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The Relationship between Intelligence and Creativity within the Threshold Theory among Gifted Students in Saudi Arabia

Yusra Zaki Aboud[1], Rommel AlAli[2]

Abstract

Threshold theory is an intelligence and creativity theory that proposes that there is a minimum degree of intelligence, or "threshold," required for creativity to occur. Above this point, intelligence ceases to be a key influence in creativity. This study uses the Threshold Theory to investigate the relationship among exceptional gifted, gifted, and promising gifted students' creativity and intelligence scores. The study included 3843 gifted students (male=2176; female= 1667). Students in grades three through eleven from the Eastern Province of the Kingdom of Saudi Arabia made up the study sample. The Torrance Creative Thinking exam (TTCT) and the MAWHIBA intelligence test were used (MMCAT). Between 2020 and 2023, a period of three years, data were gathered. The Threshold Theory was applied to test the collected data. The results of the study indicated that the IQ = 118 criterion is evaluated and that there is a positive and significant relationship ($r = 0.532$; $p>0.05$) between intelligence and creativity. They are not significantly different from the cutoff ($r = 0.22$; $p > 0.05$). Based on the suggested liberal criterion, these findings support the threshold theory.

Keywords: *Creative Thinking, Creativity; Intelligence; Threshold Theory.*

Introduction

While various perspectives exist regarding the connection between creativity and intelligence (Christensen et al., 2017), most contemporary studies on creativity tend to perceive creativity and intelligence as distinct attributes that share some level of relation (Çetinkaya, 2023; AlAli & Abunasser, 2022). However, there is no consensus on how to interpret the findings of these studies despite extensive research on the link between creativity and intelligence. The question remains whether these two constructs are interdependent, separate but overlapping, completely unrelated, or if there is a connection yet to be clarified (Al-Hassan et al., 2023; Bani Irshid et al., 2023; Fraihat et al., 2022; Mourgues et al., 2016; Kim, 2005). The correlations between creativity and intelligence can be either positive or negative, leading to four main scenarios: (1) They are essentially the same; (2) They are distinct from each other; (3) One is a sub-dimension of the other; (4) They have overlapping areas but are otherwise separate. The relationship between intelligence and creativity has been strongly supported by research (Jauk et al., 2013; Mourgues et al., 2016; Shi et al., 2017; Christensen et al., 2017; Akhtar & Kartika., 2019; Nakano et al., 2021; Khasawneh et al., 2022; Khasawneh et al., 2023; Aboud & AlAli, 2023; Çetinkaya, 2023). According to the threshold theory, there is a correlation between IQ and creative capacity up to an IQ of approximately 120, but not beyond. Below this threshold, the association between creative individuals and IQ is positive and significant, supporting the threshold theory of creativity. However, above the threshold, no significant relationship is observed, and there is a notable disparity between the two correlations (Karwowski & Gralewski, 2013). Although contemporary intelligence models advocate for a multidimensional structure (see McGrew, 2005), the threshold hypothesis has only been explored using a single measure of intelligence (i.e., total IQ), raising questions about its validity. While a composite intelligence score may be indicative of general cognitive efficiency, it fails to account for potential individual differences, and the universal nature of IQ may contribute to conflicting outcomes in threshold theory studies (Al-Barakat et al., 2023; Sternberg, 2022). Multiple models and concepts support this connection. For example, Yılmaz et al. (2020) investigated creativity and intelligence using the threshold theory in 492 Turkish students aged 5 to 7. The Çetinkaya study (2023) also employed the threshold theory to examine the relationship between creativity and intelligence scores in gifted and bright children, involving a total of 1155 Turkish students. The researcher

[1] The National Research Center for Giftedness and Creativity, King Faisal University, Al-Ahsa, Saudi Arabia, https://orcid.org/0000-0003-4432-3592; yozaki@kfu.edu.sa.
[2] The National Research Center for Giftedness and Creativity, King Faisal University, Al-Ahsa, Kingdom of Saudi Arabia, https://orcid.org/0000-0001-7375-4856; ralali@kfu.edu.sa.

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utilized the Torrance Creative Thinking Test (TTCT) and the Wisc-R intelligence test, finding a significant correlation between the IQ of gifted students and their creativity ratings. The threshold theory has not been tested in Saudi Arabia, with Mourgues et al. (2016) being the only study to explore this theory. They examined the relationship between analytical and creative cognitive skills in middle childhood to adolescence using the previous version of the Mawhiba test.

The present study emphasizes the importance of creativity in IQ and its structure through the threshold theory, which also guides the identification of giftedness and the development of tailored educational programs for gifted students. To gain a deeper understanding of this topic, the researcher compared the creative potential, specifically divergent and integrative thinking, among three distinct groups: the exceptionally gifted group (with a total IQ higher than 130), the gifted group (with a total IQ lower than 120), and the promising gifted group (with a total IQ lower than 110). The objective of this study was to investigate the relationship between intelligence and creativity within the threshold theory across these three groups in Saudi Arabia, as well as to examine the threshold hypothesis about different measures of intelligence.

Study Importance

Understanding the importance of studying the relationship between intelligence and creativity is crucial for teachers and education policymakers. From association with better future life and possibilities to the research which shows evidence, there are many reasons why it should be given emphasis. For many years, the educational community has been emphasizing and emphasizing the traditional view that intelligence and creativity are opposing each other. Let's put it simply, the definition of intelligence has everything to do with a high level of cognition while creativity is more along the line with the ability to invent, see things in a new light, and think outside the box. A lot of education activities from class assignments to scholarship selection, have followed the tradition for years because intelligence according to the traditional view is the one leading to success, and creativity is not necessary. There are so many studies about the effectiveness of gifted programs and the findings show they have a very small and even negative effect. However, a newly embraced idea, the 'threshold theory', means that there is a threshold of intelligence, a level of intelligence, such that the positive relationship between intelligence and creative qualities will show and that level of intelligence is a minimum request for the development of more creative qualities. Whether creativity can be taught has been a controversial topic in the field of creativity. There are controversies about both the scientific definition and the teaching. Students can create their definitions regardless of the scientific base and some students come up with very bizarre and absurd ideas about creativity. Thus, scientific consensus should be reached so that misunderstanding of concepts will not mislead teachers in the classroom. Numerous studies in the literature have pointed out a promising element called 'teaching creativity'. The dependent variable for the success is continuous improvement such as promoting a supportive environment that provides students with a high level of autonomy and some initial autonomy and some initial creative skills to be creative. In contrast, reliance or guidance can be turned down. Consequently, the importance of creativity can never be stressed more in the future world, a world full of challenges and changes. We are living in a digital world. Things are changing so fast, greater than what we could ever imagine. If one looks back to just a few decades ago, things we are now using are just simply not exist. We have passed the era of computers and are now in a digital age. What we can expect in the future is beyond our imagination. This has led to more corporations adopting a strategy to encourage creativity in the workforce and there are lots of employment opportunities that require employees to have creative ideas.

