An investigation of the gender differences in creative thinking abilities among 8th and 11th grade students

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\textbf{A B S T R A C T}

This study investigated the gender differences in creative thinking subtests between males and females among 8th and 11th grade students. A suburban independent public school district in Minnesota provided student responses to the Torrance Creative Thinking Test (TTCT) Figural Form A. The sample included 996 8th and 748 11th grades students. One-way ANOVAs were used to analyze the differences between males and females in the two study samples. Results of the study revealed that there were statistically significant differences on the majority of the subtests between males and females in favor of the females among both the 8th and 11th grade students. However, there were no statistically significant differences in the fluency subtest between males and females among the 8th grade students. The results also revealed that there were no statistically significant differences in the fluency and originality subtests between males and females among the 11th grade students. Educational implications and suggestions for future work were presented.

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The need for creative people is a necessity in the modern age, and this makes creative thinking an increasingly important area in education. One of the first people to define creative thinking was Torrance, who defined it as “the ability to sense problems, make guesses, generate new ideas, and communicate results” (1965, 1966, 1988, as cited in Wang, 2011, p. 1). That definition informs this study, as it informed the tests Torrance developed to identify creative thinking abilities of individuals.

The Torrance Tests of Creative Thinking (TTCT) are one of the best measures of creativity (Almeida, Prieto Prieto, Ferrando, Oliveira, & Ferrandiz, 2008) and the most widely used tests to identify the creative thinking abilities of individuals. Torrance and his associates developed the tests in 1966 in Minnesota. There are two forms of the TTCT: (1) TTCT Figural and (2) TTCT Verbal. Each form has two parallel forms, A and B (Torrance, 1974, 1990, 1998, 2008).

Testing for creativity is considered a vital part of educational assessment (Rudowicz, Lok, & Kitto, 1995), primarily because creativity is highly valued in modern technological society and should be developed in as many individuals as possible.

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However, individual and group differences can occur for creativity and such differences warrant study to permit understanding of their underlying causes. One such class of group differences for creativity is gender differences. Boys and girls may differ in their creativity, due to sex differences associated with different biological influences on the two sexes and/or due to gender differences associated with different socio-cultural influences on the two sexes. This research is an investigation of creativity differences between boys and girls with an emphasis on gender differences on creativity.

The study of gender differences in creativity constitutes a vital as well as a complex and controversial topic in the study of creativity. Abra (1991, as cited in Stephens, Karnes, & Whorton, 2001, p. 3) asserted that the significance of investigating creativity depends essentially on the socio-cultural differences among both girls and boys. Socio-cultural factors could affect girls and boys differentially, including the development of their creative capabilities.

Although extensive research has been carried out on creativity and creative thinking, far too little attention has been paid to the role of gender differences on creative thinking skills of students in creative thinking literature. Drawing on a comprehensive review of literature on gender differences in creative thinking, Baer and Kaufman (2008) point out that “Yet despite the many studies that have been done, gender differences in creativity have not become an important focus in either the creativity or psychology of women literatures” (p. 76). In addition, the analysis of the current literature on gender differences in creative thinking abilities of students offers contradictory findings about how males and females differ in their use of creative thinking skills (Hong, Peng, O’Neil, & Wu, 2013).

Some empirical studies have indicated that females tend to have higher creativity scores than men (Anwar, Shamim-ur-Rasool, & Haq, 2012; Awamleh, Al Farah, & El-Zraigat, 2012; DeMoss, Milich, & DeMers, 1993; Hong et al., 2013; Kousoulas & Mega, 2009; Stephens et al., 2001). DeMoss et al. (1993) investigated the relation between creativity and affective symptoms using the TTCT Figural and Verbal A forms as a measure of creativity. The participants included 128 (71 males and 57 females) eighth and ninth grade students. The results indicated that males and females did not differ in their creative performance as assessed by the TTCT Figural; whereas, females had a significant advantage over males in the verbal component of the TTCT.

Stephens et al. (2001) investigated gender differences in creativity with a sample of 165 third and fourth grade American Indian students, of whom 86 were boys and 79 were girls. Stephens et al. (2001) used the Torrance Test of Creative Thinking (TTCT) Figural Form A to gather data from the students. The results indicated that females performed significantly better than males in the subtests of originality and creative index.

