Assessing Aspects of Creativity in Deaf and Hearing High School Students

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To address the paucity of current research on the development of creativity in deaf students, and to extend existing research to adolescents, the present study investigated divergent thinking, a method of assessing creativity, in both deaf and hearing adolescents. We assessed divergent thinking in two domains, figural and verbal, while also adjusting the instructional method in written format, sign language, or spoken English. Deaf students’ performance was equal to, or more creative than, hearing students on the figural assessment of divergent thinking, but less creative on the verbal assessment. Additional studies should be conducted to determine whether this was an anomalous finding or one that might contribute to hypotheses yielding effective interventions.

Creativity is an important aspect of intellectual functioning (Bately & Furnham, 2006). People found to be highly creative have made noteworthy contributions throughout history. Creativity is perceived as a trait or gift to certain individuals and may be a key factor that drives our human race towards success (Bately & Furnham, 2006). Members of society deemed creative are thought to be unique and are expected to contribute to the betterment of society beyond what the average person can. Well-known creative individuals, such as Picasso, da Vinci, and Einstein, for example, have made lasting contributions to culture and society (Hennessey & Amabile, 2010). Continued advancement of culture and society relies on better understanding individual differences in the development and application of creativity.

The purpose of the present study was to compare outcomes on assessments of creativity between hearing and deaf adolescents in two different domains: figural and verbal. Minimal current research examining creativity among deaf individuals is available in the extant literature. Previous research findings present a contradictory picture. On the one hand, findings suggest that, in comparison to hearing individuals, deaf individuals may think in a more rigid and concrete manner (Myklebust, 1964; Singer & Lenahan, 1976). Conversely, other findings suggest that it may be more flexible (Kaltsounis, 1971). Creativity has been associated with success in many areas of the education of hearing students including but not limited to reading, writing (Wang, 2012), mathematics, and the arts (Jeon, Moon, & French, 2011). If creativity plays a role in the education of hearing students, then perhaps it is important in the education of those with hearing loss. Recent changes in early identification of deafness and increased access to sign language in schools have resulted in a new generation of deaf learners whose opportunities to develop creativity may differ from those previously studied (Marschark & Spencer, 2011). Our primary goal was to determine if there exists a pattern of strengths in deaf students’ creativity in the figural and verbal domains relative to hearing students. We assessed the quality of students’ creativity by administering measures of divergent thinking that have previously been used with hearing students. These tests ask participants to think...
of as many unusual ways to complete drawings or to use objects. A secondary goal was to examine the effect of translating tests’ written instructions into sign language to determine if this accommodation would improve deaf students’ performance.

**Divergent Thinking and Creativity**

Creativity is difficult to define and even more difficult to measure (Bately & Furnham, 2006). The most commonly applied definition of creativity is the ability to think divergently, that is, the ability to produce novel and original responses to existing conditions (Burgett, 1983; Sternberg & Lubart, 1999). Guilford, who is considered the father of creativity research (Guilford, 1957, 1962), includes the following facets as part of the Guilford Battery of Creativity: fluency, originality, elaboration, and flexibility. Part of this battery includes measures of divergent thinking. Briefly, fluency is the number of ideas expressed by the learner; originality is the number of infrequent ideas; elaboration is the number of ideas added to a provided question or picture; and lastly flexibility is the number different categories a response may be included (Guilford, 1962). Expanding Guilford’s work, Torrance (1962, 1968) created the Torrance Tests of Creative Thinking (TTCT), which incorporated part of Guilford’s Battery of Creativity. Thus, creativity may be best measured through divergent thinking, which is typically measured in verbal (e.g., written responses) and figural (e.g., drawing/picture responses) domains. The TTCT is one of the most commonly used research tools for measuring creativity in both verbal and figural domains (Zeng, Proctor, & Salvendy, 2011). The TTCT is a simple test of divergent thinking and other problem-solving skills.

Silvia et al. (2008) posited self-awareness of divergent thinking as an important component of creativity. Expanding on the works of Guilford and Torrance, Silvia et al. (2008) developed the Top 2 scoring method for assessing divergent thinking. This method requires participants to judge their own creative performance. In this assessment, participants complete a verbal measure of divergent thinking and then circle two responses they think are most creative. This allows the participant to be the judge of his or her own creative thinking.

The present study incorporates two different measures of divergent thinking: the classic TTCT assessment and the more recent Top 2 method. The TTCT figural assessment is used because of its history in creativity research, especially with deaf children, and the Top 2 verbal method was chosen because of its importance of judging one’s creativity, something the TTCT does not require.

