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THE IMPACT OF CODE-SWITCHING ON ENHANCING COGNITIVE FLEXIBILITY.

the case of master two efl students at biskra university.

A Dissertation Submitted to the Department of English and Literature in Partial Fulfillment ofthe Requirements for the Master's Degree in Sciences of the Language

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Declaration

I, **Bouki Roua** , do hereby declare that this submitted work is my original work and has not previously been submitted for any institution or university for a degree. I also declare that a list of references is provided forward indicating all the sources of the cited and quoted information. This work was certified and completed at Mohammed KHEIDER University of Biskra.

Algeria

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Dedication

To my beloved self, for my struggle and my passion for learning

To my family, Dad Bouki Nourddin, Mom Laouni Bariza, my sister and brothers for supporting me in their own ways

To my friends, for sharing the best moments that I will never forget

To Boudaa Maroua, for being my best friend

Acknowledgements

Abstract

The present study attempts to explore the effect of code-switching on enhancing cognitive flexibility of the EFL learners. The research method was adopted mixed method to carry this study. Furthermore, the sample of this study consisted of Master Two students of English at University of Mohamed Kheider Biskra. A questionnaire with students and an interview with teachers were the data collection tools use in this study. After collecting and analyzing the data, the findings showed the great effect of code-switching on the students cognitive flexibility. The study related code-switching with cognitive flexibility. Therefore, the study findings support that the use of code-switching has great influence on improving the students' cognitive flexibility.

Key words: **Code-switching, Cognitive Flexibility, EFL Students.**

List of Abbreviations and Acronyms

EFL: English as a Foreign Language

EF: Executive Function

CD: Code-switching

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General Introduction

Introduction

Language is a powerful human ability that shapes our thoughts and our perceptions of everyday experiences at a cognitive level, language helps us to understand events and experiences in our environment, and ascribe meaning to these events within our minds. For bilingual speakers, the ability to communicate, think, and understand the environment may be different from monolingual speakers due to the influence of managing multiple languages on the cognitive system (Freeman et al., 2016)

Bilingual and multilingual individuals' resort to code-switching when they cannot fully express themselves in one language. Although this may be partially true when a bilingual person is momentarily at a loss for words in one of their languages, code-switching is a widespread practice among bilinguals and takes on many forms. A long story may be divided into different parts, each expressed in a different language; sentences may start in one language and end in another; and words and phrases from different languages may be used interchangeably.

Code-switching has been studied extensively by linguists, who have demonstrated that it involves a skilled manipulation of overlapping areas between two or more grammars, and that there are virtually no instances of ungrammatical language combinations in code-switching, regardless of the speaker's linguistic ability. Some scholars even suggest that code-switching is a distinct mode of communication in and of itself. (The Handbook of Bilingualism and Multilingualism, n.d.)

Cognitive flexibility refers to the ability to switch one's thinking and adapt to new or changing situations or tasks. It involves the ability to shift attention between different stimuli, switch between different mental sets or perspectives, and adapt to new or unexpected situations. Cognitive flexibility is a major aspect of executive function and is important for

problem-solving, decision-making, creativity, and learning. A study by Diamond and Lee (2011) investigated the cognitive benefits of cognitive flexibility training in preschool-age children. The study found that children who received cognitive flexibility training showed significant improvements in their cognitive flexibility skills compared to the control group.

Similarly, a study by Colzato et al. (2010) investigated the relationship between bilingualism and cognitive flexibility in young adults. The study found that bilingual individuals had better cognitive flexibility skills compared to monolingual individuals. These studies highlight the importance of cognitive flexibility and suggest that we can improve it through training or bilingualism.

1. Statement of the problem

Code-switching is a common phenomenon among English as a foreign language (EFL) learners at Biskra University. However, these learners also face several cognitive challenges, including difficulties in comprehension, memory limitations, lack of attention, limited problem-solving skills, lack of metacognitive awareness, and anxiety. Cognitive flexibility is a critical skill for successful learning in both academic and professional settings. However, the relationship between code-switching and cognitive flexibility is not well-understood. More research is needed to explore the potential benefits and limitations of code-switching in the EFL classroom.

The use of code-switching in teachers explanations and everyday conversations of EFL students is beneficial for EFL students in developing cognitive flexibility, facilitating comprehension, enhancing language acquisition, encouraging cross-cultural communication, and building motivation and confidence. To enhance the cognitive flexibility of EFL learners, we suggest encouraging them to use code-switching more.

Students of EFL who engage in code-switching may develop greater cognitive flexibility, because they are constantly switching between two or more dialect languages.

2. The aim of the study

This research aims to examine the significance of code-switching among EFL (English as a Foreign Language) students and its potential role in enhancing their cognitive control. Additionally, the study seeks to investigate the impact of code-switching on the development of cognitive flexibility among EFL students. In essence, the study seeks to explore whether code-switching can be used as a tool to improve cognitive flexibility, which is the ability to adapt to changing situations and switch between different tasks or mental sets. By understanding the relationship between code-switching and cognitive flexibility, the study may provide insights into how EFL students can improve their language skills and cognitive abilities simultaneously by code-switching.

3. Research questions

- What are the potential benefits of code-switching practices for enhancing cognitive flexibility?
- How does code-switching impact the cognitive flexibility of EFL students?
- What is the relationship between code-switching and cognitive flexibility?

4. Hypothesis

H1: The use of code-switching enhances cognitive flexibility, leading to improved language learning outcomes among EFL students.

5. Significance of the study

This research aims to explore the effects of code-switching on the cognitive flexibility of EFL students, as well as the potential benefits of code-switching. First, it will examine the effectiveness of code-switching as a mental process, helping students to develop their

cognitive flexibility. Second, it will contribute to the growing body of research on bilingualism and cognitive development, particularly in promoting cognitive flexibility. Third, the study could provide insight into the cognitive processes involved in language learning and code switching, which could inform future research and theoretical frameworks in the field of psycholinguistics. Overall, this research on code switching and cognitive flexibility could have practical, theoretical, and educational significance with potential implications for language teaching, cognitive development, and psycholinguistic research.

Operational Definitions of Terms

Code-switching: In the present study, code-switching refers to Master two students' code-switching process while using language. Carol Myers-Scotton (2002) stated that Code-switching is the use of two or more languages in the same conversation or sentence. It is a common phenomenon in multilingual societies, and it can be used for a variety of purposes, such as to express identity, to emphasize a particular point, or to accommodate the needs of the interlocutor.

Cognitive Flexibility: In the present study, cognitive flexibility is the Master two students' cognitive flexibility. Russell A. Poldrack (2016) declared that Cognitive flexibility is the ability to switch between different mental sets or tasks. It is a key component of executive function, which is a set of higher-order cognitive processes that control and regulate other cognitive functions, such as attention, memory, and planning.

6. Review of Related Literature.

Klein et al. (1994) conducted a study to investigate whether bilinguals have an advantage over monolinguals in their ability to selectively attend to relevant information while ignoring distracting information. The results showed that bilinguals were faster and more accurate in naming the ink colour than monolinguals, suggesting that they were better

able to selectively attend to relevant information and inhibit the irrelevant word meaning. However, the study did not investigate whether these advantages were related to specific linguistic features of bilingualism, such as the degree of proficiency in each language or the age of acquisition. Overall, these studies contributes to the growing body of research on the cognitive advantages of bilingualism, particularly in the area of attentional control.

Abutalebi, Cappa &Perani (2001) conducted a study to investigate the neural basis of switching between languages in bilingual individuals. They found that switching between languages activated a specific neural network that included the left prefrontal cortex, left anterior cingulate gyrus, and left caudate nucleus.

Kim (2016) conducted a study to investigate the Effects of code-switching on the cognitive flexibility and lexical access of Korean-English bilinguals. The study involved 27 Korean-English bilinguals who performed three tasks: a lexical access task, a code-switching task, and a set-shifting task. The results showed that code-switching had a positive Effects on the cognitive flexibility of the bilinguals, but no significant Effects on their lexical access. The author suggest that code-switching can be a useful tool in enhancing cognitive flexibility in bilinguals, and that it can be incorporated into language teaching and learning to provide a more challenging and engaging learning environment. The study adds to the growing body of literature on the cognitive benefits of bilingualism and highlights the importance of considering code-switching in language learning and teaching.

The study conducted by Garcia-Sierra, Dependable, and Thierry (2016) aimed to investigate the impact of code-switching and bilingualism on cognitive flexibility. The participants of the study included Spanish-English bilinguals who were proficient in both languages. They were divided into two groups: the code-switching group and the single language group. In the code-switching group, the participants were asked to listen to

sentences that were either in Spanish or English and had a code-switched word in the middle of the sentence. The single language group listened to sentences that were entirely in one language. The participants then had to decide whether the sentence was grammatically correct or not. The results of the study showed that the code-switching group had better cognitive flexibility than the single language group. The study concluded that bilinguals who engage in code-switching exhibit better cognitive flexibility than those who do not.

Li, Li, and Zhao (2019) investigated the Effects of code-switching on cognitive flexibility and learning outcomes in an EFL classroom. The study involved 60 Chinese undergraduate students who were randomly assigned to a code-switching group or a monolingual group. The code-switching group received instruction in both Chinese and English, while the monolingual group received instruction only in English. The study measured the students' cognitive flexibility using the Wisconsin Card Sorting Test and their learning outcomes using a written test. The results indicated that the code-switching group outperformed the monolingual group in both cognitive flexibility and learning outcomes. The study suggested that code-switching can enhance cognitive flexibility and improve learning outcomes in an EFL classroom.

Several studies have been carried out in relation to the current study amongst them, The study conducted by Yang and Gao (2020) aimed to investigate the Effects of code-switching on the cognitive flexibility of EFL learners during English listening comprehension. The study involved 120 Chinese EFL learners who were divided into three groups: code-switching, non-code-switching, and control. The participants listened to two audio recordings, one with code-switching and one without, while their cognitive flexibility was measured using a set-shifting task. The results showed that the code-switching group performed better than the non-code-switching and control groups in the set-shifting task,

indicating that code-switching during English listening comprehension can enhance cognitive flexibility in EFL learners. The authors suggest that incorporating code-switching activities in English language teaching can provide a more diverse and challenging learning environment, leading to improved cognitive flexibility in EFL learners.

Chapter One:

Cognitive flexibility

Introduction

Cognitive flexibility is a fundamental cognitive ability that allows us to adapt to changing environments and situations. It involves the ability to switch between different tasks, generate novel ideas, and adjust behavior in response to feedback or changing demands. Recent research has shown that cognitive flexibility plays a crucial role in various cognitive processes, including decision-making, problem-solving, creativity, and social cognition. It has also been implicated in various developmental and clinical disorders, such as autism spectrum disorder, schizophrenia, and traumatic brain injury.

The purpose of this chapter is to provide a comprehensive overview of cognitive flexibility. The chapter will begin with an overview of cognition and bilingualism, focusing on their relationship. The section ended with an introduction to executive functions (EF) as an essential component of cognition. It defined EF and examined how these functions operate. The concept of cognitive flexibility is then explored, including its definition, approaches to studying it, its developmental aspects, and various measures of flexibility. The theoretical framework of cognitive flexibility is outlined, focusing on the cognitive flexibility theory. The chapter further explores the common influencing factors between cognitive flexibility and code-switching, highlighting the role of cognitive flexibility in bilingualism.

1. An overview about Cognition

1.1. What is cognition

(Dixit & Das, 2022) Cognition refers to the mental processes involved in acquiring knowledge and understanding. It is well-known that cognitive abilities play a vital role in

language learning, enabling individuals to acquire, store, and process information. However, is there more to explore regarding the relationship between cognition and language? Could learning a new language have a broader impact on our mental processes beyond the basic functions of acquiring and retaining information?

Cognitive processes are undoubtedly crucial for language learning, encompassing various aspects such as attention, memory, problem-solving, and decision-making. Research has shown that learning a new language can indeed have a profound impact on these mental processes, extending beyond the basic functions of acquiring and retaining information. This flexibility extends beyond language use and can positively influence other cognitive domains, such as problem-solving skills and creativity. Kroll & Bialystok, (2013)

Additionally, bilingual individuals have been found to exhibit improved executive functions, including inhibitory control, working memory, and cognitive control, which are essential for efficient information processing and decision-making (Bialystok, 2017). Therefore, learning a new language not only expands our linguistic repertoire but also exerts a broader influence on our cognitive abilities, highlighting the intricate relationship between cognition and language acquisition.

1.2. The cognitive difficulties in second language acquisition

Ellis, R. (2008) suggested that Language acquisition poses several cognitive difficulties for learners, such as vocabulary acquisition, grammar and syntax, pronunciation and phonetics, language processing speed, understanding the cultural context of the target language, and developing pragmatic and discourse skills. Vocabulary acquisition involves actively associating new words with their meanings and integrating them into one's mental lexicon.

Grammar and syntax involves understanding and internalizing the grammatical rules and structures of a new language, pronunciation and phonetics involves mastering pronunciation and phonetics, language processing speed involves real-time processing of speech or written text, understanding the cultural context of the target language requires cognitive flexibility and an understanding of the broader cultural context, and developing pragmatic and discourse skills requires cognitive effort. With persistence and dedication, learners can navigate these cognitive challenges and achieve proficiency in their target language.

2. An Overview of executive functions

2.1. Definitions

Executive function (EF) is an umbrella term that incorporates a collection of interrelated processes responsible for purposeful, goal-directed behavior (Gioia, Isquith, & Guy, 2001). These executive processes are essential for the synthesis of external stimuli, formation of goals and strategies, preparation for action, and verification that plans and actions have been implemented.

Executive functions are the set of cognitive skills necessary for controlling and self-regulating your behavior. It allows you to establish, maintain, supervise, correct, and carry out a plan of action. This set of cognitive functions make up part of our everyday lives, and help us successfully and efficiently get through daily activities. The term was proposed by Muriel Lezak in 1982.

Executive functions include basic cognitive processes such as:

Attentional Control: refers to an individual's capacity to choose what they pay attention to and what they ignore. It is also known as endogenous attention or executive attention.(Astle, D. E.; Scerif, G ,2009)

Cognitive Inhibition: refers to the mind's ability to tune out stimuli that are irrelevant to the task/process at hand or to the mind's current state. Cognitive inhibition can be done either in whole or in part, intentionally or otherwise. (MacLeod. Colin ,2007)

Inhibitory Control: permits an individual to inhibit their impulses and natural, habitual, or dominant behavioral responses to stimuli in order to select a more appropriate behavior that is consistent with completing their goals. (Ilieva IP, Hook CJ, Farah MJ ,2015).

