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## Evaluating Cognitive Growth: Indicators of Actively Open-minded Thinking in Gifted Programs of Al-Ahsa

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### Abstract

*Actively open-minded thinking is a multifaceted construct encompassing flexible, context-independent thought, awareness of personal biases, avoidance of confirmation bias, and the willingness to revise beliefs in light of contradictory evidence. This study evaluated the influence of gifted educational programs in Al-Ahsa, Saudi Arabia, on fostering these skills among students. This study utilized quantitative descriptive survey design. The results indicated that the gifted program significantly enhanced actively open-minded thinking among participating students. Assessment results revealed high overall levels of actively open-minded thinking, with particularly strong performance in the dimensions of belief identification and dogmatic thinking, while flexible and constructivist thinking dimensions showed moderate scores. To further enhance these outcomes, the researchers recommended involving gifted students in the design of interdisciplinary programs that incorporate multiple personality assessments and foster diverse intelligence.*

**Keywords:** Actively Open-Minded Thinking, Gifted Education, Cognitive Skills, Flexible Thinking, Multiple Intelligence.

### Introduction

Gifted individuals are the quintessential catalysts for societal development as their intellect is a strategic asset for civilization's advancement. During the time of knowledge explosion, technological inventions, and worldwide interconnections, nurtured talent is important in making sense of the modern economy, culture, and geopolitical terrain (Abu Nasser & AlAli, 2022). Now, every nation competes for global superiority based on intellectual power. Therefore, the cultivation of giftedness is not an educational issue, but rather a socio-economic challenge of growing concern (Al-Barakat et al., 2025).

In response, the Ministry of Education in Saudi Arabia has developed and adopted a comprehensive policy framework for the education of the gifted that includes specialized administration for policy planning and program management. These policies include enrichment programs like Creative Problem Solving and Independent Scientific Research, as well as some learning by doing programs such as leadership and scientific excursions. The purpose of these programs is to cultivate gifted students' cognitive, emotional, and social skills (Ministry of Education, 2024). These programs offered through both the classroom and the resource room are indicators of a system's commitment to innovative growth. Nevertheless, after many investments into such programs there is still no clarity on whether the attempts were successful or if the programs were able to change the students' cognitive frameworks on education (Mawhiba, 2014).

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There is lacking attention on the systematic assessment of these programs. While the design of any program pays attention to assessment as a centerpiece, practice evaluation remains in a primitive state, often confined to basic checks of service quality instead of deep diving into learning analyses (AlAli, 2023; Robbins, 2019; Ruwaili, 2018). This neglect, as Alqadhi (2016) and Al-Barakat et al. (2024) highlighted, has the gaping flaw of running the risk of enveloping powerful programs in obscurity; without evaluation frameworks capable of robust examination, evidence of impact on gifted learners' development—intellect, critical engagement, and psychosocial dimensions—tend to be elusive. Many Arab studies (AlAli, 2024; Mansour & Hariri, 2020; Aljghaiman & Maajeny, 2013) and global ones (Stankovska & Rusi, 2014; Callahan et al., 2020) provided evidence of a narrowing focus to empirical constructs, particularly achievement and self-concept, omitting more sophisticated 21st century readiness cognitive frameworks.

This discourse features actively open-minded thinking (AOT), which encapsulates cognitive traits such as intellectual agility, epistemic humility, and reflective thought. AOT goes beyond critical thinking: actively open-minded thinking requires one to engage with opposing stances free of cognitive distortion and bias, while fairly weighing conflicting assertions (Stanovich & Toplak, 2023; Baron, 2018). AOT is essential for gifted learners since the very design of their educational paths revolves around agile problem solving and novel idea generation. Sadly, it is very much an outcome of advanced programming endeavors yet far too neglected in evaluation-focused research.

This gap is the most pressing issue that needs to be examined in the context of research. This study attempts to explain how such efforts foster thinking traits are important for dealing with uncertainty, multifaceted problems, and inter-disciplinary by looking into the relationship between gifted programs and AOT development. Following Zajda & Zajda (2021) premise that is created by thinking, that constructive thinking is a result of careful cultivation rather than forced authority, this study approaches AOT as a goal of instruction, and at the same time, a criterion for the achievement of instructional design.

This study aims to assess the impact of gifted educational programs in the Al-Ahsa region of Saudi Arabia on developing actively open-minded thinking (AOT) as a cognitive learning outcome among participants, using the AOT measure as a proxy for intellectual agility. The central research question guiding this investigation is: *What is the impact of gifted programs on fostering actively open-minded thinking as a cognitive learning outcome among participants?* To explore this, the following sub-questions are addressed:

1. What is the level of actively open-minded thinking observed as a cognitive learning outcome in gifted programs?
2. How does the level of actively open-minded thinking as a cognitive learning outcome in gifted programs differ based on the students' gender and the number of gifted programs they have attended?

This study aims to advance the evaluative frameworks, policies, and the strategic impact of gifted education through integrated intellectual and international empirical engagement by understanding the insights theories to foster advanced learning and engagement.

## **Theoretical Framework**

Actively open-minded thinking (AOT) is regarded as a type of cognitive disposition due to its introspective nature, intellectual humility, and ability to change one's beliefs. Chen (2015) states, "AOT is an individual's ability to scrutinize and interrogate their own thinking within a disconfirming evidence framework and objectively integrate such information to update prior beliefs." Ahmad (2019) underscores epistemic flexibility, and merging 'aimed at', he defines bias transcendence, dismantling outdated perspectives in deference to new evidence, and rigidity of thought. At its core, AOT embodies the balance of cognitive and moral flexibility (agility), ethics on expediting the process of believing contraries with truth without concern that preserves ego).

Baron (2018) monumental contribution elaborates on AOT as a multidimensional construct synthesis of aspects of critical reflection, intellect, and a blend of openness and metacognitive awareness. His approach defines AOT as a compilation of flexible thinking (the ability to accept new viewpoints), openness to experience (receptivity to different ideas), critical thinking (systematic analysis of evidence), and reflexivity (self-initiated controlled thinking), dogmatism, absolute belief, and extreme view on pseudoscience. This model explains the difference between considering AOT just as a skill, showing it as a trait that embodies a predisposition masked by complexity tempered with integrity.

The importance of AOT is within its improvement of decision-making, problem solving, and learning adaptability. Those with high AOT show flexibility toward confirmation bias, tend to give more weight to statistically captured evidence rather than personal experiences, and show grit in acquiring multiple outlooks (Baron, 2022; Svedholm-Häkkinen & Lindeman, 2018). Such individuals exhibit preference for subdued reasoning instead of impulsiveness, welcoming uncertainty as a fertile ground for positive developmental outcomes while cultivating meta-awareness and steering away from self-inflicted cognitive distortions (Stanovich & Toplak, 2019). These characteristics resonate with the enduring goals of gifted education, which aims to develop learners who can ethically and sensibly tackle issues and challenges at the crossroads of multiple domains.

