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Relationship between Characteristics and Left-Handed among Gifted and Talented Muslim Students

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ABSTRACT

A hand is the main organ used to manipulate the environment and to perform daily activities. Every human is endowed with a pair of right and left hands. A person's tendency to use the left or right hand can usually be seen during childhood, which is from the age of two. Most children perform various activities and hold objects automatically with the right hand. However, there are a few individuals who are born with a tendency to use left-handedness. They feel that the left hand is stronger than the right hand, and they are more comfortable doing many things. This group of individuals is called a recessive gene. The choice of hand use is based on a person's genetic variation. Previous studies have proven several factors influence the preference for hand use, such as environment, gender and genes. The main purpose of this study is to analyse the genetic factors that influence the use of left-handedness on gifted and talented Muslim students at Kolej PERMATA Insan. Based on the survey, the results show that most left-handed students have a family background of left-handedness inherited from their parents. The advantage of left-handed individuals is that they have a high ability in Mathematics. Achievement of students' understanding of Mathematics can produce Muslim scholars who are future-ready and excel in the field of Mathematical Sciences and increase their critical thinking ability.

1. Introduction

Individuals' hand preferences may be influenced by random variation. Handedness, like many complex traits, does not have a clear pattern of inheritance. According to Halpern and Coren [1], the left-handed could be a sign of birth stress-related neuropathy, developmental delays and irregularities and lack of immune system caused by the intrauterine hormonal environment. Their interactions with the environment are more likely to be risky. However, Kovel *et al.*, [2] express that the left-handed was affected by the year and location of birth, probable to have cultural effects. People who are left or right-handed use their brains in distinct ways. Asymmetries such as this can even develop before birth. As early as 15 weeks, some babies prefer to suck their left or right thumb. Furthermore, they said maternal smoking around the time of birth was not associated with left-hand

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preference. Meanwhile, Llaurens *et al.*, [3] concluded both of their studies, which stated left-handedness could be influenced by genetic, hormonal, developmental and cultural factors.

Researchers have proposed a relation between handedness and ability in Mathematics. The relation is proposed by Geschwind *et al.*, [4], Annett *et al.*, [5] in their studies. According to them, a brain with no extreme bias towards locating language in the left hemisphere would have an advantage in mathematical ability.

It is assumed that hand preference is continuous variation. The frequency of left-handedness never reaches 50 per cent in any human population investigated for now. Thus, left-handed is recessive. The purpose of the present study is to analyse the factor of left-handed preference among gifted and talented students in Kolej PERMATA Insan.

2. Methodology

This research explains the left-handed genetically and their behaviours among gifted students. A survey method was used to collect data from the gifted and talented Muslim students at Kolej PERMATA Insan. The survey defines the population of left-handed from 205 respondents in Kolej PERMATA Insan, including determining the family background of left-handed and proof in some researchers' studies regarding the left hemisphere would have an advantage in mathematical ability. The data is collected from gifted and talented students in Kolej PERMATA Insan using a survey method to study the background of left-handers. Aside from genetics, other factors that influence left-handedness were stated. Then, the survey has been analyzed according to the factors and categories that have been made.

3. Results and Discussion

3.1 Survey

This section discusses the results obtained from the survey that was conducted to gifted and talented Muslim students in Kolej PERMATA Insan with 205 respondents between the ages of 13 until 17 years old. The purpose of this survey is to analyse the genetic factor that influences the use of left handedness on gifted and talented Muslim students at Kolej PERMATA Insan.

According to Figure 1, the population of left-handed gifted and talented Muslim students at Kolej PERMATA Insan, known as 79.8 percent of right-handed students and 20.2 percent of left-handed students. Hence, the right-handed is dominant at Kolej PERMATA Insan. Besides, the main factor of left-handed at Kolej PERMATA Insan is the genetic factor seen in Figure 3.

