

Impact of Learning Multiple Languages on Intelligence

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ABSTRACT

This article delves into language learning and its importance in cognitive advantages, specifically in terms of intelligence. How human intellect may be influenced for a variety of causes, including language learning. This study included 111 individuals, divided into two groups: monolinguals and multilinguals. The IQ test devised by Dr. K. S. Misra and S. K. Pal was used on this sample size. The null hypothesis was developed to compare the means of these differences. A comparative research design was adopted, and a t-test was performed for statistical analysis of the raw data. The research findings clearly indicate that there is a considerable difference between monolinguals and multilinguals. The t-value in the present study is higher than the critical value ($6.06 > 1.98$) with 109 degrees of freedom and a significance threshold of 0.05. When these data were analysed on gender level, there were substantial disparities between monolinguals and multilinguals. As a result, it was concluded that multilingual persons had a higher IQ than monolinguals.

Keywords: *Language acquisition, Language learning, Cognition, Intelligence*

Intelligence, a term with intricate and diverse interpretations, has been defined differently by various scholars and psychologists. One of the most common definitions of intelligence is the capacity to acquire, understand, and use information and skills to solve issues. Language is an important part of human communication and has a considerable effect on how we see the world. Language is an essential component of human communication and has a significant impact on how we view the world. Due to globalization, it has become important for anyone wishing to excel in global business to learn different languages, and learning multiple languages can have cognitive benefits, which particularly impact mental functions such as attention, memory, reasoning, and problem solving, according to British Academy research led by Professor Bensie Woll FBA and Professor Li Wei (Woll & Wei, 2019). Furthermore, there is a notion that those who are bilingual display better efficiency in multitasking, which demands efficient time management and cognitive agility. (Rio et al., 2014).

Learning a language allows us to organise and make sense of the world we live in. Learning a language is important because it allows us to convey our thoughts, feelings, and experiences, develop relationships in our community, and travel throughout the world (Colombetti, 2009; Saito et al., 2018). Learning a new language takes effort, practice, and

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consistency over a long period. To be deemed fluent in a language, one must consistently practice both speaking and writing. A newborn instinctively picks up the language used in his immediate environment. To be deemed fluent in a language, one must consistently practice both speaking and writing. A newborn instinctively picks up the language used in his immediate environment. Although children tend to imitate the things and people around them, speaking many languages in their environment won't hinder their growth; rather, they will become fluent in those languages rather easily (McCathren, 2001). Speaking numerous languages is also typically seen to make one wiser and more charismatic than someone who may only speak one.

The process by which people learn to understand and use language is called language acquisition. It is critical to communication, social interaction, and cognitive growth and is an important part of human development. For several reasons, the study of language learning is crucial. Learning a second language can improve cognitive abilities, such as attention, inhibition, and working memory, among other things (Luque & Morgan-Short, 2021)

1. Understanding language acquisition - can help us better comprehend how humans learn and develop, which is a crucial aspect of human development. It can shed light on the mental, interpersonal, and emotional processes that shape human growth.
2. Increasing educational outcomes for children - The study of language acquisition can influence teaching strategies. For example, understanding how children acquire language can assist teachers in developing language classes that are appropriate for their developmental stage.
3. Cultural understanding – Since language is a major component of culture, research on learning languages can help us understand the diversity of cultures and languages. It is spoken all over the world. It can also help us understand how language shapes cultural identity.
4. Developing language technologies - Research into language learning and acquisition can contribute significantly to the advancement of language technologies. This includes the development of improved speech recognition software, language translation tools, and natural language processing algorithms.
5. Determining language disorders - Language problems can be identified through research into language learning in both infancy and adulthood. Clinical practitioners can utilise this information to develop interventions and therapies that will assist persons with language challenges in communicating more successfully.

In a nutshell, research on language acquisition forms the basis of human understanding development, improvement of education, recognition of cultural diversity, language development technology and diagnosis of language disorders.

This article will explore these benefits in greater detail and examine the research supporting them. The relationship between language acquisition and intelligence may be affected by many factors, even though there is substantial evidence to support the cognitive advantages of learning many languages. The cognitive advantages of language learning, for instance, may depend on the age at which someone starts learning the language (Poulin-Dubois et al., 2011). According to research by Harvard University psychologist Steven Pinker, persons who start learning a second language early in life may gain cognitively more than those who start later in life. They concluded that, at least linguistically, the capacity to learn a new language is greatest before the age of ten (Sihombing, 2022).

