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Research Paper

Gender Difference in Fluid Intelligence: Breaking The 'Brilliant= Male' Stereotype

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ABSTRACT

It has been a long-held notion that males as a group are more intelligent than females. This 'male=brilliant' stereotype is not only an untested belief, but has also influenced the way men and women are perceived and the careers they choose or the roles they are assigned. Previous studies that have looked at gender differences in intelligence have more often focused on the crystalized or acquired aspect of intelligence. In this research, an attempt was made to test this long held stereotype, by studying gender differences in fluid intelligence. For this purpose, a sample of 140 children (74 boys and 66 girls) was taken (age range between 5 – 10 years). The Draw A Person Test of Intelligence for Children, Adolescents & Adults (Reynolds & Hickman, 2004) was administered on the sample and the scores of boys and girls were statistically analyzed using t test. The present study found girls to be significantly superior in comparison to boys when tested on fluid intelligence ($p<0.05$). The results are discussed in light of Cattell's GF- GC theory. Conclusions about possible reasons for the existence of the 'male=brilliant' stereotype and implications of research on this topic in light of the changing demands of the society are drawn.

Keywords: *Crystalized Intelligence, Fluid Intelligence, Gender, Gender Stereotypes, Non-Verbal Tests*

Among the many gender stereotypes that commonly exist in societies across the world, one is the 'brilliant= males' stereotype (Upson & Friedman, 2012; Lecklider, 2013). Several assumptions regarding specific cognitive abilities have long stood in academic as well as professional fields. For example, Males are far superior in mathematical ability in comparison to women (Davies, Spencer, Quinn & Gerhardstein, 2016; Cvencek, Meltzoff & Greenwald, 2011; Murphy, Steele & Gross, 2007). Such assumptions not only cause biases in selecting candidates for jobs and education, but they have also shown to influence the career choice that men and women make for themselves (Meyer, Cimpian & Leslie, 2015; Wood & Eagly, 2012; Fiske, Cuddy, Glick & Xu, 2002).

So engrained are these stereotypes in the sociocultural fabric that children as young as five associate attributes such as genius, superior intelligence, brilliance, giftedness, etc. more

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often with males than with females. Research has indicated that owing to this gender stereotype, many girls steer away from pursuing academics and professions in fields which are identified as requiring higher levels of intelligence (Cimpian & Leslie, 2015; Storage, Horne, Cimpian & Leslie, 2016; Leslie, Cimpian, Meyer & Freeland, 2015;).

Research comparing intelligence across gender has focused largely on adults and adolescents (Uppu, Devi.B, Anitha.N & Rani.K.C, 2015); Ritchie, 2015; Lemos, Abad, Almeida & Colom, 2013; Lynn, 1994; Lynn & Meisenberg, 2016).

The empirical attempts made to measure intelligence among children across gender have done so using either scholastic achievement or measures of specific cognitive abilities (such as mathematical reasoning or verbal comprehension) as the criteria (Keith, Reynolds, Patel & Ridley, 2008; Winstein, 2008; Voyeur, 2014; Lindberg, Hyde, Shibley, Petersen & Linn, 2010). These abilities are heavily influenced by education and exposure and thus generalizing these results to the more general aspect of intelligence is not possible. Thus, in order to test the long standing stereotype of males being generally more intelligent than females, the fluid component of intelligence needs to be measured across gender.

One of the widely used and popular approach to studying intellectual ability was proposed by R.B. Cattell in the 1940's. The model conceptualizes intelligence as comprising of two components, a general fluid component (GF) and an experience based crystalized component (GC).

Cattell (1940) defined fluid intelligence as the general ability used to discriminate and perceive relations between any fundaments, new or old. This ability is related to the action of the entire cortex. Conversely, crystalized ability Comprises of discriminatory habits long established in a particular field, originally through the operation of fluid ability, but no longer requiring insightful perception for their successful operation.

Cattell stated that the first component, GF, is the one that develops earlier and reaches its peak by early adolescence. In adulthood, due to the decline of fluid ability, it is the crystalized component of intelligence which dominates in the influence on performance (Cattell, 1943). Drawing on this conceptualization of intelligence, it would be viable to take fluid intelligence as a more accurate measure of children's intellectual ability. Unfortunately, the studies conducted so far have largely focused on assessing children's intelligence by testing acquired knowledge (Capie, 2006; Badaruddoza & Afzal, 1993; Singh, Makharia, Sharma, Agrawal, Varma & Yadav,2017).

Very few attempts have been made to identify if gender differences exist in the fluid component as well (Halpern & LaMay, 2000; Bandikolla & Violet, 2015; Baraheni, Heidarabady, Nemati & Ghojazadeh, 2018; Nasser, Singhal & Abouchedid, 2008). As the fluid component develops earlier than the crystalized component, studying gender differences in fluid intelligence among children would provide the most clear picture.

Thus, the aim of the present research is to study gender differences in fluid intelligence. Measuring the fluid intelligence among boys and girls of primary grade students would allow testing the long held stereotype that males are more intelligent than females.

