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The role of gender and group preferences in problem-finding and problem-solving

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ABSTRACT

Creative problem-solving is a critical skill for 21st-century learners, yet its relationship with gender and creativity preferences among gifted students remains underexplored. This study investigated how gender and individual versus group creativity preferences influence problem-finding and problem-solving abilities in intellectually gifted secondary students in Kuwait. A sample of 98 participants was assessed using the realistic problem generation and presented problems evaluations and the collectivism/individualism creativity preference scale. Statistical analysis included cluster analysis and the Point-Biserial correlation coefficient (Pbis). Results revealed that individual creativity had a stronger correlation with problem-solving skills than group creativity, while gender showed no significant effect. These findings support the development of personalized, gender-neutral educational strategies that nurture the distinct creative strengths of gifted learners to optimize academic performance.

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1. INTRODUCTION

According to the Framework for 21st century learning [1], critical thinking, communication, collaboration, and creativity are the 21st-century essential skills. It provides students with the tools to deal with real-life problems, helping in solving problems and thinking critically. These skills are fundamental in preparing students for future challenges, both in personal and professional contexts. The Organisation for Economic Co-operation and Development (OECD) PISA study [2] shows that creative thinking is vital in education. It is key as one of the core competencies for tackling complex problems. Promoting creativity in the classroom is, therefore, a key strategy for equipping students to solve social and work-related problems. The contribution of teachers is equally significant for creativity. In the words of Tripon [3], teachers have the opportunity to assist students in developing original solutions and the collaborative construction of problem statements. Teachers create spaces that nurture imaginative thinking and problem-finding skills, linking creativity to jobs.

The examination of creativity works on both the individual and the united front. It shows that creativity can be understood on both the individual and the group level. This dual perspective supports the importance of fostering creativity through both personal development and collaborative learning environments. Creativity is a valuable competence in an individual. It has great importance across various disciplines. The early model 4P's framework (person, process, product, and press) shows that creativity is multi-dimensional. It can refer to personality, processes, products, and the press (environment) according to

Kozbelt *et al.* [4]. The elements are basic measure the definition of creativity. For instance, Diedrich *et al.* [5] state that creative outcomes are both new and useful, and experts or peers in the relevant field evaluate them.

Besides cognitive creativity, emotional creativity is being recognized for its importance in creative competence. Emotional creativity is the ability to produce new, authentic and effective emotional responses to a wide range of situations [6]. The concept shows how emotions help in improving adaptability, building relationships and promoting creativity at both personal and professional levels.

According to new studies, emotional creativity in education helps students face difficult emotional problems more resiliently in a creative manner. As per Bulathwatta and Lakshika [7], emotional creativity is correlated with achievement motivation and the effective management of trauma symptoms. Moreover, emotional intelligence and creativity work together to support insightful and intuitive thinking, which fosters creative development on cognitive and emotional levels [8], [9].

Processing emotions creatively helps to perform better in a specific domain like art and music. This is because this creativity helps resilience which is further boosted by gratitude. Thus, one can tackle challenges that are complex emotionally. Additionally, various measures of creativity, including divergent thinking, creative production and beliefs about one's creativeness, are correlated with divergent thinking being a significant predictor of creative achievement [10]. By enhancing cognitive and emotional creativity as part of the educational policy, innovations would be accomplished in self and school context.

Researchers agree that creativity is about producing original and useful ideas or solutions [11]. Research shows that creativity is related to academic achievement. For example, several studies [12]–[14], as mentioned by Bart *et al.* [15] reported that creativity rated by teachers predicted high academic performance of Spanish secondary students. Creativity may look different in different contexts. Gifted individuals with high intellectual and/or creative abilities often benefit greatly from periods of solitude in which uninterrupted time enables deep thinking [16], [17]. With this seclusion the default mode network of the brain is activated which is crucial for introspection and creative problem-solving.

But, being too isolated means less opportunity to work with others and get different views. These are being seen as so important for innovation [18], [19]. Interdisciplinary exchanges in cooperative environments can enhance creativity by merging different views and providing solutions cooperatively. Even though creativity is known to be an important skill for the 21st century that is necessary for finding and solving problems, there is still a big gap in understanding of how gifted students' creative preferences (individualism vs. collectivism) affect their abilities in these areas. Also, the role of gender differences in these situations, especially among a special group of gifted students, has not been studied enough. This study fills in the gaps by looking at these connections to give teachers and policymakers important information about how learning styles affect how people think and how well they do in school.

The current study on creativity investigates the gifted students in Kuwait. The creativity study investigates the individualistic and collectivistic approach study the subjects of this study are gifted students who study at the Sabah Al-Ahmad Center for Giftedness and Creativity. This study examines whether there are gender differences in one's preferences for individualism versus collectivism in creativity and the impact those have on finding and solving problems. Through a cognitive science lens, the research is aimed to try to provide insights for educators and policymakers by examining how children's learning style preferences influence cognition and educational outcomes. This study aimed to investigate the following questions:

- What are the creativity preferences (individualism vs collectivism) and problem-finding/problem-solving abilities profiles of gifted secondary school students?
- How do the abilities to find and solve problems relate to the preference for creativity (individualism versus collectivism)?
- What are the impacts of the problem-finding and problem-solving dimensions on creativity (e.g., fluency, originality) according to identified profiles?