One study by Kousoulas and Mega (2009) investigated the gender difference in divergent thinking among 228 Greek primary school students (129 boys and 99 girls). Teacher ratings and divergent thinking tasks focusing on linguistic expression were used to evaluate student creative performance. The results of the divergent thinking tasks indicated that female students scored higher than the male students did in the subtests of fluency and flexibility, and for the total score of divergent thinking, except for the originality subtest.

Awamleh et al. (2012) studied the impact of age, gender, and GPA on creative thinking abilities. The sample consisted of 31 male and 32 female students from the first, second, and third grades. Using the TTCT Figural Form B as the main data collection tool, Awamleh et al. (2012) found the presence of gender differences in creative thinking abilities. Their study indicated that females had a significant advantage over the males on the subtests of fluency and flexibility.

A recent study by Anwar et al. (2012) examined gender differences among 208 10th grade students in Pakistan using a self-developed instrument called ITCT. The participants were 104 girls and 104 boys, with an equal number of low and high achievers in each gender group. The results revealed that both low and high achieving females scored higher than males in their creative thinking abilities.

In another recent study, Hong et al. (2013) investigated gender differences in creative thinking among 10th grade students using a domain-general and a domain-specific creative thinking test. The sample included 234 male and 244 female Chinese students. Hong et al. (2013) found that females had a significant advantage over the males in the subtests of fluency, flexibility, and elaboration, but not in originality when domain-specific items were used. The results of the study further indicated that there were no differences between males and females in their domain-general creative thinking scores.

The studies presented thus far provide evidence that females have mostly higher creativity scores compared to males in different age groups. However, opposed to the previous results, some studies revealed that males scored higher than females in creative thinking subtests. Stoltzus, Nibbelink, Vredenburg, and Thyrum (2011) examined the issue of gender, gender role and creativity among 136 undergraduate students (57 males, 79 females). They used a modified version of the TTCT, which included tasks from both verbal and figural TTCT. The results of their study indicated that although males had higher scores than the females in the verbal creativity tasks, the differences were not significant. The results also revealed that males had significantly higher scores than females in the non-verbal creativity tasks.

Similarly, He, Wong, Li, and Xu (2013) investigated gender differences among 627 students in China using the Test for Creative Thinking-Drawing Production (TCT-DP). Of the participants, 332 were boys and 295 were girls. He et al. (2013) found that males had superiority over the females in creativity test performance as demonstrated by both composite creative scores and individual subscale scores.

Differing from those studies, some studies indicated that there were no gender differences in creative thinking. These studies were mostly conducted in higher education settings. Ayvildz-Potur and Barkul (2009) conducted a study among 147 (88 females, 59 males) undergraduate students to explore gender differences in creative thinking in Turkey. They used the TTCT Figural test to collect data regarding creative thinking abilities of the individuals. The results revealed that there were no differences among males and females in their use of creative thinking abilities. Similarly, in a study conducted by
Aitken-Harris (2004) among 404 undergraduate students (203 males and 201 females) using an abbreviated version of the Remote Associates Test (RAT), no significant differences in creativity were found between males and females.

One another study which is worth mentioning here was conducted by Saeki, Fan, and Van Dusen (2001). In a comparative study, Saeki et al. (2001) investigated cross cultural differences in creative thinking among 51 American and 54 Japanese college students using TTCT Figural Form A. The results of their study indicated that males and females did not differ in their use of creative thinking abilities in both cultures; whereas, culture was found to be a factor that accounts for the difference in creative thinking abilities between the students from the two different cultures.

The studies presented in the previous section offer contradictory findings about gender differences in creative thinking using different samples from different cultural settings. In addition, the studies reviewed in the previous section have mostly used the verbal tests or combined tests. Considering that figural tests are generally less common compared to the verbal tests in divergent thinking literature, it is important to investigate gender differences in creative thinking in large samples using the TTCT Figural. This becomes much more important when one reviews the recent literature on whether the figural divergent thinking tests measure the same thing as the verbal subtests, and thus whether different DT tests are interchangeable.