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The cognitive advantages of language learning may also depend on the level of linguistic proficiency attained. Also, encouraging language acquisition in schools and communities may enhance cultural knowledge and understanding while also providing long-term cognitive benefits. By supporting bilingualism in society and supporting language education programs, public policy can also encourage language learning.

Being literate in several languages can be quite helpful in this age of globalization. Speaking multiple languages can be advantageous in several ways, so many schools and other educational institutions have started to integrate language courses into their curriculum. Learning several languages can help you not only get a good job or grow in your profession but also have a deeper understanding of other cultures. Travelling the globe and learning about other cultures may then be made simpler. Our options are also limited by our lack of knowledge about other languages, particularly when travelling. You won't be able to take part in numerous activities if you travel to a foreign country without even a rudimentary grasp of the local tongue. Even ordering lunch by yourself or requesting facilities may be difficult. You might experience feelings of frustration or even loneliness as a result.

Understanding of how learning a language affects intelligence is still in its early stages. This research compares monolingual and multilingual people's overall intelligence levels and investigates the possible consequences of learning a second language on people's ability to think divergently. Learning a new language activates several parts of the brain, leading to enhanced cognitive abilities such as memory, problem-solving, and executive functions.

One of the main benefits of learning a new language is that it improves memory. Learning a new language requires memorizing pronunciation, grammar, language, etc. Vocabulary that can improve your working memory skills. Also, when learning a new language, Information must be stored for a long time, Memory recovery option (van den Noort et al., 2019). Developing problem-solving skills is another benefits of learning a language. To learn a new language, learners must: Understand and analyze various grammatical structures and sentence patterns which helps develop critical thinking and problem solving skills (Useini, 2022).

Moreover, exposure to many cultures and mental processes through language education broadens one's perspective and improves problem-solving abilities. Learning a new language necessitates a lot of focus and attention, which might aid in better attention management (van den Noort et al., 2019). Also, the constant switching between tasks required when learning a new language such as speaking, listening, reading, and writing can improve working memory.

It has additionally been proved that multilingual individuals are more creative and mentally flexible. Learning a new language exposes you to numerous cultures and languages, which may broaden your perspective and develop creativity and open-mindedness (Chen et al., 2022).

Also, being able converse in other languages may provide you access to a wider range of knowledge and information sources, allowing you to be more creative. Thus, it may be argued that learning a new language has the potential to boost an individual's intelligence and cognitive abilities. In their Critical Period Hypothesis (1967), Johnson and Newport discovered that persons who learn a second language after puberty are less proficient than

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those who learn it earlier in life. They suggested that language acquisition has a critical time that ends around puberty (Leiderman, 2019).

Another study discovered that bilinguals have more grey matter in regions of the brain responsible for language processing, attention, and executive control (Kaiser et al., 2015).

The intriguing branch of study that investigates the link between language proficiency and intellect has received a lot of attention recently. Learning a new language offers several benefits, including increased cultural knowledge, job opportunities, and improved communication skills. However, the notion that learning a new language might boost IQ has aroused the curiosity of many researchers and language aficionados.

The objective of this study was to provide a comprehensive review of the studies on the relationship between intellectual capacity and language learning, as well as to compare monolinguals and multilinguals. The study's goal was to assess the current level of knowledge on this topic and weigh the advantages and disadvantages of past research.

Furthermore, the study's goal is to critically analyse data and offer conclusions based on the findings. It investigates how cognitive abilities such as intellect, working memory, and attention affect language learning. The study investigated the influence of language acquisition on cognitive development in terms of intelligence. The ultimate purpose of this study was to inform language education policies and practices while also contributing to a better understanding of the complex links between language acquisition and general intelligence.

The intent of this study is to see if there is a causal relationship between cognitive skill development and language learning. If this association is discovered, it might have a major influence on how children learn and grow cognitively. Language acquisition benefits can also be studied for specific groups, such as children, the elderly, and those with cognitive disabilities.

The primary purpose of this research is to get a better understanding of the link between language learning and cognitive development, as well as to discover if language learning may be utilized to improve cognitive skills.

