

Post Hoc Analysis of TTCT Results for Creative Ability

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Abstract

Creativity is often thought of as only belonging to the most privileged. This study is an examination of creative capability of students of different income levels. Eighth grade students from six middle schools in a Minnesota school district were tested using the *Visual Format* of the Torrance Test of Creative Thinking (TTCT). Data was also gathered regarding individual participation in the Federal Free or Reduced Price meals program (FRP) as an indicator of family income. Significant differences in performance were found between students classified as FRP eligible and non-eligible in four of six test areas. This observation will allow schools to better address the need for opportunities to assist low income students in becoming more creative.

Introduction

Creativity is often thought of as only belonging to those with schooling, opportunity, or with the availability of the arts. 995 8th grade students 13 to 14 years old from six middle schools were tested using the *Visual Format* of the Torrance Tests of Creative Thinking. Data was collected and anonymized by the district research department, and additional demographic and academic information was included in materials provided to researchers. This study involved dividing the data by participation or non-participation in the Free and Reduced Price meal program, an indicator of low family income.

Why does creativity matter? “Creativity is a fundamental component of the human experience and is generally regarded in many societies and cultures as being among the highest qualities of human performance and character, as expressed through art and science” (Collard and Looney, 2014). Plucker (2010) has found creativity to three times stronger and indicator of lifetime success as is intelligence. Unfortunately, not everyone has the opportunity to become a creative person. People who are born into situations that undermine their way of life affecting their creativity are in danger of not developing creative skills.

The study of creative development seeks insight into ways for individuals to become better problem-solvers and promote their ingenuity. “Creative thinkers tend to be innovative, explorative, can educate others, and are generally highly targeted by businesses. Highly creative people are good at problem solving, and problem-solving capability has been used to measure creativity of individuals in the past” (Hirschman, 1980). Creativity does not only benefit the individual in the long run, in adult life, but creative development on a higher scale will promote the wellbeing of our population.

The purpose of this study is to investigate how the effects of socioeconomic status are evident in measured creativity. The Torrance Test of Creativity (TTCT) was the instrument used to measure the creativity of students. The Free or Reduced Price program (FRP) represents students who are from low income households. The tested participants were divided into two groups, consisting of students who were eligible and those who were not eligible for the FRP program. A mean score from each of the six components between our two variable groups was determined and a T-Test was conducted to determine the P-value of each. The difference in means indicates the

relationship of performance in terms of creativity between groups. T-tests were used at .05 to look for significant differences between groups on each component.

Although research has examined the effects of ethnicity, gender, and intelligence on creativity, little published research has examined the relationship between socioeconomic status and creativity. In this study, the goal was to find out if creativity scores are affected by socioeconomic status. This is a question of people's lives, beyond the value of their homes: The results of creativity enrich the culture and so they indirectly improve the quality of all our lives" (Csikszentmihalyi, 1997).

Literature Review

Research into creative development began with J.P. Guilford's charge to the American Psychological Association in 1950, which was significantly advanced by Paul Torrance. "Ellis Paul Torrance, the creator of the Torrance Test of Creative Thinking, has stressed the importance of developing children's creative abilities since society advances most effectively through the contributions of its creative individuals" (Kim, 2006). The development of creative skills remain an important element of education. "Testing for creativity is considered a vital part of the educational assessment, mainly because it is valued in modern technological society and should be developed in as many individuals as possible" (Bart & Hokanson, 2014).

The Torrance Test (TTCT) is a widely used tool to determine an individual's creativity and is considered the best form of measurement for creativity to date. "The TTCT is the dominant measure of divergent thinking as it captures the major components of divergent thinking and creativity" (Sternberg, 2000). There are two major test forms, Verbal and Figural, and the Figural form was used in this instance. It has a number of elements that are scored. "The test consists of six sections (Fluency, Flexibility, Elaboration, Originality, Abstractness of Titles, and Resistance to Closure) that ask for multiple written responses to illustrations and verbal prompts. Each section is timed, with responses measured within 5 to 10 minutes each" (Im, Hokanson, & Johnson, 2015).