In an earlier study conducted by Clapham (2004) revealed a similar pattern in terms of the interchangeability of the DT tests. Examining the convergent validity of the TTCT Figural and Verbal and two creativity interest inventories, Clapham (2004) has suggested that “...different types of creativity tests should not be assumed to measure the same construct and should therefore not be used interchangeably” (p. 838). These studies might highlight the emerging need to investigate gender differences in creative thinking as measured by the TTCT Figural since most of the work on this issue has either used verbal or combined tests, and their results may not apply to the figural tests.

Considering that the TTCT Figural may be less biased as a divergent thinking test (Kim, 2006b), it makes more sense to use the TTCT with seemingly unused two population groups (i.e., 8th and 11th grades) in the American context, which includes underrepresented groups. In parallel, the present study expands on previous research by contributing to recent discussion on whether divergent thinking tests can supplement intelligence tests. Focusing on the concept of creative giftedness, Kaufman, Kaufman, Beghetto, Burgess, and Persson (2009) state that “…creativity measures appear much less culture-dependent than most IQ measures” (p. 5), and they highlight the asset of using creativity measures, one of which is the TTCT, to complement IQ testing especially while determining giftedness in underrepresented groups. This is further supported by Torrance who “concluded that if we identify gifted children only on the basis of IQ and scholastic aptitude tests, we are eliminating approximately 70% of the top 20% of creative students from consideration” (1960, 1962, 2002, as cited in Kim, p. 9).

With that as background, the purpose of this paper is to examine gender differences in the creative thinking abilities of 8th and 11th grade students by addressing the following research questions: (1) Are there any differences between males and females among 8th graders in terms of the five subtests of creativity as measured by the TTCT? (2) Are there any differences between males and females among 11th graders in terms of the five subtests of creativity as measured by the TTCT?

1. Method

This study was part of a larger study of creativity among school-aged students, and was funded within the University of Minnesota. The funded larger study was intended to shed light on the incidence and development of creativity in school districts. Although we have other data such as SES and achievement scores of the students, we decided not to include them in this manuscript, primarily because we wanted to focus on the gender differences for creativity as indicated among the participating students in the participating school district. We do consider grade as a factor in the study to determine the extent to which gender differences for creativity for 8th grade students are similar to gender differences for creativity for 11th grade students.

1.1. Participants

The participants of this study were 996 8th grade students including 503 boys and 493 girls and 748 11th grade students including 407 boys and 341 girls from a suburban independent public school district in the Twin Cities region of Minnesota in the United States. The 8th grade students had a \( M_{age} = 14.11 \) years with \( SD_{age} = .34 \) years. The 11th grade students had a \( M_{age} = 17.32 \) years with \( SD_{age} = .35 \) years.
Table 1
Gender comparison for 8th grade students for creative thinking subtest scores (N=996).

<table>
<thead>
<tr>
<th>Subtest</th>
<th>M (SD)</th>
<th>95% CI for M</th>
<th>F(1, 994)</th>
<th>P</th>
<th>Cohen’s d [CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluency</td>
<td></td>
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<td></td>
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<tr>
<td>Males</td>
<td>23.78 (9.82)</td>
<td>22.92, 24.64</td>
<td>0.70</td>
<td>.40</td>
<td>0.05 [−0.07, 0.17]</td>
</tr>
<tr>
<td>Females</td>
<td>24.28 (8.99)</td>
<td>23.48, 25.07</td>
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<tr>
<td>Originality</td>
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<tr>
<td>Males</td>
<td>16.03 (7.20)</td>
<td>15.40, 16.66</td>
<td>8.24</td>
<td>.00</td>
<td>0.18 [0.06, 0.30]</td>
</tr>
<tr>
<td>Females</td>
<td>17.31 (6.80)</td>
<td>16.71, 17.91</td>
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<tr>
<td>Elaboration</td>
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<tr>
<td>Males</td>
<td>6.91 (2.42)</td>
<td>6.70, 7.13</td>
<td>105.59</td>
<td>.00</td>
<td>0.65 [0.52, 0.78]</td>
</tr>
<tr>
<td>Females</td>
<td>8.60 (2.75)</td>
<td>8.36, 8.84</td>
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<tr>
<td>Abstractness of titles</td>
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<tr>
<td>Males</td>
<td>5.62 (3.61)</td>
<td>5.30, 5.93</td>
<td>20.61</td>
<td>.00</td>
<td>0.29 [0.16, 0.41]</td>
</tr>
<tr>
<td>Females</td>
<td>6.76 (4.32)</td>
<td>6.38, 7.15</td>
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<tr>
<td>Resistance to premature closure</td>
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<tr>
<td>Males</td>
<td>13.01 (3.97)</td>
<td>12.67, 13.36</td>
<td>10.04</td>
<td>.00</td>
<td>0.20 [0.08, 0.32]</td>
</tr>
<tr>
<td>Females</td>
<td>13.82 (4.03)</td>
<td>13.46, 14.17</td>
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</tbody>
</table>

