

Research Article

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A Study of Saudi Gifted Students: How IQ Affects Creativity about the Threshold Theory

Yusra Zaki Aboud , Mamdouh Mosaad Helali , Rommel Mahmoud Alali 

Abstract

Background/purpose. Threshold theory posits that a certain minimum level of intelligence, the "threshold," is essential for creativity to emerge. Beyond this level, the influence of intelligence on creativity diminishes. This study investigates the relationship between creativity and intelligence scores among exceptionally gifted, gifted, and promising students in Saudi Arabia.

Materials/methods. A sample of 3,843 students (2,176 male and 1,667 female) from grades three to ten in the Eastern Province was assessed using the Torrance Creative Thinking Test (TTCT) and the MAWHIBA intelligence assessment (MMCAT). Data collection spanned from 2021 to 2023.

Results. Findings identified a breakpoint at an IQ of 118, supporting the threshold theory. The results revealed that the relationship between intelligence and creativity diminishes as intelligence scores increase. This study contributes to understanding the role of intelligence in creativity and informs the development of specialized educational programs for gifted students.

Conclusion. Educators should measure children's intellect to see if they meet the necessary threshold for creativity ($IQ \geq 118$). The study suggests that gifted programs be tailored to serve individuals with average to moderately gifted intelligence, as they may have a higher association between creativity and intelligence. Furthermore, stressing creative thinking abilities in the curriculum might help pupils successfully use their intelligence, especially those who are just above the threshold. Educators must recognize that creativity can thrive in individuals with varied intelligence levels, indicating a more nuanced approach to gifted education.

1. Introduction

The relationship between intelligence and creativity is considered one of the fundamental topics in the field of educational psychology, where recent studies aim to understand how mental abilities interact with aspects of creative thinking. The relationship between creativity and intelligence has been a subject of considerable academic discussion, with varying perspectives shaping the discourse (Christensen et al., 2017). Modern research often treats creativity and intelligence as distinct yet interconnected traits (Çetinkaya, 2023). Despite extensive studies exploring this connection, there is no unanimous agreement on how these findings should be interpreted. The central debate revolves around whether creativity and intelligence are interdependent, entirely separate, partially overlapping, or connected in a manner not yet fully understood (Kim, 2005; Mourgues et al., 2016).

The relationship between these constructs can yield both positive and negative correlations, leading to four prevailing interpretations: (1) they are fundamentally identical, (2) they are entirely separate, (3) one encompasses the other, or (4) they share overlapping yet distinct elements. Numerous studies support a connection between intelligence and creativity, presenting evidence for various models and interpretations (Jauk et al., 2013; Mourgues et al., 2016; Shi et al., 2017; Christensen et al., 2017; Akhtar & Kartika, 2019; Nakano et al., 2021; Çetinkaya, 2023; Aboud & AlAli, 2024).

One widely discussed framework is the threshold theory, which suggests that intelligence and creative potential are positively correlated up to an IQ level of approximately 120. Beyond this threshold, the relationship becomes insignificant. This theory posits that while intelligence may support creativity up to a certain point, other factors become more influential beyond that (Karwowski & Gralewski, 2013). Despite extensive examination, this theory primarily relies on overall IQ as a measure of intelligence. Critics argue that composite IQ scores, while reflecting general cognitive ability, may fail to capture individual variations, leading to inconsistencies in threshold theory research (Sternberg, 2022).

Recent studies continue to validate the threshold theory, demonstrating a nuanced link between intelligence and creativity (Yilmaz et al., 2021; Nakano et al., 2021; Çetinkaya, 2023). However, research within specific cultural and educational contexts, such as Saudi Arabia, remains limited. Mourgues et al. (2016) conducted one of the few studies in this region, examining the connection between analytical and creative cognitive abilities among middle childhood and adolescent learners using an earlier version of the MAWHIBA test.

This context demonstrates the value of exploring creativity through the lens of intelligence frameworks, particularly the threshold theory, to identify gifted individuals better and design tailored educational programs. To contribute to this understanding, the present study compared creative potential—specifically divergent and integrative thinking—among three distinct groups: exceptionally gifted students (IQ > 130), gifted students (IQ < 110), and promising students (IQ > 110). The primary aim was to investigate how intelligence influences creativity among gifted students in Saudi Arabia, offering insights into the applicability of the threshold theory within this unique context. Most studies examining the relationship between intelligence and creativity have focused on Western contexts, making the generalizability of their findings to other environments inaccurate. In Saudi Arabia, research examining the relationship between intelligence and creative thinking patterns among gifted students remains limited, and studies examining the applicability of threshold theory in the Arab educational context are rare. This study aims to fill this gap by exploring the relationship between intelligence and creativity among gifted students in Saudi Arabia and contributing to the development of educational programs more appropriate to the local context.

1.1 Study Problem

The relationship between intelligence and creativity has interested researchers in psychology and education, with the threshold theory suggesting that a certain level of intelligence is needed for creativity to develop, but after that level, the link between the two becomes weaker or less important (Runco & Albert, 1986; Kaufman et al., 2012). Various cultural and educational frameworks have explored this theory, but its relevance for gifted students in Saudi Arabia remains largely uncharted.

In Saudi Arabia, programs for gifted education focus on cultivating both intellectual and creative talents among students, yet the precise nature of the relationship between IQ and creativity in this group lacks clarity. Do Saudi gifted students with elevated IQs show a consistent increase in creativity, or does creativity reach a plateau after a certain level of intelligence? This lack of insight prompts crucial inquiries regarding the allocation of educational resources to optimize the creative capabilities of students.

