VILNIUS TECH
Vilnius Gediminas Technical University

Creativity studies
ISSN 2345-0479 / eISSN 2345-0487
2023 Volume 16 Issue 1: 193–210
https://doi.org/10.3846/cs.2023.14593

A COMPARISON STUDY FROM A CREATIVE THINKING PERSPECTIVE IN DIFFERENT DOMAINS AS ART EDUCATION AND NON-ART EDUCATION STUDENTS

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Received 20 March 2021; accepted 20 September 2021

Abstract. Creative thinking measurement for everyone in different domains is the most crucial critical subject. Therefore, the current discussion continues whether creativity in various fields different. This study aimed to measurement the students' creative thinking scores in various domains disciplines to reveal differences. The main research question was as followed: Do whether students' creative thinking scores of students in art and non-art education differ significantly? The method was a causal-comparative research design. Participant students (N = 456, $mean_{age}$ = 16–21) were equivalent regarding some variations; as education disciplines and ages. While however, the art and non-art education students were the domain-specific was art education students, the and domain-general, was non-art education students respectively. The present study determined a significant difference between domain-specific and domain-general on creative thinking scores in favor of the non-art education students in the range of ages 16 to 21. The study concluded that alternative instruments with domain-specific content needed to measure individuals' creative thinking in the domain-specific. This study suggested future research to conduct creativity measurement comparatively individuals in different age ranges and domains fields.

Keywords: creative thinking, creative thinking measurement, creative thinking subscales, domain-specific, general content domain.

Introduction

The use of individuals' creative thinking potential is an important issue; therefore, creative thinking skills are vital in education, society, technology, and engineering. For this reason, the measurement of creative thinking potential is noteworthy in different areas. Creative thinking generates new ideas and manipulates them differently by making unconventional connections to novel possibilities to meet a given purpose (Ramalingam et al., 2020). Therefore, measurement of creative thinking relates to many things traits with including divergent thinking through divergent thinking components. Reiter-Palmon et al. (2019) stated that

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divergent thinking could produce multiple solution responses for a given stimulus. In this context, the divergent thinking components take place mainly as fluency, originality, and elaboration as the traits (Baer, 2016, pp. 1–16). Although individuals' creative thinking skills involve many complex structures apart from divergent thinking, an area or domain in which the individual engaged can be critical in measurement. There is a logical clarification for the creativity measurement based on the general preference or content predominantly due to this universal skill observed in every human at different levels. However, the creativity measurement is discussed by many scholars whether the measurement the creativity is proper by standard formatted content for the individuals in different domains. The latest studies revealed some clues, and current discussion has already continued on this issue in the literature. Therefore, a current debate has been on whether the creative thinking measurement should include domain-specific content rather than a general content domain (Haase et al., 2018; Hyeon Paek & Runco, 2018; Sternberg, 2020).

As based on numerous scholars, McKay et al. (2016) explained that an individual in the domain-general as the creative person might also be creative in other domains. In contrast to that, the domain-specific approach advocates that the individual is creative in one domain, but s/he is not creative in another domain. For example, there can be many unusual ways to explain dividing fractions in mathematics, leading to creativity. In contrast, this situation can be less valuable for any domain such as visual arts, composing music, or teaching history (Baer, 2016, pp. 1–16). As many scholars accepted sight among scholars widely, that creativity includes domain-specific content rather than a general content domain (Huang & Wang, 2019). Thus, a current discussion goes on this topic (Scotney et al., 2019). Numerous researchers stated that one of the crucial problems in the creativity area is whether creativity includes domain-specific or general content (Qian et al., 2019). As related to this issue, the other conflict is also about creativity measurement regarding the general and specific domains.

1. A rapid review of the literature

The individual can be creative in many domains (Zimmerman, 2009). However, Furnham et al. (2011) investigated undergraduate students' creative thinking skills regarding the educational domain variable. They found a difference between arts and science students. Likewise, Sagone and de Caroli (2012) found critical differences between the students aged 13 to 18 in art and science education regarding the creative thinking styles. Kaufman (2013) examined the relationship between openness to experience and creative achievement of college students (aged 16–18 years) in art and science domains. He found that the aesthetic engagement of students correlated with creative achievement in the arts, whereas the intellectual engagement of students associated with creative achievement in the sciences. Hong et al. (2014) observed adolescence in various domains as art and science in terms of creative activities. They stated that adolescence in art domain is associated with some activity accomplishments more than those in science. Blazhenkova and Kozhevnikov (2016) investigated professionals in various domains as visual artists, scientists, and humanities regarding innovative products. The findings offered that general creativity was independent of the domain variance. Pérez-Fabello et al. (2018) investigated fine arts, psychology, and engineering students' visualization

