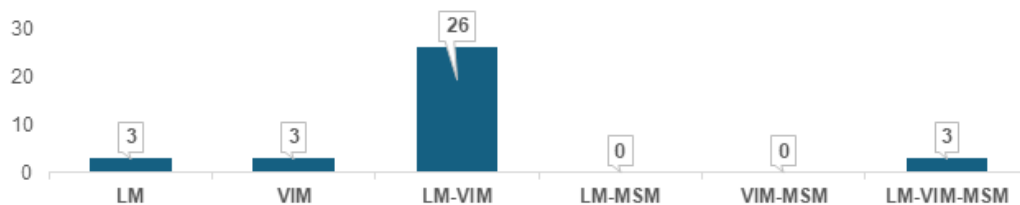
Figure 7 displays that the most common mode structure is LM and VIM. Secondly, almost half of the participants deployed the tree modes to express their conceptions of "being gifted" and "being talented". Only two participants expressed their conceptions through monomodal texts. Participants used the affordances and functionalities of various semiotic resources and modes to realize and materialize their conceptions of "being gifted" and "being talented".

Figure 6
Mode Structures of Texts Expressing "Being Gifted"



Similarly, Figure 8 shows that the majority of participants recruited multimodal semiotic choices for the expression of conceptions of "being gifted" and "being talented". But the most observed difference is the number of deployed modes. Since cognitive skills are less related to "being talented", the use of MSM is scarce. The mostly observed text structure is multimodal but engaging LM and VIM. This situation demonstrates that they use diverse types of semiotic resources to make meaning of questioned terms, and the variety in the deployment of these semiotic resources implies that multimodal expression facilitates them to externalize their mental images better than a monomodal expression, such as interviewing.

Figure 7
Mode Structures of Texts Expressing "Being Talented"



An Exemplary Case of Expressions about Being Gifted and Being Talented

In this section, we present one exemplary case of expressions and how the conception or mental image is externalized through the multimodal selection of semiotic resources.

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Figure 8
A Text Designed by a Participant to Express "Being Gifted"

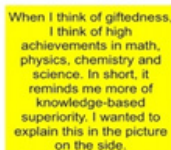


Table 4
The Filled MSAP for Expression of "Being Gifted"

Learning Skill Domain	Ideational Meaning			Interpersonal Meaning		Textual Meaning
	Appearance	Occupational Field	Feel-ing	Value	Graduation	Modes
Modes	Cognitive	Knowing many science fields.	An occupation in the fields of Mathematics, Physics, and Chemistry.	Positive	Significant. "Being gifted" was seen as a significant factor in doing the depicted actions.	3 Modes. The value is expressed in three different modes. LM VIM MSM
	Cognitive	A thinking kid with closed eyes. The thinking action includes creating and calculating.	-			
	Cognitive	The thinking action includes creating.	An occupation in the fields of Mathematics, Physics, and Chemistry.			
LM						
VIM						
MSM						

Figure 9
A Text Designed by a Participant to Express "Being Talented"