### **Actively Open-Minded Thinking Dimensions**

Using available literature and considering the sociocultural context of Saudi Arabia, this study attempts to define AOT in terms of four dimensions:

#### **1. Flexible Thinking**

The ability to reflect deeply and tolerate ambiguity defines this dimension, which also describes an individual's willingness to change and explore contradictory viewpoints. Key indicators include:

- Endurance of core beliefs amid external challenges.
- Acceptance of new conceptualizations and other possibilities.
- Trust in one's intuition and analytical abilities to resolve problems.
- Seeking competing explanations out of curiosity.

## 2. Belief Identification

This dimension explains the difference between self-concept and self-identification, permitting someone to change one's belief without undergoing an identity crisis. Recognition includes,

- Acknowledgment that personal belief systems do not necessarily equate to identity.
- Resistance to personal attacks on one's belief.
- Intellectual independence from familial and social belief systems while still acknowledging them.

## 3. Dogmatic Thinking

As the AOT's opposing view, dogmatism joint-headedly depicts inflexible thinking, black and white absolutism, and lack of self-criticism. Recognition includes:

- Adherence to one-sided "truths" or decision-making based on authority.
- Binary classification (e.g. right/wrong; us vs. them) stereotypes.
- Closed mindedness to outside opinions or feedback or any other way of thinking.

## 4. Constructivist Thinking

This resilient, adaptive dimension focuses on emotion regulation and effective problem solving.

- Using past experiences to make current decisions.
- Adjusting behavior to fit the context.
- Maintaining a positive attitude and focusing on what needs to be done rather than counter-productive negativity.

Figure 1 illustrates the foundational components of actively open-minded thinking, which served as the basis for the development of the scale's dimensions and items.

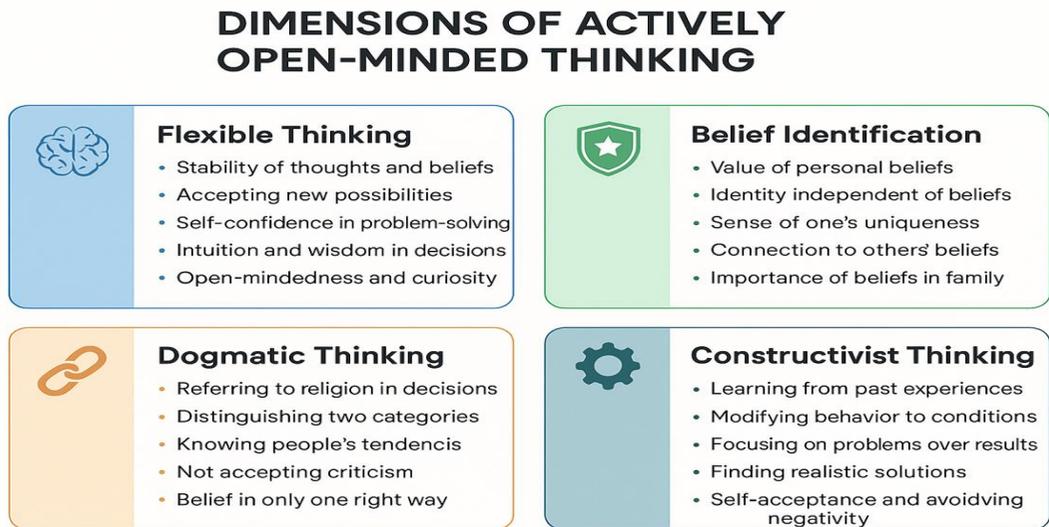


Figure 1. Dimensions of Actively Open-Minded Thinking and its Indicators

**Literature Review**

Actively open-minded thinking (AOT) is regarded as an important cognitive construct today and has developed in the light of empirical studies examining its connection with many intellectual, psychological, and sociocultural factors. A consistent finding across various studies is the significant correlation between epistemic curiosity, which is defined as intrinsic motivation for knowledge acquisition, and AOT (Abdellah, 2018; Stanovich & Toplak, 2019; Svedholm & Lindeman, 2018). It follows from this relationship that those predisposed to AOT will more likely engage with information from counter sources to resolve disputes and strengthen their beliefs (Stenhouse et al., 2018). Studies also revealed gender differences, noting that males and females exhibit different levels of AOT, although findings are context dependent (Mohamad & Bendania, 2021; Martin et al., 2017). Such differences may be the outcome of socio cognitive bias and point to the gaps that exist in AOT research using intersectionality frameworks.

The interactions of AOT with cognitive belief frameworks drew the interest of researchers. Here, strong correlations exist between AOT and constructive epistemic activities, including the believability practices reflecting readiness to change beliefs when faced with contradicting information (Ahmad, 2019; Ayoub et al., 2022). This work attributes AOT to the postponement or the delay of rational decision making in contexts characterized by high complexity such as scientific reasoning or ethical reasoning (Al-Hassan et al., 2025a; Baron et al., 2016). Stanovich & Toplak (2019) were the first to implement AOT by a multi-faceted approach including flexible cognition, value openness, intellectual closure/opening, categorical thought, identification of belief, and counter/for factual reasoning. This approach has informed later developments, including shortened versions of the original instrument developed for specific cultures, disciplines, or both (Baron et al., 2015; Gürçay, 2016).

AlAli (2023) examined the impact of gifted programs in Saudi Arabia, on actively open-minded thinking. Results showed significant development, with high levels in belief identification and dogmatic thinking, and moderate levels in flexible and constructivist thinking. The study recommended involving gifted students in program design to foster personality growth and enhance multiple intelligences.

In the Arab context, attempts to recalibrate the AOT measurement have led to constructs that meet the culture. For example, Ayyash and Saif (2018) translated Stanovich & Toplak (2019) scale into Arabic and suggested the existence of six dimensions capturing the socio constructs of the region. Usama's (2010) Saudi study simplified AOT into three categories: flexible thought, identification or modification of belief, and rigid attitude towards adopting new ideas. Later research supported these findings (AlAli, 2023; Samah, 2019; Abdullah, 2018). Such adjustments demonstrate the cultural flexibility of the construct, suggesting that the local systems of beliefs dominate intellectual openness.

The empirical applications of AOT help to shed light on its teaching and learning consequences. AOT was found to be a strong predictor of creative problem-solving in Parham's (2017) study on cognitive driving forces and innovative behaviors which demonstrates AOT's role in shaping adaptive expertise. Likewise, AOT was found to be positively correlated with active learning by university students, which highlights the need to employ reflection and inquiry teaching methods to promote and foster higher-order thinking skills (Chen, 2015).

Within this body of literature, this study seeks to deepen the research on AOT in the context of gifted education by exploring the behaviors of AOT in gifted learners in the Al-Ahsa region of

Saudi Arabia. This work aims to fill the gap in how gifted programs incorporate regionally validated frameworks designed to address cognitive challenges critical for the 21st century through global theoretical perspectives.

### **Importance of the Study**

As noted earlier, program evaluation is an intentional activity that systematically or routinely tries to determine the value, relevance, or impact of an educational activity in order to provide for decision making (Al-Hassan et al., 2025b; Mertens & Wilson, 2018). For gifted learners who depend on community and institutional resources in their programs, these evaluations provide added value. However, the need for endurance and continued funding creates the need to evaluate these programs reliably and validly measure outcomes. These evaluations tend to overly focus on logistical metrics, such as participation rates, while neglecting basic intellect and psychosocial development outcomes that are necessary to address the other complex and critical questions that exist.