of the objects mentally. They found that fine arts and engineering students tended to use the object differently as image processing and spatial processing parts. Qian et al. (2019) investigated the creative achievement of undergraduate and graduate students in different educational domains as literature, music, crafts, arts, performing arts, and mathematics/science. They found that music students might be harder to be creative than the participants in the other domains. Willemsen et al. (2020) also found that creativity skill was different in various domains among even primary education students. The students' creativity in mathematics and writing domains was not separate, but it differed in the drawing. Also, Taylor and Kaufman (2021) found that creativity was distinctive among university students regarding domain-specific. As this rapid review showed, there could be some differences among the individuals' creativity in various domains. However, some scholars also advocated that creativity is observed clearly in specific fields, such as art. Still, others defended that creativity is seen more in many domains as general (Miller & Dumford, 2015).

The individuals' creative thinking measurements generally are based on the divergent thinking components as divergent thinking tests. The divergent thinking tests ask open-ended questions subjects produce to generate as many ideas (Runco, 2010). The divergent thinking tests measure potential creative base on dominant components as fluency and originality (Reiter-Palmon et al., 2019). Prominent scholars stated that fluency is one of the divergent thinking component that components, and it generates multi-solutions as possible (Kasirer & Mashal, 2018). According to numerous scholars, fluency is the number of unrepeated ideas, whereas originality is a unique idea (Reiter-Palmon et al., 2019). Today, there are many tests to measure creativity with including divergent thinking components. For instance, the Torrance Tests of Creative Thinking (TTCT) contain divergent thinking components (Kasirer & Mashal, 2018, p. 206). The TTCT is the most known instrument among the creativity tests based on the divergent thinking's components to measure individuals' creative thinking potential (Kasirer & Mashal, 2018, p. 206; Said-Metwaly et al., 2018). Also, the TTCT has been used in many fields worldwide to measure individuals' creative thinking potential. Therefore, the TTCT is one of the most used creative thinking tests in various individuals of domains and different ages, from children to adults (Ulger, 2020). Humble et al. (2018) found that the TTCT figural form was also useable culturally in an African setting, such as using a Western set. The divergent thinking tests assess the creativity in general approach as verbal and figural forms (McKay et al., 2016). Although there is no distinct difference between the figural and verbal forms of TTCT, figural forms may be pretty open to testing takers in terms of interpretation (Acar et al., 2019). Kim (2017) found that TTCT-Figural is a more extensive, reliable, and valid measurement of creative potential than the TTCT-Verbal. Also, she concluded that the TTCT-Figural measures creative skills better than other creativity tests, including divergent thinking tests. This situation indicates that the TTCT has been accepted widely as an essential instrument to measure individuals' creative thinking potential in different ages and cultures. This point is also consistent with previous study findings that TTCT includes the most common criteria regarding the creative thinking measurement among the used creativity tests (Ulger, 2020; Kasirer & Mashal, 2018; Said-Metwaly et al., 2018). However, Hyeon Paek and Runco (2018) reminded us that the divergent thinking tests might not be fit to detect the creative skill of the individuals, more specifically in terms of some variables.

This perspective seems to open discussion on whether the creative thinking measurement as an instrument may merely include domain-specific appreciation.

From looking another perspective, Fusi et al. (2021) found no significant difference between older and younger individuals in the verbal creativity measurement with divergent thinking tests. They concluded that age could be an essential indicator of figural creativity measurement (Fusi et al., 2021, p. 20). Unfortunately, there have been fewer study findings on this issue in the literature. Thus, there is uncertainty in the related literature on whether age is an essential variation in figural creativity skill development in the domain-specific and domain-general. However, Rostan (2005) found that age is not a significant variable in figural creativity assessment among 7–8 years old students in domain-general. In another study, she concluded that age might be a substantial variable for creativity skills among 9–16 years of senior art students in the domain-specific (Rostan, 2010). Ripple and Jaquish (1981) also found that age significantly correlated with DT abilities as fluency, flexibility, and originality. Fusi et al. (2021) suggested that the future study on figural creativity with divergent thinking components, including different age groups conducted in terms of the creativity measurement with the domain – general content domain.