METHODOLOGY

Participants

The study included 140 children between the age of 5 and 10 years. The sample comprised of 74 boys and 66 girls. The participants belonged to an urban middle class background. The sample was drawn from 7 educational centres across Uttar Pradesh, India. Informed consent was taken from the guardians of all the participants before enrolling them into the study.

Tools

The Draw A Person IQ Test for children, Adolescents and Adults by Reynolds & Hickman (2004) was used to assess children's intelligence. The test is a non verbal, non invasive and culture reduced means of measuring IQ. The test is a standardized measure loaded on the factor of fluid intelligence and has proved reliable and valid in the measurement of IQ of individuals above age 4.

Administration

The Draw A Person IQ Test was administered in small groups as per the instructions provided by the test makers in the manual. The children were asked to make a drawing of themselves on a blank sheet of paper. There was no time limit for making the drawing. As soon as each child was finished making the drawing, their sheet was collected and they were thanked for their participation.

Analysis

Each drawing was scored based on the procedure specified in the test manual of the DAP-IQ. The scoring yielded a final IQ score for each child. An independent sample t test was then performed between the scores of boys and girls to ascertain if any gender difference exists in fluid intelligence.

RESULTS

The aim of the study was to identify if gender differences exist in fluid intelligence. The t test conducted on the IQ scores of primary grade boys and girls yielded a t value of 2.28 which is significant at 0.05 level.

Table 1 Results of t test between IQ scores of girls and boys.

Group	Mean IQ score	Standard Deviation	Df	t	Sig.
Boys	111.23	14	138	2.28*	0.02
Girls	117.53	18.5			

As table 1 indicates, the mean IQ score of girls (117) was significantly higher than the mean IQ score of boys (111). Thus, the results clearly show that primary grade girls are much higher in terms of fluid intelligence in comparison to their male counterparts.

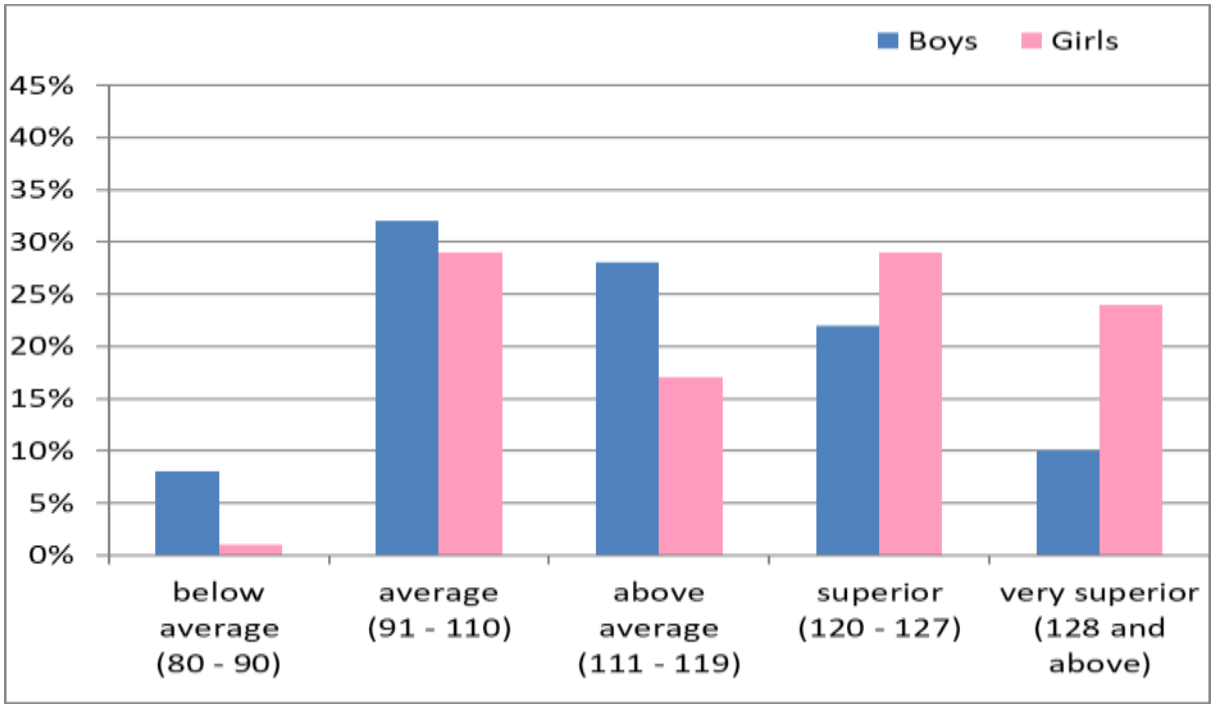

Figure 1 Distribution of IQ scores according to gender.

Figure 1 presents the distribution of boys and girls across the various levels of intellectual ability. This allows for a closer analysis of the pattern of the gender difference. As is clearly indicated in the figure, while majority of boys (60%) obtained IQ scores lying in the average and above average range (IQ between 91 and 119), maximum girls (53%) earned IQ scores ranging from superior to very superior intellectual ability (IQ 120 and above). Thus, the spread of IQ scores shows different patterns for boys and girls which re-emphasises that girls are significantly higher on fluid intelligence in comparison to boys.