Background

Threshold Theory and the Relationship between Intelligence and Creativity

The theory known as the "Threshold Hypothesis," or Threshold Theory, proposes that creativity must initially develop at a specific level of intelligence. Beyond this point, further cognitive progress may not always result in equivalent improvements in creativity. According to this hypothesis, creative thinking requires a specific cognitive foundation. Research indicates that the central ideas of the Threshold Theory

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revolve around the connection between creativity and intelligence. According to this concept, intelligence and creativity have somewhat of a positive correlation. It is believed that creativity is limited below a certain IQ threshold. However, until this threshold is reached, additional intellectual progress may not always lead to an equal increase in creative capacity. Studies examining the threshold theory have produced inconsistent results. Some studies have supported the threshold theory. For instance, Mourgues et al. (2016) discovered that, contrary to the threshold theory, the link between analytical skills and creativity was only significant and positive above the thresholds for both grade groups. The types of analytical skill tasks, which are closely related to crystallized intelligence, and the educational experiences of Saudi youngsters in school are potential explanations for these findings. Karwowski et al. (2016) explained that while intelligence is a prerequisite for creativity, it alone is not enough to generate creativity. Shi et al. (2017) also observed that, in Chinese children, openness to experience moderates the connection between IQ and divergent thinking, in line with the threshold hypothesis. Divergent thinking tasks, which involve generating multiple ideas or solutions to a given problem, are commonly used to assess creativity, which is considered a vital component of the Threshold Theory. In contrast, intelligence tests primarily focus on convergent thinking, which involves finding a single, correct solution to a problem. On the other hand, creativity involves the ability to think divergently and produce multiple answers. This concept recognizes that the link between creativity and intelligence is unique to each individual. While there may be an average threshold, there will always be variations among individuals. Some individuals may require higher IQ levels to think creatively, while others may be able to do so at lower levels. Çetinkaya (2023) examined the influence of environment-related factors on the expression of creativity. Several factors, such as education, culture, and social environment, can impact an individual's ability to realize their creative potential. Supportive and stimulating environments can help individuals overcome obstacles and express their creativity. The measurement of creativity poses a challenge for researchers studying the threshold theory. Due to the diverse nature of creativity, accurately capturing it in research can be difficult. Divergent thinking exercises are one method used by researchers to evaluate creativity, but these methods may not fully capture the depth and complexity of creative thought. The theoretical framework of the Threshold Theory, like many psychological theories, is not universally accepted. It is important to keep this in mind. The relationship between intellect and creativity is complex, and creative expression is influenced by various factors, such as personality, motivation, and the surrounding environment.

Ongoing research is continuously improving our comprehension of the association between creativity and intellect (Nakano et al., 2021; Akhtar & Kartika, 2019; Christensen et al., 2017; Shi et al., 2017; Jauk et al., 2013). Numerous groups of gifted children have explored the correlation between intellect and creativity. In their investigation, Nakano et al. (2021) discovered a significant and positive relationship between intelligence and verbal and figural creativity in regular students with higher scores in verbal creativity. Akhtar and Kartika's (2019) study validated the threshold theory, which proposes that intellect is positively linked to creative abilities below a specific IQ threshold. This threshold was determined to be 106 IQ points, below which the connections between intelligence and creativity were both positive and significant (Sternberg, 2022). Kahveci and Akgül's (2019) study aimed to examine the relationship between creativity and intellect but did not yield precise findings. Furthermore, Jakubakynov et al. (2021) investigated the connection between individualization of learning and creativity in gifted children and found a minor correlation between the two. Lastly, Bahar and Ozturk (2018) explored the association between processing speed and different dimensions of creativity in gifted individuals, revealing gender differences and correlations between processing speed and specific aspects of creativity.

Evaluation of Studies Approved or Disapproved Threshold Theory

Table 2. shows which studies approved and which did not endorse the threshold theory.

Study	Sample	Analytical method	Measures of creativity	Measures of intelligence	Result
Çetinkaya, 2023	N= .1155 students	The obtained data were tested according to the Threshold Theory.	Torrance Creative Thinking	The Wisc-R intelligence test	Threshold

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			Test (TTCT)		
Yilmaz et al., 2021	N= 492 students aged 5-7 years	Examine the relationships between creative imagination and intelligence and test the threshold hypothesis with younger students	Creative Imagination Cards	The Anadolu Sak Intelligence Scale	No threshold
Nakano et al., 2021	N= 966 participants	sought to identify the relationship between creativity and intelligence in gifted students.	Creativity (verbal and figural)	The Giftedness Assessment Battery was applied to assess reasoning (verbal, logical, numerical, and abstract)	Threshold
Weiss et al. (2020)	N1 = 456; N2 = 438.	(a) scatterplots and heteroscedasticity analysis, (b) segmented regression analysis, and (c) local structural equation models in two multivariate studies	-	-	No threshold
Akhtar& Kartika., 2019	N= 222 senior high school students	confirm the threshold theory	Creativity test	IQ test	Threshold
Christensen et al., 2017	N = 4257	The threshold theory of the link between creativity and intelligence assumes that below a certain IQ level (approximately IQ 120)	Individual Innovativeness	Intelligence Test	Threshold
Shi et al., 2017	N=568 Chinese children	Investigate the relationship between divergent thinking (DT) and intelligence	divergent thinking (DT)	Intelligence test	Threshold
Guignard et al., 2016	N=338 children	Investigate the threshold hypothesis states that intelligence fosters creativity only below a 120 cut-off IQ	EPoC (Evaluation of Potential Creativity)	WISC-IV	No threshold
Mourgues et al., 2016	N= 4368 3rd to 11th grade students	Find a threshold using novel tasks of analytical skills (verbal, scientific, and mechanical reasoning) and creativity	Scales of fluency, flexibility, originality, and elaboration	Multiple Cognitive Abilities Assessment (MCAA)	Threshold
Jauk et al., 2013	N= 297	the study examined the relationship between intelligence	the Inventory of	Intelligence Structure Battery (Intelligent-	Threshold

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		and different indicators of creative potential and creative achievement	Creative Activities and Achievements (ICAA	Structure-Batterie, INSBAT	
Preckel et al., 2006	N= 1328 German students	Investigating the threshold theory	Berlin Creativity test	Berlin structure-of-intelligence test	No threshold
Kim, 2005	N= 45,880 participants	A quantitative review of the relationship between creativity test scores and IQ scores was conducted	-	-	No threshold

Table 2 summarizes some research that agrees or disagrees with threshold theory in various situations and populations.