Effects of Lifestyle/Income on Creativity

Torrance, in his research, found the TTCT was not-biased against or in favor of "disadvantaged" groups. "... some of our most outstanding performers from the very beginning were children from definitely disadvantaged backgrounds" (Torrance, 1971). This will allow an accurate correlation between income level and creativity among school children.

There are many factors that inhibit creative development that deal directly with being socioeconomically disadvantaged. "There are seven main reasons why students from low income households are more likely to struggle with classroom engagement" (Jensen, 2017). Low income families may lack the same opportunities that high income families are able to offer their children. There are numerous small elements that are also missing in children's lives in poor families. "Low income students may also lack the resources that are essential to creative development. For example, pretend play and outdoor play in an individual's childhood years is a critical component in developing higher levels of creativity" (W. Russ, 2012). "Creativity appears early in a life and it shows in the child's play. Gradually it spreads to other areas of life." (Mankar, Ugale, Rothe, 2011). Childhood play offers cognitive and affective attributes that aid in child creative development, but may not be as effective for children in low income families if they do not have access to toys, books, kid-friendly educational technology, outdoor equipment, or other such resources.

There are other pragmatic reasons that disadvantage poor children. Children from socioeconomically disadvantaged households often have to start working earlier in life, compared with those with higher household incomes. They may lack the means of transportation to get to school, or they might be required to take care of siblings while parents are at work. Impacts from a more stressful life can include a lack of motivation, negative or disobedient behavior, or being distraction from academic and creative performance. Results could also include: health, vocabulary, effort, hope and the growth mindset, cognition, relationships, distress. These can all influence the deterioration of creativity (Votruba-Drzal, Miller, Coley, 2016).

An additional developmental impact of poverty is the inability to participate in formal school-based activities such as a sports team or club which encourage a range of skills. Members learn how to be part of a cohesive unit and work together. They build relationships and learn about different personalities, different cultures, and social skills. When low income families can't afford the time or money to include their children into these clubs or sports it slows down their creative development.

A study by Mitchell (1975) revealed a number of insights that affect creative development and pertain to children from low income families. "One of them is that children frequently come from a home environment with

such a paucity of objects that the child's conceptual information formation development is adversely affected" (p.46). He found having a concrete object in front of a child helps build identity similarities, differences and develop curiosity in order to gain an understanding for new situations and experiences.

A child develops curiosity by having things to be curious about. A lack of curiosity affects both motivational patterns and the development of creative behavior. Generally, low income families may be unable to provide their children with a wide variety of experiences, the ability to provide a range of toys or travel, a moderate stress environment, or time for personal development.

It is easy to see there are many elements that students in low income families may lack which detract from having the opportunity to build creativity or be creative. Experiences with objects and experiences from visiting new places can aid in a child's ability to create new and original ideas; these are all economic opportunities, both immediately and developmentally.

FRP as an Indicator for Socioeconomic Status

"The Free or Reduced Price meals program (FRP) is a federally-assisted meal program that operates within public and nonprofit private schools to provide low-cost or free lunches to students on a daily basis" (Hinrichs, 2010). In the United States, qualification for the FRP program is generally accepted as an indicator of limited family income. Identification of students participating in the FRP was included in the demographic data received from the district research department.

Qualification in the RFP program varies by state: "To qualify for the FRP in Minnesota, annual family income for a four person family must fall under \$44,955" (welfareinfo.org, 2017). This income level is about 190% of the state poverty level: "In 2013, the poverty level was \$23,500" (welfareinfo.org, 2017). This threshold remains significantly below the median statewide household income of \$71,000 which would represent the lower end of income ranges in Minnesota. Therefore, the FRP income threshold correlates with the "low income" level of households in Minnesota and can reasonably be used as a surrogate parameter to identify students living in low income households that in turn may hinder the development of creativity. By using the FRP as our surrogate for measuring low income, we can separate students into a group that includes low income students (FRP group), and a group to represent a standard population (Non-FRP group).