Moreover, cultural influences and distinctive educational methodologies in Saudi Arabia may shape the interaction between intelligence and creativity (Mourgues et al., 2016). For instance, conventional teaching styles and societal perceptions of creativity could affect the manifestation of creative skills, independent of students' IQ scores (Aljughaiman & Ayoub, 2012; Aboud & AlAli, 2024). Neglecting these subtleties could lead to educational strategies that inadequately foster the complete potential of gifted students in Saudi Arabia.

This research aims to fill these gaps by exploring how IQ influences creativity among Saudi gifted students through the lens of the threshold theory. By analyzing this connection within a culturally relevant framework, the study aspires to deepen knowledge about intelligence and creativity, providing evidence-based guidance for educators and policymakers to improve gifted education in Saudi Arabia.

2. Literature Review

2.1 Threshold Theory and the Relationship between Intelligence and Creativity

Threshold theory posits that there exists a fundamental level of intelligence (minimum threshold) beneath which an individual is incapable of exhibiting creativity. Rather than asserting that intelligence and creativity are synonymous or entirely distinct entities, threshold theory suggests a symbiotic relationship between the two. However, a crucial takeaway from threshold theory is that, while intelligence is essential for creative accomplishments, it alone does not suffice. Consequently, if an individual's intelligence falls below the threshold, they will struggle to generate innovative ideas independently.

Once above this threshold, the potential for creativity emerges, yet it remains uncertain and not guaranteed; a person may possess that creative spark or not. Kaufman et al. (2012) argue that a significant consequence of this theory is that some individuals can be exceptionally intelligent yet lack creative vitality, indicating that intelligence and creativity do not rely on one another. Shi et al. (2017) observed that it is implausible for someone to exhibit low intelligence while simultaneously possessing high creative energy. They also highlighted that this information was derived from assessments of creativity and intelligence, indicating that the theory is founded on the abilities demonstrated in these tests rather than the practical expression of creativity or intelligence. Undoubtedly, threshold theory applies to certain intelligence assessments while not to others, yet it stands as a coherent theory that aligns with empirical findings and the overarching principle that creative accomplishments signify optimal performance. As Savin-Baden & Tombs (2019) have illustrated, a prerequisite for creativity is achieving an optimal level. Various elements influence creativity, such as divergent thinking, yet only a select few actively assist in molding this dormant potential.

Recent investigations have explored the connection between intelligence and creativity in the context of the threshold theory, which suggests a positive correlation between the two up to an IQ of 120, but no correlation beyond this point. Karwowski et al. (2016) clarified that, while intelligence is crucial for creativity, it alone is not enough to stimulate it. Research focusing on Turkish secondary school students supported this theory, revealing a significant correlation between intelligence and creativity for bright students (IQ 120-129), but not for gifted students (IQ ≥ 130) (Çetinkaya, 2023). Similar findings were reported in a study involving Turkish primary school students (Sagdiç & Şahin, 2016). Akhtar & Kartika (2019) determined an IQ threshold of 106, beyond which the correlation lost its significance. However, studies such as Preckel et al. (2006), Guignard et al. (2016), Weiss et al. (2020), Yilmaz et al. (2021), and Breit et al. (2022) did not support the threshold theory, utilizing various statistical techniques.

Evaluating creativity poses a challenge for researchers investigating the threshold theory (Kaufman et al., 2012). Due to the multifaceted nature of creativity, accurately measuring it in studies can be intricate. Divergent thinking tasks serve as one method researchers employ to gauge creativity, yet these approaches may not capture the full depth and complexity of creative cognition. The studies utilized different measures of creativity to confirm or refute the threshold theory. For example, the current study (Aboud & AlAli, 2024; Çetinkaya, 2023; Nakano et al., 2021; Jakubakynov et al., 2021; Akhtar & Kartika, 2019; Shi et al., 2017; Mourgues et al., 2016) employed the Torrance Creative Thinking Test (TTCT). Others utilized alternative creativity assessments, such as Yilmaz et al. (2021), who implemented Creative Imagination Cards. Christensen et al. (2017) utilized individual innovativeness. Jauk et al. (2013) employed the Inventory of Creative Activities, while Preckel et al. (2006) used a local creativity test, specifically the "Berlin Creativity Test," to support the threshold theory among German children.

Similar to creativity, measuring intelligence also presents challenges for researchers attempting to validate the threshold theory. Many scholars relied on the WISC-R, as seen in the work of Çetinkaya (2023) and Guignard et al. (2016), who employed WISC-IV to evaluate intelligence. Others implemented intelligence assessments designed in their respective countries. For instance, Yilmaz et al. (2021) used the Anadolu Sak Intelligence Scale to evaluate intelligence among Turkish gifted students, while Preckel et al. (2006) applied the Berlin structure-of-intelligence test. In Saudi Arabia, Mourgues et al. (2016) used tests that measure creativity in terms of fluency, flexibility, originality, and elaboration, along with the Multiple Cognitive Abilities Assessment (MCAA) to support the threshold theory for the Saudi population. The significance of the current study lies in its use of the MAWHIBA Multiple Cognitive Aptitude Test (MMCAT), the most recent version, for intelligence assessment.

Finally, studying the link between intellect and creativity is critical, especially in the context of threshold theory. This relationship is complex and nuanced, as proven by numerous studies. Distinct yet overlapping constructs, Gyllensten contends that intelligence is more than just calculation, citing creativity as a critical component, contradicting the reductionist concept of intelligence (Gyllensten, 1991). Rossman and Horn argue that, while creativity and intelligence are related, they emerge from independent cognitive and motivational processes, implying that they should be investigated as overlapping but distinct categories (Rossman & Horn, 1972). Some researchers, on the other hand, claim that the relationship between intelligence and creativity may be less relevant than previously considered, emphasizing the importance of environmental and contextual elements in developing creativity regardless of intelligence level (Shi et al., 2017).