This survey also determined the tendency of left-handed students in the Mathematical field by identifying their statistics of final examinations achievements in Mathematics with ranges below 40% as weak, the moderate level as 50%-79% and the excellent range above 80%. Data from Figure 2 shows the Mathematics achievements of gifted and talented Muslim students at Kolej PERMATA Insan. Most of them get excellent in Mathematics with a range of 80 marks and above.

Research has suggested that left-handed individuals may exhibit different cognitive processing styles, associated with enhanced problem-solving skills, and creativity qualities that are beneficial in mathematical thinking. For example, a study by Papadatou-Pastou *et al.* [6] explored the relationship between handedness and cognitive abilities, showed that left-handed students may have an advantage in certain problem-solving tasks. Similarly, Somers *et al.* [7] found that left-handed individuals are more likely to have strong divergent thinking skills, which could contribute to success in complex mathematical reasoning. The findings from PERMATA Insan College align with this, as they indicate that most of the students in the study perform excellently in Mathematics. This supports

previous research that gifted students, regardless of handedness, tend to excel when placed in specialized programs that nurture their abilities.

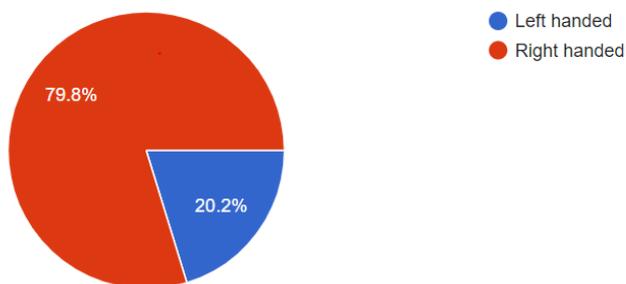


Fig. 1. Result of hand preferences of gifted and talented Muslim students at Kolej PERMATA Insan

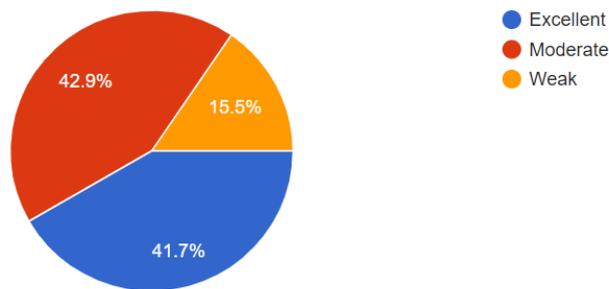


Fig. 2. Mathematics achievement of gifted and talented Muslim students at Kolej PERMATA Insan

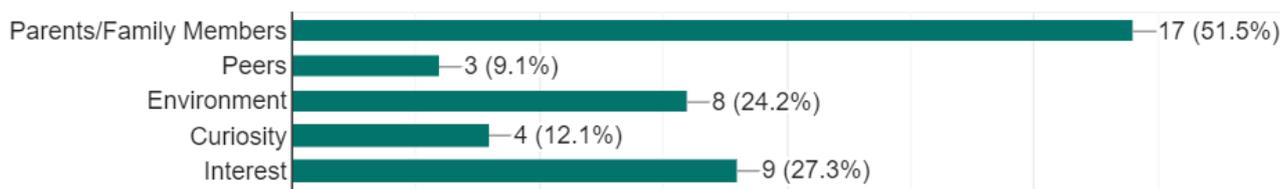


Fig. 3. Factors influence left-handedness of gifted and talented Muslim students at Kolej PERMATA Insan

3.2 Punnett Square

The likelihood that a particular event will occur is called probability. How the alleles segregate is completely random. The principle of probability can be used to predict the outcomes of genetic crosses. The gene combinations (genotype) that might result from the genetic cross can be determined by drawing a diagram known as Punnett Square. Edward [8] has explains his study of the Punnett Square that was invented by Reginald Punnett. To create a Punnett Square, a grid of four boxes is drew and the parental genotypes are added along the outside of the grid. The letters represent alleles for each gene that a sex cell from the parents.