Motivation and Significance

Research is continuously searching for positive and innovative ways to help individuals reach their highest potential. This study is motivated by the need to improve programs to help students who come from socioeconomically disadvantaged backgrounds in order to give them the same opportunities in creative development as have their better-off counterparts. By finding a link between socioeconomic status and creativity, we will have a better understanding how to assist students in reaching their highest potential. Our hypothesis is that students who are enrolled in the FRP will score significantly lower than students who are not enrolled in the program as measured by creativity testing of middle school students ages 13 to 14 in Minnesota.

This research is significant in that an individual at a lower socioeconomic class will have lower skills in creativity, and that creativity is tied to lifetime achievement. "Results suggest that just under half of the variance in adult creative achievement is explained by divergent thinking test scores, with the contribution of divergent thinking being more than 3 times that of intelligence quotients" (Plucker, 1997). If this study can provide a connection between socioeconomic status and creativity then programs can be better justified in efforts to help disadvantaged individuals be access more resources and assistance.

Methods

For this study, data was formally collected in 2013 by the school district research department. 995 8th graders from 6 different middle schools in a Minnesota district were administered the Visual format of the Torrance Test of Creative Thinking (TTCT). The 8th graders' ages ranged from 13 to 14 years old and are a roughly equal mix of male and female students.

Within each school, half of the homerooms were used, and were chosen at random. Tests were administered over three different class meetings by the home-room teachers, with one of the three prompts presented each session. 8th graders as a group were used they were also annually tested using the Minnesota Comprehensive Achievement Test (MCAT) and their academic performance could be compared. While other observations have been made about this population, the focus on this study is on the impact of lower income on creativity.

The students were separated into 2 groups based on their family's income. One group included students enrolled in the Free or Reduced Price meals program (FRP) and the 2nd group is students who were not enrolled in the program (Non-FRP).

Demographic and other academic information was provided by the school district's research department. They provided data including GPA, MCAT scores, discipline problems, and participation in the Free and Reduced Price meals program. They were also responsible to remove individual identification from the data.

The sample set can be considered representational of 8th grade students within the State of Minnesota because the district contains a variety of economic conditions and urban, rural, and suburban lifestyles. All schools in the study were public institutions.

Materials

The Torrance Test of Creative Thinking (TTCT) is the most common and accurate tool used in measuring creativity (Kim, 2006). The TTCT's purpose is to quantitatively assess the creativity of its test subjects. Individuals are asked to complete a variety of visual tasks, such as drawing pictures and adding titles their drawings. Completed tests were collected from all schools and sent to STS Testing, the publisher for scoring. The publisher's scoring interrater reliability is better than .90 (Kim, 2006).

After the test was completed, scores were broken down into six components of creative thinking: Fluency, Flexibility, Resistance to Premature Closure, Originality, Elaboration, and Abstractness of Titles. We then calculated the mean, median, and standard deviation from each group within the 6 components of the TTCT. These calculations indicated an overall difference in performance between the FRP group and the Non-FRP group.

Statistical Analysis

Each of the sub-sections of the Figural Torrance Test were analyzed separately. The means calculated were separated into the two variable groups, FRP and Non-FRP. The Non-FRP group consistently performed better on each metric in terms of a higher mean and median. Simple T-Tests were conducted comparing for each of the six scoring metrics between the FRP group and the Non-FRP group to assess if there was significance (<0.05) for each of the six scoring metrics. Results are presented below in Table 1 as well as through Figures 1-6. This is followed by a brief commentary on the findings.

Results

The study found students who are enrolled in the Free and Reduced Lunch plan score significantly lower on the TTCT than students who are not enrolled in the Free and Reduced Price mean program. The table below shows the mean and standard deviation from the data set for each metric. Table 1 shows the results from students who took that TTCT that are not enrolled in the Free and Reduced Lunch Plan. Table 2 shows results from students who took the TTCT that are enrolled in the Free and Reduced Lunch Program. Table three shows the T-Test Results from comparing students enrolled in the FRP compared to Students not enrolled in the FRP. Graphs 1-6 below show the standard deviation of the results from each of the 6 scoring metrics of the TTCT.