2.2 Importance of the Study

The investigation into how IQ influences creativity among gifted Saudi students is critically important for both theoretical and practical aspects. The threshold theory, which asserts that

intelligence and creativity are positively correlated only up to a certain IQ level, has been thoroughly examined worldwide but remains largely unexplored within the specific cultural and educational context of Saudi Arabia (Mourgues et al., 2016; Aboud & AlAli, 2024). Exploring this relationship within the cohort of Saudi gifted students is essential for comprehending the challenges associated with their cognitive and creative development.

Theoretically, this study contributes to the global discussion regarding the connection between intelligence and creativity. By focusing on a specific group—Saudi gifted students—this research can determine whether the threshold theory is a universal principle or if it varies due to cultural, educational, or societal factors. Such findings could advance existing literature by clarifying how local and cultural contexts influence the relationship between IQ and creativity.

Practically, this research holds immediate relevance for educational practices in Saudi Arabia, where there is a growing emphasis on fostering creativity and innovation in accordance with Vision 2030. Currently, gifted education programs tend to prioritize intellectual growth, frequently neglecting creativity as an important yet distinct element (Aljughaiman & Ayoub, 2012). If the results show that creativity levels off after a certain IQ, educators and policymakers might need to change their methods to encourage creativity through enrichment activities, problem-solving tasks, and interdisciplinary strategies rather than focusing solely on IQ improvement.

In addition, the findings of this research could highlight potential gaps in the existing gifted education system and inform culturally sensitive interventions. For instance, understanding how teaching practices and societal attitudes affect creativity could lead to the development of programs that balance intellectual rigor with creative freedom. By addressing these crucial issues, this study not only enhances our understanding of intelligence and creativity but also provides practical recommendations that can help Saudi gifted students realize their full potential in both areas.

3. Methodology

3.1 Research Design

In this study, the researchers adopted a cross-sectional quantitative research design to examine the relationship between intelligence and creativity within the framework of threshold theory (Tighza, 2012). The design was constructed to collect standardized data on cognitive and creative abilities over three consecutive years from a large sample of gifted students. The researchers chose a correlational approach, using structural equation modeling (SEM) to assess the factor structure and paths linking intelligence and its dimensions to those of creativity.

3.2 Sample

The study involved 3,843 gifted students enrolled in grades 3 through 10, aged 9 to 18, from public, private, and international schools in the Eastern Province of Saudi Arabia. Figure 1 provides a detailed breakdown of the sample's characteristics. To ensure student representation across variables such as gender, school type, grade level, and giftedness scores, a stratified sample was used. The study sample included promising, gifted, and exceptionally gifted students, classified according to their MMCAT scores.

The distribution across grades showed representation from third to tenth grade, with the largest group being ninth graders (24.69%) and the smallest being tenth graders (5.15%). Students were predominantly from public schools (77.62%), followed by private (15.63%) and international schools (6.73%). Male students made up 56.62% of the sample, while females accounted for 43.37%. Regarding the type of giftedness, 36.79% of participants were categorized as promising, 46.24% as gifted, and 16.97% as exceptionally gifted. Over the three years, most participants were assessed in 2023 (72.02%), with smaller proportions in 2022 (16.21%) and 2021 (11.76%).

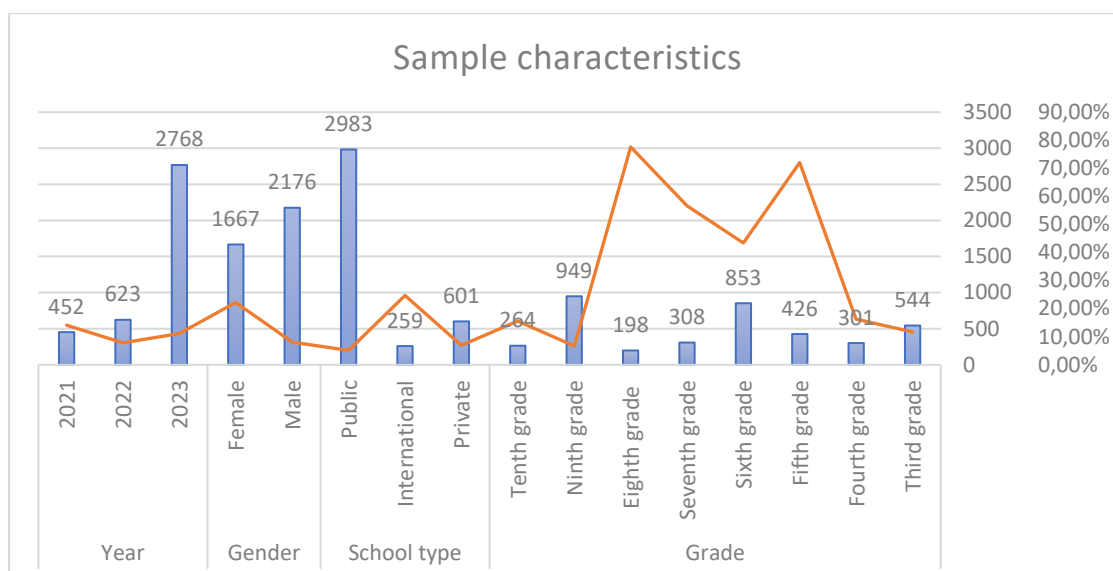


Figure 1. Provides a Detailed Breakdown of the Sample's Characteristics

The analysis of skewness and kurtosis values showed that the data distribution for cognitive abilities measured by the MMCAT, was average. These values fell within the acceptable range of +1 to -1, suggesting a balanced and representative dataset for understanding the cognitive profiles of the sampled students. This diverse and representative sample allowed for an in-depth exploration of the relationship between IQ and creativity across a range of ages, grade levels, school types, and giftedness categories.