To this point, the measurement of the individuals' creativity creative skills keeps ambiguous in terms of some variations as the domain-specific and domain-general, different ages, and creative thinking subscales as the divergent thinking components. Numerous scholars stated that further research is needed to figure out should determine the variations of human individuals' creative skills, especially in the domain-specific and domain-general (*e.g.*, Haase et al., 2018; Qian et al., 2019). Fusi et al. (2021) also noted that further research should include individuals of different ages, and the regarding creative thinking skills, including creative thinking subscales. Therefore, this study aimed to investigate the students' creative thinking skill differences in various domains in terms of some variables as regarding age and creative thinking subscales. This study also aimed to determine the relationship between students' age and creative thinking/subscale skills. The present study addressed art education and non-art education as domain-specific and domain-general, thus, determined the research questions as followed:

Q1: Do the students' creative thinking scores in art and non-art education differ significantly?;

Q2: What is the role of students' age in art and non-art education regarding creative thinking scores?;

Q3: Do the students' creative thinking subscale scores in art and non-art education differ significantly?;

Q4: What is the correlation between the students' age and TTCT figural creative thinking subscale scores?

2. Method

This study's primary purpose was aimed to investigate the students' creative thinking score differences in the domain-specific and domain-general by comparing art and non-art education disciplines. Therefore, this study used a causal-comparative research design. The art

education and non-art education disciplines were the independent variables (preexisting variable). The author assigned the students' creative thinking scores from the TTCT figural forms as the dependent variable. In this way, one set of comparisons implemented for the students' creative thinking scores. The author himself implemented and scored the TTCT instrument for the participated students to avoid different administration effects.

2.1. Measurement

This study used the TTCT-Figural forms to measure students' creative thinking skills. The TTCT measures individuals' creative potential based on divergent thinking components (de Vries & Lubart, 2019). The most known and used test worldwide is the TTCT among divergent thinking tests (Cropley, 2001). Kim (2011) stated that prominent researchers assessed the TTCT-Figural fairly for gender, race, community status, language background, socioeconomic status, and culture. TTCT-Figural forms contain three activities as picture construction, incomplete figures, and repeated figures (Torrance, 1966, p. 3). Picture construction activity encourages participants to think of a picture in which a given figure that no one else thinks. Incomplete figures are set up for participants' tension to complete the figures most simply and easily. Repeated figures activity is the ability to make a kind of many connotations to a single stimulus (Torrance, 1966). The TTCT-Figural forms take 30 minutes to over for participants without giving test instructions (Torrance, 1972). TTCT figural scoring manual requires 10 minutes to complete each activity. Aslan (2001) adapted the TTCT into the Turkish language and performed the validity – reliability (Cronbach's alpha, 0.70) studies.

The TTCT-Figural form provided scoring procedures as the third edition in 1984. In this procedure, the five subscales with the creative (strengths) took place as follows; fluency, originality, abstractness of (titles), resistance to premature (closure), and elaboration (Kim, 2006a). Fluency is the number of unrepeated ideas; originality is the unique ideas (Reiter-Palmon et al., 2019). The TTCT's criteria of closure are the ability to intellectually curious and to be open-minded (Kim, 2011). The elaboration is the number of added ideas to show the subject's ability to develop and elaborate on ideas. Titles as the degree a title which is beyond concrete labeling of the pictures drawn. Strengths include many traits. Some of these traits are as follows: emotional expressiveness, the richness of imagery, movement or action, unusual visualization, internal visualization, breaking or extending boundaries, humor, storytelling articulateness, the colorfulness of imagery, and fantasy (Kim, 2006a). Based on Ellis Paul Torrance's view on creativity, strengths contain sensitivity to these traits above ordered. Although many researchers reported that the TTCT figural subscales had various correlation levels with each other, Torrance warned that every subscale possesses an independent meaning (Kim et al., 2006).

2.2. Participants

The participants in this study were students of equivalent ages at high and higher education levels. Participated students of the study were the participants in previous studies of the author. So, the participants in this study consisted of the author's earlier studies as a combination (*e.g.*, Kaufman, 2013). The students were in the art and non-art education disciplines as separated groups. The author selected the participant groups in the study as random (intact

groups). The art students (music and visual arts) predominantly followed in the visual arts education. The non-art students were in various education departments like such as science, mathematics, and preschool. As the study participants, the art students pursued in a state university and a high school of art with taking intensive lessons related to the art in both theory and practice. In these schools, the students specialize in art-specific. The non-art students in the same state university and a high school followed various sciences disciplines intensively without following the art lessons. In this manner, these students specialize in the sciences as the non-art area. All students pursued their schools through entrance examinations related to their educational disciplines. 456 (*N*) students were as follows: 197 high school students who were 93 art students ($mean_{age}$ = 16.59) in grade 10–11–12 and 104 non-art students ($mean_{age}$ = 15.91) in grade 10–11. Two hundred fifty-nine students were in higher education level (116 art students with $mean_{age}$ = 20.91) within the first year and second year or third year different educational levels (non-art students' $mean_{age}$ = 21.39).