	Fluency	Flexibility	Originality	Elaboration	Titles	Closure
Non - FRP Mean	24.35	10.23	17.07	7.98	6.38	13.55
Non - FRP STDEV	9.22	4.12	7.00	2.73	4.00	3.85
FRP Mean	23.28	9.65	15.75	7.23	5.75	13.10
FRP STDEV	9.81	4.08	7.02	2.63	4.01	4.36
FRP & Non-FRP	0.098	0.041*	0.006*	0.000*	0.022*	0.103

* Significant at $p < .05$

Table 1: Means, Standard deviations, and T-Test comparisons of FRP and Non-FRP groups

Analysis of the TTCT Test results (by t-test) of the two groups for Fluency and the Resistance to Closure metrics found no significant statistical difference. In both instances, the non-FRP scored higher than the FRP group.

On the other hand, there is a significant statistical difference (at 0.05) between the groups on the Flexibility, Elaboration, Originality, and Abstractness of Titles scoring metrics. Figures 3 - 6 illustrating the findings are pictured below. These graphs represent the distribution of test results (horizontal) and test subjects (vertical) for both groups.

Discussion

It should be noted that in all areas, the means of the FRP subgroup are lower than the means of the Non-FRP group. The standard deviation of the FRP group is much higher, indicating a broader range of scores and creativity skill. While not significant, it may indicate a diverse difference in capability between the two groups.

The t-test results for Fluency were $p = 0.098 > 0.05$; for Resistance to Closure, $p = 0.103 > 0.05$. Fluency is the ability to generate a large number of answers to a given prompt. Resistance to Closure is the ability to accept ambiguity and not complete a figure. This could be due to random error within the data set, or an actual closer level of skill between the two groups. While the difference in means is not significant between the two groups, the Non-FRP did perform at a higher level. This result does not indicate any significance in relation to this comparison of socioeconomic status and creativity within our study.

On the other hand, the results of the t-tests for the Flexibility, Originality, Elaboration, and Abstract of Titles were all statistically significant. Flexibility is the ability to generate different types of ideas; it was significant in our study a $p = 0.041 < 0.05$. A graph of distribution is shown in Figure 1.