**Verbal and Nonverbal Creativity in Deaf Students**

Verbal creativity may be of interest to educators because deaf students struggle to master communication, whether spoken or signed. In a review of creativity and deaf children, Marschark and Clark (1987) concluded that there were surprisingly few studies that assessed creativity of any kind, and the results of those studies were inconsistent. One way we assess creativity, verbal or otherwise, is to look at how one applies divergent thinking to a task. Only two studies on verbal divergent thinking appear in the literature. Kaltsounis (1970) found that deaf children in fourth and fifth grades performed better than hearing children on the facets of fluency and originality on the verbal TTCT; unfortunately, they did not report a comparison of the overall performance of deaf and hearing children. In contrast, Johnson and Khatena (1975) found that deaf children performed worse than hearing children on a verbal TTCT assessment but did not include sufficient methodological details to elucidate reasons for these conflicting findings. Because little research on verbal creativity in deaf students has been conducted since these two studies, conflicting results remain unexplained.

Nonverbal creativity may be of interest to educators of the deaf as well because deaf students rely heavily on visual imagery (Marschark & Wauters, 2011). Research findings based on the TTCT figural assessment are also conflicting. The majority of studies suggest that deaf children may be more nonverbally creative than hearing children (Ebrahim, 2006; Johnson, 1977; Kaltsounis, 1971; Laughton, 1988; Pang & Horrocks, 1968; Silver, 1977). For example, Silver (1977) administered the figural TTCT to a group of 54 deaf, hard-of-hearing, and hearing children and adults. The deaf participants’
average scores (when compared to the hearing norms) were in the 88–99th percentile (i.e., originality, 99%; fluency, 97%; flexibility, 88%; and elaboration, 99%). Additionally, university professors of art evaluated 44 of the participants’ pictures for high levels of creative performance. Deaf participants’ pictures were judged to be more creative than those of hearing participants. It should be noted that scoring norms have changed over time; thus, these results may not reflect the current generation of deaf students.

Several studies found deaf children scoring better than hearing children on the figural TTCT, although they varied on the nature of these differences. Pang and Horrocks (1968) found average performance in the facets of originality and fluency, and stronger performance in elaboration and flexibility. Kaltsounis (1971) found that deaf school-age children performed better than hearing children in the facets of fluency, flexibility, elaboration, and originality. Laughton (1988) also found deaf 8–to-10-year-olds scoring higher on flexibility and originality than hearing children. However, in a more current study, Ebrahim (2006) found 8–to-11-year-old deaf children scoring lower than hearing children in the facets of fluency, originality, and abstractness of titles, with no differences in elaboration and resistance to premature closure.

Some of the different results across studies may be due to the children having different experiences fostering their creativity. Laughton (1988) conducted a study where she engaged 8–to-10-year-old deaf children in either a creative thinking or standard curriculum. The creative thinking curriculum, which was a 12-week curriculum taught twice a week for 45 min, was based off previous work and focused on teaching children the facets of the TTCT. Activities varied from brainstorming about different uses for items to drawing pictures. All activities within the curriculum focused on at least one facet of the TTCT. Laughton (1988) found that deaf children increased their creativity, particularly along the facets of flexibility and originality, after being immersed in the creativity curriculum compared to a standard curriculum. The two studies above focused on younger, school-age children, and only one study (Johnson, 1977) investigated adolescents’ performance on the TTCT figural assessment in both deaf and hearing groups. His results indicated that deaf adolescents performed better in the facets of fluency and flexibility, and worse in originality and elaboration, than hearing adolescents. Although there have been no longitudinal or cross-sectional studies examining creativity development across age, research with hearing children suggests that creativity increases between elementary school and adolescence (Charles & Runco, 2000; Claxton, Pannells, & Rhoads, 2005). Thus, for the current study, we focused on adolescence because developmentally it may represent the time period that students may be especially creative.