Step 1: Put the letter at the top of column into each box. Always put as the capital letter

Step 2: Do the same for the letter on the side across each row

Capital letters are dominant, and little letters are recessive. The different types of genotypes are homozygous recessive (rr), homozygous dominant (RR), and heterozygous (Rr). The homozygous dominant and the heterozygous genotypes show the same phenotypes which is dominant. Given the genotypes of offspring of hand preferences;

R - dominant (right-handed)

r - recessive (left-handed)

The possible combinations of the F2 generation are found inside the squares. Each box represents a 25% chance of that trait being produced. There are two situations to get children with left-handed alleles. In situation 1 as shown in Figure 4, the parents are left-handed and right-handed. The genotype of the left-handed parent is homozygous recessive, rr while the right-handed parent is

heterozygous genotype, Rr. The genotypes of offspring from this cross are 50% homozygous recessive, rr and another 50% known as heterozygous Rr. As already know, R was an allele for being right-handed. It is dominant over r, which is a recessive trait for being left-handed. Hence, the phenotypes of offspring from this cross will be 50% right-handed and 50% left-handed.

Situation 2 occurs when both parents are right-handed. Since both are right-handed, the genotypes for them are heterozygous, Rr. The potential genotypes of offspring that would result from this cross are 25% of RR, 50% of Rr and 25% of rr. Thus, the phenotypes of offspring in situation 2 are 75% right-handed and 25% left-handed.

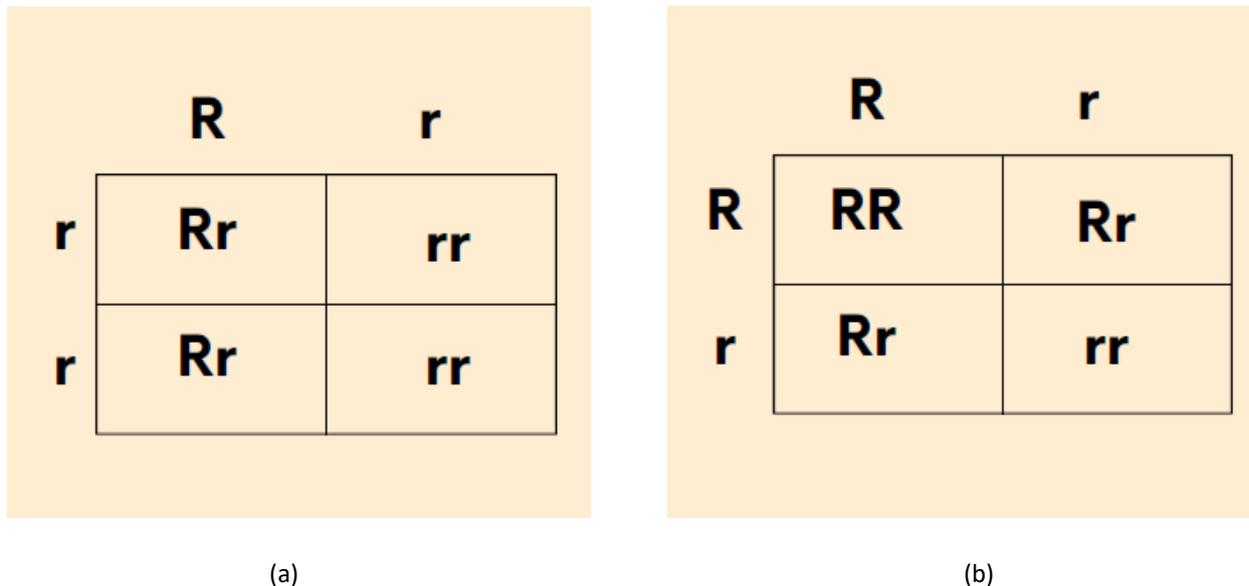


Fig. 4. Figure Punnet Square (a) Situation 1 (b) Situation 2

3.3 Integration of Dalil Naqli and Aqli (INAQ)

“Human beings, we created you all from a male and a female and made you into nations and tribes so that you may know one another. Verily the noblest of you in the sight of Allah is the most God-fearing of you. Surely Allah is All-Knowing, All-Aware.” (al-Hujurat chapter 49, verse 13).