This research aims to fill that gap by considering AOT as an indicator of cognitive outcomes for gifted education. By measuring the level of gifted programs mastered AOT skills like epistemic humility, adaptive belief revision, and reflective reasoning, the investigation addresses some programmatic absorbing insights into strengths and weaknesses. Such information is instrumental in curriculum construction, instructional strategies, and policy development concerning gifted learners.

Moreover, the focus on Al-Ahsa region adds to the pool of emerging research for the region sure that program evaluations undergo sociocultural scrutiny. This moves the needle toward international conversations around gifted education while enabling local advocates to rethink education policies using evidence with the aim of creating conditions where gifted learners can flourish as nimble, socially responsible innovators.

### **Methods**

#### **Research Design and Procedure**

This study utilized a quantitative descriptive survey design to assess the psychometric attributes of assessing a new measurement tool within the scope of achieving broader generalizability of the result. Descriptive research is both about documenting and interpreting by placing the gathered data in context through relative comparison which allows forecasting of the data into behavioral and cognitive actions (Creswell & Creswell, 2018).

The research procedure was carried out in four sequential steps which are: a) creating the AOT Scale with its four subdivisions, b) obtaining ethical approval with King Faisal University, c) conducting a pilot test which was followed with a full test, and d) conducting statistical evaluations to interpret the outcomes.

#### **Population and Sampling**

The selected population was all the gifted students who participated in the Al-Hasa Region's specialized programs in the academic year 2024/2025. A few random sampling strategies focused on gender balance as well as discipline diversity led to finding a proper sample of 150 students.

## **Instrument Development**

The development of the scale followed the four essential phases:

1. **Operationalization:** Provided the scale's description to be focused on measuring behavioral AOT in gifted learners. A description operationalized is usually worked out by discerning the connections within
2. **A literature review:** Identifying the constructs and shaped elements in Patric and Carolyn's 2007 publication on computational AOT as well as other works such as Baron's 2018 book *Building the Social World*, Ayyash's and Saif's 2018 *The Arab World's Inverted Classroom*, and Usama's 2010 publication.
3. **Constructing the Scale:** Grouping of fifty-one items into the four validated constructs which include: i. Of flexibility in thinking (20 items) ii. Identification of belief (9 items) iii. Dogmatic Thinking (12 items) iv. Constructivist Thinking (10 items)
4. **Pilot testing** Cognitive interviews with 35 students were carried out aimed at improving item definition and selected response accuracy.

## **Data Analysis**

A combination of descriptive statistics and inferential tests were performed using SPSS v.26. Construct validity and reliability were evaluated using the Rasch model (Winsteps v3.68.2) due to its clear advantages in assessing unidimensionality and interaction between items and persons (AlAli & Al-Barakat, 2022). Confirmatory Factor Analysis (CFA) was conducted alongside the Rasch results to ensure that the structural integrity of the scale was maintained.

## **Validity and Reliability Assurance**

A multi-faceted approach was taken to validate the model:

**Expert Review:** Nine specialists from King Faisal University addressed issues relating to content validity and improved item phrasing to ensure consistency with corresponding theoretical constructs.

**Pilot Testing:** Feedback from 30 participants as part of preliminary data collection led to changes in response options as well as item phrasing.

## **Rasch Parameters:**

- ❖ Mean Square (MNSQ): Prescribed limits 0.5–1.5.
- ❖ Point Measure Correlation (PTMEA): Acceptance range 0.2-1.0.
- ❖ Standardized Fit (Zstd): Acceptance limits -2.0 to +2.0

(Bond et al., 2021; Linacre, 2020; AlAli & Saleh, 2022).

The instrument's psychometric properties are sophisticated, as illustrated by the Rasch indices in Table 1.

Construct validity, and the values of infit mean square (MNSQ) for the infit range from 0.60 to 1.44, as also illustrated in Table 1, together indicating the boundaries of the strongest Rasch threshold region of 0.5 to 1.5 (Linacre, 2020). Equally, PTMEA coefficients value were in the range of 0.22 to 0.77, aligning with the recommended 0.2 – 1.0 range, as per AlAli & Saleh

(2022). Thus, the scale items consistently represented the construct intent, which is actively open-minded thinking (AOT), without apparent misuse or supernumerary items.

Items	Infit		Outfit		Pt-measure CORR
	MNSQ	ZSTD	MNSQ	ZSTD	
FT3	1.75	1.9	1.82	1.8	0.30
CT3	1.72	1.8	1.80	1.8	0.31
CT9	1.69	1.8	1.77	1.8	0.32
DT2	1.63	1.7	1.76	1.7	0.34
DT3	1.58	1.6	1.71	1.6	0.39
CT2	1.54	1.6	1.69	1.5	0.46
FT2	1.50	1.5	1.61	-0.9	0.49
DT4	1.44	1.4	1.58	1.1	0.51
CT5	1.38	1.4	1.50	1.2	0.51
FT19	1.31	1.3	1.44	1.0	0.54
CT10	1.27	1.2	1.41	0.9	0.54
FT17	1.18	1.2	1.48	0.9	0.54
FT18	1.11	1.1	1.35	0.8	0.58
DT5	1.13	0.9	1.27	0.5	0.58
DT12	1.08	0.7	1.20	0.6	0.58
DT8	1.17	0.6	1.13	0.4	0.58
CT7	1.09	-0.7	1.06	0.3	0.58
DT7	0.97	-1.2	0.97	-0.5	0.58
CT6	1.09	1.1	1.03	0.4	0.60
BI8	1.21	-1.6	1.09	0.5	0.61
DT10	0.97	1.4	0.96	-0.1	0.62
FT4	1.12	0.5	1.07	0.3	0.62
FT20	1.05	0.4	1.08	0.4	0.63
FT16	0.97	0.2	0.91	-0.2	0.64
BI1	1.06	0.3	1.88	1.6	0.64
FT7	0.95	1	1.04	0.2	0.65
CT1	1.08	0.6	1.11	0.5	0.65
DT11	1.07	0.2	1.06	0.2	0.65
FT11	1.01	0.1	1.01	0.6	0.66
FT5	0.98	0.4	0.88	-0.2	0.66
FT13	1.02	0.2	0.95	-0.1	0.66
FT15	1.08	0.3	0.90	-0.2	0.66
CT8	1.08	0.5	0.90	0.1	0.66
FT9	0.95	0.1	0.73	-0.2	0.66
BI5	0.87	1.1	0.66	1	0.68
FT12	1.05	0	0.75	-0.3	0.68
BI9	0.93	-0.2	0.78	-0.2	0.68
DT1	0.96	-1.2	0.77	-0.4	0.68
CT4	0.94	-0.3	0.78	-0.6	0.69
BI3	0.91	-0.2	0.63	-0.7	0.69

FT6	0.79	0.1	0.86	-0.8	0.69
BI2	0.88	-0.2	0.79	-0.2	0.70
DT9	0.87	-1.4	0.74	-0.5	0.70
FT1	0.84	-0.3	0.63	-0.6	0.72
FT10	0.77	-0.3	0.61	-0.9	0.73
FT14	0.69	-1.5	0.67	-0.7	0.74
BI7	0.74	-0.7	0.74	-0.4	0.75
BI4	0.67	-1.6	0.58	-0.6	0.77
DT6	0.63	-1.7	0.59	-0.9	0.79
FT8	0.66	-1.1	0.66	-0.7	0.80
BI6	0.63	-1.3	0.72	-1.4	0.80

Table 1. Item Fit Analysis for Actively Open-Minded Thinking Instrument

### Category Structure and Response Patterns

The ratings and the observed responses, which the participants gave in, are recorded in Table 2. Most responses fell into the higher categories: 29% of participants reported 4 (eg. "Agree") and followed by 27% at scale 3 ("Neutral"), and 25% at scale 5 ("Strongly Agree"). 2 ("Disagree") amassed 18% as the acknowledgment of negative statements was rather low. Their averages were shown to increase in a monotone fashion from -0.25 (scale 2) to +2.16 (scale 5). This jitter's noticed measures displayed order-diminished aligned response patterns with expectation by Rasch (Saleh & AlAli, 2024). It validates that the instrument could differentiate between test takers who have different levels of AOT mastery.