Taken together, these studies suggest that deaf children are better divergent thinkers in the figural than verbal domain. Deaf students may be more creative in the figural domain because of strengths in their visual-spatial skills (Blatto-Vallee, Kelly, Gaustad, Porter, & Fonzi, 2007; Marschark & Wauters, 2011). In contrast, poor literacy skills may interfere with deaf students’ development of divergent thinking in the verbal domain, especially when assessed through written means (Marschark, 2007). However, previous studies do not directly test this hypothesis, and the results are conflicting. The primary purpose of the present study was to examine creativity outcomes between hearing and deaf adolescents in the figural and verbal domains on measures of divergent thinking. This direct comparison has not been investigated in the past several decades and especially not in the current generation of deaf students. We hypothesized that deaf students would perform better on the figural than on the verbal divergent thinking assessment. In addition, we hypothesized that deaf students would perform similarly to, or better than, hearing participants when assessed on a figural measure of divergent thinking, but worse on a verbal measure. Lastly, we did assess whether hearing students would perform better than deaf students on the verbal divergent thinking measure but did not hypothesize differences because previous research in the area did not present contradictory results.

Our second goal was to determine whether students’ results on both divergent thinking assessments differ under two specific conditions for test instructions: a standard written condition or a sign language translation condition. That is, we looked at the effect of translating tests’ written instructions into sign to determine if this accommodation would improve deaf students’ performance. Median reading scores for deaf adolescents tend to hover around fourth grade (Traxler, 2000). Therefore, poor understanding of written
instructions may be a barrier to optimal performance. We manipulated the delivery of the instructions for both verbal and figural divergent thinking measures. Specifically, half of the students received the standard written instructions, and half received instructions in a face-to-face format (oral for the hearing students; signed for the deaf students). We hypothesized that, if reading is a barrier to deaf students, they should perform better when instructions are signed than when they are written.

In sum, this study contributes to the literature in three central ways. First, it focuses on adolescence, which may be a better time in development to examine creativity than school-age children as suggested by Claxton et al. (2005). Additionally, the little information we have about creativity pertains to children; so the present study would update this body of literature. Second, we assessed deaf and hearing students in both verbal and figural domains of divergent thinking in one study. Third, this is the first study to examine these issues in the current generation of deaf students, whose background experiences are most likely different from the experiences of students in the 1970s and 1980s. Additionally, the instructional method differed in that some students were given instructions for the assessments in a face-to-face condition (i.e., spoken English or sign language) versus a standard condition (i.e., written only). Our research questions were: (1) Does the performance of deaf students differ from that of hearing students on verbal and figural measures of divergent thinking? (2) Do deaf students receiving standard instructions translated into sign language perform differently than those receiving nontranslated instructions on measures of divergent thinking?

Method

Participants

Students (N = 52; 35 hearing and 17 deaf) ranging from 14 to 18 years old with a median age of 15 years participated in the study. Deaf students were recruited from a state school for the deaf in the southeastern United States where sign language was the primary mode of communication. Consent forms were sent home to the parents of 150 children who were enrolled in the general-track, 4-year high school curriculum program. Twenty parents returned consent forms; of these, three did not give assent, resulting in a total of 17 participants. Three deaf students had a cochlear implant, and 14 used only hearing aids.

We recruited hearing students in the same geographic area as the deaf students. In response to a recruitment letter, a high school sign language instructor agreed to have her hearing students participate. Hearing participants were enrolled in one of two introductory sign language elective courses. School officials reported that students who chose American Sign Language (ASL) as an elective were randomly placed into two separate classes. Each class had students who ranged in grade level. All 35 students in these classes returned consent forms and gave assent to participate. It should be noted that recruitment letters were sent to multiple schools across the area, and it was unexpected that students enrolled in an ASL course were the participants for this study.

Measures

Verbal divergent thinking. Silvia et al.’s (2008) measure examines divergent thinking and one’s ability to provide creative ideas in written word form. The test was developed and used with undergraduate students who had no hearing difficulties and showed strong reliability and validity (see Silvia et al., 2008, for a detailed review).

Students were asked to respond to three tasks that required the generation of word responses. This measure was administered based on the procedures published by the authors. Because the test was developed for undergraduate students, and deaf students are known to have reading delays, instructions were rewritten at the third grade level using a Lexile analyzer. Below are the directions given to the students for the three tasks:

Unusual uses task—. “For this task, you should write down all of the original and creative uses for a brick that you can think of. Of course, there are common, unoriginal ways to use a brick; but I want you to write down all of the unusual, creative, and uncommon uses you can think of. You’ll have three minutes. Any questions?”
Instances task—. “For this task, you should write down all of the original and creative instances of things that are round that you can think of. Of course there are some very clear things that are round; but I want you to write down all of the unusual, creative, and uncommon examples of things that are round. You’ll have three minutes. Any questions?”

