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# BILINGUALISM, AUDITORY STIMULATION, AND ATTENTION SWINGS IN UNIVERSITY STUDENTS

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**ABSTRACT:**
*In Peru, Spanish is spoken alongside 48 native languages, and many speakers of these languages currently attend universities. Additionally, increased access to mobile phones and laptops has fostered the habit of studying while listening to music among students. In this context, this study was conducted to determine whether bilingual students experience more or fewer attention fluctuations than their monolingual counterparts and whether studying while listening to music affects them. This research employs a quantitative approach, utilizing an experimental laboratory method. The study involved two groups of university students—one bilingual and the other monolingual—from five universities in the departments of Junín and Huancavelica, who voluntarily participated in the experiment. Attention fluctuations were assessed using a digital tachistoscope during a focused attention task. The experiment was conducted under two conditions: with and without auditory stimulation. The results indicated, among other findings, that there are no statistical differences in intragroup comparisons (with and without auditory stimulation). However, differences emerge when comparing bilinguals to monolinguals. In conclusion, studying while listening to music does not affect students' attention, whether bilingual or monolingual. Nonetheless, being bilingual appears to present a disadvantage compared to monolinguals, at least concerning attention fluctuations.*

**KEYWORDS**: Bilingualism, monolingualism, attention control, attention lapse, attention.

## 1) Introduction:

Attention is one of human beings' most important cognitive processes since it allows them to select, from among all the stimuli that reach the person, only some that will be the content of their memories, perceptions, or thoughts and ignore other stimuli (Añaños, 2010).

Attention allows consolidating action plans and programs for as long as necessary and permanently monitoring their results to sustain, modify, or suspend them (Luria, 1979).

In this sense, Tudela (1992) refers to attention as a mechanism that enables the control and regulation of conscious activity to achieve a specific objective. The author further notes that attention has a limited capacity, as it functions as a filter that restricts or prevents certain stimuli from passing through while allowing others to reach consciousness. (Treisman, 1960).

Attention has a series of characteristics such as amplitude (Añaños, 2010) which refers to the amount of stimuli that can be captured at the same time and the possibility of being better distributed among various tasks, which in Luria's proposal (1979) would constitute volume and distribution respectively. Selectivity (Añaños, 2010), refers to the possibility of ignoring certain stimuli and selecting others that will be the object of cognitive,

affective, or motor activity. Intensity, control, focus, and stability (Londoño, 2009) refer respectively to the strength of concentration on certain stimuli and the maintenance of said concentration based on the aim of the activity. Finally, a characteristic of attention is oscillation, which is precisely what allows us to move from one stimulus to another, whether voluntarily or involuntarily (Añaños, 2010), and which, in part, is contrary to the intensity, stability, control, and focus of attention. These are precisely the characteristics of attention that are emphasized in this article. In recent decades, young people have tended to study while listening to music (Ibañez, 2009). In this regard, Custodio and Cano (2017) note that the effect of music on attention is subjective and that, just as it can help concentration on certain tasks such as motor tasks, it could be a distraction in other types of activities such as cognitive ones. In this sense, the results of Sánchez and Cardona (2022) in Colombia would confirm this last idea. However, there are a series of studies that have sought to establish the positive effects of studying music on motor activity (Ortín et al. 2018), comprehensive education (López and Salcedo, 2021), learning (Intriago and Zambrano, 2023), (Valverde and Montes, 2022), perception of effort and mood (Ortín et al. 2018) and phonological skills (Rivera and Moreira, 2020), among others. As can be seen, the topic has aroused a lot of interest from researchers, and there are many things still to be clarified.

However, Peru is not only a megadiverse country (Ministry of the Environment, 2013), it is also multidiverse (Ministry of the Environment, 2019), pluricultural (Félix, 2021) and multilingual (Allaín, 2021) (Robles et al., 2021) in which being bilingual does not only mean the use of two languages and being competent in them (Sánchez, 2021) but also three and sometimes more languages. That is, a person born in a region where one language predominates may later become a speaker of a second language and, sometimes, a third, as in the case of the Matsigenkas. (Solís, 2019).

To be precise, there are multiple definitions of bilingualism. However, what most of them have in common is the fact that being bilingual implies the competence of an individual or population to communicate verbally or in writing in two or more languages, respecting the grammar of each one. (Sánchez, 2021).

This concept is very similar to that of the multilingual subject, as proposed by Kramsch (2012). However, the author distinguishes a specific category, which she calls 'silenced speakers'—individuals who understand the language but do not speak it.

In Peru, at least 48 native languages are recognized (Minedu, 2019), most of which are Amazonian (Enrique, 2021).