Category Label	Category	Score	Observed Count %	Observed Average	Infit MNS Q	Outfit MNS Q	Structure Calibration	Category Measure
2	2	2	18	-0.25	1.19	1.18	None	(-1.89)
3	3	9	27	.42	1.15	1.01	-1.23	-.18
4	4	11	29	.85	.89	.71	.04	1.31
5	5	8	25	2.16	1.17	1.31	1.21	(3.09)

Table 2 Calibration Scaling Analysis of Actively Open-Minded Thinking Instrument

### Dimensionality and Variance Explained

As it is shown in Table 3, the scale upheld the unidimensionality, which is an important Rasch benchmark. The unidimensional variance achieved through measures was 43.7% which is above the minimum value of 40%. The first contrast unexplained variance was 9.4%, below the critical cut off 15%. This confirms that the instrument captures primarily one trait (AOT) with little multidimensional noise.

	Empirical		Modeled	
Total raw variance in observations	84.5	100.0%	100.0%	
Raw variance explained by measures	41.3	44.8%		35.7%
Raw variance explained by persons	16.7	9.8%		13.5%
Raw Variance explained by items	16.8	21.9%		21.7%
Raw unexplained variance (total)	51.0	60.2%	100.0%	60.4%
Unexplained variance in 1st contrast	3.2	8.3%	12.9%	2.9
Unexplained variance in 2nd contrast	7.2%	11.2%		
Unexplained variance in 3rd contrast	2.7	6.4%	10.0%	
Unexplained variance in 4th contrast	2.3	3.6%	7.1%	
Unexplained variance in 5th contrast	2.1	4.2%	6.6%	

Table 3. Item Dimensionality of Actively Open-Minded Thinking Instrument

### Reliability and Separation Indices

The reliability metrics for the instrument are compiled in Table 4. Both person reliability (0.89) and item reliability (0.91) were above the accepted level of 0.50, meaning there is high internal consistency. The person separation index (2.47) and item separation index (4.41) were above the benchmark of 2.0. Thus, the scale can distinguish high and low responders and can assess the items in terms of their difficulty level (Saleh & AIAli, 2024). This further supports the concern of the strong psychometric properties of the AOT scale to measure the cognitive assessment of the gifted children.

	Score	Count	Measure	Error	Infit		Outfit	
					MNSQ	ZSTD	MNSQ	ZSTD
Mean		158.0	51.0	0.69	0.27		1.06	0.3
1.07	0.3							
S.D		19.6	0.1	0.99	0.11		0.63	2.3
0.59	2.1							
Real rmse		0.31						
Adj. sd		0.89						
Separation		2.47						
Person reliability		0.89						
Mean		979.4	20.0	0.00	0.09		1.02	0.4
1.05	0.4							
S.D		38.0	1.0	0.33	0.00		0.23	1.7
0.49	1.7							
Real rmse		0.09						
Adj. sd		0.30						
Separation		4.41						
Item reliability		0.91						

**Construct Validity via Confirmatory Factor Analysis (CFA)**

As for the construct validity, a Factor Confirmatory Analysis (CFA) was performed using Amos software given that the 51-item CFA instrument was created to cover four inter-related dimensions. The model aimed to determine if responses to specific items could be fitted to a four-factor structure as was hypothesized in the theory. Their model fit indices (CFI, TLI and RMSEA) were satisfactory with CFI greater than 0.90 TLI greater than or equal to 0.90 and RMSEA less than 0.08 which indicates good fit. The standardized factor loadings also exceed 0.50, which indicates that the latent constructs were significantly and, therefore, reliably measured. The p-value which tests the significance of these loadings greatly supports the argument that their respective latent constructs were indeed robustly representing these with. Through composite reliability CR scores and average variance extracted values, convergent validity was claimed exceeding the 0.70 and 0.50, Triangle relations were defended Discriminant validity was achieved if the square root of the AVE surpasses the cross factor correlational trust towards each other. The results emphasize the instrument's validity in measuring the constructs, confirming that the measurements had been planned and structured instead of being exploratory, which is an analysis that seeks to uncover data through constructed frameworks. Satisfactory-confirmatory did contemplate the validity of the construct for the tool in use since these results confirmed that it was possible to thoroughly evaluate each of the target constructs.

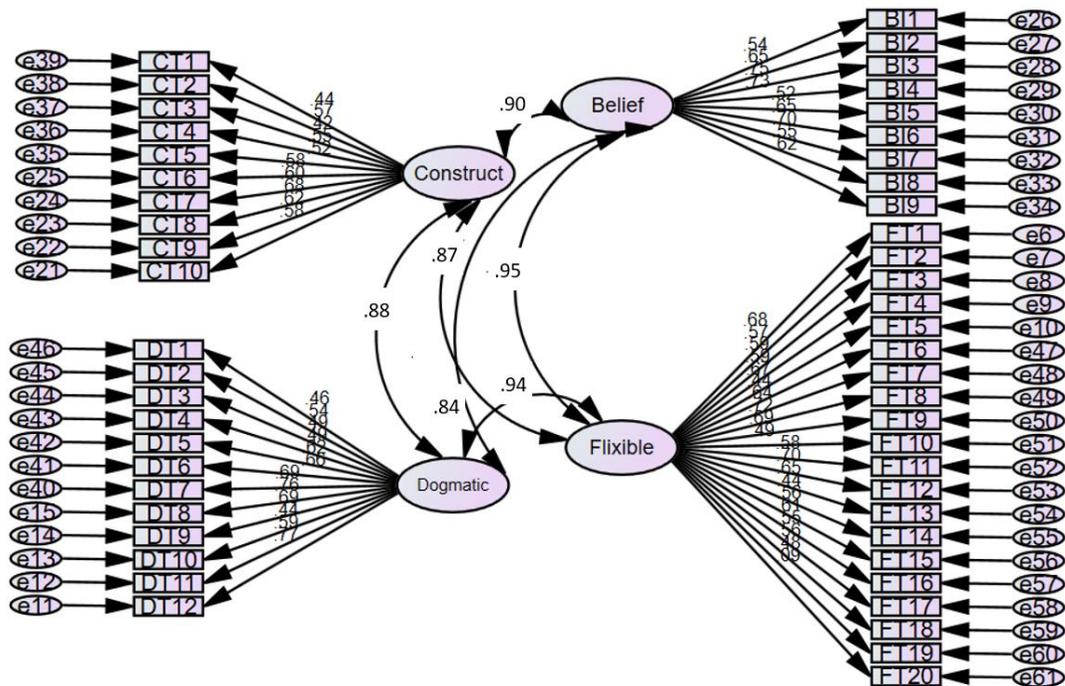


Figure 2. Results of the Confirmatory Factor Analysis of The Model Adopted for the Relationship of the Instrument Items to its Dimensions.