Consequences task—. “For this task, imagine that people no longer needed sleep. What would happen as a result? Write down all of the original, creative outcomes of people no longer needing to sleep. You’ll have three minutes. Any questions?”

After three minutes per task, the researcher asked everyone to stop writing and instructed students to “pick which two are your most creative ideas. Just circle the two that you think are your best.” Students circled their two most creative responses for each of the three tasks, for a total of six self-reported responses, which were then used for scoring.

Scoring verbal divergent thinking. Using Silvia et al.’s (2008) scoring guide and Likert-type scale, we assessed the following three facets for judging responses as creative: uncommon, remote, and clever. This scale used the following descriptors: 1 point (not at all creative) to 5 points (highly creative). A total of six responses were scored (two from each task) for a maximum overall score of 90 points.

Uncommon—. Uncommon responses were defined as those that were infrequently given by study students. Creative responses should be unique and, therefore, uncommon. High scores were assigned to responses that were infrequently given by study students. Low scores were assigned to responses given by many of the study students (Silvia et al., 2008). An example of an uncommon response that would score high (e.g., a 5) would be using a brick as a gym weight or a bookend.

Clever—. A clever response was defined as “insightful, ironic, humorous, fitting, or smart” (Silvia et al., 2008, p. 85). An example of a clever response that would score high (e.g., a 5) would be using a brick as a fly swatter.

Figural divergent thinking. The TTCT Figural Form A is a standardized test of nonverbal creativity. The researcher administered the TTCT following the published standardized procedures; no adjustment of the instructions was necessary. The following overview of administration, scoring, and examples of the TTCT is adapted by the standardized scoring manual. This assessment booklet included three tasks. For the first task, students saw a black oval shape on the first test page and were told to create a picture and story using the black oval and to give the drawing a written title. This written title introduces a minimal verbal component, which is accounted for by the facet abstractness of titles. For the second task, the researcher told the students to add to and title 10 incomplete figures or designs. The third and last task was the arrangement of 30 sets of parallel lines, with which the researcher asked the students to make a drawing with each pair. The time limit to complete each task was 10 min.

Fluency—. The score for fluency reflects whether the given stimulus is used in an appropriate manner. Ratings were based on whether the stimulus was used and the drawing was clearly identifiable. Each item is scored as 0 (stimulus is not used or identifiable) or 1 (stimulus is used and identifiable). Fluency is scored for tasks two and three (for a total maximum score of 40).

Originality—. The score for originality is based on the uniqueness and unusualness of the response. In the streamlined scoring guide for the TTCT, lists of
responses are shown for each task that should receive a score of 0 if used. If the response is not listed in the scoring guide, it receives a score of 1. Originality is scored for tasks one, two, and three (for a total maximum score of 41).

**Elaboration**—. The score for elaboration is based on two assumptions: (1) the response to the stimulus is a unique response (i.e., cannot be replicated in any other response throughout the assessment), and (2) exhibition of extreme detail. Points are given for each major feature in the design (e.g., shading, decoration). For example, a response may include a flower garden with different kinds of flowers (daisies, roses, sunflowers); a point would be awarded for each kind of flower. However, if the response were strictly a rose garden (one type of flower), 1 point would be awarded. If each flower had a shadow, 1 point would be awarded for shading because this is one major change in design. If each shadow were made to be intentionally different, the number of shadows drawn would each receive 1 point. The elaboration criteria allow the award of 1 point for each major change in design including decoration, color, or deliberate shading. Elaboration is scored for tasks one, two, and three. Raw scores were then converted to standard scores based on the scoring manual instructions for a total maximum score of 18.

**Abstractness of titles**—. The score for abstractness of titles ranges on a scale from 0 to 3, with the highest number being the most creative. Along with providing drawings as creative responses, the TTCT includes adding titles to label a creative drawing. For example, if a student drew a picture of a dog, a score of 0 is an obvious, generic title (e.g., Dog). A score of 1 involves a simple, short description (e.g., A Dangerous Dog). A score of 2 is deemed imaginative and goes beyond the response given (e.g., A Dog Named King), and a score of 3 is abstract but appropriate to the response (e.g., Time of Your Life: The Puppy Years). Abstractness of titles is scored for tasks one and two (for a total maximum score of 33).