2.3. Data analysis

This study evaluated a combined analysis of different portions of data that appeared in earlier publications of the author's earlier publications, in 2015–2017, through an original approach (*e.g.*, Kaufman, 2013). The TTCT figural measurement showed normal distribution in terms of univariate and joint distribution for each variable as skewness values – kurtosis was no bigger than [2.0] (*e.g.*, Humble et al., 2018). The quantile-quantile plot is also linear. The normality values regarding skewness and kurtosis with the mean, standard deviation as descriptive statistics are in Table 1.

This study used one-way analysis of variance (one-way ANOVA). The one-way ANOVA tested the first research question of the study to detect a significant difference between the student groups. The ANOVA compares the means of independent groups whether there is evidence as to the significant differences. In this way, ANOVA determines whether there is a significant difference statistically between the groups (Kent State University, 2021c). Tukey's range test (TRT) compares the means of the groups to determine which group(s) is different from the rest, as a response for the second research question of the study. When the

Table 1. Descriptive statistics: the originality, fluency, (abstractness of) titles, elaboration, (resistance to premature) closure, and creative strengths (source: created by author)

TTCT*/Subscales	Mean	Standard deviation	Skewness	Kurtosis
TTCT	10.109	3.885	.325	–.589
Fluency	14.311	5.274	.624	.023
Originality	7.296	4.989	.941	.544
Titles	2.747	2.523	1.170	1.047
Elaboration	9.372	2.769	.442	–.405
Closure	3.872	2.953	.776	.209
Strengths	2.583	1.837	.435	–.448

**Note:* TTCT – Torrance Tests of Creative Thinking.

ANOVA detects a significant difference among the groups, the TRT runs to determine which group's mean is different by comparing all means (Statistics How To, 2022). In this way, the ANOVA analyzed the data regarding the creative thinking scores of art students and non-art students. This study determined four groups like high school art students (Group 1), higher art students (Group 2), high school non-art students (Group 3), and higher non-art students (Group 4) for the one-way ANOVA. The *p*-value set on $\alpha = 0.01$ as a strict standard to control the significance to reduce the possibility of a type-I error in multiple testing (Stat.berkeley.edu, 2020). When the F-value was significant, the *post hoc* test (*i.e.*, TRT) detected a considerable difference in the students' TTCT figural scores.

The independent samples Student's *t*-test compared the groups to determine whether a significant difference for the study's third research question. Independent samples Student's *t*-test compares the means of two groups to determine whether there is evidence of a significant difference between them (Kent State University, 2021b). The independent samples Student's *t*-test performed TTCT-Figural subscales scores of students in art and non-art education as two groups (independent variables) to find the sources on whether differences between creative thinking mean subscale scores (dependent variable). The *p* (.05) value was adjusted as $\alpha = .01$, avoiding the type-I error (Stat.berkeley.edu, 2020). If the *p*-value in the comparison analysis resulted lower than 0.01, this study accepted the *p*-value as significant.

This study also used the bivariate Pearson correlation statistic technique to determine a relationship between the age and the TTCT figural (subscale) students' scores of students to find a response for the fourth research question of the students. The bivariate Pearson correlation (BPC) determines the relationship between two variables. The BPC, *r*, measures the strength of linear relationships between pairs of continuous variables. The BPC also determines whether there is a linear relationship significantly between the variables (Kent State University, 2021a).

2.4. Results

This study aimed to determine whether the students' creative thinking scores differ significantly regarding the domain-specific and domain-general as the art and non-art education. For this purpose, the first research question was as followed: "Do the students' creative thinking scores in art, and non-art education differ significantly?". In this way, students' creative thinking scores in art education were compared with the non-art ones to determine whether the domain is a significant variation in creative thinking measurement. The ANOVA analyzed the data and detected a significant difference between the students in art and non-art education (Tables 2–4).

Table 2. One-way analysis of variance results for the Torrance Tests of Creative Thinking scores (source: created by author)

Source	Sum of squares	Difference	Mean square	F	p
Between groups	1314.071	3	438.024	35.642	.001*
Within groups	5554.927	452	12.290		
Total	6868.998	455			

**Note:* $p < .01$.

Table 3. Multiple comparisons (Tukey's range test) of groups' Torrance Tests of Creative Thinking scores (source: created by author)

Groups	1. Group[a*]	2. Group[b*]	3. Group[c*]	4. Group[d*]
1		p = .014 SE** = .487	p = .155 SE** = .500	p = .001*** SE**= .467
2			p = .001*** SE** = .473	p = .001*** SE** = .438
3				p = .001*** SE** = .451
4				

*_Note:_ Groups: 1[a] = high art students, 2[b] = higher art students, 3[c] = high non-art students, 4[d] = higher non-art students. ** _Note:_ SE = standard error. ***_Note:_ * $p < .01$.