Figure 2 illustrates the assignment and distribution of the items in each dimension based on their factor loadings. All items have strong factor loadings above 0.60. There was also a strong positive relationship between the dimensions of the instrument, as indicated by the correlation

coefficients from the four scale dimensions. These results support the relationships among the dimensions of the construct.

This Table 5, as noted previously, depicts the outcomes of confirmatory factor analysis (CFA) conducted for assessing internal construct validity for the measurement model. The provided indices support the proposed causal relationships between the items in the instrument and the appropriate dimensions. The model achieved a good fit because all indices were met or exceeded, and all acceptance criteria were satisfactory. These included absolute fit measures and a non-significant chi-square statistic ( $p > 0.05$ ), RMSEA (Root Mean Square Error of Approximation) which was 0.076, lower than the suggested 0.08. Among the incremental fit measures were CFI = 0.931, TLI = 0.932, NFI = 0.944, all of whom – like their predecessor – surpassed the valued 0.90 cut off. Additionally, A parsimonious fit resultant from the ratio of chi square to number of degrees of freedom (3.91) was also lower than the expected value predetermined threshold (chi-square to  $df < 5.0$ ). In conjunction, those results strengthen the validity arguments with regard to the model and its relations to the scale's dimensions.

Fit Category	Index	Acceptance Criterion	Model Value
<b>Absolute Fit</b>	Chi-square ( $p$ )	$p > 0.05$	Significant
	RMSEA	$< 0.08$	0.077
<b>Incremental Fit</b>	CFI	$> 0.90$	0.931
	TLI	$> 0.90$	0.932
	NFI	$> 0.90$	0.944
<b>Parsimonious Fit</b>	Chi-square/ $df$ ratio	$< 5.0$	4.63

Table 5. Confirmatory Factor Analysis Results for the Measurement Model

## Findings

To address the first research question, "What is the level of actively open-minded thinking observed as a cognitive learning outcome in gifted programs?", means and standard deviations were calculated as descriptive statistics. These measures were employed to evaluate the prevalence and ranking of AOT indicators within the outcomes across various gifted programs.

Table 6 displays the means (M), standard deviations (SD), ranks (R), and levels of accessibility (LA) for the AOT indicators across the four dimensions of the instrument: Belief Identification, Dogmatic Thinking, Flexible Thinking, Constructivist Thinking, and Overall Scale (OS).

Dimensions and Items	M	SD	LA	R
BI5	4.07	1.12	High	1
BI3	4.01	1.37	High	2
BI4	3.72	1.14	High	3
BI1	3.67	1.33	High	4
BI6	3.59	1.36	High	5

BI8	3.40	1.19	Medium	6
BI2	3.36	1.51	Medium	7
BI7	3.29	1.44	Medium	8
BI8	2.70	1.19	Medium	9
Belief Identification (BI)	3.53	0.84	High	
DT3	3.91	1.33	Medium	1
DT2	3.81	1.05	High	2
DT7	3.76	1.20	High	3
DT11	3.68	1.37	High	4
DT5	3.58	1.37	High	5
DT6	3.49	1.29	High	6
DT4	3.43	1.30	Medium	7
DT8	3.33	1.29	High	8
DT12	3.29	1.25	Medium	9
DT9	3.28	1.34	Medium	10
DT10	3.10	1.25	High	11
DT1	3.04	1.45	Medium	12
Dogmatic Thinking (DT)	3.48	0.75	High	
FT17	3.88	1.14	Medium	1
FT14	3.80	1.36	High	2
FT2	3.79	1.22	High	3
FT3	3.63	1.30	Medium	4
FT10	3.57	1.28	High	5
FT20	3.55	1.32	High	6
FT18	3.55	1.31	Medium	7
FT6	3.55	1.25	Medium	8
FT12	3.49	1.17	High	9
FT9	3.47	1.25	High	10
FT5	3.46	1.27	Medium	11
FT15	3.43	1.34	High	12
FT8	3.34	1.23	Medium	13
FT7	3.31	1.52	High	14
FT13	3.29	1.36	High	15
FT1	3.03	1.43	Medium	16
FT19	3.00	1.41	High	17
FT16	2.97	1.30	High	18
FT11	2.73	1.40	Medium	19
FT4	2.61	1.33	High	20
Flexible Thinking (FT)	3.40	0.77	Medium	
CT7	3.72	1.29	High	1
CT3	3.52	1.28	Medium	2
CT6	3.51	1.16	High	3
CT9	3.48	0.88	Medium	4
CT1	3.48	1.25	Medium	5
CT10	3.39	0.83	High	6

CT4	3.27	1.36	High	7
CT2	3.25	1.14	Medium	8
CT5	3.17	1.51	High	9
CT8	3.01	1.43	Medium	10
Constructivist Thinking (CT)	3.38	0.78	Medium	
Overall, Actively Open-Minded Thinking Instrument	3.44	0.68	High	

From the results of the analysis in table 6, it is evident that Belief Identification, Dogmatic Thinking BI, DT had the highest mean scores ( $M = 3.53$ ,  $SD = 0.84$  and  $M = 3.48$ ,  $SD = 0.75$  respectively) and both were categorized as having a high degree of availability. However, Flexible Thinking (FT;  $M = 3.40$ ,  $SD = 0.77$ ) and Constructivist Thinking (CT;  $M = 3.38$ ,  $SD = 0.78$ ) exhibited medium availability.

Based on the mean scores, the following ranking was determined for the dimensions of the construct: BI, Dogmatic Thinking (DT), Flexible Thinking (FT), and Constructivist Thinking (CT). The mean score for AOT instrument was 3.44 ( $SD = 0.68$ ) which can be classified as high degree of availability indicating that most indicators of AOT framework are present in the gifted programs.

For the third research question, which is “Do gender differences exist in the availability of AOT indicators across gifted program outcomes?”, independent samples t-tests were performed and are included in Appendix A. The results regarding the means of male and female participants for each of the four AOT dimensions including the overall scale were provided in Table 7.

