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Gender asymmetry in verbal, visual and logical-mathematical abilities

Dadashova Aidan Guliaddin

PhD student at Baku State University, Azerbaijan, Baku

Abstract. The aim of the study is to assess verbal, visual and logical-mathematical abilities based on socio-psychological methods at the gender level, to study ways of regulating cognitive capabilities in the education system within the framework of gender equality and to analyze them from a socio-psychological point of view. **The research methodology** is based on psychological, pedagogical, sociological and cultural concepts, gender theories and theories of feminism, biodeterministics approaches and approaches to gender differentiation. **The scientific novelty** of the research is the socio-psychological assessment of verbal, visual and logical-mathematical abilities in the educational process at the level of gender asymmetry, identifying their causes and results. **Output.** Gender differences appear in the physical, psychological, behavioral and cognitive areas. There are differences in the verbal, visual, logical and mathematical abilities of the sexes in education. As a result of a comparative analysis of both approaches, we came to the conclusion that the differences in the verbal, visual, logical-mathematical abilities of the sexes observed in education have a kind of influence of both ontogenetic and gender roles. These influences usually act syncretically rather than autonomously. Therefore, researchers argue about their origin. However, recent research suggests that the perceived underdevelopment of girls' logical and mathematical abilities is in fact related to gender. That is, traditional pedagogy and family environment play an important role in the emergence of such stereotypes.

Keywords. verbal, visual, logical and mathematical abilities, gender asymmetry, humanitarian subjects, technical subjects

Introduction. The differences between the sexes are manifested in the physical, psychological, behavioral and cognitive areas. While there are enough gender differences between the sexes, there are not many psychological differences. Psychological differences manifest themselves more in the processes of cognition, in matters of motivation and morality. It is unambiguously wrong to link differences in the behavior of the sexes with objective anatomical and physiological features. Many gender scholars prefer to look for the root of the problem in sociocultural factors. There is some truth in their assertions as well. Because gender stereotypes are formed from preschool age. From this point of view, the relationship of psychological differences observed in the sexes with anatomical and physiological features can be assessed as a result of socio-gender stereotypes. That is, the psychological characteristics of an individual, formed in the environment of certain gender stereotypes, are associated not with his closed individual characteristics, but with the characteristics instilled in him by sociocultural gender values. The traditional pedagogical system is not concerned with revealing the internal psychological characteristics of a person, but with instilling the roles given to him by socio-

cultural, political and ideological constructions.

The aim of the study is to assess verbal, visual and logical-mathematical abilities based on socio-psychological methods at the gender level, to study ways of regulating cognitive abilities in the education system within the framework of gender equality and analyze them from a socio-psychological point of view, to present the results of a comparative analysis of various concepts related to the causes of gender asymmetry, assess the effectiveness of socio-psychological concepts and methods of gender asymmetry, conduct a comparative gender analysis of traditional and non-traditional pedagogy and identify strategic steps towards gender reforms in education, explore ways of regulating cognitive capabilities in the education system within the framework of gender equality and analyze them from a socio-psychological point of view, evaluate emotional intelligence and social abilities based on socio-psychological methods at the gender level, as well as emotional and intelligence and social abilities based on socio-psychological methods at the gender level, to identify emotional and social abilities in the education system at the gender level and to reveal their socio-psychological nature.

The research methodology is based on psychological, pedagogical, sociological and cultural concepts, gender theories and theories of feminism, biodeterministics approaches and approaches to gender differentiation. Since the feminist movement was the reason for the emergence of gender studies in education, they conducted the first study on gender issues in education. The theories and ideas reflected in the works of such classics of feminism as S. Bunch, S. De Beauvoir, J. Mill, M. Wollstonecraft, to some extent, became the methodological basis of modern gender studies. The methodological basis of the study is the psychology of gender differences in education (E. Maccoby, K. Jacklin, V.V. Abramenkova, K. Gilligan, J. Hyde, M. Horner, I.S.Kon, V.E. Kagan, T. A. Repina, I. I. Lunin, G. V. Turetskaya, T. I. Yufereva, etc.), Theoretical foundations of the psychology of large groups in education, problems of intergroup relations and interpersonal communication (G. M. Andreeva, V. J. Ageev, G. G. Diligensky and others), research in the field of gender psychology in education (S. Bern, S. Boehm, B. Lott., K. Do, R. Unger and others), psychological research in the field of feminist pedagogy (R. J. Hare-Mustin, N. Khodorov, R. Unger, J. Marechek and others).