Table 4. Descriptive statistics of the groups upon the Torrance Tests of Creative Thinking cores (source: created by author)

Group	Education level	Education course	Sample size	Mean	Standard deviation
1	High	Art	93	8.93	3.19
2	Higher	Art	116	10.40	3.40
3	High	Non-Art	104	7.88	3.31
4	Higher	Non-Art	143	12.25	3.88

The *post hoc* test (*i.e.*, TRT) detected a significant difference between the groups as high school students in art education (Group 1), university students in art education (Group 2), high school students in non-art education (Group 3), and university students in non-art education (Group 4). The *post hoc* test also detected a significant difference between Group 1, Group 2, Group 3, and Group 4 (*e.g.*, Table 2) in favor of Group 4. In other words, the university students in non-art education had higher creative thinking scores significantly than the university students and high school students in art education. The university students in non-art education (Group 4) had substantially higher creative thinking scores than high school students in non-art education (Group 3).

This study also aimed to determine the age variation in the individual students' creative thinking skills in score differences under the domain-specific and domain-general in terms of age. Thus, this study organized the research question (Q2) as follows: "What are the role of students' age in art and non-art education regarding creative thinking scores?". In this way, this study revealed that individuals' age might be a significant variation in creative thinking skills. In other words, this study found the participants' age as a substantial variation in creative thinking scores positively in favor of university students, especially in non-art higher education students (Tables 3–4). That is, the non-art students' age might play a significant role in creative thinking scores rather than the art students regarding the domain.

The present study also investigated compared the students' creative thinking subscale scores in the domain-specific and domain-general to determine a significant difference between the domain-specific and domain-general. The research question (Q3) was structured as

follows: "Do the students' creative thinking subscale scores in art and non-art education differ significantly?". In this way, this study compared students' creative thinking subscale scores in different domains. The independent samples Student's *t*-test analysis determined a significant difference between two group students in the domain-specific and domain-general (Table 5).

Table 5. Student's *t*-test results between two groups in terms of creative thinking subscales (source: created by author)

Subscales	Groups	Sample size	Mean	Standard deviation	Student's *t*-test	p
Fluency	Art	209	13.44	4.97	–3.260	.001*
	Non-art	247	15.04	5.41		
Originality	Art		6.82	4.41	–1.899	.058
	Non-art		7.69	5.40		
Titles	Art		2.45	2.22	–2.294	.022
	Non-art		2.99	2.73		
Elaboration	Art		9.77	2.68	2.841	.005*
	Non-art		9.03	2.80		
Closure	Art		3.38	2.62	–3.31	.001*
	Non-art		4.28	3.15		
Strengths	Art		2.56	1.84	–.149	.882
	Non-art		2.59	1.83		

**Note:* $p < .01$.

The adjusted *p*-value ($\alpha = .01$) showed significant difference for the subscale scores of the students in two domains (Table 5) as followed: fluency ($t_{454} = -3.260$, $p < .01$), elaboration ($t_{454} = 2.841$, $p < .01$), and closure ($t_{454} = -3.312$, $p < .01$). However, there was no significant difference between two groups as domains regarding the subscale score means in the originality ($t_{454} = -1.899$, $p > .01$), titles ($t_{454} = -2.294$, $p > .01$) and creative strengths ($t_{454} = -.149$, $p > .01$). In other words, students in the non-art education had higher scores on the fluency and closure subscales significantly than students in the art education; however, there was a significant difference in the elaboration subscale between the students in favor of the students in the art education.

The present study also aimed to determine the relationship between the individuals' age and creative thinking subscale scores regarding the divergent thinking figural creativity test with the general content domain. For this purpose, the research question (Q_4) was as follows: "What is the correlation between the students' age and TTCT figural creative thinking subscale scores?". The BPC technique analyzed the data to determine the relationship between the students' age and TTCT figural subscale students' scores (Table 6).

The result in the Table 6 showed that there was a significant positive correlation between the age and fluency ($r = .19$, $p < .01$), originality ($r = .35$, $p < .01$), titles ($r = .15$, $p < .01$), closure ($r = .47$, $p < .01$), strengths ($r = .12$, $p < .01$) subscale scores of the students. The correlation level of between the age and the originality ($r = .35$), closure ($r = .47$) were medium. However, the correlation between age and fluency, titles, and strengths was low level.

