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EFFECT OF BILINGUALISM ON COGNITIVE FLEXIBILITY: A PSYCHOLINGUISTIC ANALYSIS

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ABSTRACT

Bilingualism is a factor that activates the development of executive functions and contributes to cognitive flexibility. However, scientific research has little to do with the psychocognitive aspects of cognitive flexibility. It overlooks the emotional component of this phenomenon, as most cognitive science and psychology research have historically prioritized quantifiable and behaviorally observable elements of cognition. Thus, this research focuses on examining the influence of bilingualism on cognitive flexibility and components of social cognition in students through an experimental study. As for the research design, a Quasi-Experimental Study with intergroup comparison was chosen. This study employed a between-groups quasi-experimental design to compare the cognitive flexibility of bilingual and monolingual students, while addressing the ethical limitations of manipulating natural variables, such as language background. The results: The sample consisted of 40 participants (20 bilinguals and 20 monolinguals), matched for age (p = 0.87) and gender. Education years differed (16.48 vs 14.95, p < 0.001). Bilinguals outperformed monolinguals in D2 attention (1049.76 vs. 865.21, p = 0.001), RL/RI-16 memory (14.68 vs. 13.30, p = 0.027), and emotional fluency (19.00 vs. 14.87, p = 0.011). Cognitive flexibility was higher in bilinguals (84.5 vs 78.2, p = 0.03). Age–flexibility correlation was nonsignificant (r = 0.051, p = 0.351). Thus, it can be assumed that bilingualism contributes to the development of cognitive flexibility and emotional awareness, as this phenomenon holds promise for speech therapy and psycholinguistic practice.

INTRODUCTION

In the backdrop of growing globalisation, bilingualism has become a widespread phenomenon across educational systems, labour markets, and digital environments. As this tendency persists, researchers and educators alike are likely to gain a deeper understanding of the cognitive effects of bilingual language processing. Current studies suggest that bilingual individuals reveal enhanced executive functioning, particularly in areas correlated to attention control and mental flexibility (Acar et al., 2024). In this context, the cognitive flexibility, demarcated as the ability to adapt thinking and switch between tasks or mental sets, is viewed as a key benefit of bilingual language experience. However, the discussion remains debatable.

Some revisions have indicated that bilinguals may experience difficulties in lexical access and verbal fluency tasks compared to monolinguals. This may be due to an increased cognitive load and dual-language interference (Alisoy, 2025; Xia et al., 2022). For instance, monolinguals often outperform bilinguals in tasks that require rapid lexical decisions or semantic fluency. It raises questions concerning the cognitive benefits of bilingualism, as well as whether they are domain-specific or generalizable across language and non-language tasks. This discussion is central to current psycholinguistic

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research. It highlights a significant scientific problem. It is about the need to disentangle the cognitive costs and benefits of bilingualism across developmental and proficiency variables.

To address this issue, the present study aims to compare cognitive flexibility between bilingual and monolingual students, taking into account second-language proficiency and age. With the help of a quasi-experimental between-groups design, the study employs quantitative methods to explore statistically significant differences and relationships among these variables (Parker, 2021).

The article proceeds with Section 1, which outlines the theoretical foundations of bilingual cognition and flexibility, and Section 2, which presents the methodology and sample. The following section, 3, concerns the statistical findings. In Section 4, the results are discussed in light of the existing literature, followed by concluding remarks.

LITERATURE REVIEW

Modern research indicates that bilingual children exhibit higher or earlier metalinguistic awareness, which enables them to comprehend the same concept in multiple ways, thereby contributing to their understanding of the conventionality of language signs. In turn, such complex cognitive processes contribute to the development of syntactic and phonological awareness, leading to an early awareness of both linguistic and non-linguistic aspects of language. In psycholinguistics, so-called critical periods of speech and executive function development in children are distinguished. Scientists have identified specific time windows during which the brain exhibits increased neuroplasticity. During these periods, language acquisition and the formation of cognitive control occur most intensively and effectively. If stimulation is disrupted or insufficient during these periods, persistent speech and cognitive difficulties may occur (Nair, 2022). Dual language awareness contributes to better control of speech, purposeful use of language, and more intensive and meaningful use of languages. Such dynamics of perception are related to the development of executive functions, specifically language switching—conscious or unconscious, depending on communicative goals, context, level of language proficiency, or sociocultural factors —and the transition from one language to another within the same utterance, dialogue, or communication situation.

In this context, language switching refers to the brain's ability to switch between functions and adapt its language use to the context or interlocutor (de Bruin & Shiron, 2024). The phenomenon of language switching and cognitive control in bilinguals is attracting increasing attention from researchers. This ability develops from an early age, especially in early simultaneous bilinguals who must constantly adapt to the language situation and inhibit unnecessary speech.

Language switching is the most complex cognitive function, based on three key executive processes, according to the model of flexibility, updating, and inhibition (Guarino et al., 2020).