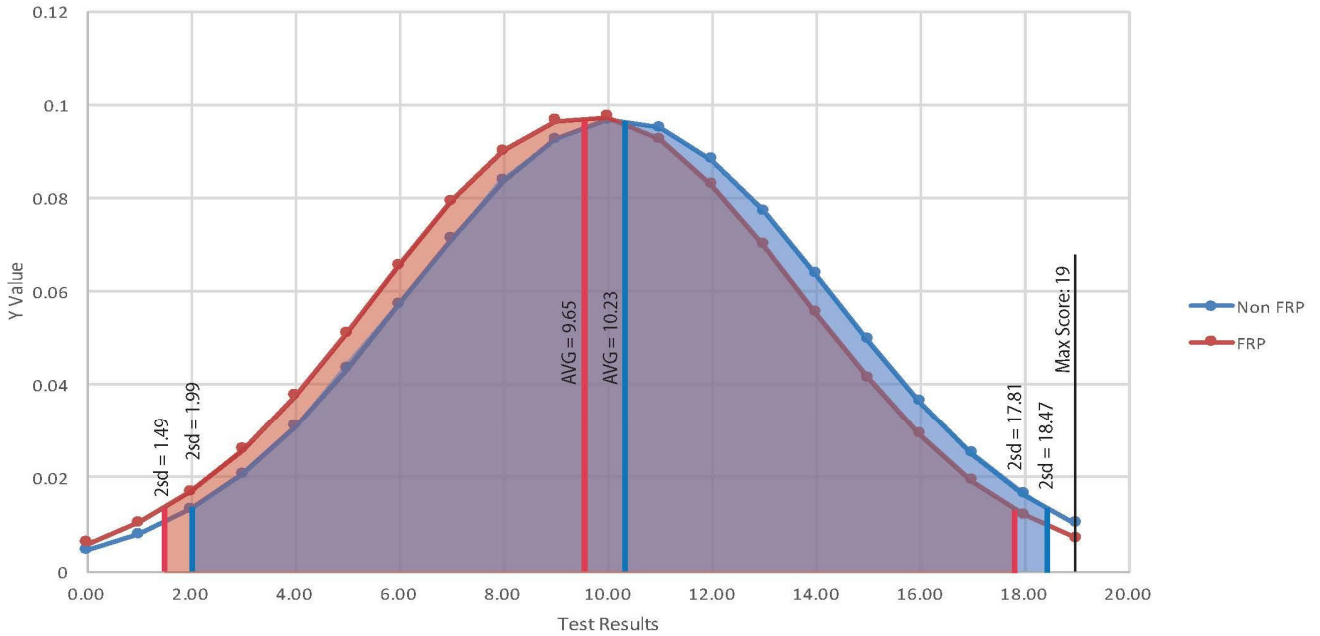


Figure 1: Flexibility Metric Results Distribution

Originality is the capability to create ideas which are unusual or rare, and it generally benefits from exposure to a broad range of experiences, including travel, diverse educational experiences, and involvement in cultural events. It was significant at $p=0.006 < 0.05$. Originality is generally connected to exposure to divergent and different ideas. The distribution of results is shown in Figure 2.