1. Gender asymmetry in verbal and visual abilities

The experiments carried out confirm that the listening ability of girls is higher than that of boys. Therefore, girls learn better the lessons learned through listening.

Boys have more developed vision than girls. Experiments show that girls have developed peripheral vision, while boys have direct distance vision. Girls perceive information better visually-horizontally (wide texts), and boys - visually-vertically (placing texts on the board in columns). That is, if girls are better than boys at assimilating text that is laid out horizontally (on a wide board), then boys better understand texts that are laid out in a longitudinal direction (with dividing a wide board into columns) [Flogging identification, p. 77-78].

The small use of visual aids in the educational process contributes to the poor assimilation of textbooks in boys and, as a result, their concentration on the lesson decreases. To eliminate this problem, it is advisable to conduct training in parallel, in the form of audio and video. Recently, the widespread use of ICT in the educational process has increased the visual potential of learning.

Visual and spatial abilities are the advantages of men from childhood. There is evidence that boys aged 8–9 have better spatial orientation skills than girls. Even boys understand spatial relationships differently. In practice, when six-year-olds were asked to build a 3D model of a school room, the boys did better.

In 1985, TL Hilton summarized test results to understand the visual and spatial abilities

of 23,000 high school students in the United States and found that boys were superior to girls in this area. When the same researcher compared his study with data from a similar study 20 years ago, he found that there was little difference between boys and girls in this area. The researchers explained this by saying that either the girls had a significant increase in visual-spatial ability, or the researchers did not aim to identify differences in this area.

A number of authors have suggested that gender differences in cognitive abilities are associated with the influence of sex hormones on the formation of brain structures during prenatal or puberty. English psychologist R.L. Woodfield compared tests of spatial ability of women before and after childbirth during periods of hormonal changes and found that the results of spatial tests improved significantly during periods when the level of estrogen (female sex hormone) in women dropped sharply. At the same time, the direction that connects gender differences in the field of cognition with the functional orientation of the cerebral hemispheres is actively developing. There is evidence that in boys, the right hemisphere is specialized in earlier space exploration than in girls.

The results of clinical studies show that in men, oral and spatial functions are more active, and in women, both types of functions are active in parallel [Vinogradova T. V., Semenov V. V., 1993, p. 68]. Girls have 30% more connections between the left and right hemispheres of the brain than boys, so they can perform several related tasks at the same time. For example, if a girl can listen to a fairy tale that the teacher reads to other children, and at the same time draw one of the plots, then the boy will not be able to do it at the same time [Eremeeva, 2005, p. 36-37].

Or, because girls' feelings are connected to both hemispheres of the brain, their feelings function simultaneously with many other brain functions (at the same time, emotions live and make logical judgments). In boys, since emotions are located only in the right hemisphere of the brain, their emotions cannot function simultaneously with many other brain functions (at the same time, emotions cannot live and make logical judgments) [Simonov, p. 41-42]. Or, if you can give an assignment to a girl in the process (for example, while writing), then the boy should be given it in stages. Because he cannot listen carefully to instructions without stopping the writing process, or makes a mistake in writing [Duskazieva, 2010, p. 66-67].

2. Gender asymmetry in logical and mathematical abilities

Psychophysiological studies confirm that in boys, the left hemisphere of the brain is more active, performing the receptive and logical functions of thinking, and in girls, the right hemisphere, performing the figurative-sensitive function. Unlike boys, girls have more active neural connections in both hemispheres. While this opens up more opportunities for girls to think, it prevents them from focusing on a specific area of the brain. The fact that boys' brains are mostly focused on one part allows them to think more deeply within limited frames. The functions of the right and left hemispheres of the brain, regardless of gender, develop differently in different environments. However, the development of the right hemisphere in girls and the left hemisphere in boys is considered one of the main reasons why girls have an advantage in linguistics and philology, and boys - in logic and mathematics. This functional asymmetry leads to certain psychological differences. They also show themselves in the educational process.