The theory of threshold, which suggests that there is a specific point at which a certain phenomenon becomes significant, has received both support and criticism in various studies. Karwowski (2013) discovered that the acceptance or rejection of the threshold hypothesis depends on the analytical approach and theoretical decisions made. Harlow (2017) and Wimshurst (2011) both applied the concept of threshold theory to different fields, with Harlow arguing that it can guide the design of teaching methods and Wimshurst suggesting that it can be useful in exploring students' understanding in uncertain fields. Foley (2008) utilized the thinking approach of the threshold concept to examine students' usage of textbooks, identifying discipline-specific thresholds and the role of textbooks in the transitional phase. These studies offer a detailed understanding of the threshold theory, emphasizing its potential but also the need for careful consideration in its application. The notion that creativity is an essential component of giftedness is increasingly recognized (Al-Barakat et al., 2022; Kaufman, Plucker, & Russell, 2012). Therefore, understanding the relationship between creativity and intelligence is important as it can provide insights into how intellect may or may not be connected to creative outcomes in a gifted population. Initial studies that investigated the threshold hypothesis divided their samples into groups based on IQ performance and then compared creativity ratings between groups using analysis of variance. The idea was that the creative scores of the high IQ group would be higher than those of the low IQ group, but the same as those of the intermediate IQ groups. Thus, if the high and average IQ groups had equal creative performance but were both distinct from the low IQ group, the threshold hypothesis was accepted, as indicated by the studies listed in Table 2 (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). Other studies, such as Kim (2008), rejected the threshold hypothesis and concluded that the relationship between creativity test scores and IQ scores is insignificant, with age and other creativity tests playing the most significant roles in this relationship. According to the findings of Guignard et al. (2016), intelligence and creativity are positively correlated in both gifted and non-gifted children, with no evidence of a threshold hypothesis. The threshold theory was validated by Jauk et al. (2013) for measurements of creative potential but not for creative performance, as no barrier related to intellectual ability was observed.

Study Justification

Saudi Arabia has a rich history of supporting giftedness to promote sustainable development in the Kingdom. To discover talented innovators, a national joint project was conceived and implemented by professional national authorities and qualified personnel in the field. In 2011, "Mawhiba," "the Ministry of Education," and "the National Center for Measurement" formed a strategic partnership to create and administer "The National Program for Gifted Identification" using standardized methods and criteria. They developed a model that utilizes advanced scientific methods and educational best practices to identify the talented, ensuring the selection of bright children (Abu Nasser & AlAli, 2022). According to the threshold

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theory, there may be a point where creativity and intelligence converge. Exploring this hypothesis can enhance our understanding of human cognition and the processes underlying intelligent and creative behavior. Understanding the relationship between intelligence and creativity can have significant practical implications, especially in the fields of education and workforce development. If a threshold effect exists, it suggests that enhancing intelligence alone may not be sufficient to foster creativity. Employers and educators can benefit from knowing how to effectively nurture both qualities. According to the threshold theory, educational approaches that solely focus on improving IQ or creativity may not be as successful if they neglect the other. Investigating this connection can help develop integrated teaching strategies that foster both qualities simultaneously. Examining the connection between creativity and intellect can provide valuable insights into human psychology. For example, understanding how specific cognitive processes interact at different levels of intelligence and creativity can help explain individual differences in decision-making and problem-solving abilities. In fields such as science, technology, and business, creativity and problem-solving skills are crucial. By understanding the interplay between intellect and creativity, businesses can enhance team structures, cultivate innovative cultures, and optimize problem-solving processes. Individuals can benefit from an understanding of how creativity and intelligence work together in their personal development. This knowledge can help them reach their full potential in various contexts, including academic pursuits, career advancement, and artistic endeavors. Additionally, studying intellect and creativity can provide insights into social and cultural dynamics. Researching how other societies encourage and reward certain characteristics can shed light on trends that promote societal development and well-being. Lastly, by examining the connection between creativity and intelligence within the framework of threshold theory, researchers can offer practical insights with wide-ranging applications and address important issues related to human cognition. Understanding social and cultural dynamics can also be gained through studying intellect and creativity. Researching how other civilizations promote and reward specific traits, for example, can identify trends that advance the development and well-being of society. Lastly, by investigating the link between creativity and intelligence within the context of threshold theory, researchers can provide practical insights with broad applications and address significant issues concerning human cognition.

Methods

One of the quantitative research methods used in this study is relational research design. The degree of variations between two or more variables is the focus of the relational research design. Relational study looks at the degree to which certain relationship types exist (Saleh & AlAli, 2024; Çetinkaya, 2023).

Sample

A total of 3884 gifted pupils took part in the study between 2020 and 2023. The pupils were in classes ranging from 3 to 11 and ranged in age from 9 to 18. Gifted and extraordinarily gifted students were selected from the Eastern Province's public, private, and international schools. Sample characteristics are displayed in Table 1.

Table 1. Sample characteristics

	Value Label	N	%	Mean	Std	Kurtosis	Skewness
Grade	Third grade	544	14.15%	1504.62	79.47	-.481-	.379
	Sixth grade	853	22.19%	1522.68	99.32	-.694-	.114
	Fifth grade	426	11.08%	1523.24	89.70	-.442-	.205
	Seventh grade	308	8.014%	1521.16	92.65	.254	-.253-
	Eleventh grade	198	5.15%	1523.85	87.31	-.746-	-.073-
	Ninth grade	949	24.69%	1524.73	97.28	-.707-	-.001-
	Tenth grade	264	6.86%	1523.78	85.13	-.558-	.093
	Fourth grade	301	7.83%	1508.30	77.67	-.530-	.038
	Private	601	15.63%	1549.04	97.88	-.358-	-.216-

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School Type	International	259	6.73%	1517.42	85.58	-.558-	.309
	Public	2983	77.62%	1513.83	89.76	-.522-	.128
Gender	Male	2176	56.62%	1526.66	95.26	-.515-	.003
	Female	1667	43.37%	1510.33	85.91	-.541-	.206
year	2023	2768	72.02%	1518.18	88.15	-.651-	.146
	2022	623	16.21%	1530.43	93.44	-.609-	.069
	2021	452	11.76%	1513.19	107.96	-.351-	.007
Giftedness Type	Promising Gifted	1414	41.69%	1442.33	88.55	-.548-	.003
	Gifted	1777	52.40%	1521.66	91.23	-.524-	.204
	Exceptional gifted	200	5.89%	1555.18	94.37	-.535-	.126

The small values of skewness and kurtosis were close to zero and fell within the normal limits ranging between +1 and -1, which indicates that the distribution in cognitive abilities - as measured by the MMCAT - was fairly moderate.