This verse explains how Allah created humans with various uniqueness so that humans can recognize and complement each other, just like the concept of left hand and right hand. This is proof that Allah's creation has many variations. The Qur'an clarifies in this verse that Allah created all men from a single mother and a single father and united them into a single brotherhood. He has, however, separated them into tribes, nations, races, lineages, and language-speakers/linguistic groups. Mutual identification is the underlying Divine wisdom in such a divide. For example, if two people have the same name, they might be distinguished by their family names. It can also display close and distant relationships. Their Shari rights can be realised through close and distant ancestors. When applying the law of succession or distributing a deceased's inheritance, it is necessary to determine the close and distant agnate heirs.

In short, referring to one's ancestors for identification purposes is not considered pride and conceit. No one is permitted to take pride or to disparage others based on the colour of his skin, the amount of riches he possesses, his rank, social status, descent, or pedigree, but rather, on his moral uprightness and the manner he fulfils his commitments to Allah and man. Humanity is just one family.

The division into nations, tribes, and sub-tribes of various sizes as well as races is purely for better identifying one another.

3.4 Relation between Hand and Brain Preferences

The brain and hands are two components of your body that are inextricably linked. The brain can be shaped by hands, and hands can be controlled by the brain. The genetic difference associated with handedness is found to be linked with the connections between brain parts responsible for language processing. It's a constant bilateral discourse that needs to be nurtured. Asymmetry of the brain and handedness are usually acknowledged as being unique to humans and related to complementary roles. The theory is that the two halves of the brain work differently. This was discovered in the research of psychobiologist and Nobel laureate Roger W. Sperry. The left brain excels in reading, writing, and computation. It is more verbal, analytical, and organised, known as the digital brain. According to Sperry's research [9], the left brain is dominant to logic, sequencing, linear thinking, mathematics, and facts. Conversely, the right brain specialisation for creativity and intuition. It is sometimes referred to as the analogue brain. It thinks more imaginatively and unorganised manner. It thinks more imaginatively and unorganized manner. Based on the study of Sperry, the right brain experts in imagination, holistic thinking, intuition, arts, rhythm, nonverbal cues, feelings visualization, and daydreaming. Indeed, asymmetries are common among animals and aid in the progressive emergence of asymmetrical activities like language and tool use. Handedness and brain asymmetry are inborn and partially genetically controlled, albeit the gene or genes responsible remain unknown.

According to Sha *et al.*, [11], left-handedness occurs in roughly 10% of people, but whether it involves altered brain anatomy has remained unclear. However, a huge study published in 2016 [12] discovered that left-handed persons had greater grey matter on the right side of their brains. This could be because the dominant left hand is controlled by the right side of the brain. Researchers also discovered that left-handed persons use distinct sides of their brains for working memory, language, vision, and hand control than right-handed ones. However, this research proves that left-handed people also have the ability in Mathematics. The psychology test in the survey was carried out to identify which brain Kolej PERMATA Insan students tend to use. From the picture, two types of people can be found based on the first thing that came up from the mind.

From the Figure 5 [10], if the person sees the frog first in the picture, it means they have a straightforward personality, perceived, feeling confident, trustworthy, and reliable. Otherwise, if the horse is seen first, it means they have an analytical mind. They have a critical approach to life and prefer to draw their own conclusions about a situation.