<i>Variables and Gender</i>	<i>Dimensions</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>t-value</i>	<i>p-value</i>	
Gender	Belief identification	Male	69	3.84	0.77	1.309	.001
		Female	81	4.12	0.63		
	Dogmatic thinking	Male	69	3.92	0.67	2.106	.045
		Female	81	4.06	0.56		
	Flexible thinking	Male	69	3.94	0.63	.438	.007
		Female	81	4.11	0.59		
	Constructivist thinking	Male	69	3.90	0.62	.757	.012
		Female	81	4.05	0.56		
	Overall average	Male	69	3.90	0.65	.965	.016
		Female	81	4.09	0.57		

Table 7 Independent Samples t-Test Results for Gender Differences in AOT Indicators

According to the findings presented in Table 7, the outcome of the tests indicated that gender differences were significant for the AOT instrument in all areas ( $p < .05$ ). In more detail:

- Belief Identification: Significantly higher scores were achieved by females ( $M = 4.12$ ,  $SD = 0.63$ ) compared to males ( $M = 3.84$ ,  $SD = 0.77$ ),  $t = 1.31$ ,  $p = .001$ .
- Dogmatic Thinking: Females ( $M = 4.06$ ,  $SD = 0.56$ ) outperformed males ( $M = 3.92$ ,  $SD = 0.67$ ),  $t = 2.11$ ,  $p = .05$ .

• Flexible Thinking: Score Females ( $M = 4.11$ ,  $SD = 0.59$ ) achieved over males ( $M = 3.94$ ,  $SD = 0.63$ ),  $t = 0.44$ ,  $p = .007$ .

• Constructivist Thinking: Scores of Females ( $M = 4.06$ ,  $SD = 0.56$ ) compared with males ( $M = 3.89$ ,  $SD = 0.62$ ),  $t = 0.76$ ,  $p = .012$ .

The AOT scale showed very important gender differences ( $t = 0.97$ ,  $p = .016$ ) while mean scores for the female participants ( $M = 4.087$ ,  $SD = 0.570$ ) were higher than for males ( $M = 3.90$ ,  $SD = 0.65$ ). This evidence looks like gender is an important factor showing the AOT thinking processes in the gifted programs results.

To investigate differences in the gaps of actively open-minded thinking (AOT) indicators alongside gifted program outcomes categorized by participant levels of program exposure, a one-way analysis of variance (ANOVA) was done. Table 8 displays findings of the ANOVA for differences in AOT dimensions corresponding with the number of programs obtained by gifted students.

Dimension			Sum of Squares (SS)	df	Mean Square (MS)	F-value	p-value
Variance Source							
Number of Programs Acquired	Belief identification	Between Groups	5.370	3	1.790	3.552	.017
		Within Groups	48.372	96	.504		
		Total	53.741	99			
	Dogmatic thinking	Between Groups	3.302	3	1.101	2.856	.041
		Within Groups	36.996	96	.385		
		Total	40.298	99			
	Flexible thinking	Between Groups	2.835	3	.945	2.543	.031
		Within Groups	35.675	96	.372		
		Total	38.510	99			
	Constructivist thinking	Between Groups	2.818	3	.939	2.718	.049
		Within Groups	33.171	96	.346		
		Total	35.988	99			
	Whole Dimensions	Between Groups	3.458	3	1.153	3.113	.030
		Within Groups	35.549	96	.370		
		Total	39.007	99			

Table 8 One-Way ANOVA Results for Differences in AOT Indicators by Number of Programs Acquired

All dimensions of AOT and the number of programs acquired did show in the ANOVA results that there are statistically significant differences:

- Identification of beliefs:  $F(3, 96) = 3.552, p = .017$
- Dogmatic thinking:  $F(3, 96) = 2.856, p = .041$
- Flexible thinking:  $F(3, 96) = 2.543, p = .031$
- Constructivist thinking:  $F(3, 96) = 2.718, p = .049$
- Overall AOT Scale:  $F(3, 96) = 3.113, p = .030$

The Tukey HSD test showed that there were differences between program exposure groups. This showed how the participants actively open-minded thinking AOT showed differences when looking at different levels of program participation.

Mean	(I) Program	(J) Program	Mean Difference (I-J)	Std. Error	Sig.
3.71	1 program	2 program	0.476	0.467	.002
		3 program	0.325	0.327	.001
		4 program	-0.146	0.318	.004
		more than 5 program	0.137	0.335	.002
3.96	2 program	1 program	-0.582	0.467	.003
		3 program	-0.218	0.372	.027
		4 program	-0.634	0.364	.018
		more than 5 program	-0.485	0.378	.000
3.98	3 program	1 program	-0.359	0.327	.004
		2 program	0.217	0.372	.024
		4 program	-0.431	0.148	.038
		more than 5 program	-0.278	0.180	.002
4.08	4 program	1 program	0.031	0.318	.001
		2 program	0.626	0.364	.016
		3 program	0.417	0.148	.034
		more than 5 program	0.139	0.164	.001
4.11	more than 5 program	1 program	-0.109	0.335	.000
		2 program	0.486	0.378	.000
		3 program	0.265	0.180	.002
		4 program	-0.125	0.164	.001

Table 9 Tukey Test for Differences Between the Number of Programs Acquired by the Gifted Students

Table 9 indicates that there were statistically significant differences across all dimensions of actively open-minded thinking indicators in relation to the outcomes of gifted programs, as assessed by the overall scale, based on the number of programs attended by gifted students.

## **Discussion**

This study sought to determine the level to which pointers of actively open-minded thinking are present in the outcomes of the gifted students' programs in the Al-Ahsa region of the Kingdom of Saudi Arabia. With the aid of a standardized tool, the results indicated that the belief identification dimension registered the highest scores. This finding could be explained by the particular context of Arab societies where great attention is given to nurturing and fostering Arab ethnic identity through several cultural facets. It is important to note that most beliefs change, or reinterpretation does not usually dismantle a person's identity. There is, therefore, maintained cognitive orientation among gifted students toward culture and ideologies.

Likewise, the dimension of dogmatic thinking also scored high marks. This can be explained using the socio-cultural frameworks of Arab societies which tend to emphasize cultural identity preservation through religion. Religion is a primary vehicle of culture and epistemology in the Arab world and often is associated with a preference for unambiguous truths that are of religious nature. Such societal factors may turn out to be the cause of rigid thinking among gifted students who tend to have a narrow view of alternative perspectives.

On the other hand, the flexible thinking dimension was rated at a moderate level. This could be attributed to the nature of gifted programs, which focus primarily on achieving short-term outcomes within specific timelines. While such an approach may promote the achievement of immediate educational goals, it may also stifle more advanced forms of cognitive engagement like deeper reflective thinking, evaluation and synthesis of diverse viewpoints, and self-guided problem-solving—features of cognitive flexibility.

Constructivist-thinking dimension also earned a moderate score. This implies that the programs might have over-emphasized achievement and content mastery while paying inadequate attention to fostering deeper levels of cognitive development through the integration of prior learning. Constructed knowledge requires thorough thinking and responsiveness to environmental stimuli and may not be fully realized in existing program designs. Adaptability, learning, and reconstruction of knowledge necessitates proactive reflection and sustained participation.

There were statistically significant differences with open-minded thinking indicators due to females showing comparatively more active indicators than males. This may reflect the considerable sociocultural changes available to women in Saudi Arabia under its Vision 2030, which focuses on the knowledge economy and women's empowerment. Such changes might have positively impacted the motivation and the engagement of female students, leading to enhanced open-minded thinking skills. These findings complement those of some other studies done by AlAli (2023), Ahmed (2019), Abdellah (2018), Mohamad & Bendania (2021), Ladd (2009), but contradict findings from Martin et al. (2017), Ayyash & Saif (2018), and Marsh (2010) who all reported biases toward males or no gender effect.