Working Memory: according to Diamond A (2013) working memory is a cognitive system with a limited capacity that can hold information temporarily. It is important for reasoning and the guidance of decision-making and behavior. (Malenka RC, Nestler EJ, Hyman SE ,2009)

cognitive flexibility: is an intrinsic property of a cognitive system often associated with the mental ability to adjust its activity and content, switch between different task rules and corresponding behavioral responses, maintain multiple concepts simultaneously and shift internal attention between them. (*Scott, William A, December 1962*)
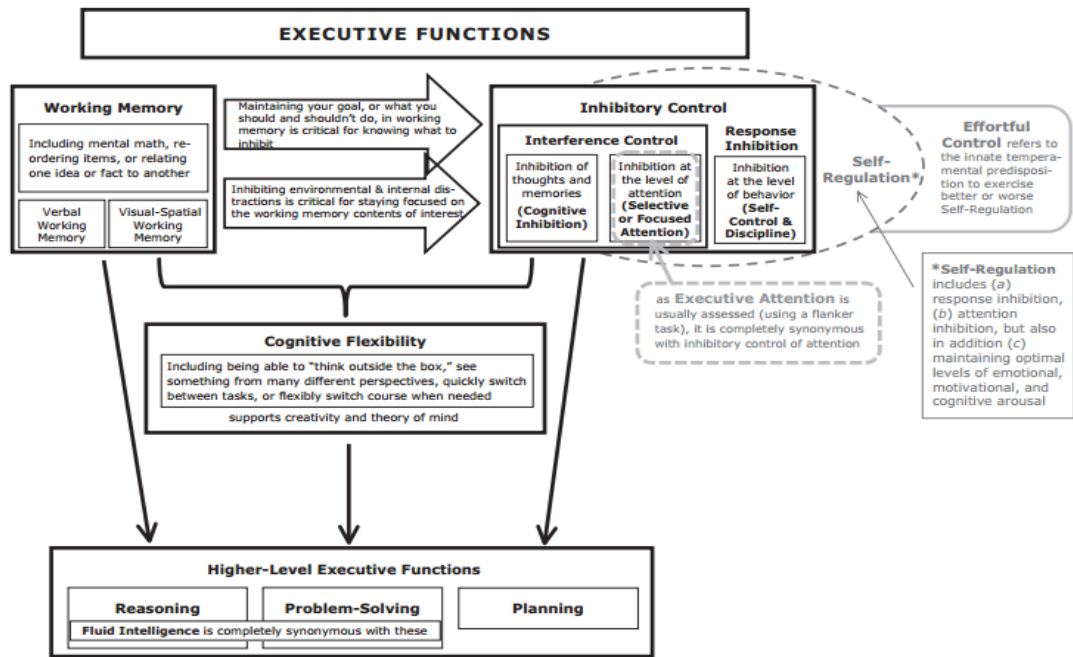
Figure 1: Executive functions and related terms.(Adele Diamond, 2012)

Higher-order executive functions require the simultaneous use of multiple basic executive functions and include:

 Planning: is a fundamental property of intelligent behavior. It involves the use of logic and imagination to visualize not only a desired end result, but the steps necessary to achieve that result. (*Owen, AM , Nov 1997)*)

 Reasoning: is associated with the acts of thinking and cognition, and involves the use of one's intellect. (*Encyclopædia Britannica. 2013*)

 problem-solving: is the process of achieving a goal by overcoming obstacles, a frequent part of most activities. (*Frensch, Peter A.; Funke, Joachim, eds. 2014*)

2.2.   How Executive Functions works

Cognitive control and stimulus control are two competing processes associated with operant and classical conditioning, respectively. These processes compete for the control of an individual's elicited behaviors. Inhibitory control is necessary for overriding stimulus-

driven behavioral responses, which is known as stimulus control of behavior. The prefrontal cortex is necessary, but not solely responsible for executive functions. Other brain regions, such as the caudate nucleus and subthalamic nucleus, also play a role in mediating inhibitory control.

However, cognitive control is often impaired in addiction, attention deficit hyperactivity disorder, autism, and other central nervous system disorders. In addition, stimulus-driven behavioral responses that are associated with a rewarding stimulus tend to dominate one's behavior.

It is possible to enhance all our cognitive skills through training. The improvement and rehabilitation of executive functions and other cognitive abilities are based on neuroplasticity. Similar to how muscles need to be exercised and challenged to grow stronger and function better, the brain and its connections require similar training. Consistently exercising our cognitive functions leads to strengthening of the brain connections and structures. (*Miller, E. K., & Cohen, J. D, 2001*)

3.   Theoretical Background Of Cognitive Flexibility

Cognitive flexibility is an essential cognitive process that allows individuals to adapt to changing situations and environments by modifying their thoughts, behaviors, and actions. It is a key component of executive function, which involves higher-order cognitive processes that control and regulate other cognitive functions. Early studies on cognitive flexibility, known as the Einstellungs-effects, focused on people's incapacity to change their thought processes even when better options were available. People who can modify their answers are said to be cognitively flexible, and they often employ inductive reasoning, think "outside the box," and are more inventive when coming up with answers.   (Diamond, A, 2013)

3.1. Definition

(José J. Cañas* et al., 2006) define cognitive flexibility as "the human ability to adapt the cognitive processing strategies to face new and unexpected conditions in the environment (Cañas et al. 2003).This definition involves three important concept characteristics. Firstly, Cognitive Flexibility is an ability which could imply a process of learning, that is, it could be acquired with experience. Secondly, Cognitive Flexibility involves the adaptation of cognitive processing strategies. A strategy, in the context of this definition, is a sequence of operations which search through a problem space (Payne et al. 1993).

Cognitive flexibility, therefore, refers to changes in complex behaviors, and not in discrete responses. Finally, the adaptation will occur to new and unexpected environmental changes after a person has been performing a task for some time".It is worth noting that cognitive flexibility shares connections with other related concepts such as adaptive flexibility, adaptive expertise, and the theory of cognitive transformation. These concepts highlight the importance of being able to adapt and transform one's cognitive processes in order to navigate complex and dynamic situations (Duchesne, 1997; Hatano & Inagaki, 1981; Klein & Baxter, 2006).

Adaptive flexibility is the ability to respond flexibly to change, while cognitive flexibility is the human ability to adapt cognitive processing strategies to face new and unexpected conditions in the environment. Task switching and cognitive shifting are two basic functions necessary for adapting to new situations or environments. Cognitive flexibility is significantly higher, particularly when one can communicate in multiple languages. It helps people adapt to stressful situations or information and improve their decision-making abilities.(Dixit & Das, n.d.)

3.2. Cognitive flexibility Study approaches

According to (*Leber, A B; Turk-Browne N B; Chun M M, 2008)* Cognitive flexibility involves implementing various EFs and shifting one's response set to the new goal, which involves identifying changes in surroundings, inhibiting previous responses, and manipulating information in real time. There are two approaches to understanding cognitive flexibility, one emphasizing the automatic nature of task switching and the other emphasizing the conscious and deliberate nature of cognitive shifting.

Task switching: is The first approach that delved into the unconscious capacity, which involves the automatic and effortless aspect of cognitive flexibility. It centers on investigating how individuals seamlessly shift their attention and cognitive resources between different tasks without conscious awareness. Studies within this approach delved into the cognitive processes underlying task switching and the ways in which individuals adapt to changing task demands.

Cognitive shifting: is The second approach focuses on the conscious ability , which involves intentional and effortful processes of changing cognitive strategies or mental sets. This perspective emphasizes the deliberate aspect of cognitive flexibility, where individuals actively engage in cognitive shifting to adapt to new information or changing circumstances. Researchers in this area explore the factors that influence individuals' ability to flexibly switch between different cognitive processes or strategies.

3.3. Development of Cognitive Flexibility

Flexible cognition in young children lies at the intersection of settings of increasing variability and an expanding cognitive and conceptual repertoire. Language is the primary system that mediates this interchange, allowing children to interact with new people and learn about materials and events in rich social contexts. Verbal acts, coordinated with novel

events and tasks, serve as the medium for these unfolding events. Preschoolers are expected to respond to adults' suggestions, statements, and instructions, and to narrate their plans and intentions. Flexible cognition involves many cognitive processes, such as the ability to inhibit prior thoughts or responses, cognitive control, and the ability to notice, analyze, and select task cues.

Evidence of developing flexibility is inherently ambiguous. The capacity to inhibit prior representations is demonstrated by the finding that children younger than 36 months tend to place several successive pictures of items from both categories into the same box. However, this could be due to weak activation of the new association, failure to remember the current task cue, failure of control over complex response choice, or failure to notice changing task cues.

Adults' capacity for flexible language processing can be compromised by certain brain insults, and this evidence may shed light on limitation of flexibility in children's language. Perseverative naming errors are influenced by exogenous factors such as stimulus type, semantic content, similarity, concurrent cognitive demands, and distracting information, as well as endogenous factors such as patient age, lesion site, age-at-lesion and recovery time.

Aphasic naming errors and injuries to other cortical regions cause language inflexibility. Speech errors in anomic adults and young children are disproportionately perseverative, while typical adults' errors include anticipatory errors. Right hemisphere patients often make rigid interpretations of jokes, stories, and indirect messages. Young children also fail to grasp nonliteral, idiomatic or metaphoric word usage. (Deák, 2004)

3.4. The benefits of cognitive flexibility

Cognitive flexibility positively influences students' learning performance and retention by enabling them to adaptively restructure knowledge in response to challenging situational demands. Random interference in complex cognitive tasks has a negative impact on performance, but benefits retention. Time allocation affects learning and retention, with less time on task leading to improved outcomes. The interaction of cognitive flexibility, contextual interference, and time has a positive effect on learning, enhancing conceptual understanding, facilitating effective learning, and supporting retention and transfer of knowledge. Overall, these factors play crucial roles in shaping students' learning experiences and outcomes. (Célia MAINTENANT and Gaëlle BODI, n.d.)

3.5. Measures of Flexibility

3.5.1. Why measure cognitive flexibility?

Cognitive flexibility is essential for being able to properly adapt to our environment and enjoy a good quality of life. It is important for children when they have to adapt to a change in subject matter at school, and can also help them learn. It is involved in the reading fluency of 7-year-olds, and cognitive flexibility training can improve reading fluency in 8-year-olds with reading difficulties. Cognitive flexibility is essential for development and can predict academic success, self-regulation, social adjustment, and theory of mind. It can be improved by daily or near-daily practice of video games, especially action video games.

This can be demonstrated by comparing action video game players to non-gamers using either a transversal or semi-experimental method. Video games have beneficial effects on mental flexibility, and cognitive tests such as flexibility and inhibition can be used to predict the diagnosis of ADHD, bipolar disorder, autism spectrum disorders, depression, and neurodegenerative diseases. A measure of cognitive flexibility can be useful in the diagnosis

of certain pathologies, whether in children or adults.(Célia MAINTENANT and Gaëlle BODI, n.d.)

3.5.2. How can we measure cognitive flexibility?

(Célia MAINTENANT and Gaëlle BODI, n.d.) The measurement of flexibility is unattainable and can be classified based on criteria such as population, ecology, spontaneous or reactive flexibility. Two main types of measurement can be used: direct measurements and indirect measurements. Direct measurements are precise and do not involve the subjectivity of any third party, but are more time consuming and not available to all individuals. Indirect measurements are quicker and less costly to implement, but may be biased and less representative of reality.

3.5.2.1.   A-not-B task

According to Jean Piaget's Theory of Cognitive Development, the A-not-B error is a sensorimotor stage error that indicates an incomplete or non-existent object permanence schema

An example of an A-not-B problem is as follows: Under box "A," an attractive object that the infant can reach is concealed by an experimenter. The infant checks under box "A" while looking for the toy and discovers it. The fact that the exercise is frequently repeated (always with the researcher concealing the item under box "A") indicates that the baby can pass the object permanence test. The experimenter next places the toy inside box "B," which is also within the infant's easy reach, for the crucial trial. Babies that are 10 months or less frequently commit the perseveration error, which occurs when they look under box "A" despite having seen the researcher move the toy to box "B," which is just as accessible. Piaget referred to this phenomena as A-not-B error.

This shows that the infant's understanding of the object's existence at this stage still depends on the actions he takes to the object, indicating a lack of, or incomplete, schema of object permanence. In accordance with Piaget's theory of cognitive development, children who are 12 months old or older (and in the preoperational stage) rarely commit this blunder. (Piaget, Jean ,2013)

3.5.2.2. Multiple Classification Card Sorting Task

In the Multiple Classification Card Sorting Task, kids are shown cards and instructed to simultaneously group them into four piles according to two different criteria (for example, color, such as yellow and blue, and object category, such as animals and food) (e.g. yellow animals, yellow foods, blue animals and blue foods). Given that seven-year-old children were unable to simultaneously sort cards based on the two dimensions, this activity looks to be more challenging. When children were eleven years old,
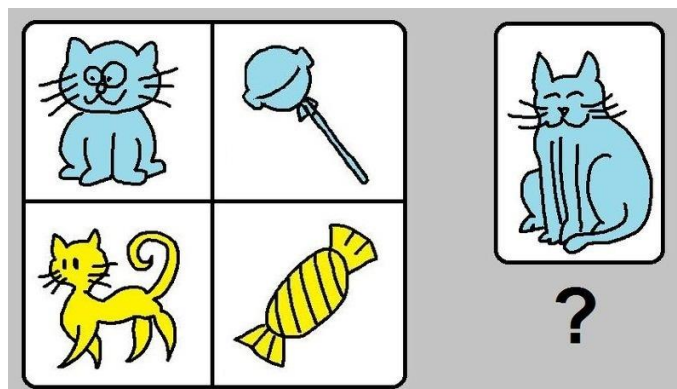
Figure 2:Multiple Classification Card Sorting Task (Bigler, R S; Liben, L S ,1992)

they were able to sort cards based on these two characteristics simultaneously, whereas these younger children concentrated on the two qualities separately. Between the ages of seven and eleven, this reveals an increase in cognitive flexibility. (Bigler, R S; Liben, L S ,1992)

3.5.2.3. Wisconsin Card Sorting Test

The Wisconsin Card Sorting Test (WCST) is used to assess a person's capacity for abstract reasoning as well as their flexibility in adapting their approach to problem-solving when necessary.
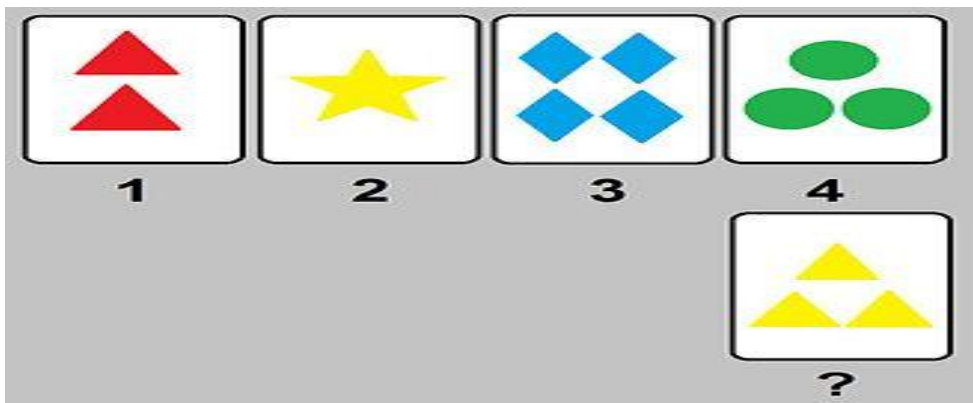
Figure 3: Wisconsin Card Sorting Test (Cognitive Flexibility - Wikipedia, n.d.)

The participants in this exam are shown a variety of cards. The shapes, sizes, and colors of the figures on the cards vary. The players are then instructed to match the cards, but are not given instructions on how to do so; instead, they are told if a particular match is correct or incorrect. The flexibility of changing matching rules is evaluated. The cognitive flexibility required for this exam is typically demonstrated in youngsters between the ages of nine and eleven.

Stroop Test

According to (Jensen, A R ,1965) The Color-word Naming Test or the Stroop Testis the delay in reaction time between congruent and incongruent stimuli. There are three different types of cards in the deck for this metric.

Figure 4: examples of the difference between the printed word (Cognitive Flexibility - Wikipedia, n.d.)

Participants are instructed to identify the various colored patches on the "color card" as rapidly as they can. Participants are once more requested to name the colors on the "word card" as rapidly as they can. The names of the hues are printed in black and white ink. The last form of card is a "color-word card," which asks participants to name the ink colors while ignoring the names of the colors that are put on it (for example, the word "RED" would be printed in yellow ink).

Figure 5: Examples of the three stimuli and colours used for each of the activities (Cognitive Flexibility - Wikipedia, n.d.)

When a color's name (such as "blue," "green," or "red") and the color it is printed in are inconsistent, for example, this effect can be seen in a simple activity (i.e., the word "red" printed in blue ink instead of red ink). If the color of the ink does not match the name of the color, naming the color of the word takes longer and is more error-prone.

4.   The Theoretical Framework of Cognitive flexibility

Cognitive flexibility in English as a Foreign Language (EFL) learners is an important aspect of language learning and proficiency. There are several theories that propose explanations for the relationship between cognitive flexibility and code-switching, including three prominent theories. These theories emphasize the role of cognitive control and flexibility in enabling bilingual individuals to engage in code-switching behavior.