The King Abdul-Aziz and His Companions Foundation for Giftedness adopted the MAWHIBA Scale MMCAT as part of its national project to detect gifted people in Saudi Arabia, which was prepared in cooperation with the Qiyas Foundation. The scale classifies students into four categories according to their scores on the talent scale: non-gifted, whose scores are less than 110; promising, whose scores fall between 110 and 120; gifted, whose scores fall between 121 and 130; and exceptionally gifted, whose scores exceed 130. Figure 2 shows the cut-point score at which students are classified according to their degree of giftedness as measured by the scale.

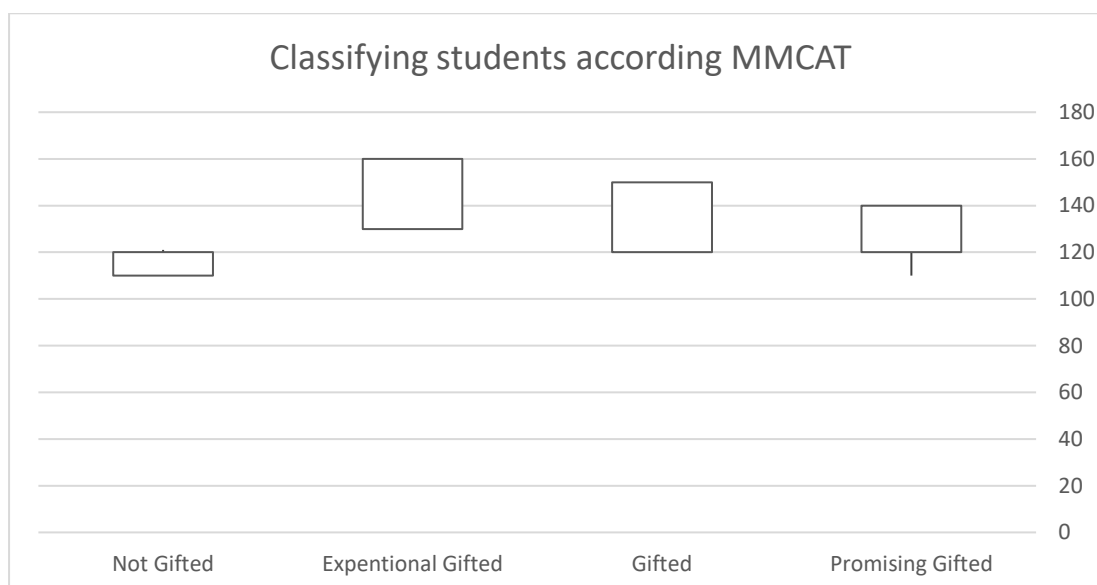


Figure 2. Shows the Cut-Point of MMCAT.

It is noted from Figure 2 that the cut-point score at which students were identified as gifted (according to the criterion for their classification on a talent scale) was 120.

3.3 Instruments

MAWHIBA Multifaceted Cognitive Abilities Assessment (MMCAA)

Utilizing an array of evaluations, segments, patterns, and visuals, the MMCAA endeavors to uncover students' prospective academic strengths and proficiencies across language, mathematics, science, and various creative dimensions. Since its inception in 2011, it has served as the principal examination for gauging students' abilities and facilitating their entrance into all initiatives and programs linked to the National Project for Gifted Identification. Experts led by MAWHIBA crafted the MMCAA, with contributions from the National Center for Assessment and local and international specialists. The MAWHIBA assessment boasts robust internal consistency and dependability, with a Cronbach's Alpha of .835. A correlation matrix among the scores in the subsections and the overall score indicated internal correlation coefficients ranging from .66 to .81 (Mawhiba, 2023).

Assessment Sections

Creativity (cognitive flexibility): the ability to conceive a plethora of ideas, to scrutinize and connect various applications, and to adjust and diversify approaches to effectively address issues by evaluating their variables to innovate solutions. Linguistic analysis and comprehension: the aptitude to utilize language for dissecting available information, along with the skill to apply language rules in engaging with readable material to extract, reorganize, and benefit from it. Mathematical and spatial reasoning: the ability to leverage mathematical skills and logical reasoning to arrive at specific answers or conclusions, as well as the capacity to identify logical connections, similarities, matches, or distinctions. Scientific and mechanical reasoning: the ability to use what you know, along with your thinking and experience, to understand new ideas, make sense of the past and future, and draw conclusions based on evidence (Mawhiba, 2023).

Torrance Test for Creative Thinking

The Torrance Test of Creative Thinking (TTCT) is one of the most popular tools for measuring creativity, especially among academics. TTCT consists of two main parts, the verbal part and the pictorial part. Together, they aim to assess the basic aspects of creativity: fluency, originality, elaboration, and flexibility. In the pictorial portion of the TTCT, students are encouraged to finalize pictures or diagrams based on partial figures, stimulating imaginative interpretation. While the verbal part requires students to answer open-ended questions or brainstorm ideas, it also involves showing their verbal creativity through written expression.

What distinguishes the Saudi image from the TTCT scale is cultural specificity. The original TTCT was modified to more closely match the cultural context in Saudi Arabia, incorporating students' local language with the examples and scenarios they circulate that reflect the local culture. This Arabized image ensures that it assesses creativity independently of cultural variances that could influence Saudi students' performance (Aljughaiman & Ayoub, 2012). The TTCT requires a more precise assessment of creativity that is compatible with the Saudi environment. To ensure uniformity between raters, correlation coefficients were calculated, ranging from 0.79 to 0.99. The test also showed reliability, as its coefficients ranged between 0.60 and 0.73. Test-derived scores provide assessments of each aspect of creativity—originality, flexibility, fluency, and detailed knowledge—across the three assigned tasks. Ultimately, these scores indicate the degree of creative thinking demonstrated by each student (Al Sharie, 2005).