Scales

Mawhiba Multiple Cognitive Aptitude Test (MMCAT)

Through a variety of measurements, sections, patterns, and pictures, MMCAT tries to determine pupils' future academic talents and capabilities in the domains of language, mathematics, science, and certain aspects of creativity. Since 2011, it has been the primary exam for assessing students' skills and admitting them to all programs and activities associated with the National Project for Gifted Identification. The MMCAT was developed by a scientific committee overseen by Mawhiba, with the assistance of the National Center for Assessment and the involvement of other local and foreign specialists.

Test Sections

- Creativity (mental flexibility): the capacity to generate a range of ideas, to examine and link areas of use, and to adapt and diversify methods of dealing with things and circumstances suitably by assessing their issues to variables that may be employed in creating solutions.

- Linguistic reasoning and reading comprehension: the capacity to use language to analyze accessible information, as well as the ability to apply language norms to dealing with readable content to derive meanings and extract, reorganize, and profit from it.

- Mathematical and spatial reasoning: the capacity to employ mathematical abilities and logical thinking to attain certain answers or conclusions, as well as the ability to discover a logical link, resemblance, match, or difference.

- Scientific and mechanical reasoning: the capacity to employ known facts via intelligence, experience, and logic to get more knowledge that has not previously been experienced, as well as to draw a view of the past and future, as well as evidence-based conclusions (Mawhiba, 2023).

Torrance Scale for Creative Thinking

The creative ability allows students to effectively adapt to new environments, tackle novel problems in innovative ways, and generate high-quality ideas (Mourgues et al., 2016). The Torrance Scale of Creative Thinking (TTCT) is commonly used to assess creative thinking. The test includes verbal and formal versions, each with forms A and B, which can be used interchangeably. Test items prompt individuals to identify potential unconventional uses for a given product. In 1966, two different batteries were developed—one formal and one verbal (Torrance, 1967). The Torrance Scale for Creative Thinking comprises three activities: picture formation, object completion, and circles. The scale was standardized in

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the Saudi environment and demonstrated strong internal correlation coefficients. Correlation coefficients between scorers were also established to ensure inter-rater reliability, ranging from 0.79 to 0.99. The scale also exhibited repetition reliability coefficients ranging from 0.60 to 0.73. The scale is then scored and provides estimates for each of the abilities it measures (originality, flexibility, fluency, and knowledge of details) within each of the three activities. Ultimately, these scores reflect the level of innovative thinking possessed by each student (AlAli & Al-Barakat, 2022; Al Sharie, 2005).

Data Analysis

The data analysis involved the calculation of the arithmetic mean and standard deviation. In relational bases, the Pearson product-moment correlation coefficient (r) was employed. In the predictive analysis, the standardized regression coefficient (b) was employed.

Procedures

The first step of the research was to obtain approval from the Research Ethics Committee. A letter was sent to the Departments of Gifted and Talented Men and Women in the Eastern Province of Saudi Arabia to obtain a database of gifted and talented students between the years 2021-2023, which includes their demographic data: (gender, type of school and grade) besides their detailed scores in the Mawhiba Multiple Cognitive Aptitude Test (MMCAT) and the Torrance Scale of Creativity.

Results

Correlation between the IQ and creativity scores among three groups: exceptional gifted, gifted, and promising gifted?

Correlation coefficient comparisons between and above the threshold among the three groups have been done. The correlation coefficients on IQ and Creativity scores, as determined by the TTCT scale, were calculated below and over the threshold (IQ = 118 points). To examine IQ thresholds, a correlation for the limitation range was also used. Table 3 shows a comparison of threshold correlation coefficients.

Table 3 shows a comparison of the correlation coefficients of the threshold.

Tested threshold	N	Mean	SD	r	r^2
IQ>= 118.00	215	71.0884	11.78890	.221	.0488
IQ< 118.00	883	82.2435	6.89463	.532*	.282

* P>.05

The IQ = 118 criterion is evaluated, and correlations between intelligence and creativity are positive and significant (r = 0.532; p>0.05). They are not significantly above the threshold (r = 0.22; p > 0.05). When the recommended liberal criteria are used, these results validate the threshold of a theory. A comparison of rs above and below the threshold reveals no significant differences (z = -0,65; p > 0.05). Correlation coefficients are also increased when range limitation is corrected. After correcting for range restriction, the correlation coefficients remained consistent with the threshold theory, with the correlation coefficient above the threshold being lower than the correlation coefficient below the threshold. Figure 1. shows breakpoint models of intelligence for creativity

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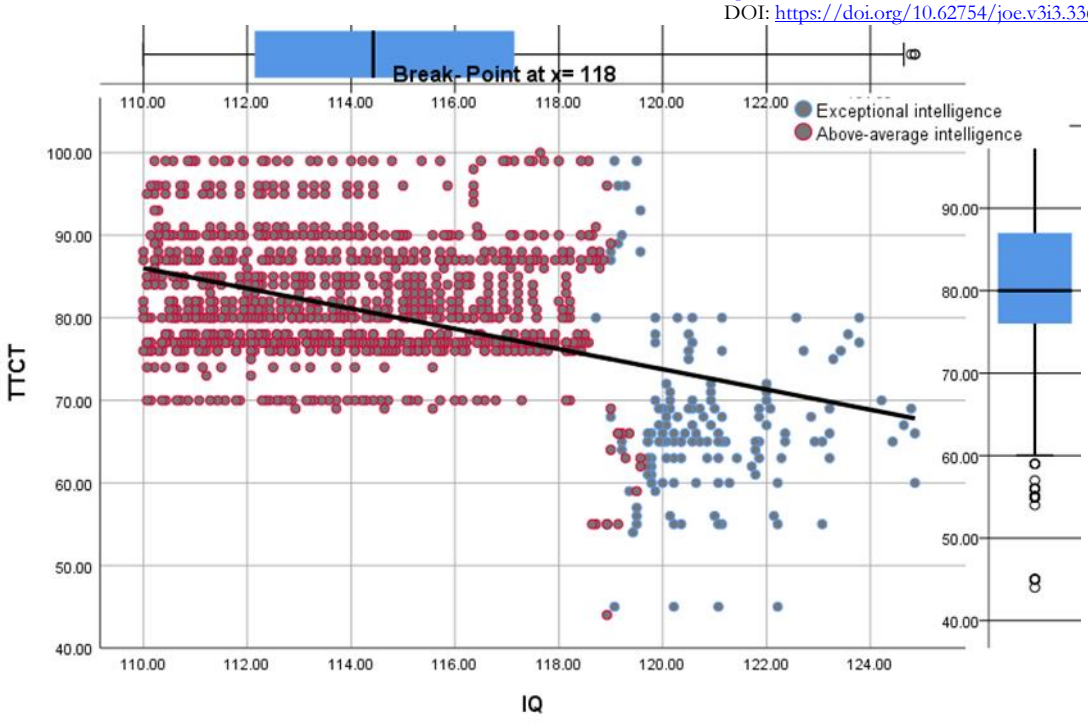