1.2. Instruments

This study made use of a general personal questionnaire and the TTCT Figural, Form A. It provides scores for five subtests: (1) Fluency, (2) Originality; (3) Elaboration; (4) Abstractness of titles; and (5) Resistance to closure. This form includes three activities: picture completion, repeated figures of lines or circles, and picture construction, each of which lasts 10 min (Torrance, 1974, 1990, 1998, 2008).

1.3. Procedure

The cooperating school district handled the collection of the data and the protection of participant privacy. The researchers and the cooperating school district received parental assent for this study. District personnel working with the researchers notified parents that the data was being gathered as part of other research being conducted in and by the district, and that all data went directly to the district research office. The research office paired the materials with student records and removed all personal identification. The study received university human subjects board review approval, primarily because the data was viewed as existing data without any personal identifiers.

As for the administration of the TTCT, one of the researchers trained the teachers to administer the instruments in several test administration workshops. Then, the teachers administered the instruments, i.e., the Torrance test and the general personal questionnaire. The publisher of the Torrance test received the completed tests and scored the test responses.

2. Results

The investigation of the gender differences in creative thinking among 8th and 11th grade students involved the analysis of data with the use of one-way ANOVAs using SPSS version 20 (IBM Corp, 2011). We also used MBESS R package version 3.3.3 (Kelley & Lai, 2012) to calculate Cohen’s d value (Cohen, 1988) for each subscale and its 95% confidence intervals (CI). According to the d scale guidelines, d = .2, d = .5, and d = .8 represent small, medium, and large effect sizes respectively (Cohen, 1988).

Table 1 provides the gender comparison for the 8th grade students for creative thinking subtest scores. From the table, it can be seen that the ANOVAs were significant for all subtests of creative thinking except for fluency. Fig. 1 provides a graphical representation of the means of the creativity subtests for the males and females of the 8th grade.

The results indicated that 8th grade female students had significantly higher scores in all creative thinking subtests except for the fluency subtest for which male and female students performed equivalently.

As Table 1 shows, the 8th grade female students performed significantly higher than the male students on the subtests of originality [F(1, 994) = 8.24, p < .01], d = 0.18, 95% CI = [0.06, 0.30], elaboration [F(1, 994) = 105.59, p < .01], d = 0.65, 95% CI = [0.52, 0.78], abstractness of titles [F(1, 994) = 20.61, p < .01], d = 0.29, 95% CI = [0.16, 0.41], and resistance to premature closure [F(1, 994) = 10.04, p < .01], d = 0.20, 95% CI = [0.08, 0.32].

Table 2 presents the results pertaining to the gender comparison for the 11th grade students for creativity subtests scores. Fig. 2 provides a graphical representation of the means of the creativity subtests for the males and females of the 11th grade.