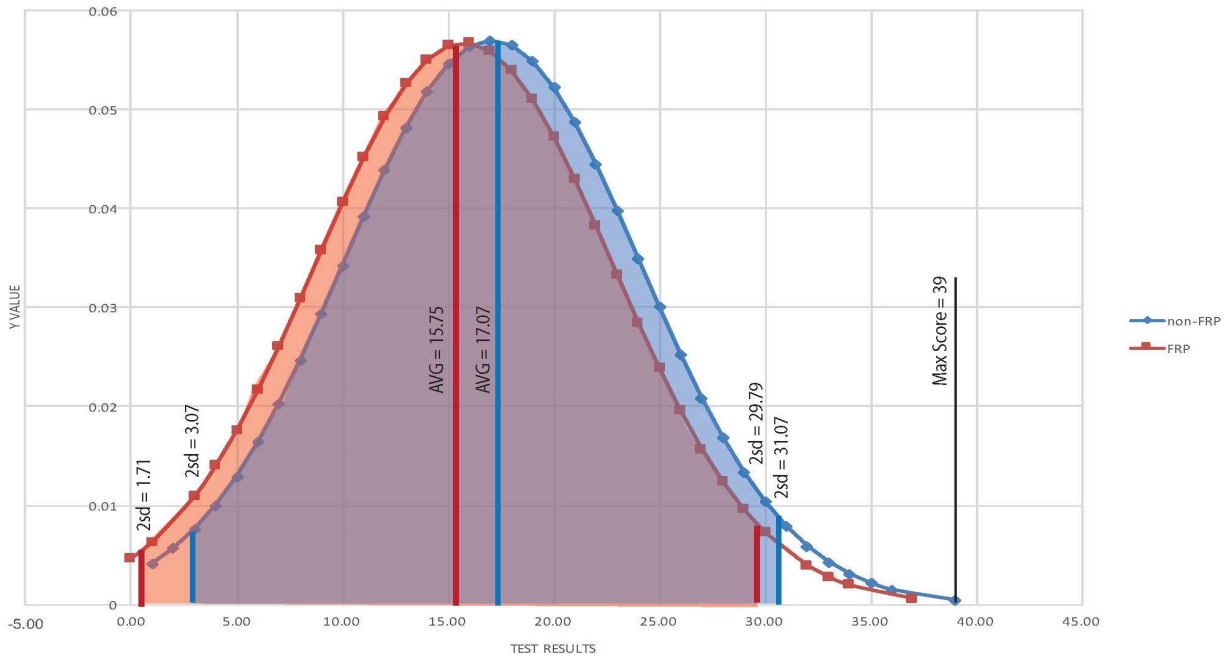


Figure 2: Originality Metric Results Distribution

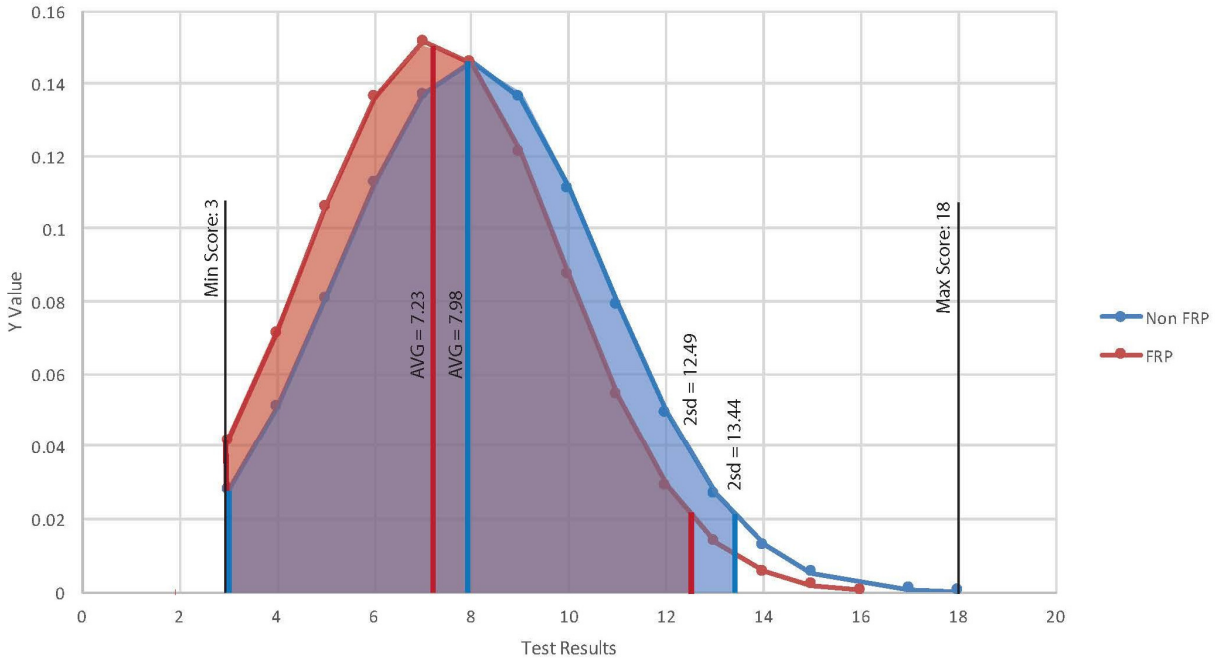


Figure 3: Elaboration Metric Results Distribution

Elaboration is the ability to add details to any single idea. Statistical significance was found with $p=0.00 < 0.05$. See Figure 3.