The second and third research questions are interrelated, and logically designed to complement one another. This is because problem-finding and/or problem-solving might depend on creativity preferences. The second question looks at whether these things are related. If they are, we can move on to looking at cause and effect. After establishing the correlations, the third question seeks to determine the profiles involved and how the identified correlations manifest in those profiles. In simpler terms, we can examine the role of problem-finding/problem-solving abilities on dimensions of creativity (e.g., fluency, originality) in various groups of students. Based on these questions, the following research hypotheses were developed: i) gifted students significantly differ from each other in problem-finding fluency and originality with respect to gender (H_1); ii) there are significant gender differences between boys and girls in problem-solving fluency and originality (H_2); iii) individual or group creativity preferences have no significant relationship with problem-finding or problem-solving dimensions (H_3); and iv) based on their creativity preferences and problem-finding/problem-solving abilities, students can be grouped into distinct clusters (H_4).

This study is among the first to assess the impact of gender and creativity tastes, i.e., individualism vs. collectivism with a core focus on intellectually gifted secondary school students in Kuwait. In contrast, previous studies do not examine this combination of factors in this demographic and cultural context. This research connects the cognitive and emotional aspects of creativity by looking at how individual vs group-based creative approaches preference relates to fluency and originality in problem identification and solving. This adds a multi-faceted understanding of creative performance. The researchers adapted and validated existing tools (e.g., Runco-Okuda realistic problem generation scale, collectivism/individualism creativity preference scale) for Arabic-speaking, Kuwaiti adolescents.

This study offers one of the few psychometrically sound measures for Arab gifted students. Further, the findings of this study explored education strategies focused on both individualistic and collectivistic creativity preferences and that provide equal opportunities for each gender. This adds to the policy and curriculum for inclusive education, especially in cultures with gender roles, making it more novel work.

2. LITERATURE REVIEW

2.1. Creativity frameworks

The understanding of creativity has evolved from static, individual-centered models to multi-dimensional and dynamic frameworks. Sosa and Gero [20] introduced a model that integrates time-based and scale-sensitive interactions, emphasizing how creative ideas evolve and gain social acceptance through 'Persuasion'. This method transforms the concept of creativity from an innate quality into a fluctuating space comprising various segments.

Similarly, Zanden *et al.* [21] proposed the concept of "mini-c" creativity, which centers on personal meaning-making and internal learning processes. It is an amalgamation of the emotional and intellectual aspects of creativity, and the concern that creativity is a social and personal endeavor. Williams *et al.* [22] emphasized that creativity manifests differently across disciplines, often under varied terminologies—such as "innovation" in education or "entrepreneurship" in business. These distinctions highlight creativity's domain-specific nature and suggest that its development requires tailored educational approaches. Quiñones-Gómez [23] defined creativity as a compound syndrome of multidimensional traits and further developed a model, referred to as the 4P, to apply this concept.

Diedrich *et al.* [5] further clarified that creative outcomes must be both novel and useful, judged by domain-specific peers, which reaffirms creativity's contextual and evaluative character. The broader frameworks collectively indicate that creativity cannot only be fostered through cognitive development but should also take into consideration affective, social, and environmental effects. These perspectives inform this study's focus on creativity not just as a trait, but as a behavior influenced by context, learning style, and social structures.

2.2. Gender and cultural expectations in creativity

Gender and cultural differences have a substantial influence on the perception and expression of creativity. In the Middle East and North Africa (MENA) region, gender norms have institutionally affected educational and cognitive opportunity access historically. Moghadam [24] criticizes such gender regimes and their influence on identity formation and preference created. For example, males generally use individualistic, risk-taking artistic styles in contrast to females who pursue a collective and harmonious style [25], [26].

Such trends are especially pronounced in Kuwait, where education and social systems tend to be gendered [15], [27]. Such divisions may influence the way students think and approach creative problem-solving. Oriol *et al.* [6] observed that women in general have greater emotional creativity, which is frequently expressed as collaborative problem-solving skills with emphasis on relationships and empathy. This observation supports the necessity of studying creativity from both cognitive and emotional perspectives. By noting the importance of the gendered patterns of cognition, educators may create interventions that normalize alternative creativity forms. Designing instruction to acknowledge these differences helps achieve the inclusive goals of educational processes that this study proposes.

2.3. Individualism vs. collectivism in creativity

Creativity works in different ways in individualist and collectivist cultures. Individual creativity is associated with concepts of autonomy, originality, and self-expression and is typically associated with characteristics such as openness and risk-taking [28]. Collectivist creativity, on the contrary, is based on co-creation, interdependence, and organized collaboration. Group creativity enhances socially enhanced innovation, although this could restrict originality where consensus plays out.

Cross-cultural stereotypes suggest that, in general, East Asian societies are less open to new experiences, which is closely correlated with creativity. In contrast, Western societies possess high levels of

collectivism but promote individual innovation [29], [30]. According to Choi [31], individualism does promote originality, but it also tends to discourage the social approval of ideas. This requires a balance of these dimensions towards exploring effective creativity in a variety of classrooms. Group dynamics are also two-faced: something that can foster creativity by promoting diversity of thought or suffocate creativity due to conformity and unequal group participation [32], [33]. This duality justifies exploring creativity preferences, whether students prefer working alone or collaboratively, as a key variable in this study.

2.4. Creativity in problem-finding and problem-solving

The connection between creativity and problem-solving is well understood. Long *et al.* [34] stressed that successful problem-solving starts with adequate and sustained problem-finding. This dual operational continuum is an indication of a cognitive aspect that comprises recognizing problems (problem-finding) and developing effective solutions (problem-solving). The cognitive processes behind it may, however, be different across gender and style of creativity.