**Resistance to premature closure**—. The score for resistance to premature closure involves the participant keeping the stimulus open. Many of the provided drawings in the test booklet present “easy” ways to create a picture. For example, part two includes 10 incomplete stimuli/pictures. It would be very easy to make box-like pictures. This facet, resistance to premature closure, welcomes unconventional responses to what may seem common. A score of 0 is given when the stimulus is closed off with direct routes, a score of 1 if there is closure, but it goes beyond what the picture is displaying, and 2 if the closure is never completed, or when the image is left open to the imagination. For example, if a student closed one side of the picture but left the other side open, even as incorporating this method appropriately in a response, this would score high on this facet. Resistance to premature closure is scored for task two only (for a total maximum score of 20). Scores for each of the three tasks were summed. The maximum grand total score for the five facets of the TTCT for this study is 152.

**Conditions**

The first author, a native hearing signer and child of a deaf adult (CODA), delivered the instructions. He administered two tests of divergent thinking sequentially to each group of students. The groups ranged from 8 to 16 students, with a total of four groups (two groups of deaf students and two groups of hearing students). All students received the verbal divergent thinking assessment first, which took approximately 9 min, and the figural divergent thinking assessment second, which took approximately 30 minutes. He told students to be as creative as possible and supplied students with a pencil that had an eraser.

**Standard condition.** The researcher told students in the standard condition to read the instructions quietly and then begin, being as creative as possible. At the end of the respective timed task, he told the students to stop and turn to the next task.

**Face-to-face condition.** The researcher signed or read aloud the instructions to the students in the face-to-face condition. All testing materials were closed as the verbal instructions were being given. Once the instructions were complete, he told the students to open their
booklets and begin the test. At the end of the respective timed task, he told the students to stop and close their booklets. The researcher read the instructions out loud for the hearing students, but delivered the instructions using a standard translation into signed English voice off to the deaf students. Students were encouraged to ask questions and the researcher responded.

To ensure that the meaning of the signed translation was clear, the first author conducted a back translation of the instructions with three native deaf signers. Deaf signers were shown a video of the first author signing the standard directions and were asked to transcribe the directions into written English. All three produced written directions that were similar to the test written directions.

**Procedure**

Deaf students were randomly assigned to one of the two conditions. For both conditions, deaf students were called into a small classroom for testing. Testing occurred over 2 days; day 1 involved the students who participated in the face-to-face condition and day 2 involved those assigned to the standard condition.

Because school officials randomly assigned the hearing students to the elective classes, the two participating classrooms were randomly assigned to conditions. The first class participated in the face-to-face condition and the second class participated in the standard condition. Testing took place in one day. Table 1 displays the demographic characteristics of the deaf and hearing students by condition.

Chi-square analyses revealed that the deaf and hearing students did not differ significantly by year in school, $X^2(4) = 3.009, p = .390$. Although this analysis was not significant, Table 1 reveals that there was variation across groups and conditions in year in school. Year in school did not correlate with any of the outcome measures. However, to be conservative, year in school was used as a covariate in all analyses.

**Reliability**

A clinical psychologist familiar with standardized testing trained the first author and three undergraduate research assistants on the scoring procedures. All protocols were scored twice independently. At intervals, the protocols were divided at random among the three research assistants and the first author. They discussed any discrepancies until reaching a consensus on the final score. To reduce bias in scoring, all raters were blind to the hearing status and condition of each student’s protocol. Pearson correlations between the initial independent scores were .84 for the figural divergent thinking measure and .98 for the verbal divergent thinking measure, suggesting excellent reliability.

### Table 1  Demographic characteristics of deaf and hearing students by condition

<table>
<thead>
<tr>
<th>Grade</th>
<th>Deaf</th>
<th>Hearing</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Face-to-face</td>
<td>Standard</td>
<td># (%)</td>
</tr>
<tr>
<td></td>
<td># (%)</td>
<td># (%)</td>
<td># (%)</td>
</tr>
<tr>
<td>Freshman</td>
<td>4 (44%)</td>
<td>1 (13%)</td>
<td>5 (30%)</td>
</tr>
<tr>
<td>Sophomore</td>
<td>4 (44%)</td>
<td>1 (13%)</td>
<td>5 (30%)</td>
</tr>
<tr>
<td>Junior</td>
<td>1 (12%)</td>
<td>4 (50%)</td>
<td>5 (30%)</td>
</tr>
<tr>
<td>Senior</td>
<td>0</td>
<td>2 (24%)</td>
<td>2 (10%)</td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>Female</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 (56%)</td>
<td>5 (63%)</td>
<td>10 (59%)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>Caucasian</td>
<td>African American</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 (33%)</td>
<td>2 (25%)</td>
<td>5 (29%)</td>
</tr>
<tr>
<td>Latino</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Native American</td>
<td>1 (12%)</td>
<td>1 (12%)</td>
<td>2 (12%)</td>
</tr>
<tr>
<td>Pacific Islander</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>2 (22%)</td>
<td>0</td>
<td>2 (12%)</td>
</tr>
<tr>
<td>Total</td>
<td>9 (100%)</td>
<td>8 (100%)</td>
<td>17 (100%)</td>
</tr>
</tbody>
</table>
Results