The question arises: is the activity of girls in the field of humanities and boys in the field of logical and mathematical sciences really connected with their objective psychophysiological functions? Or does it have nothing to do with psychophysiological functions?

Research shows gender differences. E. Maccoby and K. Jacklin, having analyzed 1600 psychological studies of existing gender differences, show that verbal (oral) intelligence develops better in girls than in boys. Boys, unlike girls, develop visual-spatial and mathematical

skills better [E. Maccoby and K. Jacklin, p. 1974].

The development of speech functions in girls begins in childhood. While girls know about 50 words in 18 months, boys can learn that many words in 22 months. In the future, the speech of girls, as a rule, becomes richer both in vocabulary and grammatical terms, and, in comparison with boys, they acquire reading skills earlier [Bern, p. 122].

An analysis of the personal data of children of different ages showed that at the early stages of ontogenesis (up to about 7 years old) girls surpass boys in intellectual development. Later, their IQ is identified. According to psychometric studies, the number of men at both ends of the IQ-based bell curve is much higher than the number of women. This means that among men there are more mentally retarded, but also more talented people. As you know, among the most talented people recognized by society, men prevail [Vinogradova T. E., Semenov V. V. 1993, p. 55].

The following question arises: if boys are superior to girls in the field of logical and mathematical thinking, then why are girls superior to boys in intellectual development at the early stages of ontogenesis (up to about 7 years)? Why does the difference between the sexes in this area change in favor of boys after 14-15 years?

Research on these issues has led to different approaches. While some researchers were looking for the cause of the problem in ontogenesis, others tried to connect it with gender stereotypes. However, both approaches have their strengths and weaknesses.

One of the hottest debates among experts is the question of the mathematical ability of sexes. Math has always been a male field, and men are better than women on math tests. According to psychometric studies, there are no differences in the level of mathematical abilities among elementary school students; these differences begin to manifest themselves in adolescence and mainly relate to complex forms of mathematical thinking. Researchers J. Benbow and J. Stanley associate high achievements of men in mathematics with the ability to solve visual-spatial problems better than women [Vinogradova T. E., Semenov V. V. 1993, p. 66].

There are those who associate the asymmetry of mathematical abilities in adolescence with changes in the hormonal background. Kenrick argues that in mathematics, gender differences are not related to differences in cognitive ability. He argues that gender differences in this area are directly related to gender differences associated with aggression and associated competition. Kenrick attributes this to the high testosterone levels in the blood of men. Despite the fact that women can successfully study mathematics, they have difficulties in a complex mathematical area [Kenrick, 1988, p. 200]. The "hormonal" theory has recently been on the verge of losing its relevance [Hyde, 1990, p. 301-302].

I. Y. Kaplunovich, as a result of his experiment, proved that the mathematical thinking of boys does not exceed the mathematical thinking of girls. It's just that their mathematical abilities cover different areas of mathematics. That is, girls have better comprehension skills than boys in certain areas of mathematics. In areas of mathematics where girls are weak, boys are more active [Kaplunovich, p. 30-31].

Paul notes that the differences in the abilities of men and women are only 5%, and 95% are explained by age, intelligence, educational level, conditions of socialization and other similar factors [Deaux K., 1985, p. 55].

It is gradually becoming clear that claims about the active participation of boys in basic technical subjects and girls in the humanities are unfounded. Then the following question arises: if the differences in certain sciences are not ontogenetic in nature, then what factors influence the occurrence of these differences?

In the United States, S. Rallis and colleagues found that girls who passed the required

tests in math and science were three times less likely than boys to work in these areas in the future. K. Benbow also achieved similar results. He says that of 2,000 American students with math ability, 63% of boys and 30% of girls prefer math. Also, there were twice as many boys who wanted to become researchers in the field of mathematics than girls [Vinogradova T. E., Semenov V. V. 1993, p. 34].