Now, the circumstances since the end of the last century and with more force since the first decade of the present century, emphasis has been placed on Intercultural Education (Robles et al., 2021) has generated the need to investigate this issue; a concern that is not exclusively Peruvian. It also occurs in Brazil (Martínez, 2015), in Colombia (Trillos, 2017), in Mexico (Belmonte, 2021), in Costa Rica (Ceciliano, 2022), in Honduras (Amador, 2022), in Chile (Aguayo et al., 2022), in Ecuador (Rodríguez et al., 2022); among others. But, it is also a subject of research in the European community. (Sánchez, 2021).

In this regard, in Peru, a study conducted with preschoolers showed that the lack of regulations, prior planning, and teachers trained in English instruction negatively affects the level of second-language acquisition, resulting in only an incipient level of proficiency. (Mourão et al., 2017).

Along these lines, in the city of Cuzco, Del Pino and Morales (2022) found important shortcomings in teachers who teach a second language, since many of them are unaware of the elements of the communicative situation and have a limited understanding of the characteristics and methodologies of bilingualism; which naturally affects those who learn the second language.

For their part, Rojas et al. (2024) in Ayacucho, demonstrated the importance of implementing bilingual teaching methodologies in the acquisition of text comprehension and production skills.

On the other hand, a study on university students has revealed that teaching a second language cannot be reduced to training skills for students to use particular linguistic forms in specific contexts but rather as a source of opportunities that allow interaction with their environment actively and constantly. (Zavala, 2019).

The existence of prejudices regarding an indigenous language in the university environment was also identified, viewing it as a language from the countryside, difficult, ancient, and from the cultural past. (Pumacahua and Zevallos, 2022).

In addition, it has been shown that university students have positive attitudes towards bilingualism when it comes to English and Mandarin Chinese (Mejía and Robles, 2024).
However, as evidenced, research on this topic in Peru is still in its early stages at all levels of education. There remain many gaps in knowledge that should be explored through further research. For example, among many other questions, it is still unknown whether bilingualism affects university students' attention or whether studying music hurts it.
It is based on all these considerations that it was proposed to establish whether bilingualism makes a difference in the attention of university students and whether studying while listening to music hurts it.

## 2) Methods and Methodology

The work was carried out with a quantitative, applied approach (Murillo, 2008) and at an explanatory level (Arias, 2012). The experimental laboratory method was used (Pérez and Hedesa, 2010). During the experiment, the subject was placed in front of a digital tachistoscope that projected a total of 40 images at a constant speed of 2 per second. The task consisted of naming each of the figures that appeared on the screen, given that all the figures are known to any student of Basic and Higher Education and the speed at which the images passed required concentrated, focused, and stable attention. Each omission is interpreted in the experiment as an oscillation in the stability of attention. These oscillations in the stability of attention are extremely important because they allow us to explain how a student loses information in reading or in a class when concentrated, focused, and stable attention is required. The speed at which the figures passed and the type of images projected through the digital tachistoscope were adjusted by the pilot groups.
In the second phase, the subjects faced an analogous series with the same number of figures, but this time, at the same time as the images passed, they listened to the music they had previously chosen through headphones. The whole experiment was conducted inside a Gesell chamber to minimize noise, interruptions, and climatic variations that could negatively impact the participants' attention. Additionally, all experiments were conducted at the same time to control for the potentially harmful effects of fatigue on the examinees before the experiment.
People who participated
The study included two groups: one consisting of bilingual participants and the other of monolingual participants, each made up of 30 students. The inclusion criteria were: informed consent, being a regular student at a University in the Junín and Huancavelica regions, male or female between the ages of 18 and 31.

## 3) Result

For data processing, the Kolmogorov-Smirnov test was used to establish the normality of the distribution; therefore, the Student t-test was used to contrast the hypothesis; since the data were interval level and comparisons of two independent samples were required when comparing bilinguals with monolinguals and the same sample measured twice when comparing attention to each group with and without auditory stimulation, all of which was done using version 26 of the SPSS software.


**Figure 1** Attentional oscillations in monolinguals

In Figure 01, the total distractions without interference in monolingual university students are shown. The results indicate that 1 student does not present any distractions, being the lowest number of distractions, on the other hand, 2 students present the highest number of distractions (24 and 25 distractions) in a total of 20 seconds and the other students present distractions from 2 and 19.