As an example, boys tend to be more original when working independently on a problem, but girls may perform better in group work-based problem situations [35]. This aligns with emotional creativity trends and the collaborative preference observed in collectivist settings. These distinctions provide a theoretical foundation for investigating how problem-finding and solving differ based on gender and creativity preferences—core aims of the current study. As personal practices in Kuwaiti classrooms can align with gendered social concepts, it is important to comprehend the way these patterns are represented in the lives of gifted pupils. Programs that are developed without appreciating such subtleties could fail in developing diverse talents.

2.5. Emotional aspects of creativity

Recent research highlights the role of emotional creativity—defined as the ability to generate novel and effective emotional responses—in enhancing cognitive flexibility and social adaptability [6], [8]. Emotional creativity helps one become self-aware, resilient, and understand their relationship, all of which enable them to solve their problems better in both academic and real-life environments. Bulathwatta and Lakshika [7] found strong associations between emotional creativity and trauma management, suggesting its role in enhancing student well-being.

Xu *et al.* [9] demonstrated that emotional intelligence and creativity are positively correlated, reinforcing the view that affective competence is integral to innovation. As students mature, both cognitive and emotional creativity can decline unless intentionally developed. This suggests an urgent need for educational models that emphasize emotional expression and reflection as part of the creative process. The present study incorporates emotional creativity as a latent factor within problem-finding and problem-solving abilities, acknowledging that creativity is not purely cognitive but shaped by students' emotional depth and expressive capability.

2.6. Educational implications

An effective education system must harness both individual and group creative strengths. Williams *et al.* [22] advocate for learning models that include solo tasks for deep focus as well as group projects for collaborative insight. Tailored approaches based on gender-specific tendencies can be beneficial. For example, encouraging girls to engage in independent, original thinking while helping boys develop collaboration and group-based problem-solving skills can bridge creativity gaps [26].

Moreover, assignments that emphasize both problem discovery and resolution can stimulate higher-order thinking. Inquiry-based learning, where students explore real-world issues or generate innovative solutions, nurtures both originality and fluency. Such pedagogies align well with the study's core instruments, such as the realistic problem generation scale and presented problems assessments. Equally important is cultivating a psychologically safe classroom environment where students feel empowered to take creative risks. Emphasizing effort and process over correctness encourages iterative thinking and builds confidence in one's creative potential. Teachers are also supposed to develop a growth mindset and avoid informing students that they are creative or not. The final aspect is cultural sensitivity. In collectivistic cultures, the process of organizing activities to celebrate collective destinies and shared successes is very important. In contrast, individualistic cultures should facilitate individuality and independence. The more teachers align programs with these cultural dimensions, the higher the probability that they will foster a creative disposition in each of their students.

3. METHOD

The method of inquiry used in this study was the descriptive survey design as a systematic investigation of the interrelationship among gender, creativity preferences, and the abilities of gifted students

in Kuwait to solve problems and find problems. This approach is taken to ensure that the data is collected holistically based on the following objectives of the research:

- To examine gender-based differences in students' creative problem-solving abilities.
- To assess the relationship between creativity preferences—individualist vs. collectivist—and problem-finding/problem-solving dimensions.
- To use cluster analysis in search of clear creativity profiles and their relation to cognitive strategies.
- To guide the creation of bespoke educational activities that will foster creativeness in gifted students.

3.1. Demographics and consent procedures

The participants were secondary school students formally identified as intellectually gifted by the Sabah Al Ahmad Al Sabah Center for Giftedness and Creativity in Kuwait. In Kuwait, individuals below the age of 21 are considered minors and cannot legally consent to participate in research without parental approval [36]. Consequently, strict ethical procedures were implemented to ensure compliance with both legal and institutional standards. These included the following measures:

- Parental consent: written informed consent was obtained from all participants' legal guardians. A detailed explanation of the study's purpose, research procedures, potential risks, and benefits was provided prior to data collection. In accordance with guidelines from WCG Clinical, guardians were fully informed of their rights and responsibilities regarding their child's involvement in the study [37].
- Minor assent: in addition to parental consent, students were also asked to assent voluntarily. The research team explained the study's purpose and process in age-appropriate language. Participants were encouraged to ask questions, and assent was recorded only after confirming the minor's understanding and willingness to participate. This dual-layer ethical approach ensured autonomy and transparency throughout the research process.

3.2. Participants

The final sample comprised 106 gifted secondary students (52 males and 54 females), aged 15–17 years. All were enrolled at the Sabah Al Ahmad Al Sabah Center, which uses standardized psychometric instruments to identify cognitive giftedness. Students were selected using purposive sampling, which is particularly effective for targeting specific populations—in this case, youth identified as intellectually gifted with high creative potential. While this sampling method enhances internal validity by focusing on a specialized group, it inherently limits the generalizability of findings to the broader student population.

The distribution of participants across academic levels was: 53 students (51.5%) were in grade 10, 40 students (38.8%) in grade 11, and 11 students (10.7%) in grade 12. The nearly equal gender split (50.5% female and 49.5% male) enabled gender-based comparative analysis. The demographic diversity within the sample was intentionally structured to represent multiple stages of adolescent development, thereby enhancing the study's developmental relevance.

Table 1 summarizes the gender-wise descriptive statistics for the four constructs measured: problem-finding originality, problem-finding fluency, problem-solving originality, and problem-solving fluency. Across all dimensions, female students demonstrated higher average and median scores than male students. For example, in problem-finding fluency, females recorded a mean of 14.111 compared to 10.442 in males. Likewise, for problem-solving fluency, females had a mean score of 10.944 versus 8.019 in males. These gender-specific patterns will be further explored in the analysis section. All procedures were reviewed and approved by the Institutional Review Board at Al Ain University under reference number COP/AAU/AD/65. Data collection took place between January and September 2022.