One of the main reasons for this reality is the stereotype that girls are accustomed from an early age to the idea that mathematics is not their field of activity and they cannot succeed here. These stereotypes are being introduced into the psyche of children by parents in the family and teachers at school.

According to some studies, the reason girls do not attend math lectures is because they have little faith in their math ability and are not sure they will be successful in the field. Ackles' research showed how women's confidence in their mathematical abilities declined in the seventh grade and beyond, including during higher education [Ackles, 1989, p. 40].

Fennema and Sherman have shown that there is a link between confidence in mastering mathematics and excellence in this area. According to A. Meehan's research, men usually expect more success in solving problems than women. Eccles and colleagues found that men and women choose different educational programs and are inclined to different activities due to gender differences in the perception of ability [Eccles, 1990, p. 170]. In a meta-analysis of attitudes towards gender and mathematics, Hyde and his colleagues found minor gender differences in confidence in their mathematical abilities, but these differences increased during university education [Hyde, 1990, p. 304].

Girls have a gender role stereotype that math is inconsistent with their gender roles. This prevents them from studying mathematics and excelling in this area. This stereotype is exacerbated by a deeper understanding of gender roles. The attitudes of adult boys and girls to mathematics differ significantly [Etaugh, Liss, 1992, p. 133]. Hyde and his colleagues noticed that among students, boys, as opposed to girls, are more confident in math and see it as their own profession. Boys have been observed to convince their peers that mathematics is not appropriate for their gender roles and assume that they will fail in this area. Teenage girls, in order to please boys, do not want to pursue areas that are inappropriate for gender roles. Because it can negatively affect their attractiveness [Hyde, 1990, p. 303].

In general, women cannot be smarter than men due to their traditional gender roles. Because traditional gender stereotypes try to portray men as smart and women as stupid. Komarovsky's research showed that smart women try to portray themselves as less intelligent and infantile than men, so as not to achieve an image "not for a woman." Because if they try to prove that they are smarter, they will be persecuted by traditional gender consciousness.

Despite the overwhelming evidence that girls are as good at math as boys, they are less likely to become scientists or engineers. Baker and Perkins-Jones determined that the secret of a student's success in a particular subject lies in a pre-planned specialty. Eccles found that after eighth grade girls included less mathematics in their future plans and, naturally, were less prepared to participate in the selection in mathematics [Eccles, 1989, p. 41].

Baker and Perkins-Jones concluded that, if the hypotheses are correct, there should be fewer gender differences in math problems in cultures that provide women with more career opportunities in mathematics than in countries with strong gender stratification. This was confirmed by their own study of 77,602 eighth graders from 19 countries. The study found significant cross-cultural differences in gender differences in math skills. While in seven countries boys are better than girls (France, Israel, Luxembourg, Netherlands, New Zealand, Canada, Swaziland), in eight countries (British Columbia, England, Hong Kong, Japan, Nigeria, Scotland, Sweden, USA) gender no differences were found. In four countries, girls

outpaced boys (Belgium, Finland, Hungary, Thailand). The authors associate these results with data reflecting declining gender disparities in mathematics in countries where opportunities for women are expanding, and argue that the overall picture contradicts biological models of cognitive difference, which puts social factors in second place after biological ones [Baker and Perkins-Jones, from. 97-98].

Selkow found that if gender role identification was controlled, gender differences could be reduced when solving math problems. In her experiments, she found that women with strong traditional gender-role identifications performed math problems worse than others (those with weak gender identifications). This once again showed that the gender role is great in the development and manifestation of mathematical abilities [Bern, p. 96-97].

The reason for girls' low confidence in their math skills is to be found in the expectations and support of parents and teachers. Hyde, Dook, and colleagues found that parents and teachers generally view mathematics as just a male domain. The researchers note that although boys and girls are equally well educated and equally perform standardized tests, gender stereotypes are manifested in the approaches of parents [Hyde, 1990, p. 123-124]. Such approaches reduce girls' confidence in their academic ability, even if they perform better than boys.

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