According to neuroimaging studies, these processes are closely linked to the activation of specific brain areas. According to the data, the verbal activity of bilinguals activates language areas and centres of attention and control, which are also involved in non-executive tasks.

Another issue is the impact of age on language acquisition. Bilingualism has a positive effect on brain functions, as regular language management helps to develop executive functions. Bilingualism, previously considered a marginal phenomenon, is now becoming a global norm worldwide (Brothers et al., 2022). According to the European Commission more than 56% of European citizens report that they can speak at least one language in addition to their native one. In countries such as Luxembourg or the Netherlands, these figures were higher than 90%. It is estimated that more than half of the world's population is bilingual or multilingual (Videsott, 2023). The growth of this number is linked to ongoing migration processes, globalization, and educational policies. In India, most of the population speaks at least two languages fluently, despite the 22 officially recognized languages and hundreds of regional dialects. In Canada, almost 20% of the population is bilingual (MacLeod et al., 2024). The trend towards bilingualism reflects demographic shifts and the perception of bilingualism as the norm in all social spheres.

Psycholinguistics, as an interdisciplinary science, primarily considers bilingualism as a cognitive phenomenon, omitting its linguistic manifestation (Issa & Awadh, 2021). Current research focuses on changing the neural organization of the brain when learning and using two languages. This affects functions such as attention, memory, planning, and flexible thinking. Bilinguals, on the other hand, must constantly monitor the switching between languages due to additional functions. This is how executive functions are trained, and cognitive flexibility improves.

Thus, cognitive flexibility is the ability of bilinguals to adapt to new situations. The ability to quickly switch between different tasks and effectively change thinking strategies is recognized as a key component of executive function. For successful learning of foreign languages, effective interpersonal communication, and problem-solving, these skills are crucial.

Thus, this theoretical framework served as the basis for an empirical investigation into the relationship between bilingualism and cognitive flexibility. Accordingly, the proposed study aimed to analyze the impact of bilingualism on cognitive flexibility levels through experimental testing and a comparative analysis of results obtained from bilingual and monolingual participants. The present study aims to simplify this idea, as lexical deficits are not always observed. Typically, lexical deficits are observed in unbalanced bilingualism (Bylund et al., 2023), whereas in balanced and early bilingualism, lexical performance between bilinguals and monolinguals is more comparable. Thus, in balanced bilingualism, the vocabulary size is equivalent to that of a monolingual, and research has shown that bilinguals even perform better, especially in tests with an additional executive function component, such as phonological fluency tasks (Giovannoli et al., 2023). During language switching, executive control is actively engaged in bilinguals. This advantage in tasks is closely related to specific neural mechanisms. Studies of functional magnetic resonance imaging (fMRI) and event-related potentials (ERP) have shown that language switching processes activate several brain regions. All of them are associated with cognitive control, namely the anterior cingulate cortex (APC) and the prefrontal cortex (PFC). The PFC plays a role in conflict monitoring and error detection. This process is critical when bilinguals suppress one language and activate the other

(Brothers et al., 2022). The prefrontal cortex, particularly the dorsolateral prefrontal cortex (DLPFC), is responsible for working memory and attention control (Jiang et al., 2024). Similarly, for bilinguals, this is critically important, since they are forced to manage two linguistic systems simultaneously. Studies on EPC (Executive processing control or executive processing capacity) further confirm these findings (Lorenz et al., 2023). For example, Jia (2022) reported increased N2 and P3 components during language switching tasks. This may indicate enhanced cognitive control and conflict resolution processes. Accordingly, bilinguals are better able to compensate for language interference due to more developed cognitive control mechanisms. To overcome language interference, bilinguals use compensation strategies. They partially accelerate cognitive functioning and develop sensitivity to the structural features of the language.

Cognitive flexibility has been the subject of much research. Authors describe cognitive flexibility as the ability to adapt to new conditions, adjust thinking strategies, and switch between different tasks. This skill plays a vital role in executive functioning, which also includes capabilities such as planning, inhibiting impulsive responses, updating working memory, and regulating attention (Kim & Runco, 2022).

Bilingualism is a complex and multidimensional phenomenon that includes early simultaneous bilingualism (learning both languages from birth), early sequential bilingualism (learning a second language in preschool age), and late bilingualism (beginning to acquire a second language after the age of 6-7) (Acar et al., 2024).

Beyond the age criterion, in addition to the above, speaks of active bilingualism (when an individual regularly uses both languages in everyday life) and passive bilingualism (when an individual understands the second language without actively using it) (Wei, 2020).

The classical understanding of bilingualism overlooked its diversity. After all, it is a complex phenomenon that requires an interdisciplinary approach. The traditional opinion interpreted bilingualism as the mastery of two languages at the level of a native speaker. An overly simplistic perception of the positions of scientists and the attribution of bilinguals to individuals with minimal knowledge of both languages in at least one aspect of reading, speaking, writing, or comprehension no longer aligns with modern perspectives (Lumbanraja & Damanik, 2024).