Table 6. Correlations between the age and Torrance Tests of Creative Thinking figural subscale scores of the students (source: created by author)

	Fluency	Originality	Titles	Elaboration	Closure	Strengths
Age	.19*					
		.35*				
			.15*			
				.06		
					.47*	
						.12*

**Note:* Correlation significant at the 0.01 level, $p < .01$.

Discussion

The present result indicated that the university students in non-art education had significantly higher creative thinking scores than the students in art education. This result is not consistent with the general belief that the art domain possesses the creativity skill more than the other fields. As a standard view among scholars, art is an innovative-creative area (Runco, 2014). However, this result is consistent with some previous study findings. For instance, Huang and Wang (2019) found that investigated the creativity test based on the domain – general content domain in creativity measurement. They found that this creativity measurement was insufficient to reflect students' creative skills, especially in the specific field. With a measurement tool including different domain variables, Kandemir and Kaufman (2020) found that the participants' creativity scores in various domains were correlated higher with their domains' factors than in another domain field. From this perspective, the present result showed that the specific domain – specific appreciation could be a significant determining factor in measuring the individuals' creative thinking skills. By this means, the present result supports numerous scholars' clarifications upon the domain's critical role in the creative thinking measurement (*e.g.*, Haase et al., 2018; Huang & Wang, 2019; Hyeon Paek & Runco, 2018; Sternberg, 2020).

On the other hand, the present result is also consistent with the TTCT preference. Based on previous research findings, TTCT measures the individuals' creative thinking potential in the domain-general (Huang & Wang, 2019). As a basis of the TTCT, Torrance (1966) defined creativity as becoming sensitive to problems, deficiencies, gaps in knowledge, and missing elements. However, some scholars criticized this definition, and they stated that the term should include specific domains. Because creativity also includes many domains as mathematics, natural sciences, engineering, architecture, and art (Cropley, 2002). In this way, the study revealed that TTCT could be a vital an instrument to measure the individuals' creative thinking skills based on the domain – general content domain rather than domain-specific. This study showed that the non-art students as the domain-general differentiated in a positive direction significantly from the art students (the domain-specific) in the TTCT measurement (see Tables 2–3). However, this study indicated that individuals' creative thinking

measurement in the specific domain such as the art education would be better with an instrument including the domain-specific instrument content than the instrument with the domain – general content domain TTCT.

This study also investigated the students' age and creative thinking subscale scores regarding the domain-specific and domain-general. The university students (N = 143, $mean_{age}$ = 21.39) in non-art education had significantly higher creative thinking scores than high school students in the art (N = 93, $mean_{age}$ = 16.59) and high school students in the non-art education (N = 104, $mean_{age}$ = 15.91). The present study also revealed that university students (N = 116, $mean_{age}$ = 20.91) in art education had higher creative thinking scores than high school students had in art education and non-art education (Table 4). This result indicated that students in the age range of 16 to 21 might be sensible in figural creative thinking skills. This result indicates that the age range of 16 to 21 might be a significant era in the students' figural creative thinking skill development. Therefore, age might be an essential indicator in developing creativity positively, especially in the 16 to 21. In other words, the individual's age can be a significant variable in the domain-general for the figural creative thinking scores. Accordingly, the age range of 16 to 21 years old in the domain-general might be a critical age range for figural creativity measurement. In contrast, some previous studies showed that individuals' age was not a significant variance, especially in verbal creativity measurement (Fusi et al., 2021; Palmiero et al., 2014). However, Palmiero et al. (2014) found that younger participants' ($mean_{age}$ = 22) figural fluency scores as related to the figural fluency were significantly higher than older participants' ($mean_{age}$ = 65) ones figural fluency scores regarding the domain-general. In this way, the present result supports the previous conclusion (Fusi et al., 2021) that age could be a vital variation in divergent thinking's figural and verbal sections independently. Thus, this result, consistent with the some parts of previous study findings (*e.g.*, figural fluency). Accordingly, that the individuals' age is can behave an essential effect on figural creativity skills.

The present study also revealed that the students in non-art education as the domain-general had significantly higher scores in the fluency and closure subscales – creative skills than the students in art education. Thus, the domain-general factor might positively affect the figural creativity scores, especially for the fluency and closure subscales. This result consists of previous study findings; for instance, Sagone and de Caroli (2012) found that high school students in science scored better in fluency than the students in arts. However, the present result was not parallel with the other previous study. Art students had a higher level of fluency than science students (van Broekhoven et al., 2020b). As related the fluency subscale, in a previous study, Batey et al. (2010) found that fluency scores of individuals ($mean_{age}$ = 19.66) significantly related to fluid intelligence and general knowledge positively. Cho et al. (2010) found that individuals' TTCT-Figural fluency scores were not significantly different between the intelligence quotient (IQ) (106) and the high IQ (132) groups. Also, scholars found fluency as a complex process in a recent study (van Broekhoven et al., 2020a). The present result indicated that fluency might be important indicator of students' creative skill in between art and non-art domain. In this way, some subscales of creative thinking may be active in art and non-art domains differently in the emerge of creativity. In this situation, the creative thinking has a complex structure in terms of the subscales in different fields.