Figure1. Breakpoint models of intelligence for creativity

Means of the three groups in intelligence according to giftedness type were displayed in Figure 2.

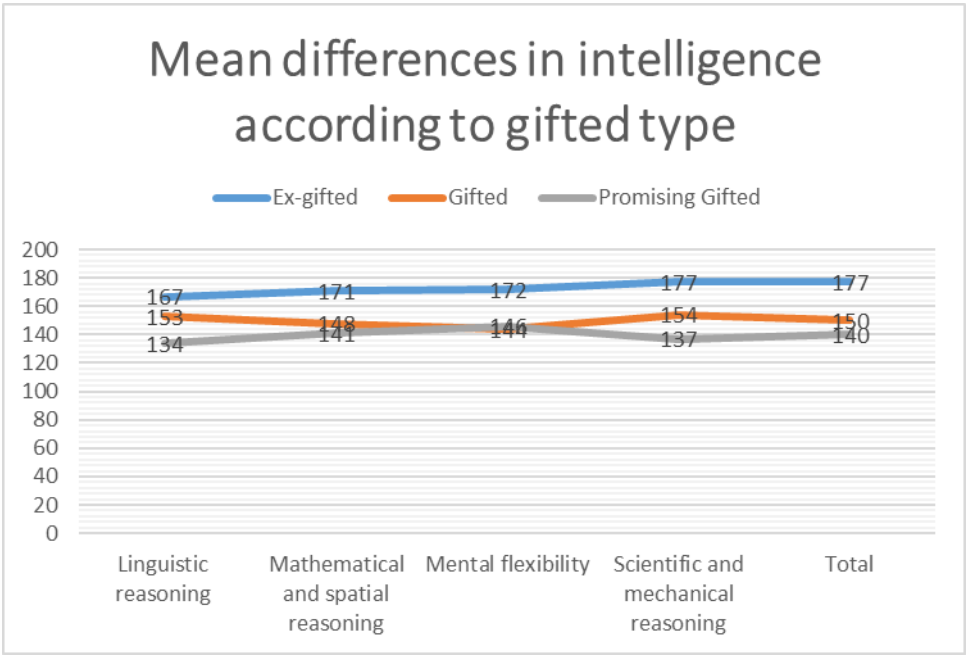

Figure 2. Mean differences in intelligence according to giftedness type

Figure 2 depicts three categories of gifted students (promising gifted, gifted, and exceptional gifted) on the Mawhiba Multiple Cognitive Aptitude Test (MMCAT) subtests: Linguistic reasoning, mathematical and spatial reasoning, mental flexibility, scientific and mechanical reasoning, besides the overall score. Figure 2

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shows also that the averages of exceptionally gifted youngsters on all subtests of the MMCAT test outperform those of their gifted and promising gifted counterparts.

Impact of intelligence scores on the predictive ability of creativity scores

Pearson correlations between IQ and TTCT scores have been calculated for three groups: Promising gifted r= 0.75>0.000, gifted r= 0.406>0.000, and exceptional gifted r= 0.26>0.003. Table 3 displays the Correlation results between intelligence and creativity. Regression analysis on the prediction of creativity results has been shown in Table 4.

Table 4. Correlation results between intelligence and creativity

	120-129 Promising gifted (n=1414)		**130-145 Gifted (n=1777)**		**164-160 Exceptional gifted (n=200)**	
	r	p	r	p	r	p
TTCT	.752**	.000	.406**	.000	.263*	.003

Table 5. Regression Analysis on the Prediction of Creativity

Model	B	Std. Error	Beta	t	Sig.
(Constant)	220.152	8.542		25.772	.000
Promising gifted	.799	.019	.752	42.971	.000
Gifted	.736	.054	.406	13.641	.000
Exceptional gifted	-.087-	.005	-.444-	-16.407-	.000

a. Predictors: (Constant), IQ

b. Dependent Variable: TTCT

The breakpoints for the exceptional gifted (Group 1) and promising gifted (Group 3) were not significant when taken together, indicating that the threshold hypothesis was not confirmed. However, the breakpoint was significant for gifted Group 2, confirming a threshold in the relationship between the MWHIBA Scale and creativity (as evaluated by TTCT). As shown in Figures 3, 4, and 5. Furthermore, except for Gifted Group 2, the relationships below the threshold were non-significant. The correlation coefficients below the threshold were less than the correlation coefficients above the barrier for all three groups.

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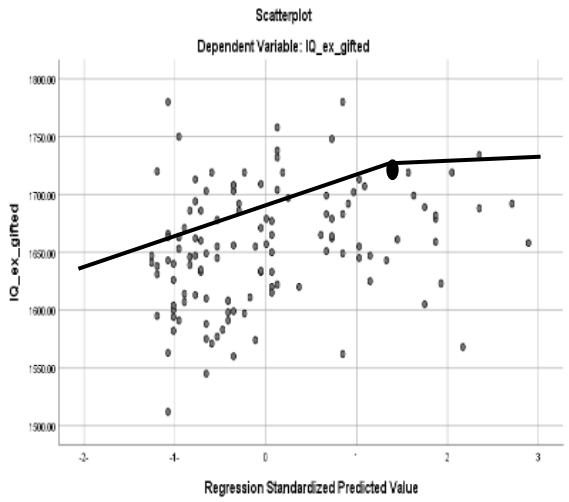

Figure 3. Regression Analysis on the Prediction of Creativity by IQ for Exceptional Gifted

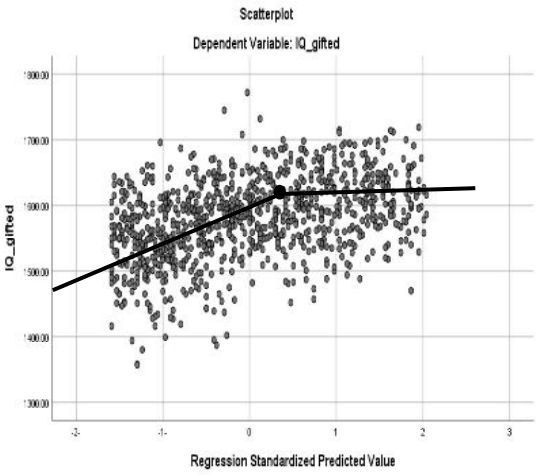

Figure 4. Regression Analysis on the Prediction of Creativity by IQ for Gifted.