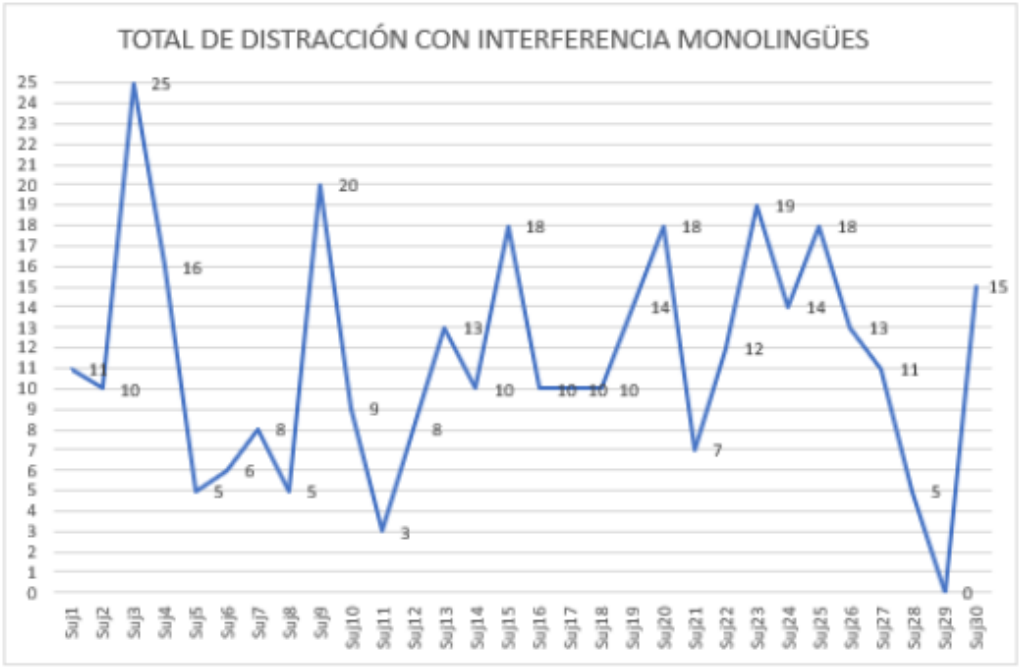


**Figure 2** Attentional oscillations in monolinguals with stimulation

In Figure 02, the total distractions with interference in monolingual university students are shown. The results indicate that 1 student does not present any distractions, being the lowest number of distractions, on the other hand, 1 student presents more distractions, this being 25 distractions, and the other students present distractions from 3 to 20 distractions.


**Figure 3** Attentional oscillations in bilinguals

Figure 03 shows the total distractions with interference in bilingual university students. The results indicate that the distractions range from 3 distractions to 27 distractions, this being the largest number of distractions.


**Figure 4** Attentional oscillations in bilinguals with auditory stimulation

Figure 04 shows the total number of distractions with interfere with bilingual university students. The results indicate that the distractions range from 4 distractions to 25 distractions, this being the largest number of distractions.

**Table 1: Comparison of attentional oscillations in monolingual and bilingual university students with and without interference**

| | | Descriptive statistics | | | t test for equality of means | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Groups/Experiment condition | Experiment condition/groups | N | Average of oscillations | Desv. | T | gl | Sig. (bilateral) | Comparison of P, value with Alpha | Decision |
| Monolinguals | Without interference | 30 | 10.100 | 5.851 | -1.727 | 29 | 0.095 | > 0.05 | There are no significant differences |
| | With interference | 30 | 11.43333 | 5.60593 | | | | | |
| Bilinguals | Without interference | | 14.967 | 5.690 | -1.998 | 29 | 0.055 | > 0.05 | There are no significan |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | With interference | | 16.2 | 5.14882 | | | | t differences |
| Without interference | Monolinguals | 30 | 10.100 | 5.851 | -3.266 | 58 | 0.002 | < 0.05 | There are significant t |
| | Bilinguals | 30 | 14.96667 | 5.69018 | -3.266 | 57.955 | 0.002 | | differences |
| With interference | monolinguals | 30 | 11.433 | 5.606 | -3.430 | 58 | 0.001 | < 0.05 | There are significant t |
| | Bilinguals | 30 | 16.2 | 5.14882 | -3.430 | 57.585 | 0.001 | | differences |

Table 1 shows that when comparing the means of attention swings of monolingual students in two conditions: with and without interference: 10.100 and 11.4333 respectively, a T = 1.727 is obtained with a P value = 0.095, which indicates that there are no significant differences. Similarly, in the comparison of bilingual students with and without interference, no significant differences are found in the means of attention swings, with the value of T = 1.998 and the P value = 0.055 greater than 0.05. However, when comparing the means of attention oscillations between groups: Monolinguals and bilinguals without interference present means of 10.100 and 14.96667 respectively, with a T value of 3.266 and a P value of 0.002 < 0.05, which indicate that there are significant differences between the groups when there is no interference; the monolingual group presenting fewer oscillations. The comparison of the monolingual and bilingual groups with interference results in a T value of 3.43 with a P value of 0.001 < 0.05, indicating that there are significant differences in the means of attention oscillations, with the monolingual group presenting fewer oscillations. The means were 11.433 and 16.2 for monolinguals and bilinguals respectively.