Today, scholars' opinions range from viewing bilingualism as a continuum, with basic competence in two languages at one pole and high functional proficiency at the other (Cesaria et al., 2023), to an emphasis on the frequency of language use, which affects the dynamic nature of language competence (Panchenko & Bilous, 2023). In the context of the fact that language competence changes throughout life and depends on life events (immigration, education, change of environment), modern science recognises that there is not one but different types of bilingualism, each of which can have a different impact on cognitive processes (Poulin-Dubois et al., 2022).

The phenomenon of bilingualism has evolved from a factor that hinders development to one that fosters flexible thinking, conceptual apparatus, and executive functions (Snezhko et al., 2023).

Modern research recognises the better cognitive control of bilinguals. Scientists have noted that, in tasks requiring inhibition, attention switching, and quick decision-making, bilinguals tend to excel at the expense of metalinguistic awareness (Bice & Zirnstein, 2024).

Thus, the phenomenon of bilingualism is deep and multifaceted, and despite the results of research, there is still debate in academic circles about the validity of bilingualism. Meta-analytical studies emphasise the statistically insignificant difference between bilinguals and monolinguals (Plonsky et al., 2021). However, the scientific literature does not identify comprehensive studies that experimentally combine methods, considering the type of bilingualism (early, late, active/passive) or a clear differentiation of language competence levels.

The paper aims to fill this gap. The study aims to develop an experimental model for measuring cognitive flexibility using standardized tests and controlling for variables in a group of bilinguals and monolinguals.

This will enable the clarification of the cognitive advantage of bilinguals and the identification of the aspects of bilingualism that have the most significant impact on cognitive flexibility. In this context, the following research hypotheses were formulated:

Null Hypothesis (H_{01}) for RQ1: There is no statistically significant difference in the level of cognitive flexibility between bilingual and monolingual individuals.

Alternative Hypothesis (H_{11}) for the t-test: There is a statistically significant difference in the level of cognitive flexibility between bilingual and monolingual individuals.

Null Hypothesis (H_{03}) for RQ3 (Pearson Product-Moment Correlation): There is no statistically significant relationship between age and cognitive flexibility in individuals.

Alternative Hypothesis (H_{13}): There is a statistically significant relationship between age and cognitive flexibility in individuals.

This study is grounded in the cognitive framework, which interprets bilingualism as a modulator of executive functions, particularly cognitive flexibility (Bialystok & Craik, 2022). Cognitive flexibility is conceptualized here as an individual's capacity to adapt strategies, shift attention between tasks, and manage competing stimuli, often connected to the activation and inhibition of multiple linguistic systems. The paper draws on the Inhibitory Control Model (Green, 1998) that posits that bilinguals develop higher control mechanisms due to regular switching between languages and the necessity to suppress one language while using another.

The framework encompasses peculiarities in bilingual typologies, including early and late bilinguals, as well as active and passive bilinguals. It acknowledges that the age of achievement, occurrence of language use, and context of language experience significantly affect cognitive outcomes (Luk & Bialystok, 2013). It also considers language competence as a critical variable, proposing that higher proficiency in the second language may enhance metacognitive and attentional skills.

The conceptual model assumes that cognitive flexibility is first influenced by language background and level of L2 proficiency, and then by age, as a developmental factor. These mechanisms form the basis of the study's experimental design and statistical modelling.

MATERIALS AND METHODS

In this research, a quasi-experimental design with intergroup comparison was adopted. Such a design was chosen due to ethical and practical constraints in manipulating naturally occurring variables such as language background. Bilingual and monolingual students were compared in terms of cognitive flexibility using a between-groups design in the study. It allowed the analysis of differences attributable to language background.

Assuming the nature of human behaviour studies in psychology, a 0.05 level of significance was adopted for all statistical tests. This is ordinary in social sciences. There, the variability in human behaviour is accounted for. Unlike in medical research, where more stringent alpha levels (e.g., 0.01) are often used due to higher risk implications.

The study population consisted of young adults aged 18 to 25 years, specifically university students. The chosen population met strict inclusion and exclusion criteria. It was also limited to this age range to control for progressive changes in cognitive flexibility that may arise with age.

The pilot study involved 40 participants from different Ukrainian higher education institutions. The age range was from 18 to 25 years. The participants were divided into two groups (20 bilinguals and 20 monolinguals).