3.4 Procedures

Prior to data collection, the researchers obtained ethical approval from the King Faisal University Research Ethics Committee (approval code: KFU-ETHICS2835). All procedures strictly adhered to the ethical principles of research involving minors, including informed consent and assurances of confidentiality.

Coordination with Gifted Centers

Official letters have been distributed to gifted centers in the Eastern Province of the Kingdom of Saudi Arabia. These centers, in coordination with the King Abdulaziz and His Companions Foundation for Giftedness and Creativity (Mawhiba), maintain comprehensive databases of students participating in national gifted identification programs and assessments. Researchers submitted a formal request to these centers for access to de-identified student data from the Mawhiba Multifaceted Cognitive Ability Test (MMCAT) and the Torrance Test of Creative Reasoning (TTCT) for the 2021–2023 school years. The goal was for the data to represent the most recent assessments and reflect a representative range of giftedness levels across grade levels and school types.

Parental Consent for Data Use

Before accessing individual student records, researchers contacted parents through gifted care centers. They were provided with a detailed information sheet explaining the purpose of the study, the data protection measures in place, and the prohibition of any additional testing or direct contact with the students. The researchers ensured that no identifying information about the students was published. Finally, written informed consent was obtained from the parents before data extraction and use.

Data Verification

After obtaining consent, the researchers received anonymized student records, which included individual scores on the MMCAT in the verbal, mathematical, scientific, and cognitive flexibility domains, and individual scores on the TTCT in the fluency, originality, elaboration, and flexibility domains, as well as demographic information (age, gender, grade, and school type).

To ensure data accuracy and completeness, the researchers reviewed the data for duplicate or incomplete records and verified that each record contained MMCAT and TTCT scores to ensure they could conduct correlation and path analysis. The researchers also checked for outliers or data entry errors.

Analytical Techniques

The data were examined for missing values, outliers, and normal distribution. Descriptive statistics were also calculated for the variables. The skewness and kurtosis values were within the acceptable range (± 1), ensuring that the data met the assumptions of parametric analysis.

To validate the threshold theory model, structural equation modeling (SEM) was used, allowing for a simultaneous examination of the structure of creativity factors and their direct and indirect relationships with multiple intelligence domains. The SEM analysis involved setting up measurement models to check how well the factors loaded, analyzing paths to see direct and indirect effects, and using fit indices (like RMSEA, CFI, and TLI) to evaluate how well the model worked.

To ensure comparability across measures, all cognitive variables were standardized using the Z-test. Regression coefficients were also estimated to determine the influence of different cognitive domains on creativity scores.

It is worth noting that all statistical analyses were conducted using AMOS and SPSS.

4. Results

4.1 Scatter Plots and Homogeneity

To explore the potential existence of a threshold, the researcher initially employed scatterplot analysis. The researcher focused on identifying heterogeneity in the data due to the subjective nature of visually interpreting scatterplots. Typically, one observes homogeneity in a dataset with normally

distributed residuals. If a linear relationship exists between creativity and intelligence, researchers expect the values to demonstrate homogeneity, which can be tested using the Breusch-Pagan test (Breusch & Pagan, 1979). Under the null hypothesis, this test assumes that the variance of the variables remains constant. A significant result from the Breusch-Pagan test would strongly suggest the presence of a threshold.

In the present study, scatterplots and heterogeneity tests served as the initial tools for analyzing the relationship between creativity and intelligence, identifying any potential breakpoints. The analysis revealed a moderate correlation between creativity and intelligence ($r = 0.40$, $p < 0.01$). At first glance, the scatterplots in Figure 3 appeared to suggest the presence of a threshold. Also, the plots that examined for uneven spread showed flat lines, meaning the leftover values were spread out evenly across the predicted values. The Breusch-Pagan test for homogeneity also yielded a significant result ($BP = 0.64$, $p = 0.02$), supporting the inference of homoscedasticity. This suggests that a threshold is likely to be present in the relationship between creativity and intelligence.

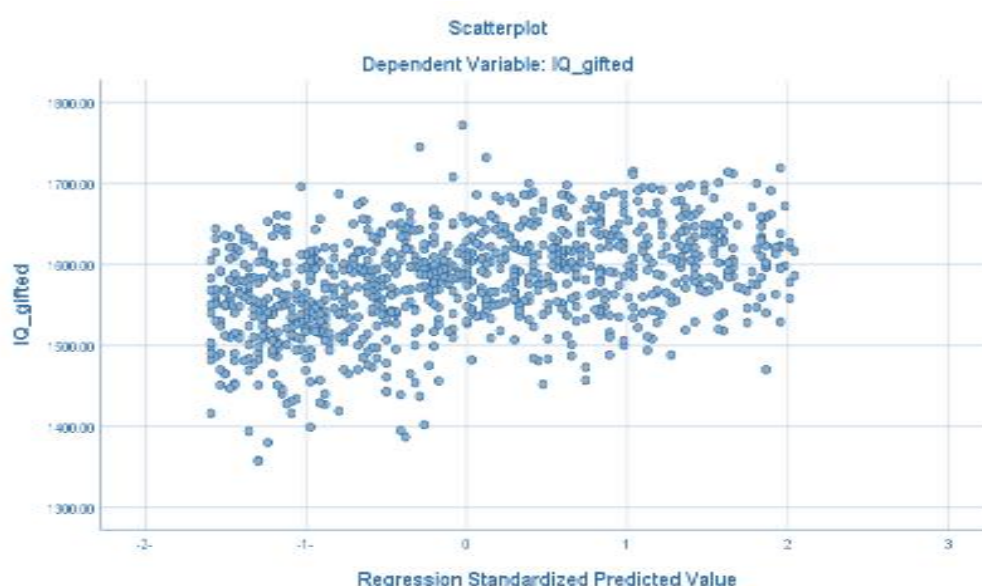


Figure 3. Scatter Plots and Homogeneity

4.2 Regression Analysis

As a secondary method to test the threshold hypothesis, regression analysis was conducted. In this approach, a significant change in the slope of the linear regression between intelligence and creativity would indicate the presence of a threshold. In this study, intelligence was treated as the independent variable, while creativity served as the dependent variable.