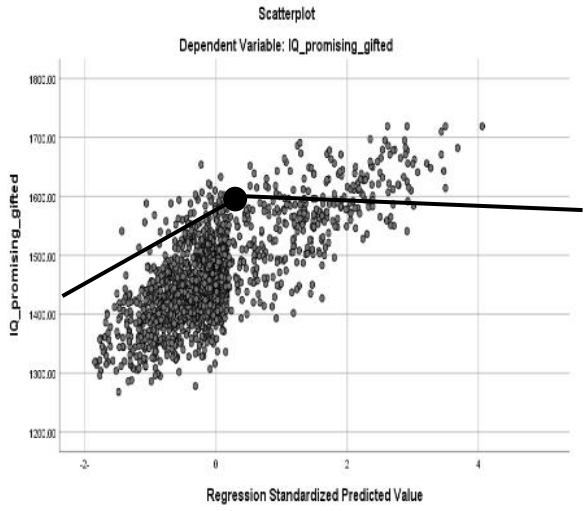

Figure 5. Regression Analysis on the Prediction of Creativity by IQ for Promising Gifted

The creativity score average of X= 124.22 6 2.46 is 86.85 6 8.34. In the range of giftedness (130–145), the average intelligence score of students is X= 139.05 6 4.07 and the creativity score average is X= 44.66 6 24.60. For the exceptionally gifted range (146–160), the intelligence score averages are X= 152.46 6 4.13, and the creativity score averages are X= 45.00 6 22.92. The observed ranges of TTCT are provided, with a small range of 55 to 99 for gifted, a larger range of 9 to 97 for gifted, and an even larger range of 9 to 92 for exceptionally gifted. This difference in range size is evident in the scatter plots shown in Figures 3 to 5, which allows for predictive analysis. Table 3 presents the results of the Pearson Product-Moment Correlation analysis, which was used to determine the relationship between MMCAT and TTCT test scores. The analysis revealed a positive and significant (r= .41, p\ .001) relationship between intelligence and

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creativity scores (n= 1777) with gifted intelligence (120–129). However, no significant correlation was found between intelligence and creativity scores (r= .75, p. .05) of gifted students (n= 1414), as well as between intelligence and creativity scores (r= .26, p. .05) of children (n= 200) with exceptionally gifted intelligence (146–160).

There exists a moderate level of correlation (r=.41, p<.001) between the predictor variables and the dependent variable in terms of gifted students. There was a low significant correlation (r=.41, p<.05) found between giftedness and creativity. A high significant correlation (r=.75, p<.000) was found between promising giftedness and creativity. The order of importance for the predictor variables on creativity, according to the standardized regression coefficient (b), is: promising, gifted, and exceptionally gifted. The regression analysis reveals that only the level of bright intelligence is an important predictor, while the variables of giftedness and profound giftedness do not have an effect. We examined the scatter diagrams of the standardized predicted values for the analyses. Figures 3 to 5 present these diagrams. The relationship levels are explained based on the dispersion of the points. As depicted in the figures, Figure 1 demonstrates a linear scattering. However, Figures 3 and 4 show a non-linear and horizontal scattering. Figure 1 illustrates a positive and linear relationship between bright intelligence and creativity. Conversely, Figures 3 and 4 display a non-linear graph, indicating no relationship. Figures 3 and 4 further demonstrate that the point scattering becomes more extreme and moves away linearly. Upon examining all the predictive analyses and graphical results, it can be concluded that the data aligns with the Threshold Theory. When intelligence and creativity are highly correlated, around 118 IQ, the relationship disappears as the intelligence score increases.

Discussion

Creativity is increasingly thought to be a required component of giftedness (Mourgues et al., 2016). Thus, depending on how creativity and intelligence are connected, it can give information on how intelligence may or may not be related to creative results in a gifted population. The researcher investigated the association between intelligence and creativity in a population of children from third to eleventh grade in Saudi Arabia who were part of a normative study to investigate the performance of the MMCAT and the TTCT creativity scale in the population.

The central assertion of the threshold hypothesis is that high levels of creativity necessitate high levels of intelligence, or intelligence that is at least above average. It is posited that above-average intelligence is a prerequisite for high levels of creativity, although it is not sufficient on its own (Alali and Al-Barakat, 2023a, Karwowski et al., 2016; Guilford, 1967). In examining the relationship between categories of creativity and intelligence among exceptionally gifted, gifted, and potentially gifted children, the present study identified significant variations. Variations within this last group were determined by the specific domain of identification and the type of creativity and intellect that were assessed. The findings provided validation for the notion that the relationship between these constructs will be influenced by the specific creative domain and the characteristics of intelligence that are taken into consideration. Regarding the question "Is there a difference in the correlation coefficients of the threshold for those with an IQ of 118.00 or higher compared to those with an IQ below 118.00?", there is evidence to suggest that the correlation coefficients of the threshold differ between individuals with an IQ of 118.00 or higher and those with an IQ below 118.00. Sligh et al. (2005) discovered that the connection between IQ and creativity was just as strong in the high-IQ group as it was in the average-IQ group, indicating that the threshold hypothesis was not supported. Kiv (2020) found that the group with the lowest IQ parameter had the highest values for the correlation coefficients of IQ and EQ features. Orsini et al. (2014) argued against using an IQ cut-off threshold value based on an incorrect standard deviation figure. Kim (2005) found that test results for creativity have very little correlation with IQ. Because of this research, it is possible to infer that the correlation coefficients of the threshold differ between individuals with an IQ of 118.00 or higher and those with an IQ below 118.00. This finding aligns with the study by Sligh et al. (2005) which stated that, according to the threshold theory, creativity and intelligence are strongly linked except at the upper end of the IQ distribution, where they are unrelated. The results demonstrate that only an IQ above 120 predicts creativity, which supports the assumption that the threshold hypothesis has frequently been used as a framework for