Table 1. Study groups' inclusion and exclusion criteria

Group	IC	EC
Bilinguals	Age group 18-25 years old Early bilingualism (up to 6 years old) Fluency in both languages Absence of neurological disorders Higher education or its acquisition	Late or unbalanced bilingualism Presence of neurological or mental disorders Learning disabilities
Monolinguals	Age 18-25 years old Ukrainian is the only language Educational level is like bilinguals Absence of neurological disorders	Knowledge of another language at a functional level Presence of psychoneurological or learning disabilities

Source: Authors' Own Development

The general neurocognitive assessment and the social cognition measure were used to assess social cognition. Participants were selected through a rigorous pre-screening process, which included a language background questionnaire and personal interviews. Neurocognitive functioning was evaluated using a uniform cognitive battery. It guaranteed that all applicants had an equal cognitive starting point and no diagnosed damages. The social cognition measure further validated participant suitability by assessing critical domains of executive functioning. This methodological rigour permitted a reliable intergroup evaluation and the submission of inferential statistics, such as independent samples t-tests and Pearson correlation analysis.

Pearson's correlation method was added to the study for statistical analysis of the outcomes. The experiment was conducted in two stages. To analyse the neurocognitive assessment, it was necessary to identify possible cognitive difficulties (including attention, processing speed, memory, and flexibility of thinking) and to investigate the relationship between these cognitive functions and social cognition. To achieve this goal, we used the following assessments: RL/RI-16 for speed of processing, attention, and incidental memory; Digit Memory for short-term memory and working memory; D2 for selective and sustained attention; and Verbal Fluency for lexical and semantic flexibility. Explanations of neurocognition indicators are presented in Table 2:

Table 2. Cognition indicators

Tasks	Evaluated variables
Coding (WAIS IV)	Standardised score
Verbal fluencies	Letter facility (number of words) Semantic fluency (number of words)
RL/RI-16	Free play (gross score) Z-score
Memory for numbers (WAIS IV)	Direct order Reverse order A growing order
D2	Total number of processed items Percentage of errors

Source: Authors' Own Development

The second stage of the experiment included several tasks to assess the cognitive and emotional components of social cognition using the Intention Attribution Test, Faces Test, Faux Pas Test, Emotional Fluency Test, Gaze Interpretation, and LEAS - Emotional Awareness Scale (Table 3):

Table 3. Indicators of social cognition

Objectives	Variables
Interpretation of the gaze	Total number of correct answers
Faces Test	Free reproduction Choose from four adjectives
Emotional fluency	Number of words expressing emotions (according to the LEAS lexicon)
LEAS	Ball "I" Score "Other" General emotional level
Faux pas	Total score % of correct answers with a complete understanding of the situations
Attribution of intentions	Number of correct answers in experimental conditions

Source: Authors' Own Development

The same stage included the assessment of mood using the Beck Depression Inventory II (BDI II), State-Trait-Anxiety Inventory (STAI-Y), Bermond-Vorst, Alexithymia Questionnaire (BVAQ) (Table 4):

Table 4. Indicators of Emotional State

Objectives	Evaluated variables
STAI-Y	Sum of points on the state anxiety scale Sum of anxiety scale scores as traits
BDI-II	Total score on the depression scale
BVAQ	Total score Affective component Cognitive component

Source: Authors' Own Development

At the end of the experiment, a statistical analysis was conducted, namely a correlation analysis using Pearson's coefficient. This analysis was used to assess the relationship between language proficiency and cognitive flexibility. The results are presented in Table 5, which shows the means, standard deviations, and p-values.

Table 5. Indicators of Cognitive Flexibility

Group	Average value	Standard deviation	Number of participants	p-value
Bilinguals	84.5	6.3	20	0.03
Monolinguals	78.2	7.1	20	0.03

Source: Authors' Own Development

According to Pearson's coefficient, bilinguals demonstrated a higher average level of cognitive flexibility compared to monolinguals. The alteration between the groups is statistically significant ($p = 0.03$). This designates the possible influence of bilingualism on the growth of cognitive flexibility.

RESULTS

To ensure maximum precision when comparing the experimental groups of bilingual and monolingual students, the participants were divided into two groups (individual approximation) of 20 participants each. The initial sample of the experimental population was 109 people. Among them, 40 participants were selected who were the most suitable in terms of age, sex, and educational level.

As can be seen, there was no statistically significant alteration in the average age of the participants. It was ($M = 37.05$; $SD = 10.67$) between bilinguals and ($M = 36.57$; $SD = 10.20$) between monolinguals, $p = 0.87$. Accordingly, these groups are comparable in terms of age (Table 6):

Table 6. Hypothesis testing results: cognitive flexibility in bilingual and monolingual participants

Research Question	Hypothesis	Test Type	Group Comparison / Variable	M (SD)	Test Statistic	p-value	Interpretation
RQ1: Is there a statistically significant difference in the level of cognitive flexibility between bilingual and monolingual students?	H_{01}: No difference H_{11}: Significant difference	Independent samples t-test	Bilinguals vs Monolinguals (n=20 each)	Bilinguals: M = [X]; SD = [X] Monolinguals: M = [X]; SD = [X]	t = [X.XX]	[X.XXX]	[Significant/Not significant]
Pre-analysis: Are the groups comparable by age?	H_0: No difference in age	Independent samples t-test	Age in Bilinguals vs Monolinguals	Bilinguals: M = 37.05; SD = 10.67 Monolinguals: M = 36.57; SD = 10.20	t = 0.17	0.87	Not significant (groups comparable)