4.1.   Cognitive flexibility theory

Cognitive flexibility theory suggests that for learning to occur, the learner must develop knowledge and understanding of the concept and apply it flexibly in diverse contexts. Linear media results in loss of vital information when content complexity increases. Dynamic tasks bring to the forefront the importance of the ability to adapt to changing success rates. Inflexibility impairs the ability to think and concentrate, leading to attention deficiency and decreased choice consistency. Flexibility is an integral element of decision making, also affecting the individual's potential to learn and sustain information in the changing environment.(Suryavanshi, 2015). The following themes constitute different facets of what we call cognitive flexibility (Spiro, et al., 1987). The themes are, in a sense, conditions for developing mastery of complexity and knowledge transferability.

4.1.1. Avoidance of Oversimplification and Overregularization.

Advanced knowledge acquisition must emphasize the importance of demonstrating complexities and irregularities, highlighting exceptions, and highlighting component interactions. Cognitive flexibility involves using knowledge to adaptively fit the needs of understanding and decision making in a particular situation. (Spiro, et al., 1987)

4.1.2. Multiple Representations.

(Spiro, et al., 1987) Cognitive flexibility is dependent on having a diversified repertoire of ways of thinking about a conceptual topic. Multiple representations are important at different levels, such as understanding complex individual concepts. However, it is even more important for larger units of analysis. For example, students' understandings of the entire domain of biomedical knowledge are adversely affected by the tendency to use just one way of modeling the various phenomena they encounter. The need for multiple representations applies not only to complex concepts, but also to cases in an ill-structured domain.

If cases are treated narrowly, the ability to process future cases will be limited, as there will be an assumption that cases are simpler than they are, as well as insufficient preparedness to deal with the specific patterns of interaction of theoretical/conceptual perspectives within cases. Additionally, the likelihood of having case representations available in prior knowledge is lessened when there is substantial across-case dissimilarity.

4.1.3. Centrality of Cases.

In an ill-structured domain, the application of knowledge to cases becomes increasingly indeterminate due to variability from case to case and reliance on reasoning from precedent cases. Examples/cases are necessary, not just nice. (Spiro, et al., 1987).

4.1.4. Conceptual Knowledge as Knowledge-in-Use.

(Spiro, et al., 1987). In an ill-structured domain, abstract concepts/theories are inadequate to determine responses to new cases and there is indeterminateness in defining conditions for accessing conceptual structures. Additionally, there is increased variability across cases in how the same concept is used or applied, making it harder to apply a concept once accessed. Wittgenstein's dictum that meaning is determined by use applies here.

Cardio world Explorer hypertext allows learners to selectively examine the full range of uses of any selected basic science concept across cases with differing clinical features, teaching the patterns of concept application and facilitating access to conceptual information in clinical contexts. In an ill-structured domain, the meaning of a concept is intimately connected to its patterns of use, so greater weight must be given to activating concepts in a new case by examination of family resemblances.

4.1.5. Schema Assembly (from Rigidity to Flexibility)

In complex and ill-structured domains, the use of rigid knowledge structures must be replaced by flexible, recompilable knowledge structures, as there is little repetition of patterns across case-specific assemblies of these smaller pieces of precompiled knowledge. Storage of fixed knowledge is devalued in favour of the mobilization of potential knowledge. (Spiro, et al., 1987).

4.1.6. No compartmentalization of Concepts and Cases

(Spiro, et al., 1987) Our systems strive for multiple interconnectedness of knowledge representations in our hypertexts by coding case segments with a multidimensional vector indicating the relevance of a variety of thematic/conceptual dimensions to that case segment. This helps with the problem of teaching conceptual knowledge-in-use and guides the learner in exploring patterns of overlap in the vectors.

Hypertext systems enable flexible, situation-adaptive schema assembly and multiple routes for memory access to any node in the system. Examples include Cardio world Explorer, which encodes segments of clinical cases with a vector of clinical and basic biomedical science themes relevant to each segment. The multiple-conceptual coding scheme employed in systems allows the hypertexts to automatically generate large numbers

of lessons and prevents the subsumption to a "common denominator" that occurs when larger structural units are used.

Cognitive flexibility requires that case information be coded conceptually for the many different kinds of use that new situations may require. Our approach helps to forestall the development of misconception networks by developing a kind of positive reciprocation.

4.1.7. Active Participation, Tutorial Guidance, and Adjunct Support for the Management of Complexity

(Spiro, et al., 1987) Active learner involvement in knowledge acquisition is essential in ill-structured domains, with expert guidance and aids to help manage complexity. Hypertext programs allow learners to explore complex conceptual landscapes with expert guidance and cognitive support.

5. Conclusion

In conclusion, the chapter provides a comprehensive overview of cognition, executive functions, cognitive flexibility. Understanding these concepts and their interplay is essential for exploring the cognitive aspects of language processing and bilingual individuals' abilities to adapt and switch between languages.

Chapter Two: Code-switching

Introduction

Code-switching   is a linguistic phenomenon that occurs when bilingual or multilingual individuals alternate between two or more languages or language varieties in a single conversation or discourse. It is a common practice in many societies, and it can take various forms and functions depending on the context and the communicative goals of the speakers. Code-switching has been a topic of interest for linguists, sociolinguists, and educators for many years, as it reflects the complex nature of language and its role in shaping social identities and interactions.

The purpose of this chapter is to provide two overviews, one of bilingualism and the other for code-switching, its definition, forms, and functions in term of Psycholinguistic. The chapter will begin by defining bilingual and explain what's going on his mind then, defining code-switching and distinguishing it from other language contact phenomena such as borrowing, and code-mixing. It will then describe the various forms of code-switching, including tag-switching, inter-sentential switching, and intra-sentential switching. Also, in this chapter, we present the main bilingual language processing models.

1.   Theoretical Background of Bilingualism

The Ethnologue (2009) reports that there are more than 7,000 languages spoken in the 194 countries of the world, with 94% of the population employing 5% of them. Many languages, such as Hindi, Chinese, Arabic, Bengali, Punjabi, Spanish, Portuguese, and English, are spoken in multiple countries around the globe. Contacts and interactions between languages are essential for a society or individual to become bilingual or multilingual. Over the years, bilingualism and multilingualism have become a major topic of multidisciplinary research, attracting the attention of scholars in various disciplines. However, scholars with different disciplinary backgrounds and research interests often have

different views of what bilingualism and multilingualism entail, which can influence their choice of research methods and designs.

In the early 1960s, studies began to reveal a positive correlation between bilingualism and intelligence. Peal and Lambert (1962) examined ten-year-old middle-class children who were either bilingual or monolingual and found that bilingual children outperformed their monolingual peers in both verbal and non-verbal intelligence tests. However, the authors acknowledged that their study could not determine the directionality of the relationship. It is generally agreed that there are advantages to acquiring bilingual competence early in life, but there is a risk of overemphasizing the young brain's plasticity or receptivity. Older learners bring cognitive experience that young children lack and, with sufficient motivation, can be better learners. Therefore, it is important to combine the strengths of both early and late learners to achieve rapid and proficient bilingual acquisition.

1.1. Who is Bilingual?

The term "bilingual" is most frequently used to describe someone who is able to speak or understand two languages, especially fluently. It can also refer to assets that include, have writing on, or are spoken in two different languages. Trilingual refers to three distinct languages, while multilingual implies over two, especially multiple languages. Both trilingual and multilingual are used interchangeably. (Elkins & Hanke, 2018)

For a bilingual, speaking in two languages and flipping between them is as easy and as natural as breathing. It's harder, however, to describe the phenomena of bilingualism than it is to come up with a scientifically reasonable way of talking about breath. Bilingualism is a complex facility, and any attempt to describe it, of necessity calls on distinctly different perspectives. (Bilingualism: The Sociopragmatic-Psycholinguistic Interface, 2005)

1.2. What Goes on in a Bilingual Mind?

1.2.1. Biologically

Learning multiple languages changes both the structure and function of the brain, and not only in relation to language. Some studies have shown that bilinguals have a higher density of grey matter in certain brain regions, such as the left inferior parietal cortex, which is associated with experience-dependent plasticity. Additionally, bilinguals have increased volume in certain regions of the brain, such as the anterior midbody of the corpus callosum, which is related to motor and somatosensory function, due to the demands of their phonemic capacity. These differences in brain structure and activity are related to the challenges faced by bilinguals, such as increased vocabulary search space and inhibition demands.

Before modern brain-imaging techniques such as Positron Emission Tomography (PET) scans and Functional Magnetic Resonance Imaging (fMRI) were developed, researchers used clinical evidence from studying aphasias (language disorders) and experimental techniques such as dichotic listening and tachistoscopic presentation to investigate the relationship between the brain and behaviour in bilingualism. Albert and Obler (1978) suggested that there was greater activity in the right hemisphere of the brain in bilingual language processing.

However, being bilingual also has non-linguistic advantages, such as enhanced executive or attentional control, which bilinguals of all ages exhibit in tasks involving selective attention, inhibition of misleading information, and switching between competing alternatives. Bilinguals may continually exercise and refine these executive skills, which are critical for bilingual communication, such as selecting words and structures from the active language, inhibiting the inactive language, and switching between languages at fast communication speeds.

1.2.2. Processes in bilingual mind

(Mishra, 2018) in his book "Bilingualism and Cognitive Control" aimed to raise questions around bilingualism and its necessary links with cognition. It is important to understand what mental and cognitive mechanisms define a bilingual, as it is difficult to demonstrate how the various psycholinguistic performances by bilinguals use common cognitive mechanisms. He summarise what happened in the bilingual mind in five processes which are:

1.2.2.1. Translation

Bilinguals process their second language differently depending on the type of bilingual they are. Studies have shown that even highly proficient bilinguals show unconscious translation between the languages when using their second language. This is seen in the translation recognition task, where bilinguals take more time rejecting pairs of words that are phonologically related to the translation of the first word. Low proficient L2 learners showed higher semantic interference in a translation recognition task, while highly proficient bilinguals showed translation affects around 200 ms of word onset. Costa, Pannunzi, Deco, and Pickering (2017) suggested that these effects may have little to do with translations, as the English lexicon of second-language speakers is organized differently from that of native English speakers.

Bimodal bilinguals who know ASL (American Sign Language) showed facilitation in the production of ALS signs when they were preceded by words phonologically related through translations. All kinds of bilinguals show automatic contact between the lexicons of their two languages at phonological and semantic level, which is often dubbed as non-selective parallel activation. Understanding the nature and extent of cross-linguistic

activations during bilingual language processing is critical for understanding the control involved.

1.2.2.2. Inhibition

Inhibition is a key mechanism in language control, but how far it is linked to executive control remains contested. The bilingual mental control model proposed by Green (1998) proposed a general purpose inhibitory control mechanism in the bilingual brain, which led to the idea that bilinguals should differ from monolinguals on non-linguistic tasks such as the Stroop or the Stop Signal task. Picture naming has been used to study the mental dynamics of language control, and there is a cost involved in switching between languages. Braver (2012) has offered theoretical accounts for reactive and proactive types of inhibitory control. Forstmann et al. (2008) distinguished between two types of inhibitory systems, one is selective and applies to specific types of stimuli, and the other is non selective.

Shao et al. (2014) showed that quantum of selective inhibition applied to reduce distractor interference during object naming correlates with the N200 component, which has been linked with inhibitory processes. Hilchey and Klein (2011) argued that if two groups differ in inhibition in a Stroop-like task, the difference should only be observed in the performance on the incongruent trials, however, Mishra and colleagues found that bilinguals were faster on all types of trials, suggesting both a general speed advantage and an inhibitory control advantage.

1.2.2.3. Task Switching

Switching between languages is a diagnostic feature of bilingualism, as it involves executive control in a big way. Brain imaging studies have shown that frontal control areas are active when bilinguals switch between languages and when they translate words. Different bilinguals differ in their degree of switching depending on the social context and

language proficiency. Switching is important as it involves executive control in a big way, and can be used to understand the cognitive advantages that bilingualism may bestow. Verreyt, Woumans, Vandelanotte, Szmalec, and Duyck (2016) found that balanced bilinguals who were frequent switchers outperformed others on executive control tasks.

Poplack (1988) reported the difference in the extent of code-switching among Puerto Rican speakers of Spanish and English in New York, USA, and the French–English bilinguals in Ottawa, Canada. Code-switching in everyday speech of bilinguals is dependent on who they talk to. This leads to a link between levels of social conflict, the frequency of switching in certain bilingual places, and the degree of executive control. The adaptive control hypothesis Green &Abutalebi (2013) has attempted to link the frequency of code-switching in a particular context to executive control. Bilingualism can have cognitive and psycholinguistic implications, but it is difficult to understand.

Recent studies have shown that bilinguals from a single-language context showed a higher switch cost on a non-linguistic switching task than bilinguals from a dual-language context. This research deviates from early approaches as it takes into account the speaker's linguistic and social habits. It is difficult to understand the cognitive and psycholinguistic implications of bilingualism without good data on switching situations in many parts of the world.

1.2.2.4. Monitoring

Monitoring the environment for any conflict is an essential component of executive control. Neuro-imaging evidence suggests that when presented with conflict, bilinguals adapt better and show less activation in the ACC. This study compared bilinguals and monolinguals on the Flanker task in an fMRI experiment. It is unclear how the bilingual brain adapts to linguistic and non-linguistic conflict. The demands of monitoring may vary

depending on the bilingual context, such as if in a social situation one does not expect sudden appearances and reappearances of interlocutors for whom one may need to change control settings.

Bilinguals in western countries should have different experiences than those from other cultures, as their cultural context of speech use and switching may vary. It is important to know what kind of bilingualism is in practice in the participant's culture and which mechanism may be in use for language control.

1.2.2.5. Attentional Disengagement

Attention has been found to be a key factor in the differences between bilinguals and monolinguals. Studies have shown that bilinguals perform better at parallel search in a visual search task than monolinguals. The Posner cueing paradigm can reveal attentional engagement and disengagement. Mishra et al. (2012) found that highly proficient bilinguals showed early onset of inhibition of return (IOR), indicating rapid disengagement of attention from the cue compared with the low proficient bilinguals. These results show that bilingualism aids in better attentional movement.

Attentional disengagement from a stimulus or an event can be visualized in many different ways. In conflict tasks, congruent and incongruent trials are presented at random in a mixed block. In a study with younger bilinguals, bilinguals showed a higher sequential congruency effect (SCE) than monolinguals, suggesting that they could disengage attention from the previous stimuli better than the monolinguals. Bilingualism aids in the development of endogenous attention and is better at orienting attention to peripheral cues. Hernandez et al. (2010) found no advantage for bilinguals in terms of facilitation or IOR, which was seen in Mishra et al. (2012).

Singh and Mishra (2012) and Mishra (2016) used eye tracking to study attentional mechanisms that are modulated by bilingualism. Ratiu, Hout, Walenchok, Azuma, and Goldinger (2017) compared bilinguals and monolinguals on a visual search task using eye tracking and found that manual response times may be different from saccade latencies for the same task. The results showed no group difference for first saccade or overall speed, but bilinguals were slightly faster in decision-making than monolinguals. However, the sample size was too low and bilinguals came from different cultures and spoke a variety of first languages.

1.3.   The Cognitive Advantages of Bilingualism

The idea that bilingualism has some influence on executive control has an interesting history. Research has shown that bilinguals are better at non-verbal and verbal tasks, particularly those that call for higher mental flexibility. Bialystok & Martin (2004) have consistently found that bilingual children show superior cognitive abilities than monolingual children on tasks that call for conflict resolution.

Bialystok, Craik, and Luk's (2012) article reviews the research on bilingualism and its benefits for the mind and brain. They argue that bilingualism provides cognitive, linguistic, and socio-cultural benefits that extend throughout the lifespan. Bilingualism enhances cognitive processes like attention, inhibition, and cognitive flexibility. It also influences brain structure and function, potentially delaying the onset of Alzheimer's disease. Bilingualism is a valuable and positive experience for individuals and societies with benefits beyond just speaking two languages.