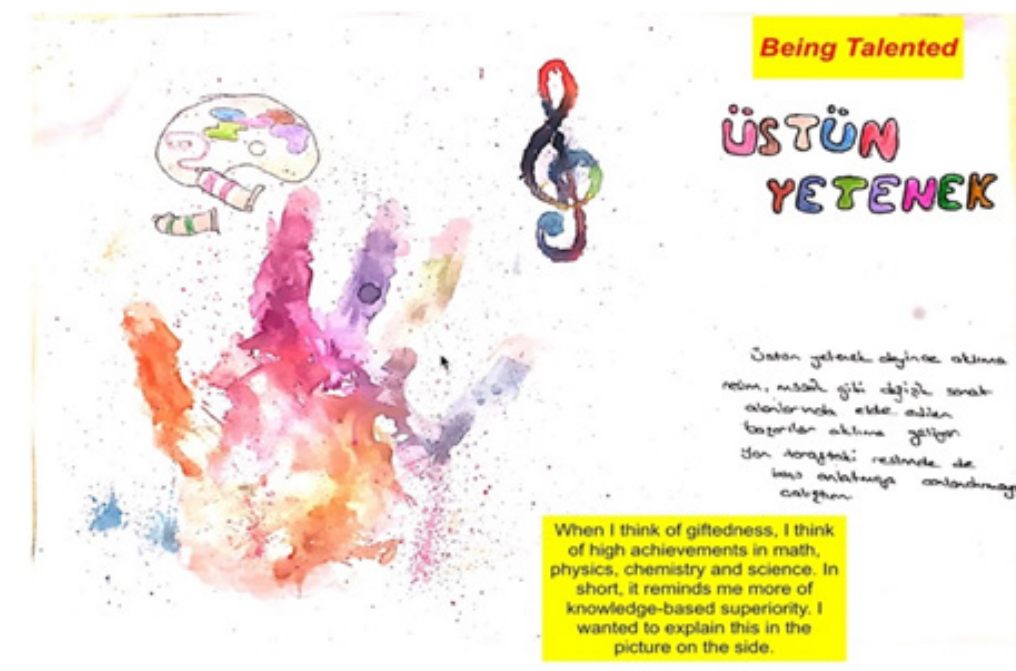


Table 5*The Filled MSAP for Expression of "Being Talented"*

Learning Skill Domain		Ideational Meaning			Interpersonal Meaning		Textual Meaning	
		Appearance	Occupational Field	Feeling	Value	Gradu-ation	Modes	
Modes	LM	Cognitive and psycho-motor	Painting Playing	An occupation in the fields of Music and Painting	Positive	Significant. "Being gifted" was seen as a significant factor in doing the depicted actions.	2 Modes. The value is expressed in two different modes.	LM VIM
	VIM	Psycho-motor	Painting Playing	An occupation in the fields of Music and Painting				
	MSM							

Overall, the findings reveal that pre-service teachers' conceptions of "being gifted" and "being talented" are shaped by both scientifically informed models and culturally persistent stereotypes. While participants demonstrated a general awareness of cognitive and performance-based distinctions, their conceptualizations often relied on static traits and overlooked the developmental processes underpinning talent emergence. Notably, emotional and psychological characteristics were frequently attributed to giftedness, reflecting broader social narratives.

Discussion

Teachers' conceptions of gifted and talented students are shaped by a confluence of pedagogical beliefs, cultural narratives, and the nature of their professional preparation. These conceptions play a pivotal role in how giftedness is identified and how instructional support is structured (Golle et al., 2023; Reis-Jorge et al., 2021). The current study explored how pre-service mathematics teachers conceptualized "being gifted" and "being talented" within the framework of DMGT (Gagné, 2013), which distinguishes innate aptitudes (gifts) from systematically cultivated competencies (talents). Although participants were introduced to giftedness theories and talent development through coursework, their responses revealed persistent misconceptions—particularly a tendency to equate giftedness with static cognitive traits (e.g., high IQ, creativity) and talent with excellence in performance areas like music, sports, or mathematics. This oversimplification reflects earlier findings that teachers often rely on lay beliefs and media stereotypes rather than nuanced developmental models.

Importantly, this study did more than identify the content of participants' conceptions; it also innovated in how these conceptions were captured and analyzed. Much of the existing literature on teacher beliefs about giftedness relies on interviews, surveys, or metaphor analysis—methods that privilege linguistic forms of expression and may not fully access participants' implicit knowledge. In contrast, this study employed a multimodal semiotic approach to data collection and analysis, allowing participants to express their mental representations using various semiotic resources, including drawings, symbols, spatial arrangements, and language. Grounded in representational redescription theory (Karmiloff-Smith, 1992) and multimodal discourse analysis (Baldry & Thibault, 2010; Jewitt et al., 2016), this method successfully uncovered both explicit (verbalized) and implicit (non-verbalized or symbolic) layers of teacher

conceptions. Participants' visual and multimodal productions frequently revealed nuanced associations, emotional attitudes, and conceptual distinctions that were not fully articulated in their written or spoken responses. This approach proved especially useful in exploring abstract constructs like giftedness and talent, as it allowed a richer view into how future teachers mentally organize, prioritize, and connect these ideas.

Despite the previous trainings, participants often failed to recognize the dynamic developmental processes that transform giftedness into talent. Most treated giftedness and talent as static traits or dichotomous identities, rather than seeing talent as an emergent outcome of sustained development. Furthermore, few participants acknowledged the multidimensional domains outlined in the DMGT model—such as socio-affective or sensorimotor domains—focusing instead on high academic performance or cognitive ability. This suggests a persistent gap between theoretical models and teacher reasoning, raising concerns about the effectiveness of current teacher education in fostering accurate and applied understandings of talent development (Subotnik et al., 2011).

Participants also interpreted giftedness through a strong lens of non-cognitive traits. Many emphasized positive attributes like curiosity, independence, and motivation, but they frequently paired these with traits such as anxiety, introversion, or perfectionism. These characteristics were often portrayed as defining features of gifted individuals, echoing the culturally entrenched stereotype of the "mad genius" (Baudson, 2016). Yet recent large-scale reviews call this stereotype into question. For example, Turreix et al. (2024) found that gifted students, on average, are not more psychologically vulnerable than their non-gifted peers; in many cases, they display equal or greater well-being (Francis et al., 2016). Thus, while some participants identified emotional complexity, they often framed it as an intrinsic cost of giftedness rather than a possible byproduct of environmental mismatches.