The paper will provide a thorough review of the research on language learning and intellect. It investigates the research methodology utilised in past studies, statistical computations, and results gained. The report also analyses the limits of current research and offers suggestions for future investigations.

The study looks at the research's practical implications including any potential advantages of language acquisition for individuals and society as a whole. The overall goal of this research is to improve knowledge of the link between language acquisition and cognition, as well as to provide useful information to researchers, educators, and language learners.

In general, learning many languages is important for a variety of reasons. First and foremost, it exposes people to a diverse variety of cultures, increasing their awareness and respect for various points of view, beliefs, and traditions. This might lead to improved communication and social skills, as well as better empathy and understanding for others. Second, the ability to speak many languages may open up new professional opportunities in the worldwide job

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market. Many organizations and agencies value employees who can successfully communicate in many languages. Third, studies show that studying various languages helps boost cognitive capacities such as memory, attention, and problem-solving ability. It can also delay the onset of cognitive impairment caused by ageing (Bialystok, 2021).

METHODS

Samples

A sample was drawn from the population. 111 students participated in this study. 63 males and 48 females took the general mental ability test. From the male sample around 26 of them were monolingual while 37 men were multilingual. From the female sample, there were 32 monolingual females and 16 multilingual females respectively. The sample was drawn mainly from the city of Dehradun, Uttarakhand, India.

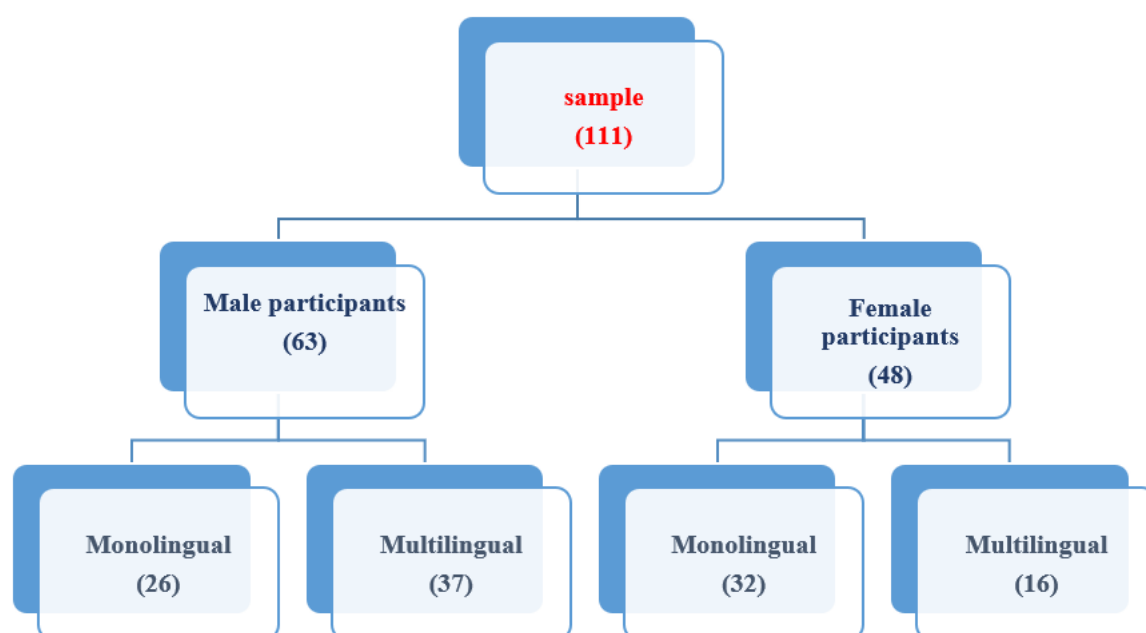


Figure 1- Sample Structure

Measures

Drs. K. S. Misra and S. K. Pal created the questionnaire employed in the current study as a general IQ test. 1990 was the year. Six brief test parts with ten questions each make up the questionnaire. Multiple-choice questions are present. The participant is required to select the best response.

Each subtest's number of ticks should be counted, and the individual subtest scores should then be totaled up to produce a composite result. Scores can be between 11 and 55. An IQ below 70 is considered as extremely low while IQ between 85 and 115 is considered average. IQ above that is gifted. The test is both reliable and valid. Reliability in the original study was found out to be 0.95 while the criterion validity came out to be 0.68.