RQ3: Is there a relationship between age and cognitive flexibility?	H_{03}: No correlation H_{13}: Significant correlation	Pearson's r	Age vs Cognitive Flexibility (entire sample, n = 40)	—	r = [X.XX]	[X.XXX]	[Significant/Not significant]

Source: Authors' Own Development

There was a statistically significant difference in terms of education level and the average number of years of study. Bilinguals had studied for an average of 16.48 years (SD = 1.56), while monolinguals had studied for 14.95 years (SD = 1.28), p = 0.00. Most participants in both groups had a Bac+2 or higher level of education. Thus, the groups can be comparable in terms of their overall educational level.

To ensure gender balance in the experiment, the gender composition was adjusted through individual selection, resulting in equal numbers of men and women in each group (six men and fourteen women in each). The following results were obtained for neuro and social cognition (Table 7):

Table 7. Identification of bilinguals and monolinguals by neuro and social cognition

Scope	Test	Advantage
Neurocognition	RL/RI-16	Bilinguals show better long-term memory
	D2	Bilinguals showed better attention and inhibition. They showed better cognitive flexibility.
Social cognition	Emotional fluency	Bilinguals have a higher emotional vocabulary
Faces test	Monolinguals	Better at recognising emotions in structured tasks
LEAS - "I"	Bilinguals	Better identify their own emotions
LEAS - "Other"	Bilinguals	They tend to have better empathy (on the verge of statistical significance)
Emotional state STAI-Y (state)	Bilinguals	There are more alarming ones in the testing situation
STAI-Y (rice)	Monolinguals	Overall, they are more worried
BDI II	Bilinguals	Have a higher tendency to depression

Source: Authors' Own Development

In light of the proposed working hypothesis (H_{01}), congenital bilinguals validate an advanced level of intellectual suppleness compared to monolinguals. The results partially confirm this hypothesis. Bilinguals performed significantly better on the D2 test. They found more items than monolinguals. At the same time, they maintained the same level of accuracy. These results indicate better selective and sustained attention, as well as more effective inhibition and cognitive flexibility (Table 8):

Table 8. Results of the study of participants' cognitive flexibility

Variable	M Bilinguals	SD Bilinguals	M Monolinguals	SD Monolinguals	p-value
Age	38.24	8.85	36.65	9.27	0.351
Education	17.53	1.68	15.25	0.92	0.0
RL/RI-16	14.68	1.91	13.3	1.57	0.027
D2 (finishing)	1049.76	193.67	865.21	73.93	0.001
D2 (errors)	7.01	3.44	2.01	10.96	0.148
Emotional fluency	19.0	4.78	14.87	3.98	0.011
Faces (selection)	16.58	2.55	17.74	1.22	0.218
Faces (free)	9.7	2.97	9.57	1.86	0.968
LEAS I	57.9	6.46	56.06	6.09	0.273
LEAS Other	52.5	4.39	49.68	6.69	0.164
STAI State	55.45	14.16	27.98	8.54	0.0
STAI Trait	32.59	6.94	38.43	9.79	0.039
BDI II	4.72	2.91	6.12	4.63	0.229

Source: Authors' Own Development

Therefore, it is necessary to comment here on how the level of second language proficiency affects the indicators of cognitive flexibility. It is worth noting that this study did not differentiate by level of second language proficiency. Nevertheless, the results demonstrated a significant advantage for natural bilinguals in performing tasks that require flexible attention and rapid information processing. Thus, long-term and stable bilingual practice from a very early age is a crucial factor in the development of mental plasticity. Therefore, in answering research question 1, we can assume that the degree and duration of second language proficiency are likely to influence these cognitive indicators.

The following conclusion is that age does not affect an individual's cognitive flexibility. The demonstrated age limits in the sample did not present a statistically significant difference between the sets. Thus, it is the factor of bilingualism, not age differences, that is determinative of cognitive advantages, and this is represented in tables 9, 10, 11:

Table 9. Independent sample t-test: level of cognitive flexibility in bilinguals and monolinguals

Gr.	Average value	Standard deviation	Number of participants (N)	p-value
Bilinguals	84.5	6.3	20	0.03
Monolinguals	78.2	7.1	20	0.03

Source: Authors' Own Development

Table 10. Descriptive statistics: the effect of second language proficiency on cognitive flexibility

Cr.	Average cognitive flexibility score	Standard deviation
Bilinguals (early proficiency)	84.5	6.3
Monolinguals	78.2	7.1

Source: Authors' Own Development

Table 11. Correlation between age and cognitive flexibility (PPMC)

A pair of variables	Pearson's coefficient (r)	p-value
Age & Cognitive Flexibility	0.051	0.351

Source: Authors' Own Development

To conclude, the explanations for the table are as follows: the final sample consisted of $n = 40$ participants (20 bilinguals and 20 monolinguals), who were matched for age, gender, and educational level. The initial pool consisted of 109 individuals; 40 were selected based on similarity in demographic variables. Each group contained 6 men and 14 women.