## 4) Discussion

The results presented have shown that in the monolingual group, the oscillations of attention in 20 seconds can vary between 0 and 25, with and without auditory stimulation. (Graphs 01 and 02). And the Kolmogorov-Smirnov test showed that the distributions were normal in both groups. The student t-test showed that there are no significant differences between the 2 measurements (without and with auditory stimulation) (Table 01). As regards the bilingual group, the number of oscillations varies between 3 and 27 and from 4 to 25 respectively (Graphs 3 and 4) here there are also no significant intragroup differences.

However, the fact that no intragroup statistical differences were recorded in either bilinguals or monolinguals suggests that it could be a regularity; That is to say, whether the students are bilingual or monolingual, receiving auditory stimuli while paying attention to visual material would not be noticeable increase or decrease the number of oscillations of their visual attention. In other words, students whose attention tends to oscillate more would not increase or decrease their oscillations due to listening to music while paying attention, and the same would occur with those who have medium and low levels of oscillations, that is, greater stability. This allows us to legitimately assume that the student's brain can distribute attention between two stimuli that enter consciousness through different analyzers without benefit or harm to the main one (Treissman, 1960), which would put an end to the idea that the student should seek an environment with absolute silence to learn better.

It is also pertinent to remember that the experiment is not about any auditory stimulus but about the music preferred by each of the subjects. The same should have more distracting power than any other song or

auditory stimulus, but our results show that even when it is the subject's favorite music, he or she may be able to escape its influence when facing a task that requires concentrated visual attention. There are a series of studies that highlight the beneficial role that music can have in a series of psychological processes and phenomena. (Ortín et al. 2018) (Rivera and Moreira, 2020) (López and Salcedo, 2021) (Valverde and Montes, 2022) (Intriago and Zambrano, 2023), among others. While it is true that this work does not ratify the beneficial role of music concerning attention, it does not demonstrate the opposite either. Indeed, just as there are some students with a high level of intensity, control, and focus of attention (Londoño, 2009), which is expressed in a low number of oscillations (distractions) that can attend to up to 100% of stimuli, there are also some who have very little development of these qualities; a fact that can be seen in the highest number of oscillations that would only allow them to capture 32.5% of the stimuli, that is, less than a third and that implies a lower intensity, concentration, stability and selectivity (Añaños, 2010), (Luria, 1979).

Although the majority, as expected in a normal distribution, tends to be located in the central part of the curve. It is clear that, by losing more information, they will tend to lose efficiency in their performances and therefore have less chances of success in the tasks of their university studies. The fact that attention fluctuates a lot despite the verbal order that the subject receives to concentrate on the visual material that is presented to him, supposes loss of control and selectivity (Añaños, 2010), but also indicates less intensity of concentration and therefore less stability in it (Luria, 1979).

Thus, our results would lead parents and teachers not to worry about students working listening to music but rather to put emphasis on the development of the aforementioned qualities of their attention, which would have to be done from the first stages of formal education.

On the other hand, the comparison between the monolingual and bilingual groups allows us to observe that the monolingual group has students who can pay attention from 100% of the stimuli presented to them to only 37.5% of the stimuli, that is, more than a third, while in the bilingual group, those with the greatest development of attention would pay attention from 92.5% of the stimuli to only 32.5%, that is, less than a third of the stimuli presented during the experiment. It would be interesting to investigate whether this development of attention is related to their academic performance.

In any case, the work has allowed us to clarify some aspects of the qualities of attention in bilingual and monolingual university students, but a series of questions have also arisen that will require the development of new research.

## 5) Conclusion

The fact that no statistical differences were found within groups in the two conditions of the experiment allows us to conclude that receiving auditory stimuli while trying to pay intense, sustained, and stable attention to visual stimuli does not improve or worsen the stability of attention, its intensity, and concentration; which would prove that the student is capable of distributing his attention between two stimuli that access consciousness through different analyzers.

2. Having found intergroup differences in the oscillations in the two conditions of the experiment, it is legitimate to assume that the fact of being bilingual represents a disadvantage for the student in his stability, concentration, and intensity of attention if the test is administered in his second language, which would be because the interference of the two linguistic systems forces the bilingual to carry out more cognitive processes and consequently more nervous processes when faced with a task of concentrated attention.

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