Procedure

The sample was chosen from the population using the purposeful sampling approach. The term "purposeful sampling" refers to a group of non-probability sampling techniques where units are selected for your sample depending on the presence of particular characteristics. A sample of the population was requested to complete the Google form after being provided it.

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Data for the current research was collected through online mode. A Google form of the 'general mental ability test' was made circulated among the research participants using different social media platforms and emails options such as Whatsapp, Telegram etc. Online data collection requires less time and is cost efficient. People speaking either one or multiple languages were provided with the online link and were asked to fill it. The participants for this study were males and females between the ages of eighteen to twenty-five. Ethical guidelines were followed and confidentiality of the responses were maintained.

Statistical Analysis

Statistical analysis of the present study was calculated using the t-test with two tailed null hypothesis and 0.05 level of significant.

RESULTS

Table 1 for difference between monolingual and multilingual

| Groups | Mean | N | SD | Df | t-Value | Significance level |
|--------------|--------|----|------|-----|---------|--------------------------|
| Monolingual | 101.12 | 58 | 4.69 | | | Result is significant at |
| Multilingual | 107.07 | 53 | 5.63 | 109 | 6.06 | 0.05 level |

Table 1.0 shows the mean value of monolingual individuals – 101.12 and the mean value of multilingual individuals – 107.07 in regard to their intelligence level and the standard deviation came out to be 4.69 and 5.63 respectively. The table shows t-value 6.06 which is higher than the critical value ($6.06 > 1.98$) with 109 degree of freedom which is statistically significant. Hence, there is a significant difference in the intelligence level of monolingual and multilingual individuals. The hypothesis "There is no significant difference in the intelligence level of monolingual and multilingual individuals" has been rejected.

Table 2 for difference between monolingual and multilingual males

| Groups | Mean | N | SD | Df | t-Value | Significance level |
|--------------------|--------|----|------|----|---------|-------------------------------------|
| Monolingual Males | 101.46 | 26 | 4.08 | 61 | 4.95 | Result is significant at 0.05 level |
| Multilingual Males | 108 | 37 | 5.62 | | | |

Table 2.0 makes it clear that multilingual males have higher mean and standard deviation than monolingual males. Monolingual males have a mean and standard deviation of 101.46 and 4.08. On the other hand multilingual males have the mean and standard deviation of 108 and 5.62 respectively. The t-value is greater than the critical value $4.95 > 1.98$ with degree of freedom. So, there is a significant difference in the intelligence level of monolingual males and multilingual males. Thus, the null hypothesis has been rejected.

Table 3 for difference between monolingual and multilingual females

| Groups | Mean | N | SD | Df | t-Value | Significance level |
|--------------------|-------|----|------|----|---------|-------------------------------------|
| Monolingual Males | 100.4 | 32 | 3.97 | 46 | 4.07 | Result is significant at 0.05 level |
| Multilingual Males | 106 | 16 | 5.35 | | | |

Table 3.0 makes it clear that multilingual females have higher mean and standard deviation than monolingual females. Monolingual females have a mean and standard deviation of

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100.4 and 3.97. On the other hand multilingual females have the mean and standard deviation of 106 and 5.35 respectively. The t-value is greater than the critical value $4.07 > 1.98$ with degree of freedom. So, there is a significant difference in the intelligence level of monolingual males and multilingual males. Thus, the null hypothesis has been rejected.

DISCUSSION

Intelligence is the capacity for thought, experience-based learning, problem-solving, and situational adaptation. Since intelligence affects a wide range of human activities, it is significant. General intelligence (g), according to psychologists, is the concept that encompasses all of the individual variances in intellect (Ackerman, 2022; Selivanov, 2019). General intelligence is also referred to as general factor, or g factor. General intelligence refers to a wide range of mental abilities that influence performance on various cognitive ability tests. Other terms used interchangeably include intelligence, i.e., general intelligence, general intelligence function, general cognitive function, general mental ability, etc (Gajewski et al., 2023).

The general mental ability underpins specific mental abilities related to areas like spatial abilities, numerical abilities, mechanical abilities, verbal abilities, etc. We can describe general intelligence as a construct made up of multiple cognitive talents since general intelligence influences performance on every cognitive task. People can learn and solve issues thanks to these qualities.