DISCUSSION

In many cultures across the world, a long standing stereotype has been that of males being smarter than females. This assumption limits itself not only to specific mental abilities (such as mathematical reasoning or spatial intelligence) but also extends to the more general or fluid component of intelligence. The aim of the present research was to study gender differences in fluid intelligence. By choosing a non verbal, culture reduced test of fluid intelligence and by measuring the IQ of children, the study ensured that the ability being measured was free of any acquired knowledge or learnt skill. As the results in the previous section suggest, while gender differences in the IQ scores of children do exist, the difference is in favour of girls.

The sample of girls showed a significantly higher fluid intelligence as compared to boys in the study. Additionally, as the distribution of the sample across the various levels of intelligence suggests, a much higher percentage of girls showed very high or superior level intelligence in comparison to their male counterparts.

These results are in stark contrast to the 'brilliant=male' stereotype. In the present study, girls showed a much higher percentage of brilliance or superior intellectual ability as compared to boys.

These results find support in some of the studies conducted on children from other geographical and cultural background, using the same measure. Baraheni, Heidarabady, Nemati & Ghojazadeh (2018) in a study on 4 and 5 year old Iranian children's performance on the Goodenough Harris Draw A Person test found that girls reported higher mean IQ scores on the test than their male counterparts. The authors of the DAP-IQ (Reynolds & Hickman, 2004), also reported higher IQ scores of female children as compared to their male counterparts on the test.

Buczyłowska, Ronniger, Melzer & Petermann (2019) in a study on Dutch and German 2- to 8-year-old children reported an overrepresentation of girls scoring above mean and an overrepresentation of boys scoring below mean on fluid intelligence in early childhood. These findings are similar to those reported in the present study.

In fact, studies that use a performance measure to assess intelligence among children mostly report a female advantage. Bandikolla & Violet (2015) compared the intelligence of Indian urban and tribal boys and girls using the Seguin form Board test. They found that more girls (42%) scored high IQ compared to boys (38%).

Hooman & Asgari (2013) in a study used the Scale 3 (form A) of Cattell's Culture Fair Intelligence Test to examine gender differences among Iranian hi school students. They found that the mean score of female students on fluid intelligence was significantly higher than that of male students.

Performance tests measure the fluid or general aspect of intelligence, indicating that females are probably higher in terms of this component. In addition, as Cattell (1943) stated with regards to the fluid component of intelligence, it develops before the crystalized component and is dominant throughout childhood. Thus, studies that estimate IQ of children using performance measures lend an accurate evaluation of sex differences in fluid intelligence.

A possible line of reasoning for these gender differences could be found in research that compares the brain size of children and adolescents, correlating it with changes in intelligence. Lynn, Allik & Must (2000) and Lynn (1999) compared the intelligence of children (aged between 7 – 15 years) across gender. They found a similar pattern of results in children from Estonia and U.S.A, with sex differences in intelligence peaking around the age of 10 years in favour of girls. They concluded that the cause for this difference could be the growth of the brain, which is more rapid in girls between the ages of 7 and 10 as the growth spurt occurs in females earlier than boys.

It might however be wondered that if research has continuously indicated that females are far superior to males in terms of fluid intelligence, then what led to the 'brilliant=male' stereotype? After all, the female advantage in terms of fluid capacity would be reflected in their day to day functioning and thus the notion that males are smarter should never have been formed.

Taking a look at the specific abilities in which intelligence reflects itself in everyday functioning might provide an answer to this question. While females have consistently outperformed their male counterparts on tests that measure fluid intelligence as a single or global construct, gender differences in the specific cognitive abilities that are associated with fluid intelligence don't all show a female advantage.

Several studies have found that while females perform better in some aspects, such as the processing speed, logical reasoning and tasks that require fine motor coordination and use of long term memory, males usually score higher on other aspects, such as quantitative reasoning, latent comprehension and visuo-spatial processing (Keith, Reynolds, Patel & Ridly, 2008; Halpern & LaMay, 2000; Nasser, Singhal & Abouchedid, 2008).

This disparity in specific abilities might have led to males, who show a superiority in some of the aspects of intelligence that are associated with understanding, manipulating and applying knowledge, to be considered superior. Females on the other hand, seem to dominate in the abilities which are required to deal with the more day to day problems. In other words, the 'brilliant = male' stereotype might have been a result of males simply being slightly more brilliant in fields of academics and work, which have traditionally relied more on processing knowledge and tossing numbers (Galdi, Cadinu &Tomasetto, 2014; Murphy, Steele, & Gross, 2007). While females prove to be more brilliant in areas that have not really been acknowledged as requiring intelligence by the lay person.

However, with the recent shifts in societies, with the tide moving towards jobs that require finding quick solutions to real life problems, juggling several tasks at once and sifting through information stored in the long term memory, the female brilliance would perhaps finally be recognized.

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Conflict of Interest

The author(s) declared no conflict of interest.

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