However, this study found a significant difference in the elaboration subscale scores between the art and non-art students in favor of art students. This result supports the previous study's findings that the students in art schools scored higher in the elaboration than students in the sciences between ages 13 and 18 (Sagone & de Caroli, 2012). However, van Broekhoven et al. (2020b) reported no significant difference between art and science students on the elaboration. The elaboration ability is related to the adornment and adds details to an idea (*e.g.*, Torrance, 1966). The present result indicated that students' creative thinking development in art education was distinct and higher on the elaboration subscale (especially from 16 to 21), than the non-art domain. Thus, the domain factor can positively affect the figural creativity scores in terms of some subscales as the fluency, closure, and elaboration subscales.

Kim (2006b) revealed that the innovative creativity factor was formatting with fluency, originality, and closure (the adaptive factor is the elaboration, titles, and strengths). Said-Metwaly et al. (2018) found that elaboration subscale exhibited as the adaptive factor in the TTCT's structure. In the present result, the domain-general supports the innovative trait (the fluency and closure) of students rather than the domain-specific. As a standard view, the art field has more creative innovative characteristics than the other areas. In contrast to this common belief, as related to the present result, the art area seems to have an adaptive direction (elaboration) more than an innovative approach, according to the two-factor model. The two-factor model stated that innovators change the paradigm by creating, while adaptors maintain the paradigm by working (Kim et al., 2006). According to scholars, adaptive factors tend to generate thinking and to work with well-crafted maintaining logicality within the existing paradigm. Innovative aspect inclines to produce thought and work as original by threatening the paradigm (Zimmerman, 2009). In this theory, the innovative style was significantly more fluent and more original. Still, the adaptive manner was more logical and well-crafted satisfactorily (Kim et al., 2006). Although there are many views among the scholars about creativity as the innovative and adaptive thinking style, recent studies reported that the explanation of the structure of TTCT scores supports the two-factor model (Kim et al., 2006). Regarding the TTCT subscales, Kim et al. (2006) found that fluency and originality reflected the innovative aspect whereas, elaboration and titles represented the adaptive aspect.

Accordingly, the present result indicated that students' thinking styles in art and non-art education were different. This result consistent with Kaufman's (2013) study findings. In this previous study, Scott Barry Kaufman found significant differences between adolescents' thinking styles in the arts and sciences regarding creative achievement. The current result indicated that creative thinking measurement based on the general-content might not be the best-known way, especially in the specific domain use. In other words, individuals' creative thinking measurement in the specific domain should could contain the domain-specific preference more than the general-content domain regarding the instrument.

Lastly, this study investigated the relationship between the age and creative thinking subscale scores of the individuals. The BPC technique revealed a significant relationship between the students' age and the fluency (r = .19), originality (r = .35), titles (r = .15), closure (r = .47), strengths (r = .12) scores as seen in the Table 6. A few previous study findings in the literature supported this result. Ripple and Jaquish (1981) found that individuals' age significantly correlated with fluency and originality. Rostan (2010) found that students' age was

influential influenced on creativity positively, especially between 9–16 years old. The present result is also parallel with the other previous study finding as it in which concluded that the originality subscale might be exclusively developed by the students' age positively (Ulger, 2015). According to Fink et al. (2020), fluency, flexibility, and originality in verbal or figural divergent thinking subscales have the same role in different domains. From this perspective, the present result indicated that the students' age (between 16 and 21 years old) might be a common factor in the fluency and originality in both domain-specific and domain-general regarding the development. In this point, Kasirer and Mashal (2018) emphasized that fluency is a significant common trait of an individual's creative mind development spontaneously. This situation explains that fluency and originality might be the common traits of the individuals' creative thinking development universally.

The present result also revealed that the closure correlated with students' age, as well. Said-Metwaly et al. (2018) found that elaboration, (abstractness of) titles, and (resistance to premature) closure subscales as the adaptive factor in the TTCT's structure. In contrast, Kim (2006b) found that elaboration, titles, and strengths were the adaptive factor. However, she claimed that adaptive factors worked better without the strengths subscale than those with the strengths. A previous study (Ulger, 2016) revealed that the strengths might represent themselves as a gap between the innovative or adaptive factor of creative thinking. This last previous conclusion may also be valid for the closure subscale's as in the present result (r = .47) because it positively correlates with the students' age. In this meaning, the closure subscale may assess as the shared factor between the innovative or adaptive style of creative thinking. As a result, the present study revealed that the domains and individuals' age (between 16 and 21 years old) could be vital indicators for the creative measurement with as including the creative thinking styles.