Table 1. Descriptive statistics of problem-finding and problem-solving measures by gender

Measure	Gender	Valid (n)	Median	Mean	Sd	Min	Max
PF originality	F/M	54/52	12.0/10.0	13.17/11.60	5.07/5.69	5/4	28/34
PF fluency	F/M	54/52	11.0/8.5	14.11/10.44	10.52/6.98	3/3	50/39
PS fluency	F/M	54/52	10.0/8.0	10.94/8.02	5.31/3.05	3/3	29/19
PS originality	F/M	54/52	8.0/7.0	10.11/9.04	6.68/5.69	3/3	30/29

3.3. Cluster analysis procedure

To uncover distinct student profiles based on creativity preferences and cognitive performance, K-means cluster analysis was performed using SPSS (Version 26). The variables used for clustering included standardized Z-scores for problem-finding fluency, problem-finding originality, problem-solving fluency, problem-solving originality, and scores from the collectivism/individualism creativity preference scale. The optimal number of clusters was determined through visual inspection of the elbow plot, which graphs the

within-cluster sum of squares (WCSS) against the number of clusters. The analysis revealed a three-cluster solution as the most stable and interpretable structure. The clusters were subsequently labeled as high creativity profile, moderate creativity profile, and low creativity profile based on their relative scores across the key variables. This allowed for a nuanced understanding of the interactions between creativity preferences and problem-solving capacities among the participants.

3.4. Instruments

A triad of psychometrically validated instruments was employed to capture the multidimensional nature of creativity in a culturally relevant manner. All tools were translated into Arabic and evaluated for contextual relevance by expert panels.

3.4.1. Realistic problem generation scale

Developed by Runco and Okuda as cited in Willemsen *et al.* [38], the problem generation (PG) scale measures students' capacity for identifying realistic and meaningful problems. Participants responded to prompts such as, "Describe a problem you face at home and how you would solve it." The instrument evaluates fluency and originality—two critical dimensions of creativity. The Arabic adaptation, previously used in eight Arab countries with over 600 adolescents, showed strong reliability coefficients (0.87 fluency, 0.79 originality) and was contextually suitable for Kuwaiti students aged 15–17. The scale is valuable in educational research as it captures students' intrinsic ability to identify challenges, a cognitive precursor to innovative thinking. Its ecological validity—its alignment with real-life student experiences—makes it a robust measure for this study.

3.4.2. Realistic presented problems (RPP) assessment

The realistic presented problems (RPP) assessment evaluates how effectively students generate creative solutions to typical life challenges. Items include questions like: "How do you find innovative solutions to problems which you encounter in your daily life?" The tool is designed to capture both fluency and originality in problem-solving. In the pilot study with 50 students, the Arabic version demonstrated Cronbach's alpha values of 0.80 (fluency) and 0.83 (originality). The content was carefully adapted to the Kuwaiti sociocultural setting to ensure that scenarios were familiar and relatable to participants. This ensures ecological validity and supports authentic assessment of students' creativity in action.

3.3.3. Collectivism/individualism creativity preference scale

The original 22-item scale developed by Shaw *et al.* [39] assesses students' preference for working alone or in a group. Items are as: "I prefer to work with a group of people rather than alone (collectivist)", and "in doing my job, working by myself is more effective for me." The students were instructed to respond in 5 points. The students were asked to give a 5-point answer. For this study, the Arabic version underwent expert review to ensure cultural and linguistic suitability, with a content validity index (CVI) of 0.91. Seven items were rephrased to better reflect local norms. Reliability was strong for both subscales (α=0.82 for individualism, α=0.88 for collectivism). Reverse scoring was applied where appropriate to ensure balanced interpretation. This instrument was crucial for examining the students' preferred cognitive styles, an essential factor in understanding the interplay between culture, creativity, and problem-solving ability.

4. RESULTS

This research attempts to analyze creativity preference, problem-finding, and problem-solving abilities among gifted secondary school students. Moreover, it also investigates whether these abilities manifest any gender difference, the relationship among the three main variables, and the classification of the gifted secondary school students into different clusters.

4.1. H_1: gifted students significantly differ from each other in problem-finding fluency and originality with regard to gender

Researchers conducted an independent samples t-test to see if there were gender differences in problem-finding fluency and originality among gifted students. From the t-test results shown in Table 2, no significant differences between males and females in problem-finding fluency ($t=1.85$, $p>0.05$) and problem-finding originality ($t=-1.86$, $p>0.05$). Research results and conclusions indicate that gender does not matter with respect to the problem-finding dimension.

4.2. H_2: there are significant gender differences in problem-solving fluency and originality

An independent samples t-test for problem-solving fluency and originality was conducted with respect to gender. T-test results indicate that shown in Table 2, like problem-finding, gender did not produce

significant differences in problem-solving fluency (t=1.85, p>0.05) and problem-solving originality (t=1.9, p>0.05). Research reveals gifted students can solve problems regardless of gender differences.