To further interpret these misconceptions and propose corrective frameworks, this study explains this situation, referring to novel talent development theories such as Merello's (2024) Non-Orthogonal Multidimensional Theory (NOMT). As a synthesis and expansion of existing models, NOMT offers a more dynamic view of talent development—one that emphasizes the transformation of genesis-based aptitudes (giftedness) into observable outcomes through four interdependent tools: cognitive profile, psychosocial skills, non-cognitive traits, and contextual conditions. The model culminates in three interconnected developmental products: domain-specific performance, psychological balance, and social contribution. By reframing giftedness and talent not as fixed traits but as evolving, co-constructed outcomes, NOMT helps explain why misconceptions persist even after formal coursework: teachers are often introduced to definitions without being shown how development actually unfolds over time, across environments, and in response to diverse internal and external influences. Moreover, NOMT may provide a valuable framework for teacher training itself. The findings of this study suggest that beliefs about giftedness function not only diagnostically—shaping who gets identified—but normatively, reinforcing narrow ideals of what giftedness "should" look like. Participants often overlooked or misclassified students whose abilities or traits did not align with these static ideals. To counteract this, this paper recommends that teacher education programs incorporate dynamic, systemic models like NOMT, alongside multimodal expression opportunities that support deeper conceptual integration. Importantly, theory must be paired with practice. Pre-service teachers should be given structured, guided opportunities to engage with gifted learners in real or simulated contexts, allowing them to observe and interpret development as a fluid, context-sensitive process rather than a fixed category. Only through this integration of comprehensive theory, reflective practice, and multimodal expression can teacher beliefs begin to shift toward a more inclusive and accurate understanding of giftedness and talent.

Conclusions and Implications

This study contributed to the growing field of gifted education by examining how teachers conceptualize “being gifted” and “being talented,” both in content and expression, using a multimodal semiotic approach. The findings revealed that, despite exposure to theoretical models like Gagné’s (2013) DMGT, participants frequently maintained simplified, essentialist understandings—equating giftedness with static cognitive traits (e.g., high IQ, creativity) and talent with visible performance outcomes as an unrelated concept to giftedness. While participants demonstrated generally positive attitudes toward gifted learners, their mental representations often failed to capture the dynamic, developmental nature of talent formation emphasized in models like DMGT. This framework was particularly valuable in interpreting why such misconceptions persist: teacher beliefs are often shaped not just by theoretical exposure, but by limited practical experience and a lack of integrative, developmental models that emphasize the transformation of innate potential (genesis) through psychosocial, cognitive, and contextual interactions over time.

Critically, the use of a multimodal semiotic data collection and analysis strategy allowed this study to access both explicit and implicit layers of participants’ conceptions—something traditional interviews or surveys may not fully reveal. This methodological innovation offered richer, more nuanced insights into how pre-service teachers visualize and internalize constructs of giftedness and talent, highlighting the potential of multimodal tools for teacher education and research alike.

The implications for teacher education are both conceptual and practical. First, training must move beyond static definitions and equip future educators with developmental perspectives that treat talent as a trajectory rather than a fixed label. Models like NOMT, which link cognitive potential with psychological balance and social contribution, provide an integrative lens that can clarify the distinction and interdependence between giftedness and talent. Second, trainings, based on theoretical knowledge alone, are insufficient. Teachers must engage in experiential learning contexts—observing or working with diverse learners—where they can apply these frameworks to real developmental trajectories and interpret variability as part of the talent emergence process.

Limitations

Several limitations should be acknowledged in interpreting the findings of this study. First, the sample size was limited and comprised exclusively of pre-service mathematics teachers, which may restrict the generalizability of the results. Participants’ disciplinary backgrounds may have influenced their conceptualizations, particularly in terms of favoring cognitively oriented or mathematically inclined abilities and career trajectories when discussing giftedness and talent. Future studies including pre-service teachers from diverse subject areas may reveal broader or contrasting perspectives. Second, participants had previously completed coursework related to gifted and talented education, but the depth, content, and instructional quality of that course were not systematically examined. As a result, variations in prior knowledge may have shaped participants’ responses in ways that this study could not fully control or account for. More comprehensive evaluations of teacher education curricula—including exposure to theoretical models, practical strategies, and real-life classroom experiences with gifted learners—would help contextualize and extend the current findings.

Notes

Some parts of the findings in this study were previously presented at the 17th Asia-Pacific Conference on Giftedness, held in Taipei, Taiwan, from July 7 to 10, 2022.

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