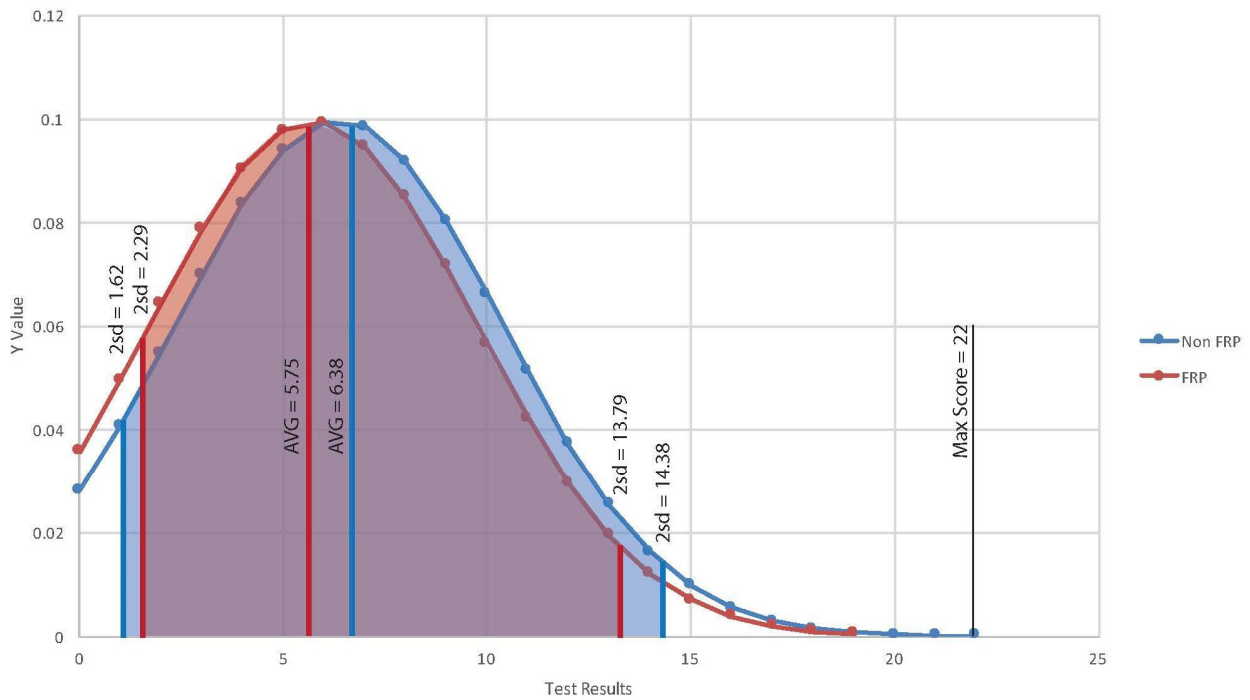


Figure 4: Abstractness of Titles Results Distribution

Abstraction of Titles reflects the ability synthesize different ideas and present these ideas in the labeling of images. This metric was significant at $p = 0.022 < 0.05$ and is shown in Figure 4.

These results show there appears to be a relationship between socioeconomic status and creative testing scores. Based on the data, comparisons of four of the six scoring metrics were statistically significant (>0.05), and therefore the hypothesis is accepted.

Within this research, decreased creativity development is tied to low socio-economic status. This and other comparable research would argue a need for programs to benefit students from low income families. How low-income parents can be made aware and address the importance of creative development remains open to discussion.

Limitations and Suggestions for Future Research

One of the pitfalls of a cross-sectional study is not being able to measure an exact representation of a population. Using FRP as a proxy for low income status is not a completely accurate measurement tool, but serves as the best method to date for measuring income. Thus, one of the limitations of this research is the difficulty of measuring families who do not enroll their child in the Free and Reduced Lunch program when their socioeconomic status qualifies. This may be due to a variety of reasons, one being parents who do not want to be associated with the stigma of low income, or do not want to advertise their socioeconomic status. Parents and students may also be unaware of the program being available, or forget to enroll their child. On the other hand, families may “cheat the system” and enroll their child in the Free and Reduced Lunch program when they do not qualify. These were accepted as minor errors which did not affect the results of the study.

We offer several additional suggestions for future research. Because our results indicate a connection between low income and low creativity scores, schools can justify providing more resources and diverse experiences to low income students to provide more opportunity for improving their creativity and strive for excellence. E. Paul Torrance has stressed that to provide disadvantaged children a chance to develop their creativity, school and community programs have to respect the creative positives of disadvantaged children and build upon them (Torrance, 1971).

In addition, comparisons of each of the six scoring metrics of the Torrance Test of Creative Thinking can provide more of an in-depth understanding of what aspects students in various socioeconomic classes score higher or lower in, and what components of the metrics are the most effective in identifying areas of creativity. Researchers may also want to identify cognitive abilities that hinder or enhance the development of creative problem-solving skills within students in low income families (Im, Hokanson, Johnson, 2015). Another suggestion would be to focus the direction of studying creative development to socioeconomic status, or even poverty, because it is less common. Since the majority of research conducted for creative development is focused on effects of ethnicity or gender on creativity, further research focused on the relationship between socioeconomic status and creativity would be beneficial.

In conclusion, it is critical that programs and resources are available for schooling systems to help students of low-income families to have equal opportunities as students from middle to high income families to enhance their creative development. It is also critical that further research is conducted to compare the effects of low income to creative development in other populations and cultures.

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