Table 2. T-test to indicate differences between males and females in the dimensions of problem-finding, problem-solving, and work preferences

Scale	Dimension	Group	N	Mean	SD	DF	T
Problem-finding	Originality	F	47	8.638	5.803	96	1.86
		M	51	6.569	5.220		
	Fluency	F	47	11.809	6.344	96	1.85
Problem-solving		M	51	9.549	5.770		
	Fluency	F	47	20.447	11.972	96	1.9
		M	51	16.118	10.742		
	Originality	F	47	40.894	23.945	96	1.9
Group preferences		M	51	32.235	21.484		
	Collectivism	F	47	34.064	7.121	96	-0.83
		M	51	35.157	5.934		
	Individualism	F	47	21.426	3.295	96	1.7
		M	51	20.333	3.038		

4.3. H_3: individual or group creativity preferences have no significant relationship with problem-finding or problem-solving dimensions

To test this hypothesis, Point-Biserial correlation coefficient (Pbis) was used to study the relationship between creativity preferences (individual and group) and problem-finding and problem-solving dimensions (fluency and originality). In addition, descriptive statistics were provided for context of the correlations. According to Table 3, there are no significant relationships between creativity preferences and the problem-finding dimensions. The correlation coefficients for fluency and originality were found to be -0.045 and -0.046, respectively (p>0.05). In the same way, the problem-solving dimensions showed no significant correlations. That is, fluency and originality had coefficients of -0.046 (p>0.05).

In order to further examine the findings, descriptive statistics for the problem-finding and problem-solving dimensions of creativity preference are provided in Table 4. For instance, on the dimension of problem-finding originality the mean score of individualistic students is 9.57 (SD=4.57), while that of collectivist students is 9.47. Individualistic students obtained higher (mean 5.98, SD=6.61) than collectivist students (mean 5.12) in problem-solving fluency score. The low mean score differences are consistent with the non-significant values observed in Table 3. Overall, it can be concluded that whether the students prefer individualistic or collectivist creativity, they do not differ for problem-finding or problem-solving. The findings suggest that other variables might be more significant in influencing how students perform in these.

Table 3. Point-biserial correlation results for creativity preferences and problem-finding/problem-solving dimensions

Creativity dimension	Fluency (r)	Originality (r)	p-value
Problem-finding	-0.045	-0.046	>0.05
Problem-solving	-0.046	-0.046	>0.05

Table 4. Results of the Pbis between the type of creativity (individual/group) and students' responses to the dimensions of problem-solving and problem-finding

Variables	Dimension	Work preference	N	M	SD	Pbis
Problem-finding	Originality	Individualism	40	9.57	4.57	-0.011
		Collectivism	66	9.47		
	Fluency	Individualism	40	1.58	2.12	-0.025
		Collectivism	66	1.47		
Problem-solving	Originality	Individualism	40	9.55	8.33	-0.044
		Collectivism	66	8.79		
	Fluency	Individualism	40	5.98	6.61	-0.063
		Collectivism	66	5.12		

4.4. H_4: based on their creative preferences and problem-solving/problem-finding abilities, students can be grouped into clusters

To test this hypothesis, k-means cluster analysis was performed on the z-scores' standardized measures for creative preferences, problem-finding, and problem-solving dimensions, as shown Table 5. The analysis recognized three unique clusters, further illustrated in Figure 1.

a. Group with high creativity: students in this group were good at finding problems and solving problems. They preferred to work together to create.
b. Intermediate creativity group 2 cluster: this group of students were moderately original and fluent but tended to be more individualistic.
c. Cluster group 3 is the low creativity group: students in this group received lower scores on problem-finding and problem-solving dimensions, and also had mixed preferences towards individual and group creativity. The cluster distribution: i) Cluster 1: 25 students (25.51%); ii) Cluster 2: 22 students (22.44%); and iii) Cluster 3: 51 students (52.04%)

The summary of findings is explained, i.e., H_1 and H_2: there is no gender effect on problem-finding and problem-solving dimensions. Also, the correlation between creativity preferences and abilities is insignificant. According to the analysis, three distinct clusters of students were identified based on creativity preferences and problem-solving/problem-finding abilities. The information gleaned is useful in understanding the diversity of creative choice and cognitive ability among the gifted and talented students that can be useful in developing pedagogical interventions for specific creativity profiles.

Table 5. Cluster characteristics and distribution

Cluster	Size (n)	Percentage (%)	Characteristics
High creativity group	25	25.51	High problem-solving and group creativity
Intermediate group	22	22.44	Moderate originality, individual preference
Low creativity group	51	52.04	Low problem-solving, mixed preferences

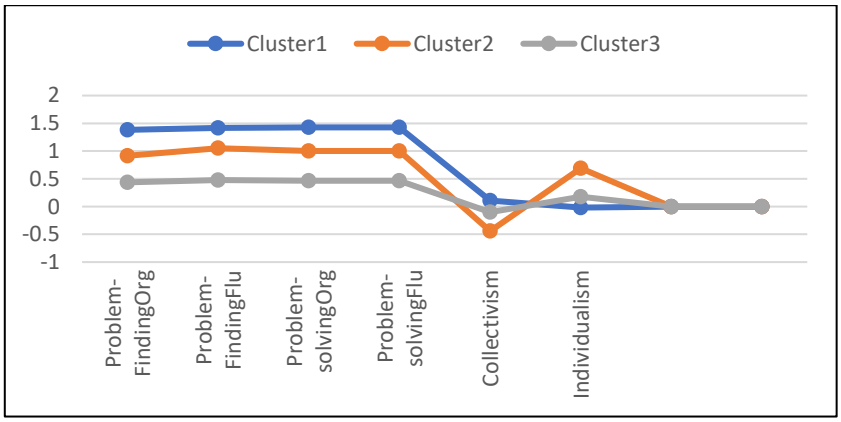

Figure 1. Cluster analysis of gifted students showing performance in problem-finding and solving

5. DISCUSSION

The research findings indicate a stronger relationship between research variables and individual creativity compared to group creativity, which can be attributed to the need for contemplation and isolation associated with individuality in the creative process. Similarly, the results of the research support the rest of the world's findings on creativity being essential in the 21st century. As for OECD [2], fostering students' creative problem-solving skills will be essential to face future challenges.