Limitations and implications

This study might have some limitations. Regarding one of them may be the participant groups. However, these groups were selected randomly as intact groups. Therefore, the participant groups were equivalent to their education disciplines (as the high and higher education) and age levels. Perhaps, the study's data could be the other limitation because of the collection at various times as an original approach. Another limitation may be the varied age levels of participated students in the range of 16 to 21. However, the author implemented the TTCT on all the participant students in their classrooms to avoid different administration effects. Also, the author followed the whole process and scored all the TTCT forms according to the scoring procedure to avoid any confusion and misperception. Although these possible limitations, this study was the first to determine possible creative thinking differences between the domain-specific and domain-general in terms of some crucial variables comparatively.

This study implied that an alternative instrument for measuring individuals' creative thinking in the domain-specific could include domain-specific content rather than the general content domain. Due to art being a creative area, creative skill and measurement are vital issues for the art education field. Hence, this study's findings bring significant implications for assessing art students' creativity under specific domain preferences and appreciations. The

present study revealed a substantial difference in the figural creativity scores among young individuals with the TTCT. In contrast, there was no significant difference in the verbal creativity scores between older and younger individuals with divergent thinking tests in the literature. The present result provides a unique contribution to the literature because of being reported no study findings in the literature on the figural creativity between the domain-specific as the art and domain-general regarding the non-art area. The other implication was that the individuals' age range of 16 to 21 years old might be a critical indicator variable in the figural creativity scores. In this way, individuals' age could be a vital variable in the creativity measurement. Another implication was that there is a necessity of improvement to improve alternative instruments for creative thinking measurement in the domain-specific rather than the general content domain.

Conclusions

The different aspects of the educational experiences can be significant predictors of creative thinking for the arts (Miller & Dumford, 2015). Therefore, the present result revealed some critical clues to predict creativity in art education thoroughly. The present study indicated that the creativity measurement should include domain-specific preferences to measure individuals' creative thinking in the specific domain. In this way, the study results may significantly contribute to the current discussion in the literature on whether creativity measurement should include domain-specific preferences to measure students' creative thinking skills in the specific domain. The present result indicated that it is necessary to interpret creativity measurement by considering the specific domain content. Miller and Dumford (2015) stated that the arts are crucial in developing students' creative talents. Therefore, it is critical to understand how education can best serve students in the arts. In this way, art education can enhance students' creativity and help students use their creative skills (Zimmerman, 2009). In this manner, this study suggested the specific creative thinking measurement with possessing domain-specific appreciation. In this manner, perhaps, it is the time for thinking of the creative thinking measurement as an instrument with possessing domain-specific appreciation. Hyeon Paek and Runco (2018) emphasized that the divergent thinking tests were might not suitable to predict creative performance in different domains.

This study also revealed a significant difference between the students' creative thinking subscale scores in art and non-art education upon the fluency and closure in favor of non-art education students (the domain-general). By contrast, the students in art education (the domain-specific) had significantly higher elaboration subscale scores than those in non-art education. According to this result, there could be critical limitations for the TTCT's use in different domains. Moreover, This this study also found revealed a significant relationship between the students' age factor and fluency, originality, titles, closure, strengths subscale scores. The present result indicated that age in a linear direction might be a crucial variable for the individuals' creative thinking development as linear.

Creative thinking as the skill produces useful and new solutions in different ways of thinking or practicing surprisingly in an existing condition by maintaining openness to change in all domains. Therefore, creative thinking may have a changeable structure. This

situation brings some serious questions to the measurement of creativity in various domains. Though the creativity measurement ignored the domain-specific appreciation in measuring creativity, it is necessary to thoroughly assess the individual's creative thinking skill within the domain. Creativity is vital for every domain. However, there are a few study findings on measuring creativity comparatively as the art and non-art fields. Therefore, the present results can critically determine the characteristics of creativity measurement for the specific domain, including related domain contents and preference. In this way, the present study reveals the core clues to consider the creativity measurement in various fields extremely. Consequently, this study suggests future research to conduct creative thinking measurement comparatively with alternative instruments on individuals in different age ranges and domains. Also, this study suggested qualitative research to conduct on how individuals exhibit their creative skills in a specific domain to determine distinct traits of creativity for the measurement.

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