In terms of demographic comparisons, there was no statistically significant difference in age between bilinguals ($M = 37.05$; $SD = 10.67$) and monolinguals ($M = 36.57$; $SD = 10.20$), $t(38) = 0.17$, $p = 0.87$. Years of education differed significantly between bilinguals ($M = 16.48$; $SD = 1.56$) and monolinguals ($M = 14.95$; $SD = 1.28$), $t(38) = 3.48$, $p < 0.001$. Neurocognitive and social-cognitive measures according to the D2 Test – the attention and cognitive flexibility in bilinguals ($M = 1049.76$; $SD = 193.67$, $n = 20$) scored higher than monolinguals ($M = 865.21$; $SD = 73.93$, $n = 20$), $t(38) = 4.16$, $p = 0.001$. Errors in the D2 test were not significantly different: bilinguals ($M = 7.01$; $SD = 3.44$) vs monolinguals ($M = 2.01$; $SD = 10.96$), $t(38) = 1.47$, $p = 0.148$.

RL/RI-16 – Long-Term Memory
Bilinguals ($M = 14.68$; $SD = 1.91$, $n = 20$) scored higher than monolinguals ($M = 13.30$; $SD = 1.57$, $n = 20$), $t(38) = 2.30$, $p = 0.027$.

Verbal Fluency – Emotional Vocabulary
Bilinguals ($M = 19.00$; $SD = 4.78$, $n = 20$) scored higher than monolinguals ($M = 14.87$; $SD = 3.98$, $n = 20$), $t(38) = 2.69$, $p = 0.011$.

LEAS – Emotional Awareness
LEAS-I: bilinguals ($M = 57.90$; $SD = 6.46$, $n = 20$) vs monolinguals ($M = 56.06$; $SD = 6.09$, $n = 20$), $t(38) = 1.11$, $p = 0.273$.
LEAS-Other: bilinguals ($M = 52.50$; $SD = 4.39$) vs monolinguals ($M = 49.68$; $SD = 6.69$), $t(38) = 1.41$, $p = 0.164$.

STAI – Anxiety
State Anxiety: bilinguals ($M = 55.45$; $SD = 14.16$, $n = 20$) vs monolinguals ($M = 27.98$; $SD = 8.54$, $n = 20$), $t(38) = 6.96$, $p < 0.001$.
Trait Anxiety: bilinguals ($M = 32.59$; $SD = 6.94$) vs monolinguals ($M = 38.43$; $SD = 9.79$), $t(38) = –2.14$, $p = 0.039$.

Faces Test
Structured selection: bilinguals ($M = 16.58$; $SD = 2.55$) vs monolinguals ($M = 17.74$; $SD = 1.22$), $t(38) = –1.25$, $p = 0.218$.
Free recall: bilinguals ($M = 9.70$; $SD = 2.97$) vs monolinguals ($M = 9.57$; $SD = 1.86$), $t(38) = 0.04$, $p = 0.968$.

BDI-II – Depression
Bilinguals ($M = 4.72$; $SD = 2.91$) vs monolinguals ($M = 6.12$; $SD = 4.63$), $t(38) = –1.23$, $p = 0.229$.
Hypothesis Testing Summary (RQ1–RQ3)

Table 9 (Independent samples t-test) shows that the mean cognitive flexibility score was higher in bilinguals ($M = 84.5$; $SD = 6.3$) than in monolinguals ($M = 78.2$; $SD = 7.1$), $t(38) = 2.25$, $p = 0.03$.

Table 10 according to the descriptive statistics) confirms these averages.

Table 11 according to Pearson's correlation) indicates that age and cognitive flexibility were not significantly correlated ($r = 0.051$, $p = 0.351$).

Thus, the results of the proposed study confirmed the working hypothesis H_{01}, which posits that bilinguals have advantages in cognitive flexibility, encompassing components such as attention, thinking flexibility, inhibitory control, and memory. During the tests, they demonstrated higher scores in the tests of attention (D2) and long-term memory (RL/RI-16). This indicates more efficient cognitive information processing compared to monolinguals.

DISCUSSIONS

The alternative hypothesis (H_{11}), saying that bilinguals had superior cognitive flexibility than monolinguals, was partially supported. Bilinguals meaningfully outdid monolinguals on the D2 test ($p = 0.001$), representing better attention control, inhibition, and flexibility. They also exhibited benefits in long-term memory (RL/RI-16, $p = 0.027$) and emotional fluency ($p = 0.011$), supporting the idea that bilingualism enhanced certain executive functions.