In a similar vein, Tripon [3] likewise argues the importance of teachers in fostering creativity through independent and group problem-solving strategies. Implications of the research can enhance creativity-focused educational practices. Studies of brainstorming show that group performance is often less efficient than individual performance. When people work collectively in groups, they more often than not contribute less in terms of effort than when working alone. This phenomenon is referred to as social loafing. Further, social loafing reduces productivity and idea generation [40], [41].

The COVID-19 pandemic, requiring social distancing, has further cultivated students' ability to work independently. Brainstorming alone increases the number and quality of ideas, as social loafing and production blocking do not occur like they do in a group setting [41]–[43]. Even though physical labor helps generation of ideas, collaboration is needed to make those ideas better.

It suggests reliance only on individual work and not on collaborative work to hone and perfect these ideas. Social distancing resulting from the COVID-19 pandemic has contributed to the enhancement of individual work among students. The research also reveals a variance in students' individual abilities regarding problem identification and solving [44].

The analyses do not show significant differences between the individual and group categories in other dimensions, indicating a convergence of research sample characteristics in the field of creativity. This aligns with societal developments where teamwork and collaborative learning have become important and effective components in educational institutions. Creative students possess the ability to work individually or collectively thanks to their discovered or hidden capabilities.

The ability to be creative depends on personal qualities, values and originality. As highlighted by several studies [45]–[47], the cognitive potential, thinking styles, and other aspects of the person will influence creativity. Every student will interact differently with education and social situations. This will result in a variety of different communication styles, responses to challenges, and interaction with available opportunities. When teachers focus on creativity in the classroom, they enable students to reach their potential. Students who are gifted benefit from differentiation, whether that is for individual students or a cluster of students. Essentially, giving these students a task at their level allows to achieve better success [48].

Recent research shows that it is important to understand the cognitive and emotional profile of gifted students for designing the intervention. Thus, these interventions boost creativity and improve academic performance as well as overall well-being [49]–[51]. When educators recognize the many sides of giftedness, they create environments that enable gifted students to thrive [51]. The alignment of educational tasks with these personal qualities is an effective method for the development of creativity and the general development of gifted students.

Personal traits, beliefs, and creativity potential are influential in many space exemplars of creativity. Such potentials are rooted cognition and thinking styles [45], [46]. Every student interacts differently in class and social situations. They also react differently in class. By focusing on students' creative potential, we can help them reach their full potential. When gifted students are assigned tasks based on their individual or collective abilities and cognitive styles, they will be more successful [48].

Recent studies show that the cognitive profile of gifted students should be kept in mind while designing interventions to not only boost creativity but also enhance academic performance [52]. By understanding the various facets of giftedness, teachers can create a setting in which gifted students flourish academically and socially [53]. Matching educational tasks with these personal characteristics is very useful in developing creativity and well-being in the gifted.

5.1. Classification of profiles in problem-finding, problem-solving, and creativity

The study revealed clear preferences for individualistic and collectivistic creativity. Male students showed a preference for individual creativity and females opted for collectivist one. These outcomes line up with the way things are done in the Middle East, where gender roles create either a preference for collaboration (female) or independence (male) in a problem-solving context [27]. The strong correlation of creativity preferences with problem-finding/problem-solving dimensions further reinforces their role in shaping cognitive processes. Students who tend to have a collectivist orientation come up with solutions for problems with focus on group rather than individual, which shows how social contexts can enhance creativity. This fits well with evidence that a collectivist environment enhances social ties and common ground, which can further group innovation [27].

Male students' individualistic creativity preferences seemed to support originality and fluency when deciding what to explore and when to explore it. According to research findings, both individual and group creativity should be recognized and nurtured within educational settings, keeping in mind individual differences in cognitive styles and cultural contexts. The categorization of profiles corresponds to Crilly [54] focus on 'Persuasion' and Runco's [23] hierarchical restructuring involving 'Potential'. The findings of this study highlight the intricate nature of creativity, which is characterized by several facets. These facets mirror the various interpretations of creativity across different fields, as addressed by Azaryahu *et al.* [55]. The diverse manifestations of creativity in gifted kids align with the literature's portrayal of creativity as a combination of innovative and beneficial solutions, in accordance with the definitions by Shalley *et al.* [11].

5.2. Gender diversity in creative and problem-solving aptitudes

The results showed that the male and female students reported the same level of problem-finding fluency, while there were significant differences in problem-finding originality with the female students outperforming the male students. This research are aligned with the findings which claim that females are likely to be more original in tasks that require emotional and contextual understanding [3]. Though, lack of differences in fluency match the OECD [2] global trends that state when given equitable opportunities, both genders are equally likely to be creative. Likewise, no significant gender differences were noted in fluency of problem-solving, though females were better on originality. These results indicate that both genders have the same ability to produce solutions. However, females may have greater novelty in their approaches. This is particularly true regarding real-life situations requiring contestants to use their emotional intelligence.