Using factor analysis, a statistical technique developed by psychologist Charles Spearman, and researchers can use a variety of test items to compare common abilities. For instance, Spearman found that people who scored well on questions that measured vocabulary also performed better on questions about reading comprehension (Michell, 2023). In 1904, Spearman proposed that this g factor contributed to overall performance on tests of mental ability. "People can and often do excel in some areas," he wrote, "but those who excel in one area tend also to excel in other areas" (Anuniação, 2018). Spearman's general intelligence or "g" is inextricably linked to specific abilities or "s" to a certain extent. All intelligence tests, verbal and mathematical, were affected by this fundamental g factor in some way.

40% to 80% of variation in IQ comes from genetics. Overall, heredity rather than environment is more important in the development of IQ disparities between people (Sternberg, 2019). Education raises intelligence, and environmental factors like poverty have an impact on it (Ilardi et al., 2023).

Since psychologists have been interested in intelligence for a long time, extensive research has been conducted to comprehend this complex and diverse idea.

The IQ (intelligence quotient) test is one of the first and most widely used tests of intelligence. A variety of capabilities, including verbal, spatial, and logical reasoning abilities, are measured by this test. However, IQ tests have come under question for their racial prejudice and their constrained view of what constitutes intelligence. The Wechsler Adult Intelligence Scale, the Cattell Culture Fair Intelligence Test, and the Kaufman Assessment Battery for Children are further IQ tests (Holden & Tanenbaum, 2023).

Some scientists have looked into how biology and genetics relate to intelligence. For example, research on twins and families indicates that IQ may have a hereditary component.

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However, the specific genetic processes that underpin intelligence remain poorly known (Haier, 2019).

Environment-related factors like as socioeconomic status, nutrition, and education have been linked to intelligence. For example, children raised in poverty frequently have lower IQ scores than their more affluent peers. Emotional intelligence is the capacity to recognise, interpret, and regulate one's own and others' emotions. Emotional intelligence has been compared to other forms of intelligence, and academics have explored how it influences leadership and academic achievement, among other outcomes. (D'Amico & Geraci, 2023; Trosman, 1978). Although creativity and intellect are often considered independent concepts, several scholars have investigated the relationship between the two. According to (Weiss et al., 2020), Some studies have shown a correlation between creativity and intelligence, whereas others (Holland et al., 1965) have found no connection.

Overall, the study of intelligence is a challenging and ongoing field of psychological research, with various unsolved questions and conflicts among specialists on the best effective ways to define, measure, and grasp this construct.

This article compares and analyses the differences in cognition levels between monolingual and bilingual individuals. The first hypothesis is the null hypothesis, which states that there is no difference in intelligence level between monolingual and multilingual persons. The findings of table no. 1 shows the mean value of monolinguals to be 101.12 while the mean value of multi-linguals came out to be 107.07 in regard to their intelligence level. The table shows t-value to be 6.06 which is higher than the critical value of 1.98, hence it can be inferred from the data of table- that there was a substantial difference in the groups' IQ levels when the t-test was calculated using the scores from both groups. I.e. monolinguals and multi-linguals.

The second hypothesis contends that the intellect levels of monolingual and bilingual males do not differ significantly from one another. Results portray the difference in the intelligence levels of multilingual and monolingual men. Multilingual men had the mean value of 108, on the other hand monolingual men had a mean value of 101.46 respectively. The t-value again came out to be greater than the critical value i.e., $4.95 > 1.98$, meaning the level of intelligence of multilingual men was slightly higher than monolingual men, a substantial difference between the males of both groups became apparent.

The third and final hypothesis, which is also a null hypothesis, asserts that there is no distinction between monolingual and multilingual females in terms of intellect level. Results showcases the difference in the intelligence level of monolingual and multilingual females. Monolingual females had a mean of 100.4 and multilingual females had a mean of 106 respectively. Again, the t-value came out to be greater than the critical value i.e., $4.07 > 1.98$. Hence, it can be interpreted that the intelligence levels of multilingual females is greater than that of monolingual females. The t-test results and score analysis once more revealed a substantial difference between the intellect levels of monolingual and bilingual females.