Overview

The first set of analyses addressed the effect of hearing status and instructional mode on creativity across domains, that is, overall performance. The verbal and figural divergent thinking assessments differed on the total number of points possible. Therefore, to compare the measures, we converted all raw scores into percentages by dividing individual total scores by the maximum total score for each test (see Table 2).

The second set of analyses addressed the facets of figural and verbal divergent thinking. In addition to overall performance in the first set of analyses, these analyses yield a more specific depiction of students’ strengths within each divergent thinking test. Deaf students’ strengths, not weaknesses, are highlighted in this section.

Differences in Total Scores for Figural and Verbal Divergent Thinking

A 2 (hearing status) × 2 (instruction) MANCOVA was conducted to explore the five facets of figural divergent thinking. There was a significant effect for instruction, F(5, 44) = 3.85, p = .006; and the hearing status × instruction interaction approached significance, F(5, 44) = 2.38, p = .054. We noted an instruction × hearing status interaction in two of the five categories; fluency, F(1, 47) = 8.94, p = .004, and originality, F(1, 47) = 5.58, p = .022. Of the five facets included in the TTCT, deaf students were more fluent and original than hearing students in the standard condition (see Table 3).

Table 2  Means, standard deviations, and percent creative of groups by hearing status, instruction, and type of divergent thinking

<table>
<thead>
<tr>
<th></th>
<th>Deaf</th>
<th>Hearing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M (SD)</td>
<td>% creative (SD)</td>
</tr>
<tr>
<td>Verbal divergent thinking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td>12.13 (13.89)</td>
<td>13 (15.43)</td>
</tr>
<tr>
<td>Face-to-face</td>
<td>21.44 (13.83)</td>
<td>24 (15.36)</td>
</tr>
<tr>
<td>Total</td>
<td>17.06 (14.25)</td>
<td>19 (15.83)</td>
</tr>
<tr>
<td>Figural divergent thinking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td>71.00 (12.52)</td>
<td>47 (8.23)</td>
</tr>
<tr>
<td>Face-to-face</td>
<td>47.22 (8.93)</td>
<td>31 (5.87)</td>
</tr>
<tr>
<td>Total</td>
<td>58.41 (16.07)</td>
<td>38 (10.57)</td>
</tr>
</tbody>
</table>

Note: The means and standard deviations are reflective of the raw scores for each divergent thinking test. Percent creative is calculated by taking an individual’s score, dividing it by the number of possible raw points for each divergent thinking test, and multiplying it by 100.

Facets of Creativity

Figural divergent thinking. A 2 (hearing status) × 2 (instruction) MANCOVA was conducted to explore the five facets of figural divergent thinking. There was a significant effect for instruction, F(1, 47) = 12.78, p = .001. Deaf and hearing students were more creative when given the face-to-face instructions than when given written instructions in the verbal domain (see Figure 1). For deaf students, the reverse was true in the figural domain (see Figure 2). Appendices A and B display examples of high and moderately performing hearing and deaf students, respectively, and their responses on a few items on the figural and verbal divergent thinking assessment.

Verbal divergent thinking. The researchers conducted a 2 (hearing status) × 2 (instruction) MANCOVA to explore the three facets of verbal divergent thinking (uncommon, remote, clever). There was a significant multivariate effect for hearing status, F(3, 45) = 16.406,
The univariate effects showed that deaf students exhibited significantly fewer responses that were uncommon, $F(1,47) = 33.885, p = .001$, remote, $F(1,47) = 33.041, p = .001$, and clever, $F(1,47) = 45.822, p = .001$, than hearing students (see Table 3). Although deaf students scored lower on all three facets of verbal divergent thinking, we were interested in whether this was due to deaf students providing fewer number of responses than hearing students. This may be a reason why deaf students performed worse because they had fewer responses to discriminate as their most creative. Indicated by a paired-samples comparison, deaf and hearing students provided a similar quantity of responses for all three questions. That is, deaf and hearing students did not significantly differ on the number of responses for any given question for verbal divergent thinking, $t(50) = −1.423, p = .161$; deaf and hearing students provided an average of 5.28 and 6.86 responses, respectively. Additionally, when responses on verbal divergent thinking were scored, grammar and spelling were ignored.