The lack of substantial gender disparities in creativity and problem-solving abilities among gifted students corroborates the idea that creativity surpasses gender prejudices, in accordance with the broader viewpoints on creativity and personality traits presented by Binyamin *et al.* [56] and Guastello [57]. This discovery undermines conventional notions of gender-based creativity and emphasizes the significance of personal characteristics in fostering innovation, rather than relying on society preconceptions. The correlation between individual and group creativity and problem-solving can be understood by considering the concepts of collective versus individual creativity, as discussed by Hofstede [58], and the contributions of creativity in both solitary and group settings, as explored by Simonton [59]. The study's results demonstrate a heightened preference for solo creation, aligning with existing research that explores the social and solitary dimensions of the creative process. This literature also examines the circumstances in which creativity thrives in isolation compared to collaborative settings.

This enlarged debate incorporates contemporary study findings with the larger academic discourse on creativity, problem-solving, and the impact of cultural and individual characteristics, by utilizing core ideas and recent studies from the literature review. This method not only places the study within the existing theoretical framework but also emphasizes its contributions to comprehending the intricacies of creativity among talented students. The results show that all gifted students in the research sample possess creativity skills, including originality and fluency in problem-finding and problem-solving, as well as individual and group creativity, without gender bias. The findings suggest no relationship between gender and the dimensions of research variables, leading to the development of two models: one focusing on individual creativity encompassing the entire sample, and another examining the direct effects of the sample on collective creativity. The sample size may have contributed to this outcome, as larger studies provide a clearer picture of research results [60].

Contrasting studies comparing gifted and non-gifted individuals, which typically show significant differences favoring the gifted. Abdulla *et al.* [61] found significant differences between divergent thinking and problem-finding among gifted and non-gifted students, with a large effect size ($\eta 2=0.359$). The results confirm the findings of Albaddai study [62], which showed no significant differences between males and females in problem-solving ability.

Male and female students exhibit equal levels of creativity, attributed to equitable educational and teaching services free from discrimination. This promotes the learning and development of gifted students, enabling them to join diverse professions and international universities, and upholds the principle of equal opportunities for both male and female students. The recent findings align with Hardy and Gibson [63], demonstrating a discernible gender disparity in creativity, where females predominantly display superior performance in creative quality, originality, and elegance, reaffirming the nuanced gender differences in creative expression and problem-solving proficiencies. These findings may reflect a convergence of creative characteristics within the research sample, mirroring broader societal changes regarding gender perceptions. The evolution of societies, exemplified by the development in Kuwait, has led to heightened awareness and an enhanced role for women across various levels and fields.

Women are also becoming more independent and, on some fronts, even outdo men. Jenan Shehab is an engineer who is a patent award holder and gold medalist at international forums, and an example of how women can transcend the barriers they are usually bound by, particularly those with higher qualifications in education [64]. The trend is reinforced by an increase in Nobel Prizes awarded to women in the past 20 years (22 females in the last 20 years between 2001 and 2018) compared to a similar period in 1901 and 1920 (4 females in the first 20 years at the turn of the 20th century).

Furthermore, the aforementioned change in mentality and decrease in restrictions can be aligned with the findings of Abdulla *et al.* [65], who observed that highly educated women tend to experience more issues associated with shame and repression than those who have lower education degrees. This decrease in obstacles and change in attitudes over the last few years indicate a growing tendency in society to value creativity more equally across genders. It is in line with the findings of Hardy and Gibson [63], who emphasize the need to foster creativity and to learn to appreciate it in all its different manifestations.

Overall, this paper has established that creativity in the gifted student is a complex phenomenon that is highly affected by personal and environmental factors. Female students' edge in originality suggests the need to recognize emotional and social intelligence in defining creativity. Although group creativity is useful, the central importance of individual ideation is still significant in problem-solving. Differentiated instruction, culturally aware pedagogy, and equitable policy will ensure that all students—regardless of gender or creative preference—are empowered to thrive in the 21st century.

6. IMPLICATIONS

The results are relevant to educational theory, policy, and classroom practice, especially as they relate to gender-responsive teaching and creativity-based differentiation of the gifted. The significant

difference in originality between male and female students—where females demonstrated superior originality—deserves critical reflection. A possible solution is at the level of emotional creativity. Previous studies indicate that females, especially because of biological and socio-cultural considerations, tend to be more sensitive and perceptive, an aspect that proves significant when it comes to creating original ideas that have a contextual and emotional focus [3], [66]–[68]. This aligns with the notion of social role conditioning, where female are traditionally encouraged to be empathetic, relational, and reflective—traits that foster deep insight and novelty in creative tasks. The collectivist nature of their creativity can also contribute to the richness of the concept, as it is the shared idea of several different people that might encourage creative thinking.

Given the gender-related trends in creativity, educational programs need to adopt differentiated orientations that leverage the strengths of each group and promote improvement. To give one specific instance, creativity programs that are geared toward female students can incorporate more open-ended and empathetic problem-solving exercises. Tasks like developing a community service project or researching social problems by creating multimedia stories can be used to direct their emotional intelligence towards worthwhile innovation. In contrast, some males might like more individualized methods of creativity; design-thinking challenges, invention challenges, and self-guided modules of inquiry-based learning might help them with their cognitive autonomy.

Creativity programs must provide a variety of individual and group activities to minimize possible gender gaps and promote a more inclusive creative development. Individual-based tasks must require students to complete tasks that are introspective and focused, like writing a persuasive essay, writing original poetry, or developing a scientific experiment. These activities enhance fluency and creativity since they involve self-drive and self-understanding. In contrast, group work-style activities may encompass the group-based challenges of problem-solving (e.g., prototyping a sustainable response to a local problem), engaging in a debate team, or a group research project. Besides being collectivist-friendly, these formats promote team building and shared responsibility.