As seen in Table 2, there were no statistically significant differences among males and females for the fluency and originality subtests. However, the ANOVAs indicated significant gender differences for the subtests of elaboration, abstractness of titles, and resistance to premature closure. According to Table 2, the 11th grade male and female students performed equivalently on the fluency and originality subtests. However, 11th grade female students had an advantage over the males...
Fig. 1. Means of the creativity subtests for males and females of the 8th graders. Note. AT, abstractness of titles; EL, elaboration; FL, fluency; OR, originality; and RPC, resistance to premature closure.

on the subtests of elaboration \( F(1, 746) = 56.09, p < .01, d = 0.55, 95\% CI = [0.40, 0.70] \), abstractness of titles \( F(1, 746) = 8.35, p < .01, d = 0.21, 95\% CI = [0.07, 0.35] \), and resistance to premature closure \( F(1, 746) = 11.60, p < .01, d = 0.25, 95\% CI = [0.11, 0.39] \).

3. Discussion

The purpose of this study was to investigate the gender differences in creative thinking among 8th and 11th grade students. One significant finding from this study is that 8th grade females scored significantly higher than the 8th grade males on all of the creativity subtests except for the subtest of fluency. Similarly, the second major finding was that females scored significantly higher than the males among the 11th grade students on three subtests of creativity, namely, elaboration, abstractness of titles, and resistance to premature closure; whereas, males and females scored equally well on the subtests of fluency and originality.

Although, these results differ from the results reported in certain published studies (Aitken-Harris, 2004; Ayyıldız-Potur & Barkul, 2009; He et al., 2013; Saeki et al., 2001; Stoltzfus et al., 2011), they are consistent with those of Anwar et al. (2012), Awamleh et al. (2012), DeMoss et al. (1993), and Stephens et al. (2001), who found that females had higher creativity scores compared to males. It is also encouraging to compare these results with the results of the studies conducted.

<table>
<thead>
<tr>
<th>Subtest</th>
<th>M (SD)</th>
<th>95% CI for M</th>
<th>F(1, 746)</th>
<th>P</th>
<th>Cohen’s d [CI]</th>
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<tbody>
<tr>
<td>Fluency</td>
<td></td>
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<tr>
<td>Males</td>
<td>20.19 (9.32)</td>
<td>19.28, 21.10</td>
<td>3.11</td>
<td>.08</td>
<td>0.13 [−0.01, 0.27]</td>
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<tr>
<td>Females</td>
<td>21.38 (9.00)</td>
<td>20.42, 22.34</td>
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<td>Originality</td>
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<tr>
<td>Males</td>
<td>14.48 (7.17)</td>
<td>13.78, 15.17</td>
<td>2.17</td>
<td>.14</td>
<td>0.11 [−0.03, 0.25]</td>
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<tr>
<td>Females</td>
<td>15.23 (6.65)</td>
<td>14.52, 15.93</td>
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<td>Elaboration</td>
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<tr>
<td>Males</td>
<td>6.57 (2.30)</td>
<td>6.34, 6.79</td>
<td>56.09</td>
<td>.00</td>
<td>0.55 [0.40, 0.70]</td>
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<tr>
<td>Females</td>
<td>7.87 (2.47)</td>
<td>7.61, 8.13</td>
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<td>Abstractness of titles</td>
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<tr>
<td>Males</td>
<td>5.93 (3.82)</td>
<td>5.56, 6.30</td>
<td>8.35</td>
<td>.00</td>
<td>0.21 [0.07, 0.35]</td>
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<tr>
<td>Females</td>
<td>6.76 (4.06)</td>
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<tr>
<td>Resistance to premature closure</td>
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<tr>
<td>Males</td>
<td>12.40 (4.37)</td>
<td>11.97, 12.82</td>
<td>11.60</td>
<td>.00</td>
<td>0.25 [0.11, 0.39]</td>
</tr>
<tr>
<td>Females</td>
<td>13.47 (4.21)</td>
<td>13.02, 13.92</td>
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by Hong et al. (2013) and Kousoulas and Mega (2009), especially in terms of the originality subtest for the 11th grade students.

Kirton’s (1976) Adaption-Innovation (KAI) theory and Kim’s (2006a) study of the factor structure of creativity provide an explanation of the results of this study. Kirton (1976) suggested that individual approaches to problem solving are either adaptive or innovative. A person who is adaptive seeks the best solution. A person who is innovative seeks a novel solution.