### Discussion

We asked the question: Does the performance of deaf students differ from that of hearing students on verbal and figural measures of creativity? In answer to that question, our results suggest that students’ creativity varies depending on domain. When given the figural TTCT assessment, a widely studied and standardized measure,
Deaf students were equally or more creative than hearing students, especially in the facets of fluency and originality. Deaf students used more stimuli in the given time allotted and generated more unusual and unique responses than hearing students. This suggests that deaf students are just as creative as hearing students in the figural domain. This study extends previous work with school-age children (Kaltsounis, 1971) to adolescents.

In contrast, deaf students showed limited creativity on the verbal divergent thinking assessment. In fact, deaf students’ average scores were less than half of the average scores of hearing students. Deaf adolescents were able to generate equal numbers of responses as hearing students, but these answers were less creative as measured by each of the three facets of verbal creativity.

These results may reflect the weak literacy skills that have been reported for deaf students (Traxler, 2000). This is consistent with other research that has observed limited vocabulary and ideas in deaf students writing (Singleton, Morgan, DiGello, Wiles, & Rivers, 2004). It is suggested that deaf students’ verbal creativity is underestimated when assessed through written English, in contrast to research that shows deaf students are verbally creative in their first language (sign). The most common approach by which verbal creativity has been studied with deaf students is the examination of metaphors, similes, and proverbs (Marschark et al., 1987). Although earlier research posited deaf children lacking linguistic creativity when assessed through writing, Marschark et al. (1987) concluded that deaf children were comparable to their hearing peers in the production of novel figurative signed language and sometimes surpassed their hearing counterparts. Future research should explore whether deaf students also are creative divergent thinkers when asked to express their verbal creativity face-to-face, rather than through the written form. Additionally, researchers should examine the educational experiences and the cognitive abilities of students. This variation may contribute to the expression of creativity.

Additionally, we asked the question: Do deaf students receiving standard instructions translated into sign language perform differently than those receiving nontranslated instructions on measures of creativity? Mode of test instruction did not have a straightforward impact on students’ creativity. The face-to-face condition appeared to help both deaf and hearing students when verbal divergent thinking was assessed. However, the face-to-face condition did not provide an advantage to deaf or hearing students when figural divergent thinking was assessed. The lack of a clear benefit of face-to-face presentation of test instructions either in sign language or spoken English is consistent with past research on these accommodations for those with disabilities. For example, some studies found a benefit for students with disabilities (McKevitt & Elliott, 2003) and others found students with disabilities doing worse (Koretz & Hamilton, 1999) across different subject areas and test questions. Similar results have been found for deaf students (Cawthon, 2006; Cawthon et al., 2010).

### Table 3

<table>
<thead>
<tr>
<th></th>
<th>Deaf Standard</th>
<th>Deaf Face-to-face</th>
<th>Hearing Standard</th>
<th>Hearing Face-to-face</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Figural divergent thinking</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluency</td>
<td>31.76*</td>
<td>7.53</td>
<td>18.33</td>
<td>6.30</td>
</tr>
<tr>
<td>Originality</td>
<td>20.76*</td>
<td>5.23</td>
<td>13.33</td>
<td>4.36</td>
</tr>
<tr>
<td>Elaboration</td>
<td>5.50</td>
<td>2.87</td>
<td>6.22</td>
<td>2.04</td>
</tr>
<tr>
<td>Abstractness of titles</td>
<td>5.37</td>
<td>4.80</td>
<td>3.11</td>
<td>2.66</td>
</tr>
<tr>
<td>Resistance to premature closure</td>
<td>7.62</td>
<td>3.96</td>
<td>6.22</td>
<td>3.49</td>
</tr>
<tr>
<td><strong>Verbal divergent thinking</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uncommon</td>
<td>3.89</td>
<td>4.52</td>
<td>7.05</td>
<td>4.96</td>
</tr>
<tr>
<td>Remote</td>
<td>3.35</td>
<td>3.95</td>
<td>5.81</td>
<td>3.65</td>
</tr>
<tr>
<td>Clever</td>
<td>3.31</td>
<td>3.64</td>
<td>5.61</td>
<td>3.63</td>
</tr>
</tbody>
</table>