 (Leikin et al., 2020) informed that bilingualism has been found to have advantages in cognitive domains such as inhibition, problem solving, attention and executive control, cognitive flexibility, and working-memory updating. It also contributes to verbal and

nonverbal creativity, mediated by improved executive functions influenced by the "juggling" of two languages.

Bilingualism has also been found to have positive effects on cognitive development in adults. For instance, a study by Bialystok and colleagues (2006) found that bilingual adults were better at tasks that required executive control, which is the ability to inhibit automatic responses and focus on goal-directed behaviour. Another study by Luk and Bialystok (2013) found that bilingual adults performed better on tasks that required working memory, which is the ability to hold and manipulate information in the mind. These findings suggested that bilingualism can have a positive effect on cognitive development in adults.

2.   The Theoretical background of Code-switching

Panhwar&Buriro (2020) suggested that Code switching (CS) is a complex phenomenon that involves linguistic and extra-linguistic elements such as identity, norms, and culture. It is investigated via three perspectives: sociolinguistic, psycholinguistic, and structural. Sociolinguistic theories investigate the social motivations that drive speakers to codes witch, while psycholinguistics theories investigate the cognitive process when two or more languages used simultaneously. Structural approaches focus on the grammatical rules that permit or interfere with the combination of different languages during the switching process.

However, the different perspectives of these disciplines can lead to contrasting views of code-switching and impact the choice of research methods and design. The most important details in this text are that bilingualism does not lead to decreased cognitive abilities and can enhance personal capacity, and that code-switching is common in bilingual and multilingual speech.

Weinreich (1953) viewed code-switching as cross-language interference, but numerous studies have shown that it can occur for emphasis or due to a better word choice in one language. Poplack's approach to code-switching focuses on grammatical constraints that govern the phenomenon, but has been criticized for being too narrow and neglecting the social and psycholinguistic factors that influence code-switching.

2.1. Similar terms

2.1.1. Language choices

The cognitive mechanism creates balance during code-switching by neutralizing the network, but no language is totally "turned off"; rather, all languages "co-exist," with one being more active than the others, or the languages cross and recross each other. According to Grosjean (2000), the interlocutors, setting, and usefulness of the interaction are crucial elements for activating the bilingual person's "language mode," which enables code-switching. As seen in the following image, a bilingual speaker's mind first "decides which base language to use, and in the second stage engages in code-switching," making it evident that it is a more sophisticated decision-making process than a monolingual speaker as illustrated in the following figure:
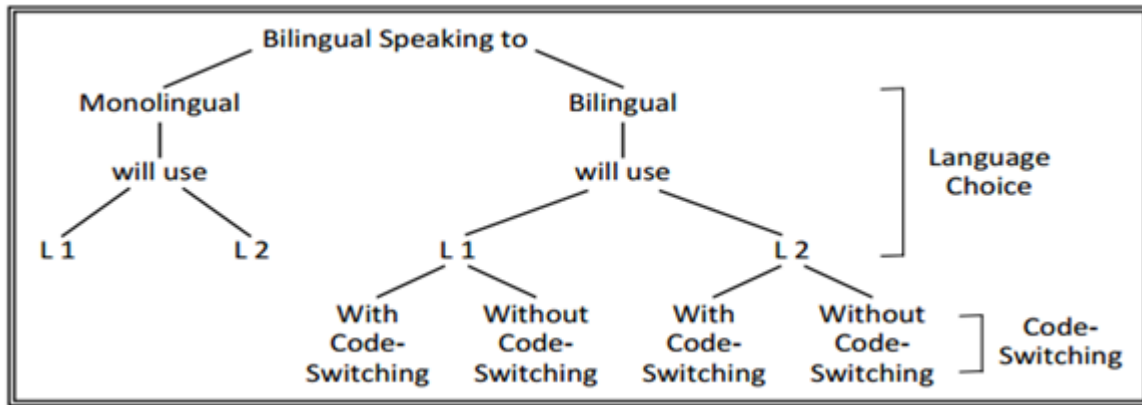
Figure 1: Language choices and code-switching (Grosjean, 1982, p. 145)

"Language choices" can have multiple meanings depending on the context in which it is used. However, a common definition of "language choices" is the decision-making process of choosing which language or languages to use in a specific communicative situation. For instance, according to Busch (2015, p11), "language choice is the decision speakers make concerning the use of different languages or varieties of languages in different communication settings".

2.1.2. Borrowing

Borrowing is the process of incorporating words or expressions from one language into another's lexicon. Code-switching and borrowing are both language contact phenomena, but differ in how they integrate elements from two or more languages. Borrowing is the adoption of lexical items (i.e. words, phrases) from one language into another, while code-switching involves the use of two or more languages in the same conversation or sentence.

Borrowing can lead to an increase in code-switching, as speakers may use borrowed words or expressions when they do not know the appropriate word or phrase in their first language. Code-switching can facilitate borrowing, as speakers who are comfortable switching between languages may be more likely to adopt new words or expressions from another language.

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In some cases, borrowing and code-switching can lead to the formation of a pidgin language, which is a simplified language that arises as a means of communication between speakers of different languages who do not share a common language. Over time, a pidgin language may develop into a Creole, a stable and fully developed language. (Gardner-Chloros, 2009)

2.1.3. Code-mixing

(Wikipedia contributors, 2023) Code mixing is the practice of mixing elements from two or more languages or dialects within a single utterance, such as using words or phrases from one language while speaking another. Code-switching refers specifically to the practice of switching between two or more languages or dialects within a single conversation, while code mixing refers to the practice of mixing languages or dialects within a single utterance.

Code-mixing is often used to describe the mixing of different languages or language varieties at the sentence or phrase level, while code-switching is often used to refer to the broader practice of using multiple languages or language varieties within a single communication event. Some scholars also use the term "code-switching" to refer specifically to the social and cultural factors that influence language choice and language use in multilingual contexts. The definitions and usage of the terms code-mixing and code-switching can vary across different subfields of linguistics and other disciplines.

Code-mixing refers to the mixing of linguistic elements at the word or phrase level, while code-switching refers to the alternation between two or more languages or language varieties at the sentence or discourse level. Some scholars use the term code-mixing to refer to the more spontaneous and unconscious use of multiple languages in everyday speech, while reserving the term code-switching for more deliberate and strategic language choices made by bilingual speakers in particular social or communicative contexts.

2.1.4. Language crossing

Language crossing is a sociolinguistic phenomenon that occurs when a speaker uses a language or dialect that is not expected of them, often involving movement across social or ethnic boundaries. Unlike code-switching and code-mixing, language crossing requires societal knowledge and expectations, as well as an interactional context and proficiency in multiple codes.

It is considered more metaphorical than other forms of code-switching, focusing on the disruption of expectations and norms, and the recognition by both speaker and listener that the situation is not "business as usual." The term "figurative code-switching" is preferred to avoid terminological confusion. (Bilingualism: The Sociopragmatic-Psycholinguistic Interface, 2005)

2.2. Types of Code-switching (forms)

Wikipedia contributors, (2023) have identified different types of code-switching based on the level at which the switching occurs.
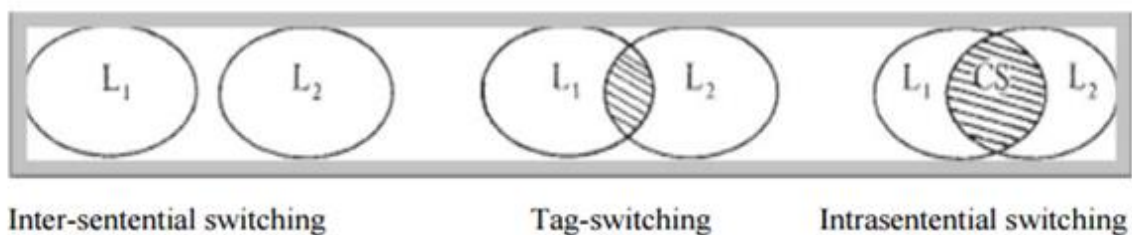
Figure 2: The type and degree of code-switching (Adapted from Poplack, 1980, p. 615)

Inter-sentential switching: Inter-sentential switching, also known as extra-sentential switching, occurs outside the sentence or the clause level and involves switching at sentence or clause boundaries.

Intra-sentential switching: intra-sentential switching occurs within a sentence or clause. Most code-switching studies focus on intra-sentential switching, as it creates many hybrid grammar structures that require explanation. There are two types of intra-sentential switching: alter national and insertional.

Alter national code-switching: creates a new grammar that is a combination of the grammars of the two languages involved.

Insertional code-switching: involves the insertion of elements from one language into the morphosyntactic frame of the other.

Portmanteau sentence is a particular type of intra-sentential code-switching. It involves a hybrid structure from two different languages in one sentence. In this type of code-switching, an item in one language acts as a bridge between portions of the sentence in languages that have differing word order typologies. A portmanteau sentence is more of a "syntactic blend" than the kind of lexical blend one sees in portmanteau words such as smog.

tag-switching

Tag-switching is another type of code-switching that involves switching of either a tag phrase or a word, or both, from one language to another. It is common in intra-sentential switches. Intra-word switching occurs within a word itself, such as at a morpheme boundary.

intra-word switching

 intra-word switching occurs within a word itself.

In general, scholars tend to focus on intra-sentential switching, as it creates many hybrid grammar structures that require explanation. The other types involve utterances that follow the grammar of one language or the other.

2.3. The Reasons Of Code-Switching

According to Wikipedia contributors, (2023) Code-switching is a complex phenomenon that can be influenced by linguistic and social factors. Other factors that can influence code-switching include the linguistic environment, the speaker's level of proficiency in each language, and the social context in which the conversation takes place. Social context also plays a significant role in code-switching, as speakers may switch languages to accommodate the language preferences of their interlocutors, or to assert their identity as members of a particular linguistic community. Code-switching can also be influenced by the genre of the conversation, such as storytelling or jokes, as speakers try to convey a certain tone or effect.

Code-switching is a dynamic and multifaceted phenomenon that can be influenced by a wide range of factors. It occurs for various reasons in a single conversation, such as the need for a particular topic, quote someone, express gratitude or solidarity, clarify a word or concept, identify with a particular group, soften or strengthen a command, use technical or idiomatic speech, unconsciously match the speech of others, or get better deals or treatments by speaking in the dialect, language, or accent of the local people.

In some situations, code-switching can help individuals avoid the effects of implicit bias. Additionally, code-switching can be used to say something in secret when a speaker wants to convey a message to someone else in a language or code that others around them cannot understand. Overall, code-switching is a complex linguistic phenomenon that can serve a variety of communicative functions in different contexts.

3. The Theoretical Framework of Code-Switching

Theoretical frameworks play a crucial role in understanding the intricate phenomenon of code-switching, where individuals fluidly switch between two or more languages or language varieties. These frameworks provide a conceptual lens through which researchers and linguists can explore the underlying mechanisms, motivations, and social implications of code-switching.

Theoretical models such as the Matrix Language Frame (MLF) model, Bilingual Interactive Activation Model, Revised Hierarchical Model, Inhibitory Control Model, and The Sociopragmatic Psycholinguistic (SPPL) processing Model offer valuable frameworks to examine the complexities of code-switching. By utilizing these frameworks, scholars can gain insights into the social, cognitive, and linguistic factors that shape code-switching practices, ultimately contributing to a deeper understanding of language use and interaction in multilingual contexts.

3.1. The Sociopragmatic Psycholinguistic (SPPL) processing Model
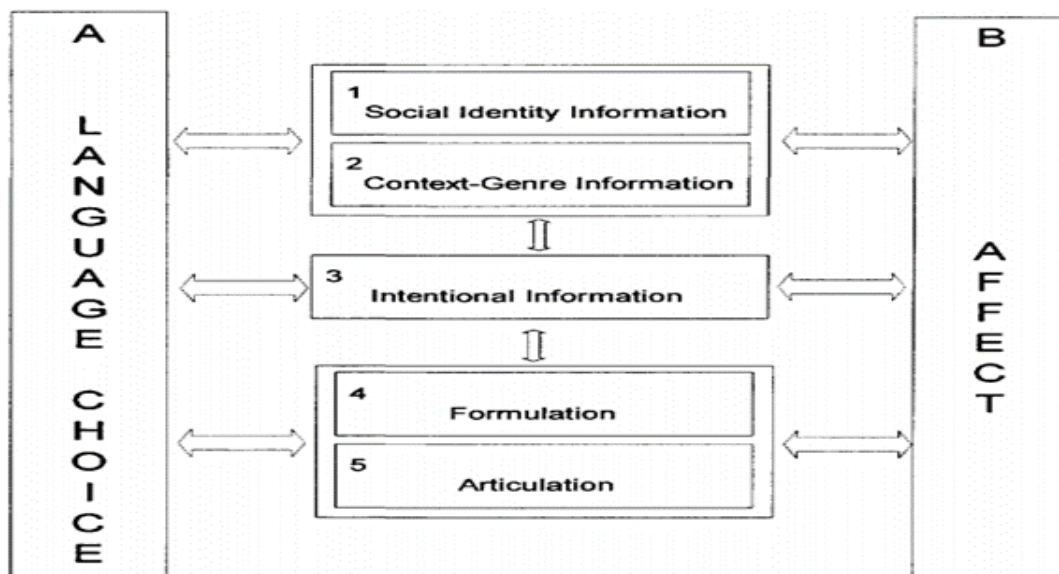
Figure 6: SPPL Model for bilingual processing (Bilingualism: The Sociopragmatic-Psycholinguistic Interface, 2005, p12)

According to Joel Walters (2005) The Sociopragmatic Psycholinguistic (SPPL) processing model is a framework that helps us understand how bilingual individuals process code-switching. It was developed by Joel Walters in 2005. The model suggests that code-switching involves both sociopragmatic and psycholinguistic factors.

The sociopragmatic factors in the SPPL model refer to the social and cultural context of the conversation and the bilingual person's knowledge of the two languages. These factors influence when and why code-switching occurs. The psycholinguistic factors, on the other hand, relate to the bilingual's ability to access and process information in both languages.

According to the SPPL model, code-switching is a two-stage process. In the first stage, the bilingual person needs to access relevant information in both languages, such as words, phrases, grammar, and cultural references. In the second stage, they integrate this information into a single utterance. This requires fluency and accuracy in switching between languages. Besides, The SPPL model divided the bilingual's mind into two parts: the functional architecture and the processing mechanisms. The functional architecture is responsible for planning and executing code-switching, while the processing mechanisms are responsible for carrying out the actual switching.

The SPPL model has been supported by various studies that have shown bilingual individuals are able to access and process information in both languages when they code-switch. However, it's important to note that the model does have some limitations. For example, it doesn't fully account for all the factors that influence code-switching, like the role of emotions.

Despite these limitations, the SPPL model provides a valuable framework for understanding the complex cognitive processes involved in code-switching. It helps us

examine the functional architecture and processing mechanisms involved in bilingualism, highlighting the interplay between language structures and the cognitive processes at play. The SPPL Model is based on the Green's Model of Inhibitory Control and the Perceptual Control Model.