Kim (2006a) found that fluency and originality loaded onto the innovative factor; whereas, elaboration and abstractness of titles loaded onto the adaptive factor. She also found that resistance to premature closure loaded onto both factors. The results of the present study indicated that females in the 8th grades had higher creativity scores on the subtests of originality, elaboration, abstractness of titles, and resistance to premature closure compared to the males, although they performed equivalently on the subtest of fluency with the males. The results also indicated that females in the 11th grades had significantly higher creativity scores on the subtests of elaboration, abstractness of titles, and resistance to premature closure, and that they performed equivalently on the subtests of fluency and originality with the males.

The females in the 8th grade had thus significantly higher scores on both the innovative and adaptive factors compared to the males. The results of the present study showed that females in both the 8th and 11th grades had significantly higher scores on elaboration, abstractness of titles, and resistance to premature closure, which load on the adaptive factor according to Kim’s (2006b) model. These findings suggest that females elaborate more with their ideas, present more detail in their responses, manifest significantly higher synthesizing and organization skills, and display more intellectual curiosity and open-mindedness compared to the males.

These differences indicate early maturation of the females compared to the males and suggest that, as males mature, the gap between males and females could close. Although we do not know when this gap starts, this interpretation is in agreement with interpretations provided by Aitken-Harris (2004), Ayvildiz-Potur and Barkul (2009), and Saeki et al. (2001), who contended that there were no gender differences in creative thinking abilities of the individuals in higher education settings.

Another important finding of the present study was that although the females in the 8th grades had higher scores on the subtest of originality, females and males in the 11th grade had similar score means on the subtests of fluency and originality. This result suggests that males and females produce original, meaningful, and relevant ideas equally well as they age. A possible explanation for this is that they might have equal opportunities to express themselves in public settings such as schools. Schools may permit comparable opportunities for girls and boys to express their fluency and originality creative thinking abilities.

The study determined that there exist gender differences in creative thinking for both 8th and 11th grades, primarily in favor of the adaptive skills of females. This study suggests several courses of action for developing creative thinking abilities of the students. In the first place, there is a definite need for integrating creativity into K-12 curricula and providing opportunities for both males and females to develop their creative thinking abilities. This necessitates curriculum designers, teachers, and decision makers to develop a broader plan of how K-12 curricula could develop creative thinking abilities of individuals, what methods and activities enhancing creative thinking could be integrated into curricula, and how both
males and females could benefit from integrated creative curricula. In the formulation of such a plan, the differences between the males and females in their creative thinking abilities should be taken into consideration, and special emphasis should also be placed on designing ways to help boys improve their creative thinking abilities. In that sense, teachers especially of boys should think of practices such as problem solving and open-ended instructional tasks that improve the learning outcomes and the creative thinking skills of students, especially higher order creative thinking skills. This study also suggests a need for not only teaching for creativity, but also teaching creatively to facilitate the development of creativity in students.

There were two limitations to this study. First, the present study has only examined the data collected from 8th and 11th grade students from a suburban independent public school district in the State of Minnesota in the United States. The findings of this study may not be generalizable to other grades, or similar grades in different settings. Second, some confounding variables such as level of student motivation (Torrance, 1974) might have an influence on student creativity, which could have affected the measurement of student creative thinking abilities. This research suggests many topics in need of further investigation. In the first place, more research is needed to better understand if 8th and 11th graders in other states or countries display similar patterns of creative thinking abilities. Replications of this study could provide researchers with insights as to how creativity is affected by different cultural and educational contexts. Further studies could also investigate the creativity profiles of females and males in different grades. This could enable researchers to explore when gender differences in creative thinking start, how the gap between males and females develops, and when the gap closes, if ever.

It would also be interesting to follow a group of students in their K-12 education to develop an understanding of how they develop creative thinking abilities and how gender influences their creative thinking skills. Another line of future research would be to explore why males and females differ from each other in terms of their creative thinking abilities by conducting a qualitative study. Semi-structured observations in classes, interviews with teachers, parents, and students, and analysis of classroom documents could provide researchers information about how schools developing creativity. This would enable researchers the opportunity to explore how instructional practices affect student creative thinking skills, and how females and males benefit from these processes.

References

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