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studying the relationship between intelligence and creativity (Alali and Al-Barakat, 2023b, Guignard et al., 2016). According to this concept, having higher levels of intelligence does not necessarily imply having higher levels of creativity (Jauk et al., 2013). More specifically, it is believed that there is a cognitive threshold, often at 120 IQ points. Below this threshold, the intellect should be the only factor limiting creativity, whereas, above it, cognitive disparities should not have any influence on creative output. It has been proposed that intelligence is a necessary but not sufficient prerequisite for creativity, leading to the emergence of the so-called threshold theory. Therefore, the threshold hypothesis predicts a correlation between creativity and IQ only in samples with IQs ranging from low to average; in groups with IQs higher than average, there should be no correlation at all (Jauk et al., 2013). This study identified a positive association between IQ and creativity scores up to 118. However, there was no relationship between IQ and creativity above this threshold. A narrative review may conclude that the findings present a mixture of results, with certain evidence opposing the existence of a predetermined limit (e.g., Yilmaz et al., 2021; Weiss et al., 2020; Guignard et al., 2016) and other evidence supporting the notion of a limit (e.g., Çetinkaya, 2023, Jauk et al., 2013; Karwowski & Gralewski, 2013). The studies that opposed the limit were grounded on the assumption that the barrier was not predetermined. These predetermined boundaries are arbitrary and offer ample opportunity for researchers with different degrees of freedom in data analysis because of the absence of a compelling hypothesis. This challenge is further exacerbated by the diverse approaches employed to address outliers or the utilization of analytical instruments.

Recommendation

Threshold theory has consequences for education and gifted education: a) Educators should focus on improving students' divergent thinking skills, b) Educators should not assume that all children with high IQs are creative, and c) Teachers should provide children with the opportunity to demonstrate their creativity.

Threshold theory is utilized to improve student learning and understanding in a variety of subjects or specialties. It is used to establish a conceptual framework for research in postgraduate teaching and learning activities. Threshold principles have also been utilized to clarify learning processes and enhance teaching approaches. Furthermore, information theory has been used to analyze and refine diagnostic test thresholds, resulting in more meaningful test value measurements.

Limitations and Future Directions

This research study has some limitations that should be considered. First, the inclusion of promising gifted pupils in our sample raises concerns about the findings' applicability to other groups or regular populations. As a result, more research is needed to determine whether the current findings can be applied to a broader variety of gifted individuals. Furthermore, it is vital to highlight that all data were taken just from the Eastern Region in the fall of 2024. As a result, it is unclear if the current findings can be applied to the broader Saudi context. Additional research is needed to guarantee that the outcomes from the MAWHIBA intelligence test are used appropriately across varied communities. Future studies should concentrate on three key areas to improve the comprehension and usefulness of the MAWHIBA intelligence exam. To validate the robustness and generalizability of these scales, the existing factor structure must first be replicated in varied student populations.

Authors' contributions

All authors have sufficiently contributed to the study and agreed with the results and conclusions.

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Data Availability Statement: Data supporting the findings and conclusions are available upon request from the corresponding author.

References

Aboud, Y. Z., & AlAli, R. (2023). Validation of the Cognitive Abilities Tests (COGAT®) for Saudi Children in Kindergarten. Arts Educa, 37.

Abu Nasser, F.; AlAli, R. (2022). Do Faculty Members Apply the Standards for Developing Gifted Students at Universities? An Exploratory Study. European Journal of Investigation in Health, Psychology and Education, 12(6). 579-600. https://doi.org/10.3390/ejihpe12060043

Akhtar, H., Kartika, Y. (2019). Intelligence and Creativity: An Investigation of Threshold Theory and Its Implications.

Al sharie, A. (2005). Measuring Creative Thinking: Validating Torrance Scale for Creative Thinking, Figure (B) and its Applications to the Saudi Environment, Fifth Administrative Forum. Riyadh.

AlAli, R. & Abunasser, F. (2022). Can the Leadership Capabilities of Gifted Students be Measured? Constructing a Scale According to Rasch Model. Educational Administration: Theory and Practice, 28(1). https://doi.org/10.18848/2329-1656/CGP/v28i01/105-121

Alali, R. & Al-Barakat, A. (2023a). Instructional illustrations in children's learning between normative and realism: An evaluation study. PLoS ONE 18(9), e0291532. https://doi.org/ 10.1371/journal.pone.0291532.

Alali, R. & Al-Barakat, A. (2023b). Leveraging the revolutionary potential of Chatgpt to enhance kindergarten teachers' educational performance: A proposed perception. Eurasian Journal of Educational Research, 106, 50-69.

Alali, R. & Al-Barakat, A. (2023c). Requirements to activate children's Islamic education concepts learning in childhood education classes. Przestrzen Spoteczna (Social Space), 23(3), 207- 244.

AlAli, R. & Al-Barakat, A. (2022). Using Structural Equation Modeling to Assess a Model for Measuring Creative Teaching Perceptions and Practices in Higher Education. Education Sciences, 12, 690. https://doi.org/10.3390/educsci12100690

Al-Barakat, A., Al-Hassan, O., Alali, R., Al-Hassan, M. & Al sharief, R. (2023). Role of female teachers of childhood education in directing children towards effective use of smart devices. Education and Information Technologies, 28(6), 7065–7087. https://doi.org/10.1007/s10639-022-11481-y.

Al-Barakat, A., Alali, R. Al-Hassan, M., & Al-Hassan, O. (2022). Supervisory performance of cooperative teachers in improving the professional preparation of student teachers. International Journal of Learning, Teaching and Educational Research, 21(8), 425-445.

Al-Hassan, O., Al-Hassan, M., Almakanin, H., Al-Rousan A., & Al-Barakat, A. (2023). Inclusion of children with disabilities in primary schools and kindergartens in Jordan. Education 3-13, DOI: 10.1080/03004279.2022.2133547.

Allison, C., Sligh., Frances, A., Conners., Beverly, Roskos-Ewoldsen. (2005). Relation of Creativity to Fluid and Crystallized Intelligence. Journal of Creative Behavior, 39(2):123-136. doi: 10.1002/J.2162-6057. 2005.TB01254.X

Bahar, A., & Ozturk, M.A. (2018). An Exploratory Study on the Relationship between Creativity and Processing Speed for Gifted Children. International Education Studies, 11(3):77-91. doi: 10.5539/IES.V11N3P77.

Bani Irshid, M., Khasawneh, A., & Al-Barakat, A. (2023). The effect of conceptual understanding principles-based training program on enhancement of pedagogical knowledge of mathematics teachers. Eurasia Journal of Mathematics, Science and Technology Education, 19(6), em2277. https://doi.org/10.29333/ejmste/13215.