Fig. 5. A frog and a horse

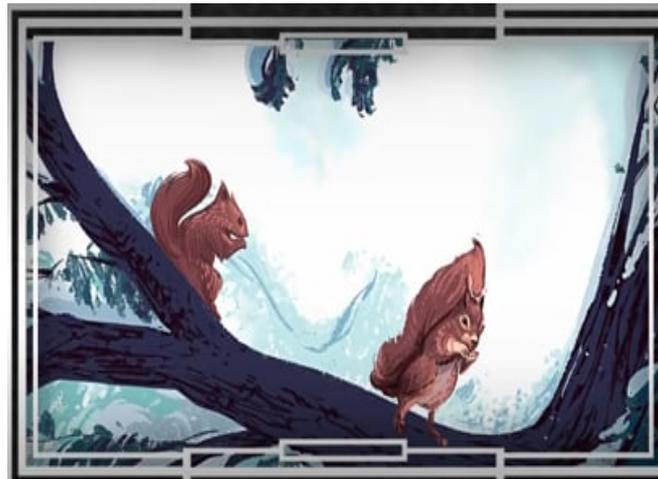


Fig. 6. A woman's face and two squirrels

In Figure 6 [10], if the people see two squirrels on a tree branch first. They are the types of people who can see the big picture effortlessly. This ability can help them correctly assess situations at first sight and solve the subsequent problem efficiently. However, they are a few people who can see a woman's face first. They are unique individuals with outstanding observational skills. This ability can help them in both their work and social interaction with other people.

The people who see a man with a pair of binoculars first in Figure 7 [10] is the person who prefers to concentrate on the big picture. They only need several glances to collect information, so they are not a big fan of thorough analysis. If they see a car first, they can notice fine details. They are the type of people who want everything to go according to their detailed plan. They can over-analyze things, which can prevent them from making quick decisions. Besides, the people that see 'A' letter first, they have a strong intuition and always suggest creative ideas and non-standard solutions.

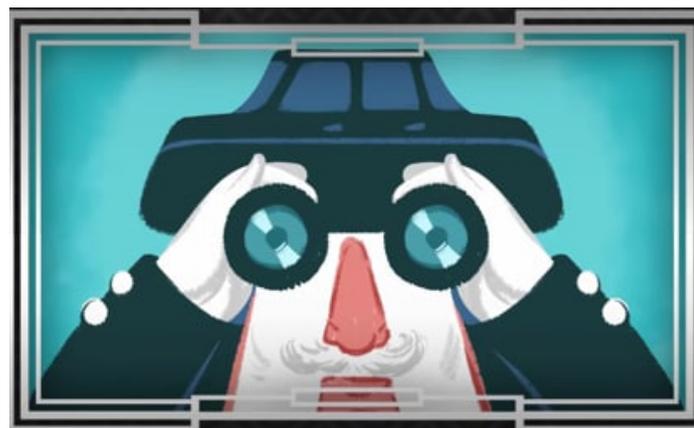


Fig. 7. A man with a pair of binoculars



Fig. 8. A tree and two faces

Based on the Figure 8 [10], if they see two faces first, they are the type of person who have a romantic heart. They value people around them, so love and understanding mean a lot to them. They also have a positive and friendly personality. Their inborn reasoning abilities can calm down even the most nervous or agitated people or else if they are instantly drawn to the tree, they're someone who occasionally needs to be on their own. They love nature and solitude but don't mind being with the one they love as well. Besides, they're a tactful person who avoids hurting people's feeling.

According to Figure 9 [10], if a mouse is seen first, they are an optimist person and prefer to look for an advantage in every situation. Sometimes they are not practical enough and people often say they have their head in the cloud. In truth, they are aware of what happened, but they prefer to look at the brighter side. If the first that things they see a cat, thus they are a realistic person. They know what they need in their life, so they do not naively build castles in the air. They see the world, and this ability helps them to plan their subsequent actions.



Fig. 9. A cat and a mouse

In Figure 10 [10], the people who see a girl's face first, they are aware of their surroundings. They know the pattern around them, and this helps them to draw the right conclusions and make a correct assessment or else they see a flower first; they probably love nature and appreciate the world. They manage to get out of everyday problems when they need to.