3.2. Inhibitory Control Model
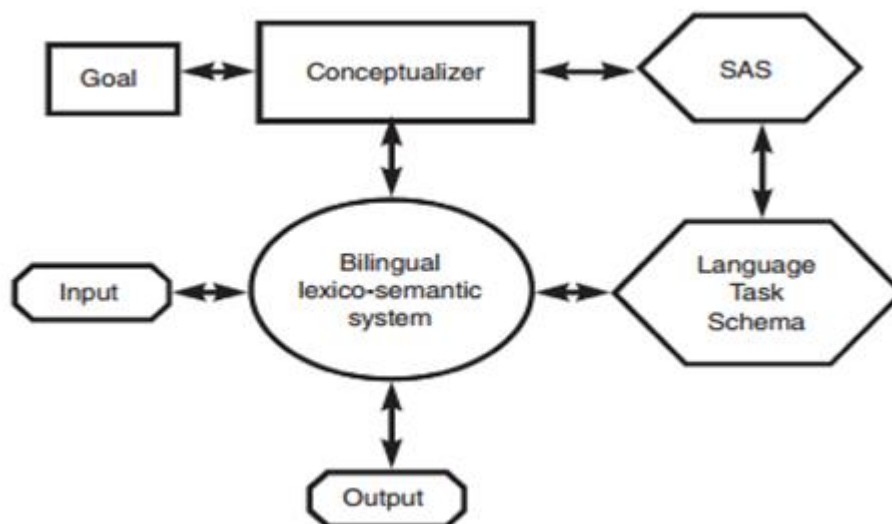
Figure 4: The inhibitory control (IC) model. (Green,1998, p4).

The inhibitory control model is a theory of how bilinguals control their two languages. It says that when a bilingual is speaking one language, they have to actively inhibit the other language. This is because the two languages are constantly competing for attention. The model was proposed by Peter Green in 1998. He based it on the idea that bilinguals have to use executive control functions to inhibit words in the unintended language. Executive control functions are a type of cognitive function that allows us to control our thoughts, emotions, and behavior.

Green's model has been supported by a number of studies. For example, one study found that bilinguals were slower to name pictures in their non-dominant language when they had just been speaking their dominant language. This suggests that the bilinguals had

to use executive control functions to inhibit the dominant language. Another study found that bilinguals were more likely to make errors when they were switching between languages. This suggests that switching between languages requires more cognitive effort than speaking one language at a time.

The inhibitory control model is a useful way of understanding how bilinguals control their two languages. It can help us to understand why bilinguals sometimes make errors when they speak, and why it can be difficult for them to switch between languages. (Stevens' Handbook of Experimental Psychology and Cognitive Neuroscience, Learning and Memory, 2018)

Conclusion

In conclusion, this chapter has provided a brief overview of bilingualism and code-switching from a psycholinguistic perspective. It has defined the terms bilingual and code-switching, and explained how they differ from other language contact phenomena. It has also presented the main forms and functions of code-switching, and discussed some of the models that account for the cognitive processes involved in bilingual language production and comprehension. The chapter has aimed to highlight the importance and complexity of code-switching as a linguistic and social phenomenon that reflects the dynamic nature of human communication."

Chapter Three: Analysis and Discussion of the Results

Introduction

The following chapter is dedicated to analysing the collected data. The primary objective of this study is to obtain answers to the research questions and evaluate the validity of our hypothesis, which aims to emphasize the significance of code-switching among EFL students at Mohammed Khaider University and its potential role in enhancing their cognitive flexibility. The purpose is to demonstrate that EFL students can improve both their language skills and cognitive abilities concurrently.

To accomplish this purpose, two data collection tools were employed: a questionnaire administered to the students and interviews conducted with the teachers. The questionnaire aimed to assess the frequency and patterns of code-switching among EFL students in the classroom, while also providing insights into the participants' attitudes and perspectives regarding code-switching and its impact on cognitive flexibility. The interviews with university teachers were conducted to gather their diverse perspectives and attitudes towards the relationship between code-switching and cognitive flexibility.

1. Methodology
1.1. Research Design

A mixed method approach is employed in the current investigation, incorporating descriptive statistics and thematic analysis to address the research questions and explore the impact of code-switching on the cognitive flexibility of EFL students. This approach allowed us to gather data from multiple perspectives and obtain a comprehensive understanding of the topic.

As Johnson and Onwuegbuzie (2004, p. 123) highlighted, "Mixed methods research provides a means to address research questions that cannot be adequately answered by either

qualitative or quantitative methods alone, offering a more comprehensive and nuanced analysis". By combining both qualitative and quantitative approaches, we are able to enhance the credibility and validity of our findings, while minimizing biases in the data collection and analysis process. This integrated approach provided a more nuanced analysis, enabling us to gain a deeper understanding of the problem and its underlying factors.

1.2. Population and Sample

In this study, the researcher selected randomly Master Two students at the Department of English at the University of Mohamed Khider, Biskra to participate in this research; Our sample involved 18 students and 2 teachers out of a population of 132 students and approximately 70 teachers. The questionnaire was accomplished online. We have chosen Master Two students because they learnt English for more than 13 years from Middle school.

1.3.Data Collection Tools

In order to accomplish the objectives of this study, data were collected using a combination of a questionnaire and interviews. Bryman(2016, p. 277) stated that "By employing appropriate questionnaires, researchers can quantify data and analyse responses using statistical methods, enabling the exploration of relationships and patterns.". The questionnaire was designed to gather data about the perspectives of students regarding code-switching and its influence on cognitive flexibility. On the other hand, interviews were conducted with university teachers to gather a range of viewpoints and attitudes concerning the connection between code-switching and cognitive flexibility. These data collection methods were chosen to obtain a comprehensive understanding of the topic from both student and teacher perspectives.

1.4. Validity

Validity and reliability are very important concepts in research . Validity , as defined by(Creswell, 2014) "Validity refers to the extent to which a test or instrument measures what it is intended to measure and how well it does so." Before administering the questionnaire , it affirms validated by the supervisor of this work who mentioned some changes to be made in terms of wordiness , the omission of some questions , and the improvement of its overall layout.

2. Students' Questionnaire

2.1. Description of the Students' Questionnaire

The questionnaire was specifically Designed for Master two EFL students who were pursuing an Applied Linguistics major at the University of Mohamed Khider - Biskra. We studied a sample of (18) students from a population of (132) students. The purpose of this questionnaire is to gather insights into students' attitudes towards code-switching and its impact on cognitive flexibility, while also emphasizing the significance of both code-switching and cognitive flexibility, besides their correlation.

The questionnaire was designed in a semi-structured format and consisted of three main sections. The questions in the questionnaire were closed-ended, requiring students to choose a response from a Likert scale or indicated a Yes/No answer, and Open-ended questions were used to allow students to provide justifications or explanations about their responses.

Section one: demographic information

The first section of the questionnaire included five questions that aimed to gather relevant background information about the participants. This section typically includes questions related to demographic characteristics such as age, gender, and language proficiency. These questions help establish a profile of the participants and provide contextual information for the analysis of the relationship between code-switching and cognitive flexibility.

Section two: code-switching

The second section included nine main questions about code-switching. At first, the participants were asked about capturing information related to their code-switching behaviour and their perceptions of code-switching in various contexts ; it involves questions about the frequency of code-switching in different settings, such as classrooms, social interactions, or specific language contexts. Participants asked to estimate the percentage of code-switching they engage. Finally, we asked students to determine the reasons behind code-switching behaviour.

Section three: cognitive flexibility

The present section is designed to assess participants' cognitive flexibility abilities and their perceptions on how code-switching may relate to cognitive flexibility. This section included questions that explore various dimensions of cognitive flexibility and its potential connection to code-switching; it is consisted of ten main questions. In the beginning, participants were asked to measure their self-perceived cognitive flexibility. This involves scales that assess their ability to adapt to changing situations, switch between tasks or perspectives, think creatively, and handle cognitive challenges. The last question in this

section aimed at assessing the participants 'level of cognitive flexibility while code-switching.

2.2. Administration of the Questionnaire

The final version of the questionnaire was created using Google Forms and distributed to the intended participants through a Messenger group on May 24th, 2021. Due to the circumstances, administering the questionnaire online was the only viable option as Master two students were not available during the second semester.

2.3. Analysis of Students' Questionnaire

Section one: demographic information

The demographic information section of the questionnaire aimed to gather relevant background information about the participants. This section includes questions related to demographic characteristics such as age, gender, and language proficiency. These questions help establish a profile of the participants and provide contextual information for the analysis of the relationship between code-switching and cognitive flexibility.

Item 01: How old are you?

Age
18 responses
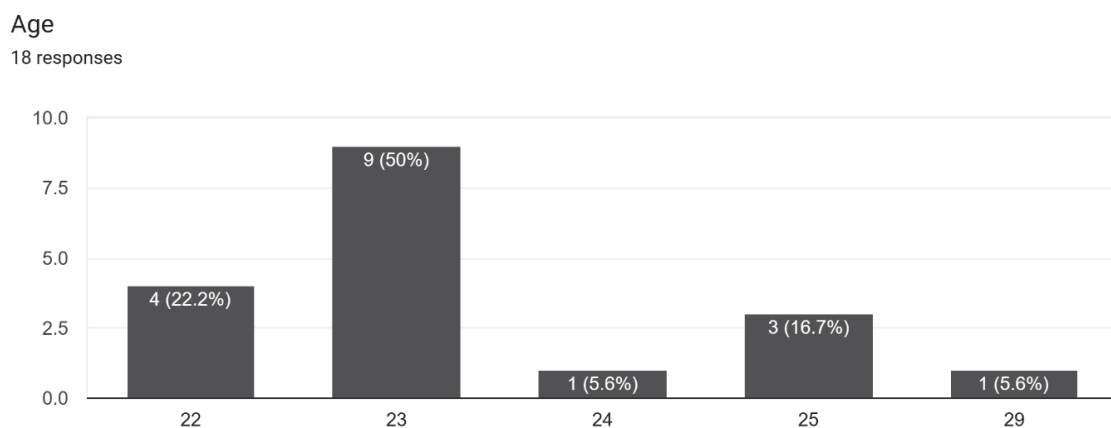
Figure 7: Participants' age

The sample in our study consisted of five age groups, as indicated in the table . Among the eighteen students in the sample, four (22.2%) were aged twenty-two, while the majority of respondents, nine (50%), were aged twenty-three. One student each represented the age groups of twenty-four and twenty-nine, accounting for 11.1% of the total sample. Additionally, three students (16.7%) fell within the twenty-five-year age range. These variations across categories indicated a diversity of abilities and viewpoints.

Age	Frequency	Percentage
22	**4**	**22.2%**
23	**9**	**50%**
24	**1**	**5.6%**
25	**3**	**16.7%**
29	**1**	**5.6%**

Table 1: Participants' age

Item 02: What is your gender?

Gender
18 responses

94.4%
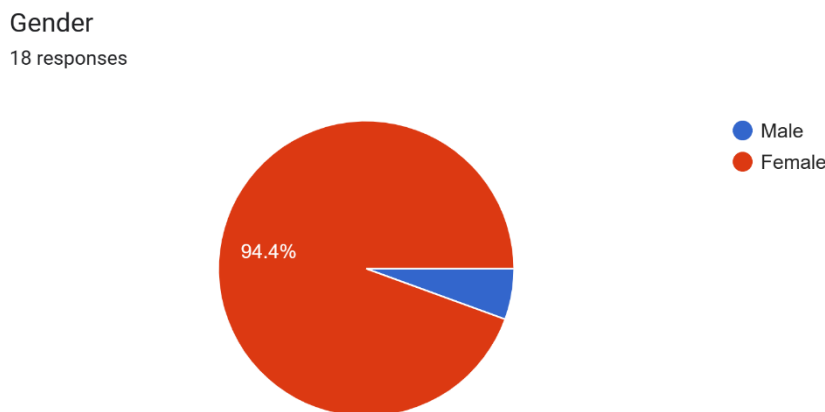
● Male
● Female

Figure 8: Participants' gender

The second question pertains to the gender distribution of the participants. As depicted in Figure 2, the majority of the respondents were females, accounting for 94.4% of the sample, while male respondents represented only 5.6%. This difference in percentages can

be attributed to the higher enrollment of female students in English as a foreign language classes compared to male students who may opt for different study majors.

Gender	Frequency	Percentage
Female	**17**	**94.4%**
Male	**1**	**5.6%**

Table 2: Participants' gender

Item 03:what is your Native Language

Native language	Frequency	Percentage
Arabic	**17**	**94.4%**
Tamazight	**1**	**5.6%**

Table 3: Participants' native language

The third question investigates the native language of the participants. As illustrated in Table 3, the majority of the respondents indicated that Arabic is their mother tongue, accounting for 94.4% of the sample, while only one respondent reported Tamazight as their mother tongue, representing a mere 5.6%. This difference in percentages can be attributed to the ethnic composition of Algeria, where the majority of the population consists of Arabs and Berbers. Arabs make up approximately 85% of the population, while Berbers represent around 15%.

Item 04:How long have you been studying English?

Period	Frequency	Percentage
Less than 10 years	**3**	**16.7%**
11-14	**13**	**72.2%**
More than 14	**2**	**11.1%**

Table 4: Participants' study English duration

Upon examining Table 4, it is evident that the largest group of students in the sample (72.2%) has studied English for eleven to fourteen years. This indicated a significant level of exposure and experience in learning the English language among these respondents. Additionally, there is a smaller group of participants (16.7%) who have studied English for less than five years, suggesting a relatively shorter duration of English language learning. Furthermore, a minority of the sample (11.1%) consists of students who have studied English for more than fourteen years. Overall, these findings demonstrate the varying levels of exposure and proficiency in English language learning among the participants.

Item 05: Current English proficiency level

Current English proficiency level
18 responses

- Beginner
- Elementary
- Intermediate
- Advanced
- Fluent/Native-like

50%

44.4%
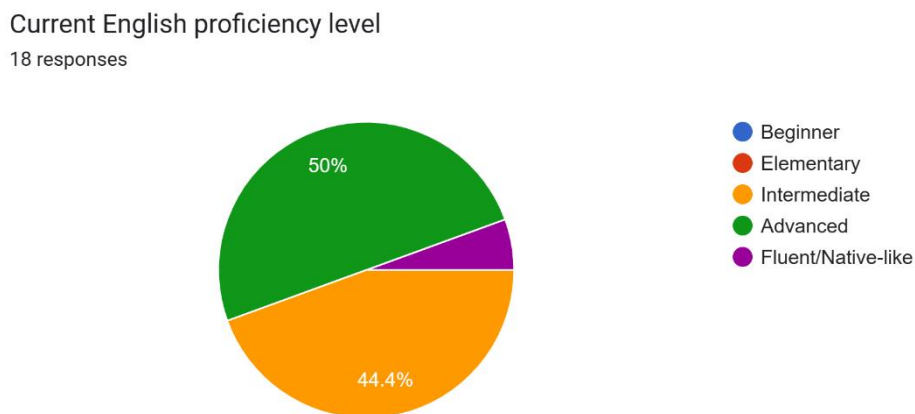
Figure 9: Participants' Proficiency level

The provided graph depicts the self-rated English proficiency of the participants. Notably, a significant portion of the participants—exactly half of them—rated their English proficiency as advanced (50%). Additionally, a considerable number of participants, comprising 44.4% of the total, assessed their English proficiency as intermediate. Only one participant (5.6%) rated their English proficiency as "fluent."

Proficiency level	Frequency	Percentage
Beginner	**0**	**00%**
Elementary	**0**	**00%**
Intermediate	**8**	**44.4%**
Advanced	**9**	**50%**
Fluent	**1**	**5.6%**

Table 5: Participants' Proficiency *level*

Section two: code-switching

The code-switching section in the questionnaire focuses on capturing information related to participants' code-switching behaviour and their perceptions towards code-switching in various contexts. This section typically includes questions that explore the frequency, patterns, and reasons for code-switching among the participants.

Item 01:How frequently do you use your native language in everyday conversations?
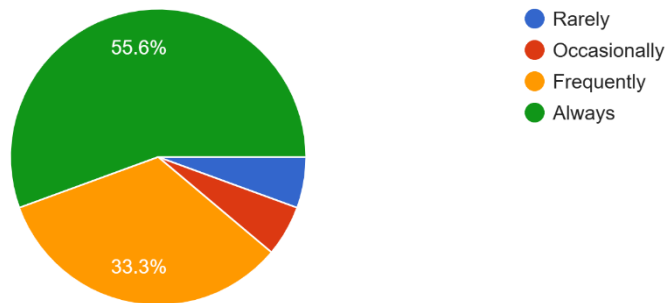
Figure 10: Participants' native language using frequency

Based on the data presented in Figure 6, a significant proportion of students (55.6%) always use their native language in their conversations. Additionally, 33.3% of the participants reported using their native language frequently, while a smaller percentage (5.6%) mentioned using it occasionally. Only a minority of students (5.6%) stated that they rarely use their native language. These varying responses indicated the existence of diverse attitudes towards code-switching among the participants.