Research findings repeatedly show that multilingual individuals have better IQ scores than their monolingual counterparts. This pattern holds for both sexes, with bilingual males and females having higher mean IQ scores than their monolingual counterparts. These findings highlight the potential cognitive benefits of multilingualism. This illustrates that learning a

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new language at a young age or later in life can improve cognitive development. It has a distinct influence on how we think, reason, understand, and solve issues.

Undoubtedly! Learning a new language, whether at an early age or later in life, can significantly improve cognitive growth. It has an impact on several cognitive functions, such as reasoning, thinking, interpretation, and problem solving. This effect has an impact on both how we see the world and how we navigate and resolve tough circumstances.

Language acquisition and multilingualism have been closely associated with cognitive development. Learning and utilizing languages requires a variety of cognitive processes, including memory, attention, problem-solving, and executive function. People engage in language learning, they exercise these cognitive skills, which can lead to improve overall cognitive capabilities.

Additionally, language production (writing or speaking) and language comprehension (reading or listening) are distinct cognitive processes requiring different parts of the brain. For example language production often requires portions of left hemisphere of the brain, such as Broca's area, but language comprehension relies on areas such as Wernicke's area. Bilinguals have a better capacity to recognize and comprehend metaphors than monolinguals, which might be attributed to the improved cognitive flexibility and inventiveness required when employing two languages (Meier & Pinker, 1995). Individuals that actively engage these brain areas during language learning stimulate neural networks responsible for language processing and cognitive functioning. In 1962, Elizabeth Peal and Wallace Lambert found that children who are multilingual had higher cognitive flexibility and problem solving capability than children who were monolingual. Additionally, bilingual people were better at resolving conflicts and decisions making than monolingual individuals (Moskowitz & McNeill, 1972; Peal & Lambert, 1962).

The study's findings suggest that while gender differences may not have a significant influence on cognitive skills, multilingualism may. This supports the idea that the cognitive benefits of multilingualism are gender-neutral. Language acquisition has a substantial impact on cognitive development regardless of gender, since multilinguals have higher average intelligence levels than monolinguals.

Overall, the study highlights the relevance of language learning in improving cognitive abilities and concludes that being multilingual has considerably cognitive benefits.

Researchers can achieve insights into the cognitive mechanisms behind language learning as well as the larger implications for cognitive development by studying the link between language acquisition and intelligence.

Study Limitation

An essential shortcoming of this article is the sample size selected from the population and the idea that the population was only confined to the northern part of India. The current study was done only on two variables. For more authentic observation and findings, socioeconomic status, culture, family conditions, etc. should also be taken into account. Moreover, as the data was collected using the online mode, it is possible that participants filled the questionnaire without taking it seriously.

CONCLUSION

The objective of this study was to investigate the influence of language acquisition on an individual's IQ. Monolingual individuals speak only one language, bilingual individuals speak two languages, and multilingual individuals speak multiple languages. The findings indicate that learning multiple languages indeed has a notable effect on an individual's IQ. The study encompassed a total of 111 participants, comprising 63 males and 48 females. Two distinct groups were established for the examination. The first group comprised 32 females and 26 males, while the second group consisted of 16 females and 37 males. In this study, the data reveals a higher participation rate of males compared to females. The impact of learning multiple languages on an individual's intellect level was investigated using a self-administered test created by Drs. K. S. Misra and S. K. Pal in 1990. The questionnaire is divided into five tests with ten questions each. There were no positively or negatively framed questions, nor was there a scoring system in place. The questionnaire consisted solely of right or wrong answers. The IQ range within the questionnaire spans from 11 to 55. A score of 11 points would correspond to an IQ of 63, categorized as below average, while a score of 55 points would equate to an IQ of 143, which is exceptionally rare and indicative of genius-level intelligence. The lowest score achieved by a participant was 24, suggesting an IQ of 87, while some participants scored 42, indicating an IQ of 119. All three of our hypotheses were rejected at a 95% level of significance. Consequently, the results unmistakably demonstrate that learning and speaking multiple languages positively influence an individual's intelligence level. But it's worth noting that there could be various other factors contributing to higher intelligence levels in individuals, such as socioeconomic status, family background, level of education, environmental factors, genetics etc.

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Conflict of Interest

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