Çetinkaya, Ç. (2023). The Relationship Between Intelligence and Creativity Within the Threshold Theory Among Gifted and Bright Secondary School Students in Turkey, SAGE, 13(4), https://orcid.org/0000-0002-1943-7873.

Christensen, T., Hartmann, P., & Rasmussen, T. H. (2017). Threshold Theory Tested in an Organizational Setting: The Relation Between Perceived Innovativeness and Intelligence in a Large Sample of Leaders. Creativity research journal, 2, 188-193. https://doi.org/10.1080/10400419.2017.1303267

Fraihat, M., Khasawneh, A., & Al-Barakat, A. (2022). The effect of situated learning environment in enhancing mathematical reasoning and proof among tenth grade students. Eurasia Journal of Mathematics, Science and Technology Education, 18(6), em2120.

Guignard, J-H., Kermarrec, S., & Tordjman, S. (2016). Relationships between intelligence and creativity in gifted and non-gifted children, Learning and Individual Differences, 52, 209-215, https://doi.org/10.1016/j.lindif.2015.07.006.

Guilford, J.P. (1967). The nature of human intelligence. McGaw-Hill.

Jakubakynov, B., I, Kartashova, B., O., & Kochetkova, G. (2021). Gifted students' creativity: The role of preliminary orientation and individual learning strategies. Thinking Skills and Creativity, 41:100883-. doi: 10.1016/J.TSC.2021.100883

Jauk, E., Benedek, M., Dunst, B., & Neubauer, A.C. (2013). The relationship between intelligence and creativity: New support for the threshold hypothesis using empirical breakpoint detection. Intelligence, 41. 212-221.

Kahveci, N. G., & Akgül, S. (2019). The Relationship between Mathematical Creativity and Intelligence: A Study on Gifted and General Education Students. Gifted and Talented International, 34:59-70. doi: 10.1080/15332276.2019.1693311.

Karwowski, M., & Gralewski, J. (2013). Threshold hypothesis: Fact or artifact? Thinking Skills and Creativity, 8, 25–33. doi: 10.1016/j.tsc.2012.05.003.

Journal of Ecohumanism
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Karwowski, M., Dul, J., Gralewski, J., Jauk, E., Jankowska, D., Gajda, A., Chruszczewski, M., & Benedek, M. (2016). Is creativity without intelligence possible? A Necessary Condition Analysis. Intelligence, 57, 105-117. Doi.org/10.1016/J.INTELL.2016.04.006.

Khasawneh, A., Al-Barakat, A., & Almahmoud, S. (2023). The impact of mathematics learning environment supported by error-analysis activities on classroom interaction. Eurasia Journal of Mathematics, Science and Technology Education, 19(2), em2227.

Khasawneh, A., Al-Barakat, A., & Almahmoud, S. (2022). The Effect of error analysis-based learning on proportional reasoning ability of seventh-grade students. Frontiers in Education, 7, 899288.

Kim, K. H. (2005). Can only intelligent people be creative? Ameta-analysis. Journal of Secondary Gifted Education,16,57–66.

Kiv, A. (2020). The method of correlation selection is based on IQ and EQ measurements for assessing the psychological stability of a person. Doi: 10.33422/10TH.HPS.2020.03.67.

Mawhiba. (2023). Mawhiba Multiple Cognitive Aptitude Test (MMCAT). https://www.mawhiba.org/en/Initiatives/Identification/Pages/Tests.aspx

McGrew, K. S. (2005). The Cattell-Horn-Carroll theory of cognitive abilities: Past, present, and future. In Contemporary Intellectual Assessment: Theories, Tests, Issues, 2nd ed. Edited by Dawn P. Flanagan and Patti L. Harrison. New York: Guilford Press, pp. 136–81.

Mourgues, C., Tan, M., Hein, S., Al-Harbi, K., Aljughaiman, A., & Grigorenko, E. (2016). The relationship between analytical and creative cognitive skills from middle childhood to adolescence: Testing the threshold theory in the Kingdom of Saudi Arabia. Learning and Individual Differences, 52, 137-147. https://doi.org/10.1016/J.LINDIF.2015.05.005.

Nakano, T., Ribeiro, W. d. J., Virgolim, A. M. R. (2021). Relationship between creativity and intelligence in regular students and giftedness students. 26(1):103-116. doi: 10.1590/1413-82712021260109.

Orsini, A., Pezzutim L., & Hulbert, S. (2014). The unitary ability of IQ in the WISC-IV and its computation. Personality and Individual Differences, 69:173-175. doi: 10.1016/J.PAID.2014.05.023

Preckel, F., Holling, H., & Wiese, M. (2006). Relationship of intelligence and creativity in gifted and non-gifted students: An investigation of threshold theory. Personality and Individual Differences, 40, 159-170. https://doi.org/10.1016/J.PAID.2005.06.022.

Saleh, S., & AlAli, R. (2024). Constructing and development of the psycho-computing traits scale: a psychometric analysis of computer users and students in the field of computer science. Cogent Social Sciences, 10(1), 2344231. https://doi.org/10.1080/23311886.2024.2344231

Shi, B., Wang, L., Yang, J., Zhang, M., & Xu, L. (2017). Relationship between Divergent Thinking and Intelligence: An Empirical Study of the Threshold Hypothesis with Chinese Children. Front Psychol, 22(8), 254- 270. doi: 10.3389/fpsyg.2017.00254.

Sternberg, R. J. (2022). The Intelligent Attitude: What Is Missing from Intelligence Tests. Journal of Intelligence 10(4), 116. https://doi.org/10.3390/jintelligence10040116

Torrance, E. P. (1967). The Minnesota studies of creative behavior: National and international extensions. The Journal of Creative Behavior, 1, 137–154. https://doi.org/10.1002/j. 2162-6057. 1967.tb00021.x

Wechsler, D. (1991). Wechsler Intelligence Scale for Children (3rd ed.). (WISC-III): Manual. San Antonio, TX: The Psychological Corporation.

Weiss, S., Steger, D., Schroeders, U., & Wilhelm, O. (2020). Reappraisal of the Threshold Hypothesis of Creativity and Intelligence, Intelligence Journal, 8(38); doi:10.3390/jintelligence8040038

Yilmaz, G., Ayas, B., & Sak, U. (2021). An Investigation of the Threshold Hypothesis Using ASIS Intelligence Scale and Creative Imagination Cards. Talent, 10(2), 143-161. https://doi.org/10.46893/talent.831465.