Additionally, differences were statistically significantly found with regard to the number of enrichment programs attended: students who attended a greater number of programs were favored. This highlights the need for programs in building and additively developing cumulative learning pathways with longitudinal developmental trajectories in fostering higher order thinking skills. Supporting literature (Alakashee et al., 2024; Landrum, Callahan, & Shaklee, 2001) stresses that one-off interventions are less effective than ongoing and growth-oriented services. The conclusions drawn corroborate Al-Harthy (2020), Al-Sultan and Al-Harbi (2021),

Buanine et al. (2015), Al-Ahmari (2016), and Al-Dalami (2015), all of whom studied the impact of enrichment programs on the diverse capabilities of gifted students and accentuated the positive impact on their cognition and creativity.

In conclusion, the gifted programs in Al-Ahsa succeeded in supporting cognitive development, as evidenced by the high-performance ratings given to the overall instrument measuring actively open-minded thinking. The effect was less pronounced in flexible and constructivist thinking, and stronger in belief and dogmatic systems thinking. This finding adds to the body of research analyzing the effects of gifted education on the cognitive abilities of students in the programs (Alelyani, 2021; Elballah, 2024; Al-Zoubi, 2014) and emphasizes the persuasive impact that program design may have on cognitive biases in thinking to be prevalent among gifted learners.

### **Conclusion, Limitations, and Future Directions**

Given the services offered by the Saudi Ministry of Education for gifted students, this study looked at the incorporation of actively open-minded thinking within the gifted program outcomes at Al-Ahsa. The results were shown to have a positive influence on students' cognitive orientations; however, the study was limited to one region within a specific demographic. More so, the findings could be generalized only with caution.

Later studies might find it useful to appreciate the perspectives of gifted students regarding the program content to appreciate its strengths and areas of improvement. There is also a need to engage others. Program developers and administrators should be included for relevant considerations regarding the gifts of learners with regard to their emotional and intellectual capacities. It is suggested that more participatory approaches, where students are more involved in the designing and evaluation of programs, be used to address the developmental needs of diverse aspects of personality and intelligence.

Among other things, further inquiry may include:

- Assessing how gifted programs impact mental health, and cognitive and emotional needs.
- Looking at the association of these programs with self-efficacy in digital and blended learning environments.
- Relating actively open-minded thinking and cognitive beliefs at different stages of development.

Examining the relations of proactively open-minded thinking with cognitive beliefs, need for cognition, and academic procrastination tendencies.

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## References

- Abdellah, Abdelrasoul (2018). The Direct Effects of the Needs for Cognition and Gender on Actively Openminded Thinking and Academic Achievement in a Sample of University Students. *Journal of the Faculty of Education at Mansoura*, 102(2), 533-595.
- Abuelgassim, A. & Ahmed, E. (2020). Assessment of gifted education programs in Khartoum state in the light of international standards of education and gifted care from the point of view of special education teachers. *KKU journal of education sciences*, 31(2), 411-452.
- 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> .
- Ahmad, Samah (2019). Cognitive beliefs and their relationship to active open-mindedness and academic achievement among secondary school students. Unpublished Master thesis, Sohag University.
- Al-Ahmari, Ahmed (2016). Impact of School Gifted Program In the Development of Creativity Thinking Skills Among Talented Students. *The International Interdisciplinary Journal of Education*, 5(11), 268-280.
- Alakashee, B, A, Al-Barakat,A, A Al Karasneh, S, M, El-Mneizel, A, F Al-Qataweh, S, S, AlSalhi,N, R, AlAli, R. (2024). Enhancing Active Learning through Educational Characteristics of Social Networking Applications: Faculty Perspectives. *Revista Electrónica de LEEME*, 53, 12-27. DOI: <https://doi.org/10.58262/LEEME.53.0002>
- AlAli, R. (2023). Indicators of Actively Open-minded Thinking as One of the Cognitive Learning Outcomes for Gifted programs in Al-Ahsa Region: “An Evaluation Study”. *Journal of Hunan University (Natural Sciences)*, 49(12), 28-44. <https://doi.org/10.55463/issn.1674-2974.49.12.4> .
- AlAli, R. (2024). Enhancing 21st Century Skills through Integrated STEM Education using Project-Oriented Problem-Based Learning. *Geojournal of Tourism and Geosites*, 53(2), 421–430. <https://doi.org/10.30892/gtg.53205-1217>
- 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> .
- AlAli, R. & Saleh, S. (2022). Towards Constructing and Developing a Self-Efficacy Scale for Distance Learning and Verifying the Psychometric Properties. *Sustainability*, 14, 13212. <https://doi.org/10.3390/su142013212>
- Al-Atwi, Saleh (2019). Programs and Methods of Taking Care of Talented Students in Mathematics and the Problems they Face in Saudi Arabia. *The comprehensive, multi-knowledge electronic journal for the dissemination of scientific and educational research*, 10, 1-11.
- Al bandar, Zina (2021). Emotional expression and Relationship existential Presence among university students. *Journal of Diyala University*,14(2), 311-353.
- Al-Barakat, A. A., AlAli, R. M., Alakashee, B. A., Al-Karasneh, S. M., Alsalhi, N. R., Al-Saud, K. M., ... & Helali, M. M. (2024). CRITICAL INTEGRATION OF ECONOMIC CONCEPTS IN EARLY CHILDHOOD EDUCATION: PERSPECTIVES FROM EDUCATORS. *International Journal of Economics and Finance Studies*, 16(2), 15-35.
- Al-Barakat, A., AlAli, R., Al Hassan, O., & Al-Saud, K. (2025). Assessing the Impact of Predictive Thinking -Based Learning Activities on Enhancing Creative Writing in Language Learning Classrooms. *Educational Process: International Journal*, 15, e2025187 <https://doi.org/10.22521/edupij.2025.15.187>
- Alelyani, S. O. (2021). Special educational need of the gifted and talented students in Saudi Arabia: A review paper. *International Journal of Educational Research Review*, 6(2), 124-133.