Fig. 10. A girl's face



Fig. 11. A skull and a woman looking out the window

From Figure 11 [10], if the first thing that they see first is a woman looking out the window, so they are someone who tends to overlook dangers around them. They might even risk their life without realizing it and sometimes they are too spontaneous and naive. That is why they may often find themselves unprepared for unpleasant consequences. If skull is seen first, they are a realist. They probably come off a bit as cynical to people who do not know them well, but they have a way of thinking that everything may end one day.

To be concluded, the genes related with handedness act via influencing brain lateralization during the early developmental period. It proves Corballis's study [13] that handedness and brain asymmetry are inborn and partially genetically controlled, albeit the gene(s) responsible are not well established.

3.5 Learning Style

Understanding the psychology of the brain and how it effectively processes information is one of the most essential components for educational achievement to make revision time more productive and gratifying. Although the results of the data analysis of Ali and Manouchehr's study [14] showed no significant difference in brain dominance between right-handers and left-handers, the differences between the groups on certain aspects of learning styles were found to be statistically significant,

highlighting the importance for educators and syllabus designers paying attention to this issue. Learning styles can be classified in a variety of ways. One of the most well-known is Neil Fleming's VARK model [15]. In 1987, Fleming developed an inventory to help students and others understand more about their specific learning preferences.

Table 1
 Types of learning style

Types of Learning Style	Preferences
Visual (learn by seeing)	<ul style="list-style-type: none"> - Images, graphics and visuals - Mindmaps and diagrams - Animation - Colour based - Infographic - Impatient - Use words and phrases that evoke visual images - See and visualize - Fast talker
Auditory (learn by hearing)	<ul style="list-style-type: none"> - Listen and verbalise - Sound recordings and mnemonic devices - Podcast - Read-aloud - Natural listeners - Linear thinker - Verbal repetition
Read and Write (learn by reading and writing)	<ul style="list-style-type: none"> - Note taking - Information in the written word - Books - Assessments - Case studies - Written text - Emphasize text-based input and output - Photogenic memory
Kinesthetics (learn by doing)	<ul style="list-style-type: none"> - Tactile learning - Physical activity and movement - Role playing - Scenario training - Hands-on - Slowest talkers - Use all senses to engage in learning - Do and solve - Learn through trial and error

Figure 12 shows the result of students learning style at Kolej PERMATA Insan. Based on the result, half of them is a visual learner.

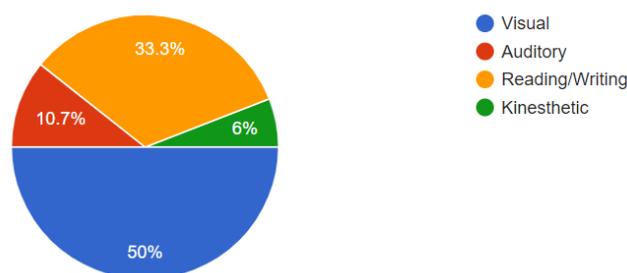


Fig. 12. Learning style of students at Kolej PERMATA Insan

4. Conclusion

Recent research on left-handedness has presented its findings, highlighting various factors that influence hand preference. Left-handedness is shaped by a complex interplay of genetic, hormonal, developmental, and cultural influences. Research suggests that hand preference may arise from random variation rather than a distinct pattern of inheritance. Some studies link left-handedness to birth-related stress, developmental irregularities, and immune system deficiencies caused by intrauterine hormonal conditions. Additionally, left-handed individuals may face greater challenges in adapting to their environment. However, emphasize the role of cultural factors, noting that the prevalence of left-handedness varies based on birth year and location. In short, multiple factors—including genetic, hormonal, developmental, and cultural elements that contribute to handedness, making it a multifaceted trait without a singular cause.

Based on the results and analysis, it can be concluded that left-handedness is largely inherited from parents. Thus, genetics play a dominant role in determining hand preference. Furthermore, the findings support the idea that left-handed individuals tend to excel in mathematics.

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