Options	Frequency	Percentage
Rarely	1	5.6%
Occasionally	1	5.6%
Frequently	6	33.3%
Always	10	55.6%

Table 6:Participants' native language using frequency

Item 02:How frequently do you use English in everyday conversations?
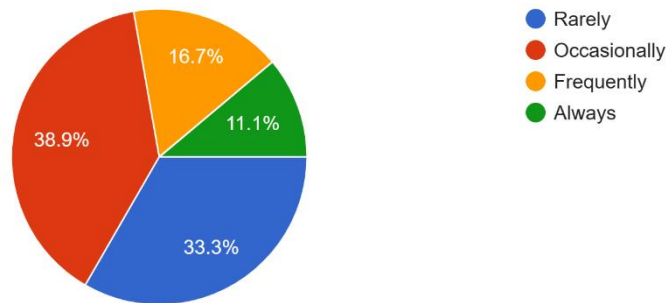
Figure 11: Participants' English using frequency

According to Figure 7, a considerable number of students (11.1%) always use English in their conversations. Furthermore, 16.75% of the participants reported using English frequently, while 38.9% mentioned using it occasionally. Interestingly, a significant proportion of students (33.3%) statedd that they rarely use English. These divergent responses indicated the presence of diverse attitudes towards code-switching among the participants.

Options	Frequency	Percentage
Rarely	6	33.3%
Occasionally	7	38.9%
Frequently	3	16.75%
Always	2	11.1%

Table 7: Participants' English using frequency

Item 03:How frequently do you engage in code-switching (switching between languages) during conversations?
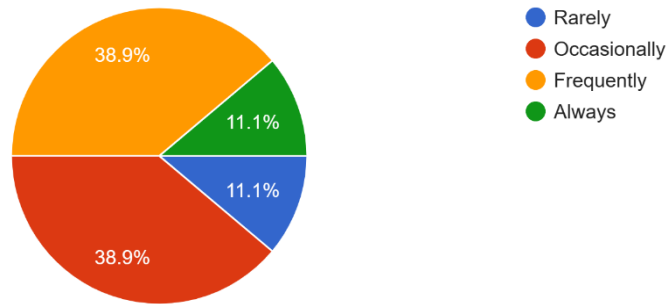
Figure 12: Participants' code-switching frequency

Based on the data presented in Figure 8, a significant proportion of students (11.1%) always switch codes in their daily discussions. Additionally, 11.1% of the participants reported using it frequently, while 38.9% mentioned using it occasionally. Notably, a considerable number of students (38.9%) statedd that they rarely use coded code-switching. These varying responses highlight the presence of diverse attitudes towards code-switching among the participants.

Options	Frequency	Percentage
Rarely	**7**	**38.9%**
Occasionally	**7**	**38.9%**
Frequently	**2**	**11.1%**
Always	**2**	**11.1%**

Table 8: Participants' code-switching frequency

Item 04:In which situations do you typically code-switch? (Check all that apply)

Figure 13: Participants' code-switching using situations
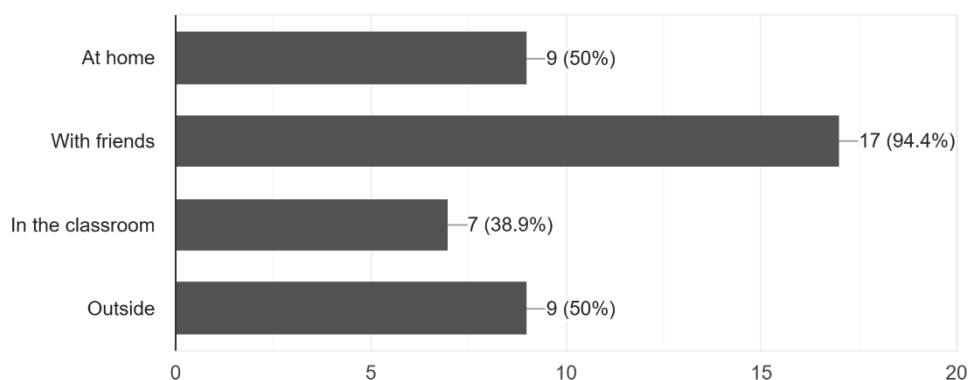
Figure 13: Participants' code-switching using situations

As shown in the table and graph above (Table 9 and Figure 9), it is evident that the majority of participants (94.4%) reported using code-switching with their friends, making it the most common option selected on the checklist. Additionally, 50% of the sample indicated using code-switching at home, while the same percentage stated using it outside. Moreover, 38.9% of the participants mentioned utilizing code-switching in the classroom. Overall, the data from the graph (Figure 9) demonstrates that students primarily employ code-switching with their friends and utilize it in various locations.

Options	Frequency	Percentage
At home	**9**	**50%**
With friends	**17**	**94.4%**
In the classroom	**7**	**38.9%**
Outside	**9**	**50%**

Table 9: Participants' code-switching using situations

Item 05: How frequently do you face any problems when you have to adjust your communication style or language use based on the formality or informality of the situation?
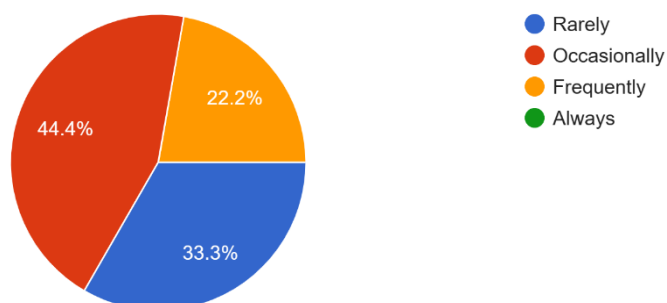
Figure 14: participants' challenges in adjusting their communication style or language

This question aims to gain insights into the challenges they face in adapting their communication to different contexts. According to Figure 10, it is apparent that all the participants encounter challenges in adjusting their communication style or language use based on the formality or informality of the situation. Among the participants, 22.2% reported facing this problem frequently, while 44.4% mentioned facing it occasionally. Additionally, 33.3% of the students stated that they face this problem rarely. This data suggested that a considerable number of participants struggle with adapting their language to different levels of formality or informality. This investigation can provide a better understanding of the complexities of human communication and help identify potential areas where individuals may require support or strategies to navigate these variations in formality.

Options	Frequency	Percentage
Rarely	**6**	**33.3%**
Occasionally	**8**	**44.4%**
Frequently	**4**	**22.2%**
Always	**0**	**00%**

Table 10: participants' challenges in adjusting their communication style or language

Item 06:How frequently do you find it challenging to switch between different registers of language?
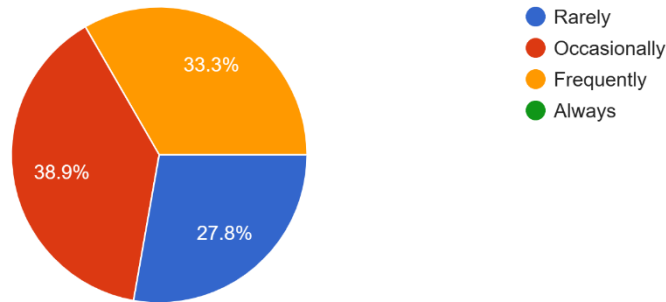
Figure 15: participants' challenges in switch between different registers

According to Figure 11, it is evident that all the participants find it challenging to switch between different registers of language. Among the participants, 33.3% reported facing this problem frequently, while 38.9% mentioned facing it occasionally. Additionally, 27.8% of the students statedd that they face this problem rarely. This data highlights that a significant a proportion of participants encounter difficulties when transitioning between various language registers.

Options	Frequency	Percentage
Rarely	**5**	**27.8%**
Occasionally	**7**	**38.9%**
Frequently	**6**	**33.3%**
Always	**0**	**00%**

Table 11: participants' challenges in switch between different registers

Item 07:What are the reasons for code-switching in your conversations? (Check all that apply)
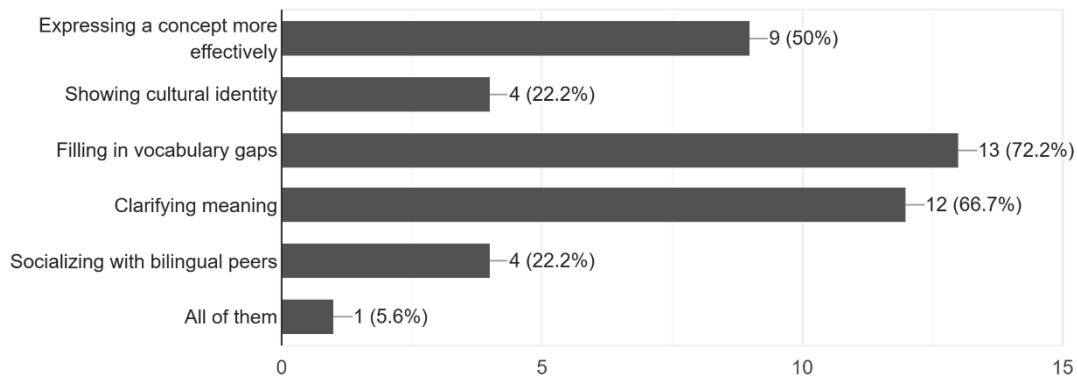
Figure 16: Participants' reasons of code-switching

As indicatedd in the presented table and graph (Table 12, Figure 12), the majority of participants (72.2%) mentioned that they use code-switching as a means to fill in vocabulary gaps during their conversations. Similarly, 66.1% of the sample reported using code-switching to clarify meaning. Additionally, 50% of the participants statedd that they engage in code-switching to express a concept more effectively, while 22.2% mentioned using it to show cultural identity. Furthermore, 22.2% of the participants use code-switching for socializing with bilingual peers. It is worth noting that a minority, representing 5.6%, reported using code-switching for all the mentioned reasons. This data highlights the various motivations behind the use of code-switching by participants in different communication contexts.

Options	Frequency	Percentage
Expressing a concept more effectively	9	50%
Showing cultural identity	4	22.2%
Filling in vocabulary gaps	13	72.2%
Clarifying meaning	12	66.7%
Socializing with bilingual peers	4	22.2%
All of them	1	5.6%

Table 12: Participants' reasons of code-switching

Item 08:How comfortable do you feel when code-switching between languages in a conversation?
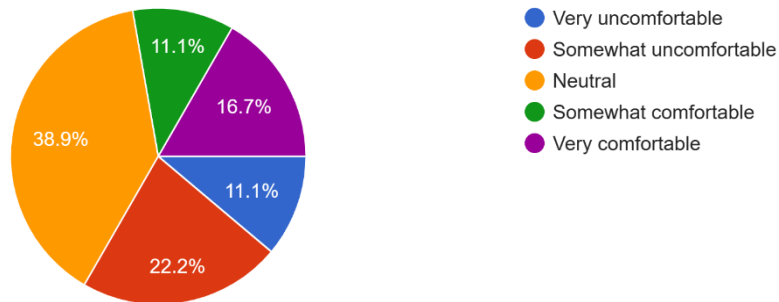
Figure 17: Participants' feeling when code-switching

As illustrated in Figure 13, the largest proportion of students (38.9%) expressed a neutral feeling when they engage in code-switching. Following this, 22.2% of the students reported feeling somewhat uncomfortable, while 16.7% felt very comfortable. Additionally, 11.1% of the students felt somewhat comfortable, and the same percentage felt very uncomfortable when using code-switching.

This distribution of responses indicated the overall positive impact of code-switching on the students, as a significant portion of them reported feeling comfortable or neutral while employing this language practice.

Options	Frequency	Percentage
Very uncomfortable	2	11.1%
Somewhat uncomfortable	4	22.2%
Neutral	7	38.9%
Somewhat comfortable	3	16.7%
Very comfortable	2	11.1%

Table 13: Participants' feeling when code-switching

Item 09:How well do you handle new vocabulary and grammar?
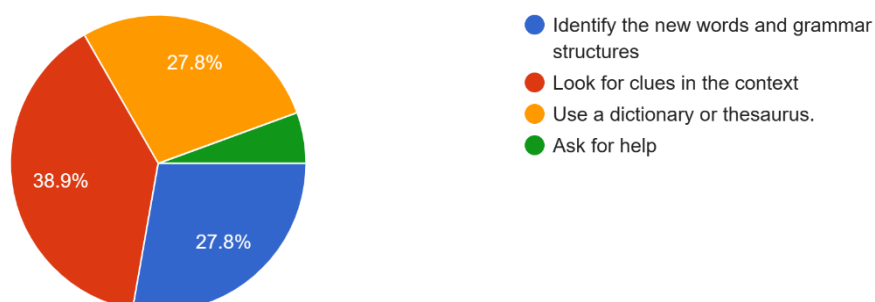
Figure 18: Participants' ways to handle new vocabulary.

As showed in figure 14, the students use different strategies to handle new vocabulary. The largest proportion of students (38.9%) resort to identify the new words and grammar structures when they handle new vocabulary and grammar. Following this, 27.8% of the students reported that they look for clues in the context to face this problem, while 27.8% use a dictionary orthesaurus. Additionally, 5.6% of the students ask for help.

Options	Frequency	Percentage
Identify the new words and grammar structures	5	27.8%
Look for clues in the context	7	38.9%
Use a dictionary or thesaurus.	5	27.8%
Ask for help	1	5.6%

Table 14: Participants' ways to handle new vocabulary.

Section three: cognitive flexibility

The cognitive flexibility section in the questionnaire aimed to evaluate the participants' cognitive flexibility skills and their perspectives on the relationship between code-switching and cognitive flexibility. This section usually consists of questions that delve into different aspects of cognitive flexibility and its potential correlation with code-switching.

Item 01: How frequently do you find yourself switching between different activities or projects in your daily life?
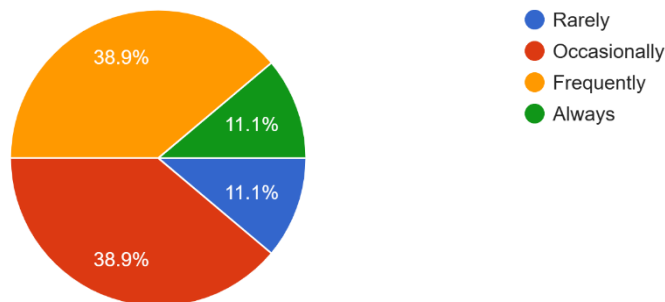
Figure 19: Participants' attitudes towards task-switching

According to the data illustrated in Figure 15, a notable percentage of students (11.1%) consistently engage in switching between different activities or projects in their daily lives. Similarly, 11.1% of the participants reported doing it frequently, while 38.9% mentioned doing it occasionally. Importantly, a significant portion of students (38.9%) statedd that they

rarely practice task-switching. These diverse responses emphasize the existence of varied attitudes towards task-switching among the participants.