To further explore the threshold, correlation coefficients were calculated and compared both below and above ($IQ = 118$ points) across three distinct groups. The correlation between IQ and creativity, as measured by the TTCT scale, was computed for both groups below and above the threshold. Additionally, a correlation for the restricted range of IQ scores was examined to better understand the threshold effect. Table 1 provides the correlation coefficients based on the threshold that was tested.

Table 1. Correlation Coefficients in the Light of Tested Threshold

Tested threshold	N	Mean	SD	r	r ²
$IQ \geq 118.00$	215	71.09	11.79	.22	.05
$IQ < 118.00$	883	82.25	6.91	.53*	.28

* $P < .05$

As shown in Table 1, a breakpoint in the relationship between intelligence and creativity was observed at an IQ of 118. When the criterion of $IQ \geq 118$ was applied, the correlation between intelligence and creativity was found to be low and not statistically significant ($r = 0.22$; $p > 0.05$). However, when the criterion of $IQ < 118$ was used, a moderate correlation was found ($r = 0.53$, $p < 0.05$). These results, based on the recommended more flexible criteria, lend support to the threshold theory, suggesting that creativity is more strongly linked to intelligence when IQ is below 118.

A comparison of the correlation coefficients above and below the threshold revealed no significant differences ($z = -0.65$; $p > 0.05$), indicating that the relationship between the variables is consistent across both groups. Additionally, after adjusting for range restriction, the correlation coefficients continued to align with the threshold theory, with the correlation above the threshold remaining lower than the correlation below the threshold. Figure 4 illustrates the models, showing the breakpoint for intelligence in relation to creativity.

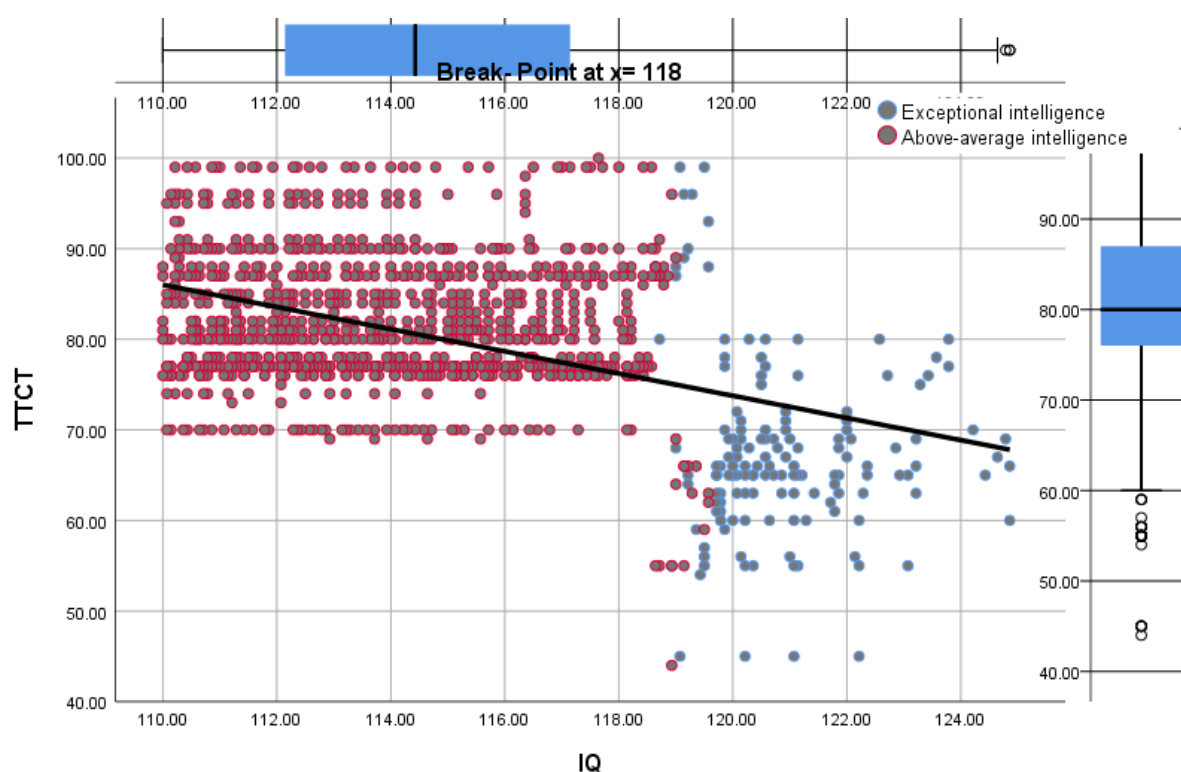


Figure 4. Breakpoint Models of Intelligence for Creativity

The predictive analysis and graphical results (Figure 4) show that the data support the threshold theory. While a significant relationship between intelligence and creativity is observed at an IQ of 118, this connection weakens as intelligence scores increase. The regression analysis on predicting creativity reveals that IQ has a positive and significant impact on the TTCT scores of Saudi gifted students ($\beta = 0.74$, $t = 13.64$, $p < 0.05$), further supporting the proposed hypothesis of the threshold theory.