The study also found preference clusters in creativity; it is therefore necessary that ID facilitates this variation. Schools can implement brief diagnostic assessments at the start of each term to classify students by creativity type—individualist or collectivist, high or low problem-solving fluency—and use this data to inform curriculum planning. As an example, learners with outstanding fluency and originality will be suggested as a group leader in project-based learning activities. In contrast, cooperative strategies and peer tutoring may scaffold low-originality learners who demonstrate strong group creativity tendencies.

Intervention is also essential in teacher training. Teachers should receive the tools to recognize various creative individualities and adjust their educational strategies to facilitate them. A specific module on creativity theory, gender-sensitive pedagogy, and varied instructions in teaching gifted students must be included in pre-service and in-service teacher education programs [68]. The training of teachers should focus not merely on their ability to identify an individual and group's creative potential but also on their ability to comprehend the influence of cultural values on creativity, such as collectivism and individualism in students. Being aware of these cultural dynamics is particularly important in multicultural or diversity classrooms.

Additionally, the curriculum designer must take care that the creative learning opportunities are integrated in other subjects as well, particularly in gifted education programs. Emphasis should be placed on inquiry-based and project-based learning strategies, which enable students to formulate real-life problems, devise solutions, and take creative risks. An example of this would be to take a science lesson and use it to design an experiment that addresses a modern environmental concern, or take a humanities lesson and use it to create campaigns on social justice issues.

Relevant pedagogy also requires a cultural touch. Collectivist communities such as Kuwait need to have their creativity programs oriented to emphasize group goals and group success. In some of the more individualistic education systems, encouraging independent thought and the creation of ideas, even with a limited amount of organized cooperation, may create a healthy balance of creative learning. Notably, an essential condition in a classroom is the culture in which students feel secure to take chances, learn through failure, and iterate their ideas to develop creativity. The educators must demonstrate positive attitudes towards learning, reward effort and creativity, but not just results, and give feedback focused on the process, not the production. By aligning teaching methods, curriculum frameworks, and policy priorities with the diverse profiles of creativity revealed in this study, schools can nurture the full spectrum of students' creative potential—regardless of gender or cultural background—and prepare gifted learners to thrive in both local and global contexts.

7. CONCLUSION

This paper presents a discussion of gender variations in the creative process among gifted students in secondary schools in Kuwait, focusing on the aspects of problem-finding dimensions, problem-solving dimensions, and individualistic or collectivist dimensions of creative styles. The results showed no statistically meaningful gender variations in fluency of problem-solving, but female students performed better in originality than males. Notably, it was found that there were three separate clusters of creativity preferences in the list of participants. However, gender did not play a significant role in the composition of noticeable sections. It allows concluding that although cognitive and creative styles can differ largely between students, it would be impossible to find a reliable assessment of this diversity based solely on gender. The study also revealed that individual creativity positively correlated with problem-solving than group-related creativity. The findings advocate for a balanced approach to gifted education—one that values both independent innovation and collaborative exploration.

Nevertheless, it should be recognized that the study has quite a few limitations. To begin with, the statistical power and generalizability of the study are limited by a relatively small sample of 106 students, all of whom were selected among the Sabah Al Ahmad Al Sabah Center for Giftedness and Creativity learners in Kuwait. Second, a major limitation is in cultural specificity of the sample. Kuwait's unique sociocultural environment—including traditional gender roles, high levels of educational investment, and specific views on individualism and collectivism—may have influenced student responses. Additionally, the study relied heavily on self-reported data and online tools for measuring creativity-related variables. Although validated instruments were used and adapted to the local context, self-report measures inherently carry the risk of bias due to social desirability, misinterpretation, or inconsistent engagement with the tasks.

Future research should pursue several specific directions to build upon this study's foundation. One promising area is the longitudinal tracking of creativity development among gifted students. Another area of exploration is the development of targeted interventions tailored to each identified creativity cluster. For instance, students with high individual originality but low group fluency could benefit from structured collaborative activities designed to enhance teamwork without stifling creative freedom. Cross-cultural research is another valuable avenue. Comparative studies between Gulf Cooperation Council countries or across Arab and non-Arab contexts would shed light on universal versus culture-bound aspects of creativity. These studies could examine how factors such as teacher creativity, parental involvement, school climate, or religious and cultural values mediate the relationship between gender and creativity. Further, researchers should aim to expand demographic inclusivity by incorporating students from varied socio-economic backgrounds, educational types (public vs. private), and different geographic locations. Doing so would improve representativeness and offer deeper insights into how social class, age, and institutional context interact with creativity. Finally, a special focus should be given to the role of technology in facilitating creativity development. Further research might address the topic of digital learning tools, virtual collaboration platforms, or even AI-based creativity assistants and their effect on the problem-solving skills of talented children.

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C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

INFORMED CONSENT

We have obtained informed consent from all individuals included in this study.

ETHICAL APPROVAL

The research involving human participants was conducted in accordance with all relevant national regulations and institutional policies and complied with the tenets of the Declaration of Helsinki. The study protocol was reviewed and approved by the Institutional Review Board at Al Ain University under reference number COP/AAU/AD/65. Data collection was conducted between January and September 2022.

DATA AVAILABILITY

The authors confirm that the data supporting the findings of this study are available within the article.

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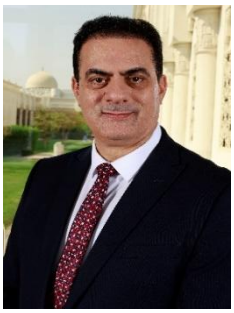

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