Options	Frequency	Percentage
Rarely	2	11.1%
Occasionally	7	38.9%
Frequently	7	38.9%
Always	2	11.1%

Table 15: Participants' attitudes towards task-switching

Item 02:How do you handle situations where you need to navigate between different English-speaking cultures or contexts, each with their own linguistic norms and practices?
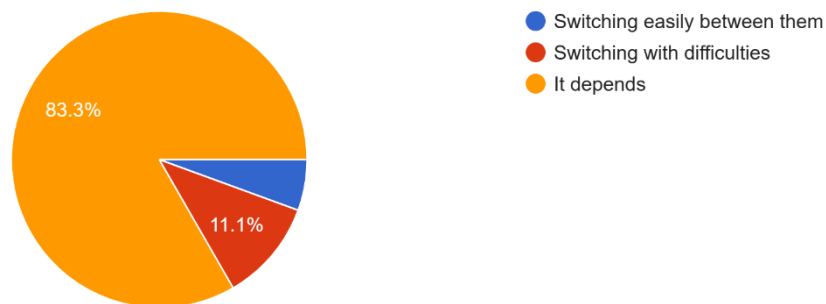
Figure 20: Participants' attitudes toward navigating between different English-speaking cultures or contexts

The question aims to understand how individuals handle situations where they need to navigate between different English-speaking cultures or contexts. As depicted in Figure 16, students employ various attitudes to manage situations requiring navigation between different English-speaking cultures or contexts. The majority of students (83.3%) indicated that they switch between them easily. Additionally, 11.1% of the students reported difficulties in switching, while 5.6% stated that it depends on the situation.

Options	Frequency	Percentage
Switching easily between them	15	83.3%
Switching with difficulties	2	11.1%
It depends	1	5.6%

Table 16: Participants' attitudes toward navigating between different English-speaking cultures or contexts

Item 03:How do you usually handle misunderstandings or communication breakdowns in English?
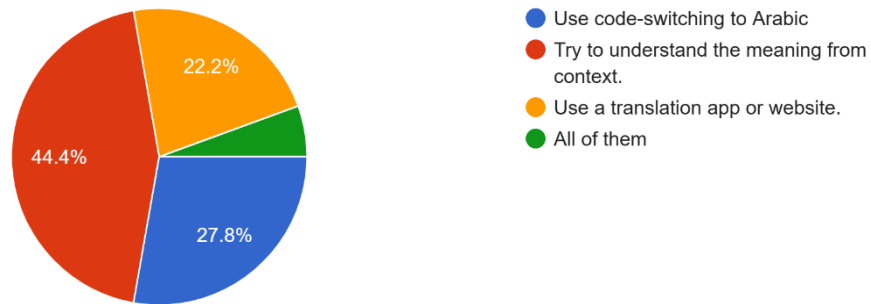
Figure 21: Participants' attitudes toward communication breakdowns in English

According to Figure 17, students utilize diverse strategies to address misunderstandings or communication breakdowns in English. The majority of students (44.4%) mentioned that they attempt to understand the meaning from context. Furthermore, 27.8% of the students resort to code-switching to Arabic, while 22.2% stated that they rely on translation apps or websites. Only a small percentage (5.6%) reported using all of the strategies.

Options	Frequency	Percentage
Use code-switching to Arabic	**5**	**27.8%**
Try to understand the meaning from context	**8**	**44.4%**
Use a translation app or website	**4**	**22.2%**
All of them	**1**	**5.6%**

Table 17: Participants' attitudes toward communication breakdowns in English

Item 04:How effectively do you move between different language skills (e.g., reading, writing, listening, speaking) during language learning or communication?
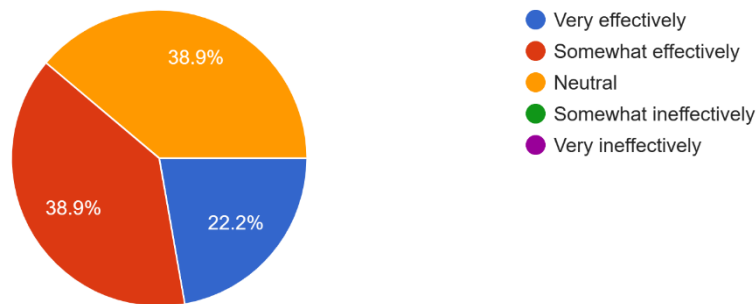
Figure 22 : Participants' attitudes toward moving between different language skills

A look at this graph reveals that a significant proportion of students (38.9%) indicated a neutral feeling when transitioning between different language skills, such as reading, writing, listening, and speaking, during language learning or communication. Furthermore, 38.9% of the students reported feeling somewhat uncomfortable, while 22.2% felt very comfortable. This distribution of responses suggested the overall positive impact of bilingualism on cognitive flexibility among EFL students.

Options	Frequency	Percentage
Very effectively	2	38.9%
Somewhat effectively	4	38.9%
Neutral	7	22.2%
Somewhat ineffectively	3	00%
Very ineffectively	2	00%

Table 18: Participants' attitudes toward transition between different language skills

Item 05: Have you ever faced challenges in comprehending or producing language in a multilingual environment?

Options	Frequency	Percentage
Yes(mention them)	3	83.3%
No	15	16.7%

Table 19: Frequency of students' issues pertaining to multilingual environment

As shown in Table 19, the majority of students reported no difficulties related to comprehending or producing language in a multilingual environment. The data presented in the table indicated that 83.3% of the participants in our sample did not encounter any issues in a multilingual environment. In contrast, only 16.7% of the participants reported facing some complications in such an environment and one among them post a comment saying that "the different Algerian dialects that have words we do not use in our region". This shows that the most of EFL learners have a high level in cognitive flexibility.

Item 06:How do you perceive the impact of code-switching on your language proficiency in English?
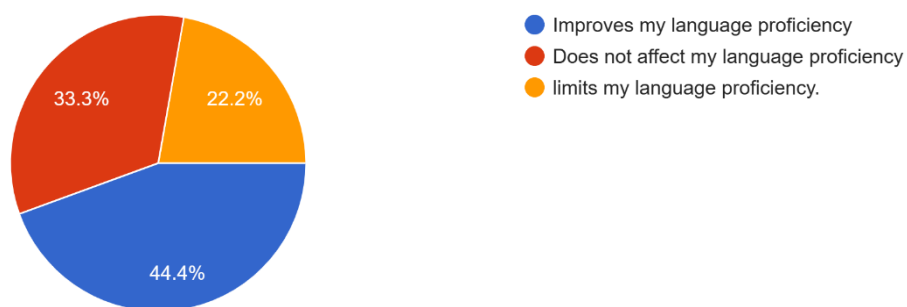
Figure 23: Participants' perception on the impact of code-switching on their language proficiency

As shown in this graph, most participants (44.4%) think that code-switching improves their language proficiency, while other respondents think that code-switching limits their language proficiency (22.2%). Furthermore, The rest of participants (33.3%) statedd that code-switching does not affect their language proficiency. Therefore, the data presented on this graph signifies the importance of code-switching in the EFL learners language proficiency.

Options	Frequency	Percentage
Improves my language proficiency	**8**	**44.4%**
Does not affect my language proficiency	**6**	**33.3%**
limits my language proficiency	**4**	**22.2%**

Table 20: Participants' perception on the impact of code-switching on their language proficiency

Item 07: In your opinion, does code-switching enhance or hinder your cognitive flexibility?
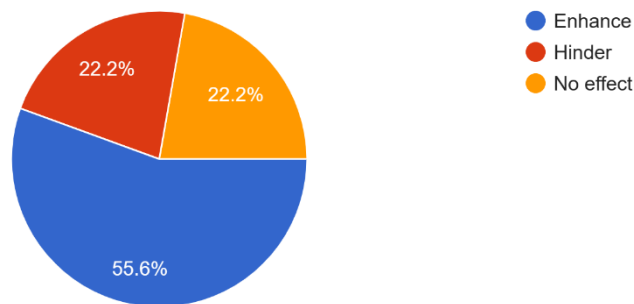
Figure 24: Participants' perception on the impact of code-switching on their cognitive flexibility

This question examines the students' perspectives on the impact of code-switching on cognitive flexibility. As illustrated in Figure 18, the majority of students (55.6%) believe that code-switching enhances their cognitive flexibility, while 22.2% believe it has no effect on it. Another 22.2% stated that code-switching hinders their cognitive flexibility.

Options	Frequency	Percentage
Enhance	**10**	**55.6%**
Hinder	**4**	**22.2%**
No effect	**4**	**22.2%**

Table 21: Participants' perception on the impact of code-switching on their cognitive flexibility

Item 08:Have you noticed any changes in your cognitive flexibility as a result of code-switching?
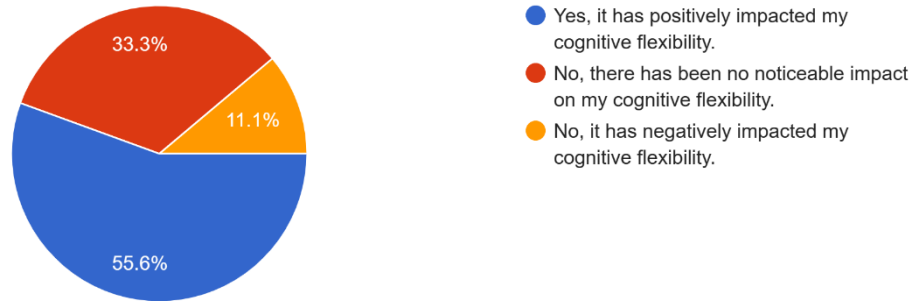
Figure 25: Participants' awareness on the impact of code-switching on cognitive flexibility

This question investigates students' awareness of the impact of code-switching on cognitive flexibility. As depicted in Figure 19, the majority of students (55.6%) stated that code-switching has positively impacted their cognitive flexibility, while 33.3% believe there has been no noticeable impact on their cognitive flexibility. 11.1% stated that code-switching has negatively impacted their cognitive flexibility.

Options	Frequency	Percentage
Yes, it has positively impacted my cognitive flexibility	10	55.6%
No, there has been no noticeable impact on my cognitive flexibility.	6	33.3%
No, it has negatively impacted my cognitive flexibility.	2	11.1%

Table 22: Participants' awareness on the impact of code-switching on cognitive flexibility

Item 09: Do you find it easier to switch between languages when engaging in tasks that require cognitive flexibility?

38.9%

55.6%

- Yes, code-switching comes naturally and facilitates cognitive flexibility.
- No, code-switching hinders my cognitive flexibility.
- It depends on the task or situation.
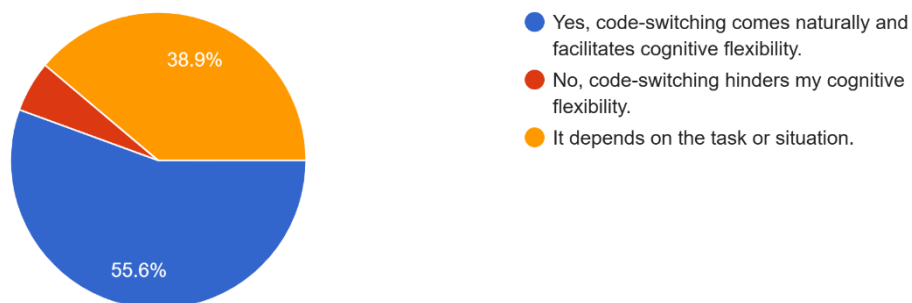
Figure 26: : Participants' attitudes toward switching between languages

This question investigates students' attitudes toward switching between languages when engaging in tasks that require cognitive flexibility. As depicted in Figure 20, the majority of students (55.6%) express that code-switching comes naturally and enhances their cognitive flexibility. On the other hand, 38.9% of students believe that the impact of code-switching on cognitive flexibility depends on the specific task or situation. A small percentage of students (5.6%) indicated that code-switching actually hinders their cognitive flexibility.

These findings shed light on the diverse perspectives and attitudes of students regarding the relationship between code-switching and cognitive flexibility. While a majority of students perceive code-switching as a facilitator of cognitive flexibility, a significant portion believes that its impact varies depending on the context. It is important to consider these different viewpoints when exploring the implications of code-switching on cognitive processes.

Options	Frequency	Percentage
Yes, code-switching comes naturally and facilitates cognitive flexibility	**10**	**55.6%**
No, code-switching hinders my cognitive flexibility.	**1**	**5.6%**
It depends on the task or situation	**7**	**38.9%**

Table 23: Participants' attitudes toward switching between languages

Item 10: To what extent are you able to maintain cognitive flexibility while code-switching?
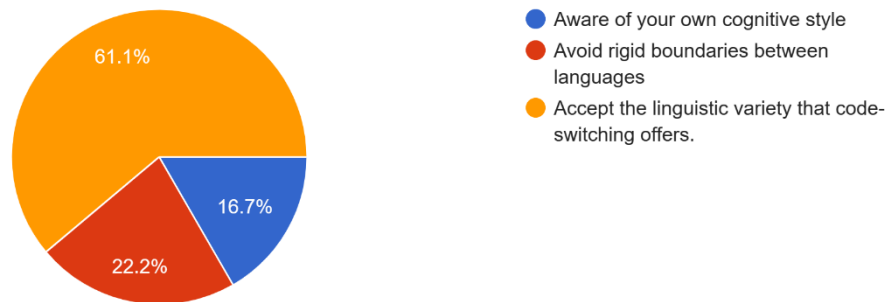
Figure 27: Participants' level in cognitive flexibility

This question assesses the levels of cognitive flexibility among EFL learners at Biskra University. The majority of participants (61.1%) exhibited a high level of cognitive flexibility, indicating their ability to embrace linguistic diversity inherent in code-switching. 22.2% of the participants demonstrated an average level of cognitive flexibility, showcasing (presenting) their capacity to navigate fluidly between languages without rigid boundaries. Conversely, a small group (16.7%) exhibited an entry-level of cognitive flexibility, indicating their awareness of their own cognitive style.

These findings provide insights into the cognitive flexibility levels of EFL learners at Biskra University, highlighting the majority's adeptness at accepting linguistic variety through code-switching. Furthermore, the results emphasize the presence of varying levels of cognitive flexibility among participants, suggesting the need for targeted instructional approaches to support learners at different stages of cognitive flexibility development.

Options	Frequency	Percentage
Aware of your own cognitive style	**3**	**16.7%**
Avoid rigid boundaries between languages	**4**	**22.2%**
Accept the linguistic variety that code-switching offers.	**11**	**61.1%**

Table 24: Participants' level in cognitive flexibility

3. Teachers' Interview

3.1. Description of the Teachers' Interview

The Teachers' semi-structured interview in this study focuses on gathering insights and perspectives from university teachers regarding the effects of code-switching on cognitive flexibility. The interview aimed to explore the teachers' experiences, opinions, and observations regarding the relationship between code-switching and cognitive flexibility among EFL students.

It delves into topics such as the frequency and patterns of code-switching observed in the classroom, the perceived impact of code-switching on students' cognitive flexibility, and any strategies or approaches employed by teachers to promote cognitive flexibility in language learning contexts. The interview provides an opportunity to gain in-depth

qualitative data and valuable insights from experienced educators, shedding light on the potential effects of code-switching on cognitive flexibility.

3.2. Administration of the Interview

The interview targeted random teachers of English who had an experience in teaching at the University of Mohamed Khaider-Biskra. Furthermore, the interview took place on May 29th, 2021. Indeed, the scope of this research was narrowed to using code-switching to improve EFL learners' cognitive flexibility skills. Each interview was written by hand, and the other was sent via email.

3.3. Analysis of Teachers' Interview

The questions and answers from the interviews were meticulously analysed individually. Due to time limitations, we were only able to conduct interviews with two experienced teachers who had over five years of teaching experience in the field. Despite the small sample size, these interviews provided valuable and diverse perspectives on the issue, allowing for a deeper understanding of the problem.

Question 01: specify your age

Teacher A: 32

Teacher B: 39

The question 1 aimed to identify the teachers' Age and determine the generation they belong to. The responses indicated that Teacher A is 32 years old, while Teacher B is 39 years old. Both of teacher A and teacher B belong to Generation Y or Millennials. The age information provided by teachers provides a basic understanding of their positions in terms of years lived, which can help to understand their experiences and perspectives. It also

provides insight into factors such as experience, generational perspectives, and teaching approaches.