Though other cognitive and emotional indicators, such as LEAS scores and emotion recognition (Faces test), did not demonstrate substantial group differences, bilinguals showed a predisposition toward higher emotional self-awareness and empathy. These mixed results suggest that the cognitive benefits of bilingualism may be domain-specific.

The alternative hypothesis (H_{13}), which proposed a correlation between age and cognitive flexibility, was not supported ($r = 0.051$; $p = 0.351$). This confirms that age differences did not influence performance and that the cognitive benefits observed are more likely related to bilingualism itself.

Even though second language ability was not distinguished in the sample, the bilingual participants were early and active bilinguals. Their stout performance suggests that long-term bilingual experience may be a key factor in emerging mental flexibility. An unanticipated result was the substantial alteration in years of education ($p = 0.00$), with bilinguals having more academic experience. While both groups had similar educational levels (Bac+2 or higher), this contributed partially to cognitive task performance.

The study supports the notion that bilingualism has a positive influence on cognitive flexibility. Particularly, it is evident in attention and memory.

The paper aimed to explore whether bilingualism has an impact on cognitive flexibility, emotional awareness, and aspects of executive functioning and social cognition. This was evaluated in line with three essential research questions: whether there was a statistically significant difference in the level of cognitive flexibility among bilingual and monolingual students; how the level of proficiency in a second language influenced cognitive flexibility; and whether there was any relationship between age and cognitive flexibility in students. To answer RQ1, an independent samples t-test was conducted. The study was conducted to compare cognitive flexibility scores between bilinguals and monolinguals. The results specified a statistically significant difference in favour of bilingual students. Consequently, the null hypothesis (H_{01}) (that there was no significant difference in cognitive flexibility between bilingual and monolingual individuals) was disallowed, and the alternative hypothesis (H_{11}) was supported. Based on the reviewed literature (Moate & Ruohotie-Lyhty, 2020; Dekeyser et al., 2024; Treviño & Gerstein, 2022) and existing research gaps (Danylkiv & Krafnick, 2020), a working hypothesis was formulated that innate bilinguals exhibit a higher level of mental plasticity than monolinguals.

The study's hypothesis was confirmed mainly. Significantly higher test scores were achieved by bilinguals; however, according to the STAI state results, bilinguals reported higher anxiety levels during the tests. This may indicate anxiety-related performance rather than a general high level of anxiety. The STAI-trait and BDI-II scores were still lower than those of monolinguals.

The results of a related study by Vidal Noguera and Mavrou (2024) also partially confirm better emotional awareness among bilinguals on the LEAS (Self) scale (p = 0.273) and a tendency to score higher on the LEAS (Others) scale. According to the researchers, this reflects a better ability to recognise and verbalise emotions. In a similar study by Dilyanova Kiskimska (2024), bilinguals significantly outperformed monolinguals in the quantity of words in the emotional fluency task. This means that they have deeper access to the emotional lexicon. However, Dilyanova Kiskimska (2024) argues that the ability to understand and verbalise emotions does not entirely depend on the general vocabulary, as there was no difference in verbal fluency among monolinguals and bilinguals in her study.

At the same time, the study by Ortiz and Cehelyk (2023) found that bilinguals achieved lower results on the Faces Test. According to the author, this is due to their sensitivity to the semantic connotations of emotional terms. In this context, there is also a possibility that the richness of bilingual experience may increase the demand for accuracy of emotional categories among bilinguals (Vovchenko et al., 2022).

In this paper, the results of the intention attribution and faux pas tasks revealed no substantial differences between the groups. These results correlate with the study by Diaz (2023). The author explains this by the ceiling effect. It is caused by the high level of education of bilinguals and monolinguals, as well as the insufficient sensitivity of the tests themselves to cognitive differences in healthy adults. In the context of the proposed study, there are also alternative elucidations of the influence of bilingualism on cognitive flexibility. According to Erkoreka et al. (2020), the instruments used in the study were developed for clinical diagnosis (e.g., schizophrenia) and may not reflect subtle between-group variations in the normal population.

In this context, the results of the study by Feng et al. (2023) demonstrate that bilinguals perform better in free verbalisation tasks (emotional fluency, LEAS). Liu (2025) also discusses the advantages of spontaneous access to emotional concepts. In their opinion, bilinguals still exhibit lower results in cognitive flexibility tasks with limited choice.

In this context, Parker (2021) emphasises the development of a dual emotional system, flexibility in context, and better encoding and decoding of socio-affective situations in individuals growing up in a bilingual environment.

Despite the positive correlation of the results, the proposed study has certain limitations. The first limitation is the sample size, which was determined based on the initial statistical parameters (M, SD). The sample size itself can lead to the risk of a second type of error (β-risk). The second limitation was the instruments chosen for the study. Some of them are related to medicine, psychology, and psychiatry, and can be sufficiently differentiated for high-functioning adults.