- Al-Harbi, Hind (2020). E-learning and nurturing the gifted in the Kingdom of Saudi Arabia in light of the Corona pandemic. *The Scientific Journal of the College of Education*, 38(3), 335-359.
- Al-Harhi, Ryan (2020). The effectiveness of an enrichment program based on the Kolb model for developing problem solving among gifted students. *Journal of the College of Education*, 11, 1533-1555.
- Al-Hassan, O. M., Alhasan, L. M., AlAli, R. M., Al-Barakat, A. A., Al-Saud, K. M., & Ibrahim, N. A. (2025b). Enhancing Early Childhood Mathematics Skills Learning through Digital Game-Based Learning. *International Journal of Learning, Teaching and Educational Research*, 24(2).
- Al-Hassan, O. M., Al-Barakat, A. A., AlAli, R. M., Bataineh, R. F., Aboud, Y. Z., & Ibrahim, N. A. (2025a). Shaping Young Minds: How Teachers Foster Social Interaction, Psychological Security and Motivational Support in the Primary Language Classroom. *International Journal of Learning, Teaching and Educational Research*, 24(1).
- Aljghaiman, A. & Maajeny, U. (2013). Evaluation of the gifted nurturing program in the Saudi public education schools with regard to the quality standards of the enrichment programs. *Journal of Educational and Psychological Sciences*, 14(1), 217-245.
- Alqadhi, Adnan (2016). Assessing the Gifted Programs in the Kingdom of Bahrain in the Light of Students, Teachers, Administrators, and Records Analysis Based on American Standards of the National Association of Gifted Children. *Journal of Educational and Psychological Sciences*, 17(3), 14-44.
- Al-Zoubi, S. M. (2014). Effects of enrichment programs on the academic achievement of gifted and talented students. *Journal for the Education of Gifted Young Scientists*, 2(2), 22-27.
- Ayoub, A. E. A., Abdulla Alabbasi, A. M., Alsubaie, A. M., Runco, M. A., & Acar, S. (2022). Enhanced Open-Mindedness and Problem Finding Among Gifted Female Students Involved in Future Robotics Design. *Roeper Review*, 44(2), 85-93.
- Ayyash, L. & Saif, G. (2018). Translation and applying scale of Actively Open-minded Thinking according to the theory of (Baron) among Postgraduate Students for Baghdad University. *Journal of Wassit for human sciences*, 14(40), 117-152.
- Baron, J. (2019). Actively open-minded thinking in politics. *Cognition*, 188, 8-18. <https://doi.org/10.1016/j.cognition.2018.10.004>
- Baron, J., Isler, O., & Yilmaz, O. (2022). Actively open-minded thinking and the political effects of its absence.
- Baron, J., Gürçay, B., & Metz, S. E. (2016). Reflective thought and actively open-minded thinking. In *Individual Differences in Judgement and Decision-Making* (pp. 117-136). Psychology Press.
- Baron, J., Scott, S., Fincher, K., & Metz, S. E. (2015). Why does the Cognitive Reflection Test (sometimes) predict utilitarian moral judgment (and other things)? *Journal of Applied Research in Memory and Cognition*, 4(3), 265-284.
- Boone, W. J. Rasch analysis for instrument development: why, when, and how? *CBE—Life Sciences Education*. 2016, 15(4), rm4. <https://doi.org/10.1187/cbe.16-04-0148>
- Callahan, C. M., Azano, A. P., Park, S., Brodersen, A. V., Caughey, M., Bass, E. L., & Amspaugh, C. M. (2020). Validation of instruments for measuring affective outcomes in gifted education. *Journal of Advanced Academics*, 31(4), 470-505.
- Chen, V. (2015). "There is No single right answer": the potential for active learning classrooms to facilitate actively open-minded thinking. *Collected Essays on Learning and Teaching*, 8, 171-180.
- Elballah, K., Alkhalifah, N., Alomari, A., & Alghamdi, A. (2024). Enhancing cognitive dimensions in gifted students through future problem-solving enrichment programs. *Discover Sustainability*, 5(1), 248.
- King Abdulaziz and His Companions Foundation for Giftedness and Creativity (Mawhiba) (2014). Strategy and Plan for Talent, Creativity and Innovation Support. Unpublished document. <https://www.mawhiba.org/Ar/About/Strategy/Documents/1000356-MawhibaticontentFile.pdf>

- Ladd, J.A. (2009). The influence of actively open-minded thinking, incremental theory of intelligence, and persuasive messages on mastery goal orientations. PhD Thesis, university of Florida, 55-58.
- Landrum, M. S., Callahan, C. M., & Shaklee, B. D. (2001). Aiming for excellence: Gifted program standards, annotations to the NAGC pre-K-12 gifted program standards: Waco, TX: Prufrock.
- Mansour, H. & Hariri, R (2020). The effect of the application of the enrichment partnership program on academic achievement in the scientific subjects of gifted girls students at the secondary stage in general education in Jeddah. *The Arab Journal of Disability and Talent Sciences*, 4(13), 89-131.
- Marsh, K. R., (2010). Examining the role of cognitive ability and individual thinking dispositions in moral judgment. Master Thesis. Graduate Faculty, James Madison University, <https://core.ac.uk/download/pdf/153206977.pdf>
- Martin, N., Hughes, J. & Fugelsang, J. (2017). The role of experience, gender, and individual differences in statistical reasoning. *Statistics Education Research Journal*, 16(2), 454-475.
- Mertens, D. M., & Wilson, A. T. (2018). Program evaluation theory and practice. Guilford Publications.
- Ministry of Education (2024). School Gifted Program. <https://www.backtoschool.sa/page/question/136/577.html> (accessed on 20 October 2024).
- Mohamad, Tarik & Bendania, Ahmed (2021). Differences in Actively open-minded thinking and Epistemological beliefs according to academic level, specialization, and social type. *Kuwait social science Journal*, 49(3), 34-56.
- Parham, W. (2017). Epistemic Motivation and Actively Open-Minded Thinking's Impact on Innovative Behavior as Moderated by a Leader's Tolerance for Disagreement Within a Dental School Community (Doctoral dissertation, Regent University).
- Robbins, J. I. (2019). Gifted program evaluation: Catalyst for change or keeper of the culture. *Gifted Child Today*, 42(4), 196-204.
- Ruwaili, Muhammad (2018). Evaluation of gifted programs from the point of view of school leaders, teachers and students: A field study in Turaif Governorate. *The Scientific Journal of the College of Education*, 34 (3), 221-238.
- 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>
- ShoaiB, Saleh & Osama, Ibrahim (2013). Evaluating the outputs of the gifted programs in Al-Madinah Al-Munawwarah region. *Journal of the College of Education*, 27, 266 – 295.
- Stenhouse, N., Myers, T. A., Vraga, E. K., Kotcher, J. E., Beall, L., & Maibach, E. W. (2018). The potential role of actively open-minded thinking in preventing motivated reasoning about controversial science. *Journal of Environmental Psychology*, 57, 17-24.
- Stankovska, G., & Rusi, M. (2014). Cognitive, Emotional and Social Characteristics of Gifted Students with Learning Disability. Bulgarian Comparative Education Society.
- Stanovich, K. E., & Toplak, M. E. (2023). Actively open-minded thinking and its measurement. *Journal of Intelligence*, 11(2), 27.
- Stanovich, K. E., & Toplak, M. E. (2019). The need for intellectual diversity in psychological science: Our own studies of actively open-minded thinking as a case study. *Cognition*, 187, 156-166.
- Sultan, Jawad & Al-Harbi, Mishaal (2021). The effectiveness of a distance-training program based on problem-solving strategy in developing creative thinking Among the talented students in Jubail Industrial City. *The Arab Journal of Disability and Gifted Sciences*, 5(17), 163-184.
- Svedholm-Häkkinen, A. M., & Lindeman, M. (2018). Actively open-minded thinking: development of a shortened scale and disentangling attitudes towards knowledge and people. *Thinking & Reasoning*, 24(1), 21-40.

- Usama, Ibrahim (2010). Cognitive and affective learning outcomes of summer talent programs: an evaluation study. *The Egyptian Journal of Psychological Studies*, 68(20), 51-107.
- Zajda, J., & Zajda, J. (2021). Constructivist learning theory and creating effective learning environments. *Globalisation and education reforms: Creating effective learning environments*, 35-50.