4.3 Structural Equation Modeling

To test the threshold theory, this study utilized Structural Equation Modeling (SEM) to examine the threshold hypothesis. SEM enables analysis of the factor structure of creativity across the four intelligence factors. A path analysis was conducted (see Figure 5), which employs a set of statistical methods designed to reveal the direct and indirect effects of a group of observed variables. The structural model was used to assess the impact of intelligence, as measured by the MMCAT scale, on creativity, as measured by the TTCT scale, as shown in Figure 4.

Within the structural model, the causal effect of the independent variable (X) on the dependent variable (Y) must be statistically significant to indicate a meaningful relationship between the variables. This significance provides support for the threshold theory.

Figure 5 illustrates the full path model proposed in this study, with standardized direct effect coefficients between the variables. Scientific reasoning has the strongest positive path coefficient (.37) with TTCT, followed by qualitative reasoning (.34) and flexibility (.30), both of which also show significant positive relationships with TTCT. Finally, verbal reasoning exhibits a lower positive correlation with TTCT (.26).

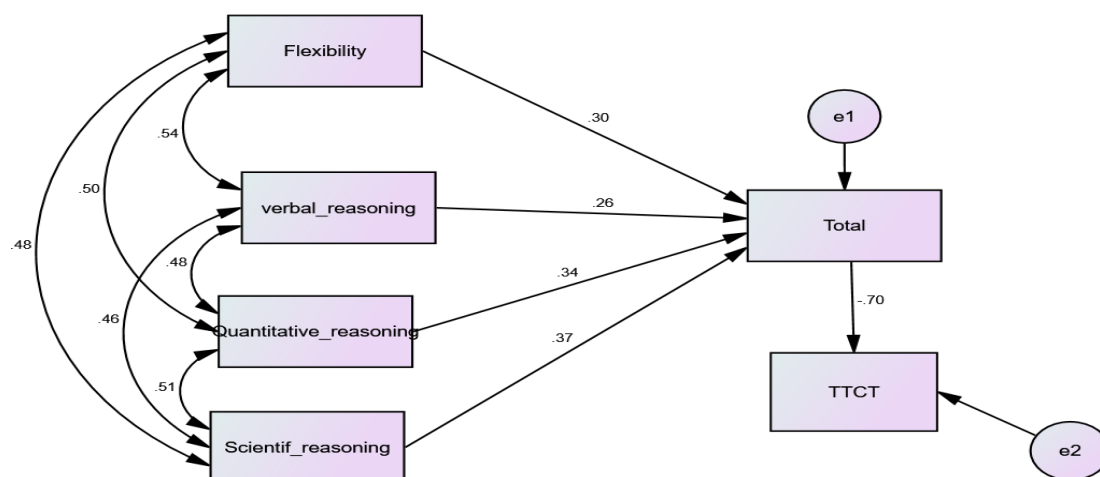


Figure 5. Path Analysis (MMCAT and TTCT)

4.4 Model Fitness

The model's fit was evaluated using five commonly used fit indices. The chi-square test was the primary measure for assessing the model's fit within a structural or path analysis framework. A significant chi-square value typically indicates a poor fit, while a value less than 3 divided by the degrees of freedom suggests a satisfactory fit (Bentler & Jamshidian, 1994). Additionally, alternative fit indices based on non-centrality, such as the RMSEA and CFI, were incorporated to provide a broader view of the model's accuracy. These indices help to cross-verify the chi-square measure, which assumes centrality. Some researchers recommend using non-centrality-based indices to evaluate whether the null hypothesis should be rejected (Kline, 2011). Specifically, RMSEA values below 0.05 are considered indicative of a strong fit, values between 0.05 and 0.08 suggest a moderate fit, and CFI values above 0.90 are typically regarded as reflecting a well-fitting model (Tighza, 2012). The chi-square index value of 2.119 is deemed acceptable for this analysis. The results of these evaluations are summarized in Table 2 below.

Table 2. Path Analysis Indicators, Their Acceptance Levels, and Observed Values

Conformity Indicators	Abbreviation	Standard Value	Value	Decision
Chi-square	Chi-square	Should not be significant	293.644	Not significant
			0.124	
Standard chi-square index	CMIN/DF	Between 1 and 5	2.119	Acceptable
Goodness-of-fit index	GFI	≥ 0.90	0.955	Good
Root means square error of approximation	RMSEA	< 0.08	0.017	Good
Comparative Fit Index	CFI	≥ 0.90	1.000	Good

Table 2 shows that the majority of the matching indicators reveal a robust correspondence of the model employing the maximum likelihood method, and the outcomes generated by the AMOS software fulfill the criteria necessary for model validation. Therefore, we can deduce that the path analysis corresponds with the theoretical model suggested in earlier research referencing threshold theory (Guignard et al., 2016; Christensen et al., 2017; Bahar & Ozturk, 2018; Akhtar & Kartika, 2019). The results from the path analysis indicate that the MMCAT factors (verbal reasoning, quantitative reasoning, flexibility, and scientific reasoning) exhibit a significant positive correlation, thereby predicting the overall score. In contrast, the aggregate MMCAT score predicts creativity (as assessed by TTCT) significantly and negatively, $r = .70$. This suggests that the path model developed in this research substantiates the threshold theory.

5. Discussion

In contemporary discourse, creativity is increasingly recognized as a cornerstone of giftedness (Mourgues et al., 2016; Aboud & AlAli, 2024). Investigating the complicated relationship between creativity and intelligence offers profound insights into how intellectual capabilities intersect with creative achievements in gifted individuals. This study addressed a fundamental concept, threshold theory, which explores the relationship between intelligence and creativity by determining whether there is a specific intelligence level beyond which the association with creativity weakens. Many foreign studies have focused on threshold theory (e.g., Jauk et al., 2013; Karwowski & Gralewski, 2013; Sagdıç & Şahin, 2016; Jakubakynov et al., 2021; Çetinkaya, 2023; Aboud & AlAli, 2024). However, it has not been sufficiently explored in the Saudi context using standardized measures appropriate to the Saudi cultural context. This research aims to fill these gaps by exploring how IQ influences creativity among Saudi gifted students through the lens of the threshold theory.