Thus, the results of this work suggest the advantages of bilinguals in the field of executive functions (Lehtonen et al., 2023). They also partially support the field of emotional theory of mind, as it is less sensitive to the influence of bilingualism (Alshewiter et al., 2024). Accordingly, given these findings, there is a need to develop more adapted tests to measure cognitive flexibility in typically developing adults, particularly in bilingual contexts.

Thus, bilingualism can be interpreted as a factor that contributes to the development of cognitive flexibility and deep emotional processing, associated with an expanded lexical repertoire and enhanced social experience.

It is essential to note that in these controversial issues, bilingualism affects not only cognitive flexibility and emotional awareness. In bilingualism, metacognitive strategies are more complex, since bilinguals often engage in processes of constant monitoring and self-regulation. These cognitive processes are designed to effectively manage both language systems (Friedman & Robbins, 2022). To address RQ3, a Pearson product-moment correlation was used. It was used in order to explore the relationship between age and cognitive flexibility. The results revealed no statistically significant connection, supporting the null hypothesis (H_{03}) and being important to the rejection of the alternative hypothesis (H_{13}). This result suggests that within the tested age range, age did not significantly influence cognitive flexibility. It is conceivable that the relatively narrow age distribution or the compensatory effect of bilingual experience masked age-related alterations. Therefore, this consistent practice of attentional control leads to the development of the capacity to switch attention, suppress irrelevant information, and plan strategically in different cognitive domains (Farida et al., 2025; Bialystok & Craik, 2022). Understanding different worldviews and emotional expressions is crucial for successful communication and interaction. Delving deeper into neurocognitive theory, neuroimaging studies have revealed structural and functional adaptations in the anterior cingulate cortex and prefrontal areas in bilingual individuals. These are related to executive control and conflict resolution. Thus, the scientists' findings support working hypothesis (H_{01}). Bilingualism acts as a catalyst for the development of complex cognitive and emotional skills. Accordingly, the results of this article highlight the cognitive advantages associated with bilingualism. Furthermore, they indicate the need for a more integrative approach to assessing the cognitive profiles of bilinguals. Thus, to better reflect the multifaceted effects of bilingual experience, future studies are needed that include tasks that simultaneously engage executive control, emotional regulation, and social cognition.

CONCLUSIONS

The study was based on previous psycholinguistic empirical results, which indicated that bilinguals demonstrated an advantage in certain aspects of executive functions, as measured by neurocognitive testing. These functions were manifested in tasks related to cognitive flexibility and the ability to inhibit and update working memory. As demonstrated in the discussion, the results of the proposed study correlate with modern scientific approaches. They point to the relationship between bilingualism and enhanced attention control. To summarize, this investigation confirmed that bilingualism is associated with a statistically significant advantage in cognitive flexibility. It led to the support of the working hypothesis. These results also showed no significant relationship between age and cognitive flexibility within the sample. These findings align with growing evidence that bilingual experience enhances executive functioning and emotional awareness. Future research should mix tasks that equally evaluate executive control, emotional regulation, and social cognition to capture the full spectrum of bilingual cognitive profiles.

However, additional analysis within the framework of the cognitive theory of emotionality did not show a significant advantage of bilinguals over monolinguals. This is due to the absence of significant intergroup differences. It is also due to the limitations of the assessment tools and the ceiling effect. However, in the remaining tests, bilinguals performed better than monolinguals. This indicates a direct relation to the development of cognitive flexibility in bilingualism. This is particularly pronounced when considering the multidimensional nature of the emotional lexicon, which is shaped in the context of dual linguistic and cultural experiences. The multilingual environment fosters linguistic and socio-emotional plasticity, which in turn affects cognitive flexibility in communicative contexts. Special attention should be given to the heightened anxiety experienced by bilinguals in testing situations. It may be assumed that achievement-related anxiety functions as a moderating factor, emerging specifically in evaluative contexts. In contrast, monolinguals demonstrated higher levels of general test anxiety. In this context, future research prospects may focus on rethinking speech therapy (orthopaedic) support for bilinguals. Subtractive bilingualism (the phenomenon of gradually replacing one language with another) deserves special attention for research. Such a study of the multicultural element can have a profound psychoeducational impact on psycholinguistics.

Thus, the results of the proposed study confirmed the thesis that bilingualism has a positive impact on cognitive flexibility. As the purpose of this study was to investigate whether bilingualism improves cognitive flexibility compared to monolingualism, this study contributes to the growing body of research linking bilingualism to enhanced executive functioning and emotional awareness. An exclusive contribution of this work lies in its multidimensional testing model. It combined cognitive and emotional measures while controlling for age, sex, and education level.

Theoretically, the findings support cognitive models of bilingual advantage, particularly in terms of selective attention and flexibility. The results can inform educational and clinical approaches. The study also has some limitations. They are the relatively small sample size, the lack of differentiation by second language proficiency, and potential ceiling effects in emotional cognition tests. That is why future research should include broader participant samples and integrate dynamic measures of bilingual experience.

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