* denotes deaf students performing better than hearing students.
The clearest result we found is the within-subject effects; that is, deaf students did better on figural divergent thinking than verbal divergent thinking. As Marschark and Wauters (2011) suggested, the visual modality is important for deaf students. This does not mean having poor hearing ability automatically increases one’s visual skills. However, when it comes to attention and perception, deaf students must rely on their vision more than hearing students do: “acquiring the ability to rapidly shift visual attention or scan visual stimuli” (Marschark & Wauters, 2011, p. 488). Although verbal divergent thinking relies solely on literacy skills, figural divergent thinking uses visual-spatial skills. This may be one reason why deaf students performed better in their figural expression. These results suggest that weak verbal divergent thinking skills do not hamper figural divergent thinking. Thus, artistic expression appears to be an area of strength for deaf students. Of course, given the small sample sizes, these results should be treated with caution.

Deaf students also performed better than hearing participants in the facets of fluency and originality. This finding supports previous research with younger children (Laughton, 1988). Fluency is scored as to whether the given stimulus is used and interpretable, which suggests deaf participants are using more stimuli in the given time allotted than hearing participants do. Originality is scored as unique and unusual responses, which suggests that deaf students provided more responses that are not common to a particular stimulus than hearing students do. What this supports is that expressing ideas in the forms of pictures may be easier for a deaf student than a hearing student in terms of using given stimuli and unique responses. These results differ from Johnson (1977) where deaf adolescents were performing better in the facets of fluency and flexibility and worse in originality and elaboration.

The present study is limited in terms of the generalizability of the sample included. The deaf sample consisted of 17 students ranging in grade level with varying levels of academic performance. The hearing sample consisted of 35 students ranging in grade level with an interest in learning sign language (as they were enrolled in a high school ASL course). Although the results are consistent with past research, more research with larger sample sizes is needed to confirm our conclusions.

Notwithstanding sample limitations, this study is the first in 20 years to examine creativity in deaf adolescents. The results clearly indicate that figural divergent thinking is a strength for deaf students and should be supported in the school environment. The teaching of creativity is not always salient, conceptualized, or even appreciated by teachers and administrators due to state standards and accountability that do not assess creativity (VanTassel-Baska, 2006). This may mean that teachers and parents may overlook students’ strengths. In Starko’s (2010) book, Creativity in the Classroom, she discusses what it means to teach creativity effectively. One of the key ideas in making a classroom problem-friendly is allowing students to seek and solve problems by encouraging self-assessment and feedback (Starko, 2010).

As mentioned earlier, Laughton (1988) is the only creativity intervention study that focused on teaching parts of the TTCT. The results of this study may influence future research when deciding how to create rigorous academic standards for deaf students and how to incorporate creative thinking into new curriculum. Unfortunately, we only have one intervention study that has looked into this area. Clearly we need additional research in the area of creativity intervention.

Conflicts of Interest
No conflicts of interest were reported.

Acknowledgments
Christopher Stanzione conducted this research at Department of Psychology, The University of North Florida. This research was the basis of a master’s thesis by the first author. Appreciation is expressed to the schools, teachers, parents, and students for supporting this research. We gratefully thank Susan Easterbrooks for comments on an earlier draft of this paper.

References
Creativity in Deaf and Hearing Students


Appendix A

High performing hearing students

High performing deaf students

1. Petals on the wind
2. Winding road
3. The Moustache
4. The Lemonade Pitcher
Appendix B

Question 1: “For this task, you should write down all of the original and creative uses for a brick that you can think of. Of course, there are common, unoriginal ways to use a brick; but I want you to write down all of the unusual, creative, and uncommon uses you can think of. You’ll have three minutes. Any questions?”

<table>
<thead>
<tr>
<th>Score</th>
<th>High performer</th>
<th>Score</th>
<th>Moderate performer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hearing students</td>
<td>5 Gym weights</td>
<td>3 Paper weight</td>
<td></td>
</tr>
<tr>
<td>4 Make a toy doll</td>
<td>3 To carve names into</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deaf students</td>
<td>1 Sidewalk</td>
<td>1 Wall</td>
<td></td>
</tr>
<tr>
<td>1 House</td>
<td>1 Floor</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. The score was based on a Likert-type scale (1 = not creative, 5 = most creative). Because there were three facets of verbal creativity, the score above reflects an average of the three facets.