First, the analysis of the results confirmed a threshold at an IQ of approximately 118, beyond which the association between intelligence and creativity diminishes significantly. This finding is remarkably consistent with the original claims of threshold theory (Runco & Albert, 1986; Kaufman et al., 2012), which postulated that intelligence only contributes positively to creativity up to a certain level, after which other factors become more pronounced. Studies by Jauk et al. (2013) and Etinkaya (2023) also support this finding, demonstrating similar thresholds in German and Turkish contexts, respectively. The cutoff point found in this study at 118 is a bit lower than the usual standard of 120 seen in some Western studies, which might suggest that cultural and educational factors can change the threshold in different places, like Saudi Arabia.

Second, structural equation modeling in the current study revealed that the four MMCAT domains—verbal reasoning, mathematical reasoning, scientific reasoning, and cognitive flexibility—were significant predictors of creativity as measured by the TTCT, although their predictive power varied. Scientific reasoning showed the strongest direct effect on creativity, followed by cognitive flexibility and then quantitative reasoning. This finding is noteworthy because it confirms that, although general intelligence provides a foundation for creativity, certain cognitive abilities—particularly flexible problem-solving and scientific reasoning—play a more important role in maintaining creative output below the threshold. This finding is consistent with Shi et al. (2017) and Nakano et al. (2021), who highlighted that specific aspects of intelligence, such as flexibility of thought, are crucial drivers of divergent thinking.

Third, the study results showed a significantly lower correlation coefficient above the IQ threshold, reaffirming that very high IQ scores alone do not produce higher creative output. This finding is consistent with Hollingworth's early observation that children with very high IQs may struggle with practical creativity (Aboud & AlAli, 2024). It also supports Kim's (2005) meta-analysis, which showed that the relationship between IQ and creativity may be weaker among gifted individuals. The results of the current study reinforce this idea in the Saudi educational context,

potentially adding local empirical evidence to the global debate about whether intelligence and creativity are overlapping or distinct concepts (Rossman & Horn, 1972; Sternberg, 2022).

Fourth, the study's findings have important implications for educational practices in gifted education in Saudi Arabia. The strong support for threshold theory in this study suggests that efforts to foster creativity should not be limited to raising the intelligence scores of gifted students who have passed the threshold. Aljughaiman & Ayoub (2012) emphasized in their study that we should prioritize enrichment programs that foster creative thinking and flexible problem solving. Our findings support this recommendation empirically and suggest that educators need to balance cognitive growth with opportunities for exploration and tasks that stimulate imagination when designing curricula.

Finally, the study's findings expand the threshold theory literature by validating it in an Arab cultural context, a context that remains underrepresented in global research. Mourgues et al. (2016) highlighted the need to adapt intelligence and creativity models to local cultures; the researchers point out that this study broadens their work by using tools that match the thinking and cultural experiences of Saudi students, specifically the updated MMCAT and the culturally adapted TTCT.

In short, the above findings collectively suggest that intelligence and creativity are related but not synonymous. While creative thinking requires a minimum level of cognitive ability, higher intelligence does not always translate into higher creativity. Rather, other factors such as cognitive flexibility, enriching learning environments, and culturally appropriate teaching methodologies all contribute to enhancing creativity once the intelligence threshold is crossed.

6. Conclusion

Educators should measure children's intellect to see if they meet the necessary threshold for creativity ($IQ \geq 118$). The study suggests that gifted programs be tailored to serve individuals with average to moderately gifted intelligence, as they may have a higher association between creativity and intelligence. Furthermore, stressing creative thinking abilities in the curriculum might help pupils successfully use their intelligence, especially those who are just above the threshold. Educators must recognize that creativity can thrive in individuals with varied intelligence levels, indicating a more nuanced approach to gifted education.

7. Suggestion

Threshold Theory offers practical recommendations for improving gifted education by emphasizing the relationship between intelligence and creativity. According to this theory, creativity requires a certain level of intelligence, and educational practices should focus on cultivating creativity in children who meet this threshold.

According to the study, educators should measure children's intellect to see if they meet the necessary threshold for creativity ($IQ \geq 118$). The study also suggests that gifted programs be tailored to serve individuals with average to moderately gifted intelligence, as they may have a higher association between creativity and intelligence. Furthermore, stressing creative thinking abilities in the curriculum might help pupils successfully use their intelligence, especially those who are just above the threshold. Finally, while threshold theory provides a framework for understanding the connection between intelligence and creativity, educators must recognize that creativity can thrive in individuals with varied intelligence levels, indicating a more nuanced approach to gifted education.

Future studies should address three key domains to enhance the understanding and applicability of MAWHIBA intelligence evaluations. First, the established factor configuration should be replicated across varied student cohorts to validate its robustness and transferability. Second, investigations should consider regional and cultural differences that may influence the relationship between

intelligence and creativity. Finally, researchers should explore longitudinal approaches to capture how these dynamics evolve, providing a more comprehensive picture of the interplay between cognitive abilities and creative potential.

Declarations

Author Contributions. Y.A: Literature review, conceptualization. R.A.: methodology, data analysis. M.H.: review-editing and writing, original manuscript preparation. All authors have read and approved the published on the final version of the article.

Conflicts of Interest. All the authors declare no conflict of interest.

Ethical Approval. This study received prior approval from the Scientific Research Ethics Committee at King Faisal University (KFU-ETHICS2835). It was conducted in compliance with established ethical standards, with informed consent obtained from all participants.

Data Availability Statement. Data will be available on request

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