Question 02: Specify the years of experience

Teacher A: 5 years of teaching experience

Teacher B: 15 years

The second question is complementary to the first question to add more information. the respondents were asked to specify their years of experience in teaching. Teacher A reported having 5 years of teaching experience, while Teacher B reported having 15 years of teaching experience. It is important to consider the different levels of experience when interpreting the responses and analyzing the data, as the insights provided by the teachers may vary based on their individual teaching experiences. The study found that Teacher B had significantly more experience in the field of teaching than Teacher A. This may contribute to a diverse perspective and understanding of the effects of code-switching on cognitive flexibility.

Question 03: How would you define code-switching in the context of education?

Teacher A: The skill of switching between multiple languages during a conversation.

Teacher B: Code-switching in the context of education refers to the practice of alternating between different languages, dialects, or registers of language in a multilingual or multicultural educational setting. It involves shifting between different linguistic codes or varieties based on the social, cultural, or educational context.

The third question aimed to explore the teachers' understanding and definition of code-switching in the context of education. Teacher A defined code-switching as the skill of switching between multiple languages during a conversation, while Teacher B defined it as

the practice of alternating between different languages, dialects, or registers of language in a multilingual or multicultural educational setting. Both definitions acknowledge the use of multiple languages or linguistic codes in educational settings, but Teacher B's response provides a more nuanced understanding by considering the various factors, such as dialects, registers, and the influence of the social and cultural context, that can influence code-switching in an educational environment.

These responses suggest that both teachers have an awareness of code-switching as a linguistic phenomenon within education, which can contribute to their teaching practices and their ability to navigate multilingual and multicultural classrooms effectively.

Question 04: How often do you engage in code-switching in your teaching environment?

Teacher A: I use code-switching sometimes, depending on the nature of the lesson /module

Teacher B: sometimes

The question 4 aimed to determine the frequency of code-switching in the teaching environment from the perspective of Teacher A and Teacher B. Both teachers acknowledged the use of code-switching in their teaching practice, albeit with varying degrees of frequency and contextuality. Teacher A's response indicated a more deliberate and thoughtful approach, while Teacher B's response suggested a general, unspecified occurrence of code-switching. Both teachers recognize the potential benefits of code-switching in the teaching environment and employ it as a strategy to enhance instruction or facilitate student understanding. Further exploration is needed to gain a deeper understanding of their specific motivations and strategies behind code-switching in their teaching practices.

Question 05: What are some of the reasons why your students code-switch?

Teacher A: Students use it when they lack the appropriate vocabulary.

Teacher B: Explaining general regulations or new reforms in the field of higher education or sharing some incidents.

The question 5 aimed to understand the reasons why students code-switch, as perceived by Teacher A and Teacher B. Both teachers recognize that students engage in code-switching for different purposes, with Teacher A highlighting the role of code-switching in compensating for vocabulary deficiencies, while Teacher B emphasizes its utility in discussing specialized topics related to higher education. These responses suggest that code-switching serves as a linguistic resource for students to overcome communication challenges and convey precise meanings in specific contexts. Further investigation and analysis would be beneficial to gain a comprehensive understanding of the various reasons behind student code-switching.

Question 06:From your perspective, what is the potential impact of code-switching on cognitive flexibility in teachers?

Teacher A:Generally, I can explain advanced concepts in two languages at the same time, but I don't consider myself a multitasker

Teacher B:We can mention the following: Language Adaptability, mental Agility, multicultural Perspective, improved Problem-Solving, enhanced Communication Skills, and cultural sensitivity

The question 6 aimed to explore the potential impact of code-switching on cognitive flexibility from the perspective of the teachers. Teacher A mentioned that he can explain advanced concepts in two languages simultaneously, but do not consider himself as multitaskers. Teacher B provided a comprehensive list of potential impact, including

language adaptability, mental agility, multicultural perspective, improved problem-solving, enhanced communication skills, and cultural sensitivity.

Both teachers acknowledge the potential positive impact of code-switching on cognitive flexibility, albeit from slightly different perspectives. These responses indicated that code-switching can have several potential benefits for teachers, including the ability to navigate diverse linguistic and cultural contexts, improve problem-solving skills, and enhance communication and adaptability. Further research and exploration are necessary to fully understand the complex relationship between code-switching and cognitive flexibility in the teaching context.

Question 07: Have you noticed any specific effects or benefits in relation to cognitive flexibility?

Teacher A:*I can think about the concepts of being taught in two languages (Arabic+ English)*

Teacher B:*Yes very often*

The seventh question aimed to explore whether the teachers have noticed any specific effects or benefits related to cognitive flexibility resulting from code-switching. Teacher A responded by mentioning that they can think about concepts being taught in two languages, specifically Arabic and English. Teacher B responded with a simple "Yes, very often." Both teachers indicated that they have noticed some effects or benefits in relation to cognitive flexibility as a result of code-switching.

Teacher A's response suggested a specific example of how code-switching facilitates their thinking and understanding of concepts in multiple languages, while Teacher B's response lacks explicit details about the observed effects or benefits. Overall, the responses indicated that code-switching has been recognized by both teachers as having some effects

or benefits related to cognitive flexibility, but further exploration and investigation would be valuable to gain more insights into the specific nature and extent of these effects.

Question 08: To what extent do you think code-switching impact a teacher's capacity to adjust to various instructional strategies or approaches? Can it potentially improve or impede cognitive flexibility in this context?

Teacher A: I think it helps teachers to explaining their lesson in a clear and simple way

Teacher B:Code-switching can have both positive and negative impact on a teacher's capacity to adjust to various instructional strategies or approaches. While code-switching can enhance cognitive flexibility, it can also present challenges that may impede this flexibility.

The question 8 aimed to understand the perspectives of two teachers on the impact of code-switching on a teacher's capacity to adjust to various instructional strategies or approaches. Teacher A believes that code-switching can facilitate effective communication and comprehension between the teacher and students, potentially enhancing the teacher's ability to adjust to different instructional strategies or approaches. Teacher B provides a more nuanced response, stating that code-switching can have both positive and negative impact on a teacher's capacity to adjust to various instructional strategies or approaches. While code-switching can offer benefits in terms of instructional flexibility, there may be also limitations or difficulties associated with the practice.

Both teachers acknowledge the potential impact of code-switching on a teacher's capacity to adjust to instructional strategies or approaches. Teacher A highlights the benefits of code-switching in facilitating clear and simple explanations, while Teacher B emphasizes the dual nature of its impact. Teacher A does not directly address the impact on cognitive

flexibility, while Teacher B recognizes that code-switching can enhance cognitive flexibility but also mentions challenges that may impede it.

Overall, the responses highlight the potential benefits and challenges associated with code-switching in terms of a teacher's capacity to adjust to instructional strategies or approaches. While code-switching can enhance communication and flexibility, it may also introduce challenges that need to be navigated. Further exploration and research would be beneficial to gain deeper insights into the specific effects of code-switching on instructional adaptability and cognitive flexibility in the teaching context.

Question 09: What strategies or techniques do you employ to balance the use of code-switching while maintaining a conducive learning environment for cognitive flexibility?

Teacher A:I include stories when I code switch to catch students attention

Teacher B:Teachers employ several strategies and techniques to balance the use of code-switching:

Purposeful Code-Switching, gradual language transition, language modelling, visual aids and contextual cues, differentiated instruction, explicit language instruction, culturally responsive teaching

The aim of question 9 is to investigate the strategies or techniques employed by teachers to balance the use of code-switching while maintaining a conducive learning environment for cognitive flexibility. Teacher A utilizes storytelling as a strategy to engage students during code-switching moments, while Teacher B provides a comprehensive list of strategies and techniques used to balance the use of code-switching in the classroom.

These strategies include purposeful code-switching, gradual language transition, language modeling , visual aids, differentiated instruction, explicit language instruction,

and culturally responsive teaching. Both teachers demonstrate a proactive approach to balancing code-switching in the classroom while maintaining a conducive learning environment for cognitive flexibility.

Question 10: Have you received any formal training or professional development related to code-switching and its impact on cognitive flexibility? If so, how has this training influenced your teaching practices?

Teacher A: I didn't receive specific training on using code-switching, but I learned how to use it in class and lectures on my own

Teacher B: No

The question ten aimed to investigate whether teachers had received any formal training or professional development related to code-switching and its impact on cognitive flexibility. The responses highlighted a difference in the teachers' experiences regarding formal training on code-switching. Teacher A acquired their knowledge and skills through self-learning, while Teacher B did not receive any specific training.

Despite this difference, both teachers have been exposed to code-switching in their teaching practices, albeit with varying levels of formal instruction or development. It is worth noting that formal training or professional development on code-switching can provide teachers with a deeper understanding of its impact on cognitive flexibility and offer strategies for its effective implementation in the classroom.

Question 11:Are there any challenges or limitations you have encountered when using code-switching as a tool for enhancing cognitive flexibility? How do you address or overcome these challenges?

Teacher A:The only challenge is that I lack advanced vocabulary in my native language

Teacher B:Yes, teachers may encounter challenges and limitations when using code-switching as a tool for enhancing cognitive flexibility. For example:

Over-reliance on Code-Switching

Linguistic Imbalance

Student Resistance or Insecurity

Curriculum Constraints

Limited Language Proficiency

Parental and Community Perceptions

The question 11 aimed to explore the challenges or limitations that teachers have encountered when using code-switching as a tool for enhancing cognitive flexibility. The responses highlighted the challenges that teachers may encounter when using code-switching, such as over-reliance on code-switching, linguistic imbalance, student resistance or insecurity, curriculum constraints, limited language proficiency, and parental and community perceptions.

To address these challenges, teachers can implement various strategies, such as being mindful of not overusing code-switching and striking a balance between languages, developing students' language proficiency in both languages, creating a supportive and inclusive classroom environment, providing scaffolding and support for students' language development, and addressing parental and community perceptions through effective communication and advocacy. By addressing these challenges, teachers can optimize the benefits of code-switching and create a conducive learning environment for enhancing cognitive flexibility.

Question 12: In your opinion, do you believe code-switching should be encouraged as a pedagogical practice to foster cognitive flexibility in both teachers and students? Why or why not?

Teacher A:Yes, because it contextualise the learning content to the students

Teacher B:Maybe during the pre-university phase but I don't think it is appropriate in EFL university classes

The question 12 aimed to gather the participants' opinions on whether code-switching should be encouraged as a pedagogical practice to foster cognitive flexibility in both teachers and students. The responses highlighted different perspectives on the role of code-switching in fostering cognitive flexibility. Teacher A believes that code-switching should be encouraged as a pedagogical practice to foster cognitive flexibility, while Teacher B expresses reservations about its appropriateness in higher education settings.

It is important to consider factors such as the language proficiency level of the students, the specific educational context, and the learning goals when deciding whether to encourage code-switching as a pedagogical practice. Further research and discussion among educators can contribute to a more nuanced understanding of when and how code-switching can effectively foster cognitive flexibility in both teachers and students.

Question 13: Based on your experiences and observations, what recommendations or suggestions would you offer to educators who are interested in exploring code-switching as a means to enhance cognitive flexibility?

Teacher A: Teacher should use code-switching in a way that makes them relatable to their students

*Teacher B:*Code-switching in education acknowledges the importance of linguistic and cultural diversity, promoting inclusive learning environments, and facilitating effective communication and understanding among students and educators. It's important to note that the impact of code-switching on cognitive flexibility can vary among teachers, depending on their individual experiences, linguistic abilities, and teaching contexts. While code-switching has the potential to enhance cognitive flexibility in adjusting to various instructional strategies or approaches, it is important to consider the individual linguistic abilities of teachers and the associated cognitive load. Supporting teachers with appropriate resources, professional development, and language support can help maximize the positive impact of code-switching on cognitive flexibility in instructional contexts.

The question 13 aimed to gather recommendations or suggestions from the participants regarding the use of code-switching as a means to enhance cognitive flexibility. Teacher A suggested that educators should use code-switching in a way that makes the content relatable to their students, while Teacher B emphasizes the importance of acknowledging linguistic and cultural diversity, promoting inclusive learning environments, and facilitating effective communication and understanding among students and educators.

Both responses recognize the potential of code-switching to enhance cognitive flexibility, stressing the importance of considering students' needs and creating inclusive learning environments. Overall, the recommendations and suggestions highlight the need for intentional and purposeful use of code-switching, understanding the diverse needs of students, and providing appropriate support to educators.

4. Synthesis and Discussion of the Findings

This section presents a summary of the key findings obtained from the analysis of the students' questionnaire and teachers' interviews. The main focus of the study was to

investigate the impact of code-switching on cognitive flexibility, as hypothesized. The collected data allowed us to examine the relationship between these two variables.

4.1. Students' Questionnaire

Based on the results obtained from this questionnaire, we conclude the following:

The collected data indicated that the great majority of EFL students are females. This indicated a gender imbalance in the sample population, where female students are more prevalent than males. Also, they belong to Generation Z. This generation is known for growing up in the digital age and having unique characteristics and experiences. Additionally, the majority of students speak Arabic as their mother tongue and consider themselves to be at an intermediate to advanced language proficiency level. Since most of them have studied English for a long time (more than 10 years)

Concerning the frequency of using language in daily life conversations, the majority of students always use their native language in their daily conversations This indicated that their native language is the primary language of communication for most of their interactions, but they engage in English frequently. This suggested that English plays a significant role in their daily lives, either through educational settings, social interactions, or other contexts where English is required or preferred.

For code-switching, the majority of the students were divided into two groups: one used it frequently and the other used it occasionally, with the same percentage. The students' ability to switch between their native language and English in daily conversations demonstrates a level of language flexibility and adaptability. They are comfortable using both languages depending on the situation or interlocutor.

Fortunately, the students showed the same attitude toward task switching. This finding could imply that the cognitive processes involved in code-switching and task-switching are perceived and experienced in a similar way by EFL learners.

Moreover, the majority of participants reported no difficulties, while a minority mentioned some challenges in terms of switching between different registers of language and communication style or language use while they generally have a neutral or somewhat uncomfortable attitude towards transitioning between different language skills

In this questionnaire, students were asked to choose where they use code-switching. Most of them select with friends, and half of them choose home and outside, but a minority of the students choose in the classroom, which means that this serves purposes such as filling vocabulary gaps, clarifying meaning, and expressing concepts effectively.

The majority perceive code-switching as beneficial for cognitive flexibility, although some acknowledge potential challenges. These findings emphasize the importance of considering students' attitudes and strategies when incorporating code-switching into educational practices to promote cognitive flexibility effectively. the findings underscore the positive perception of code-switching for cognitive flexibility among the majority of participants while acknowledging the need to navigate potential challenges. This highlights the importance of taking into account students' attitudes and strategies when incorporating code-switching into educational practices to effectively promote cognitive flexibility.

4.2. Teachers' Interview

Despite having a limited sample size of two teachers, the interviews conducted yielded significant findings. The analysis of the teachers' responses revealed several noteworthy observations.

Both teachers have a clear comprehension of code-switching in the context of education. They understand its role in language use and the factors that influence the decision to switch between languages. This knowledge is crucial for implementing code-switching strategies effectively in the classroom and creating a supportive learning environment for students.

The teachers do not rely heavily on code-switching as a constant language practice in their teaching environments. They use it selectively and contextually when they perceive it to be advantageous for their students' learning. This implies that code-switching is considered a resourceful tool that can be used strategically to enhance student comprehension and engagement in specific instructional situations.

Code-switching serves as a valuable communication strategy for students. It allows them to compensate for vocabulary gaps, convey specific information, share personal experiences, and enhance their expressiveness. Code-switching provides a flexible and adaptable linguistic tool that enables students to overcome linguistic limitations and effectively engage in communication in multilingual or multicultural educational settings.

The acknowledgment of the potential positive impact of code-switching on cognitive flexibility by both teachers suggested that incorporating code-switching practices in educational settings can be beneficial. Code-switching can promote adaptability, mental agility, problem-solving skills, and intercultural sensitivity, all of which contribute to the enhancement of cognitive flexibility in students.

These challenges underscore the complexity of implementing code-switching effectively in educational settings. They highlight the need for careful consideration and strategies to address issues such as limited vocabulary, over-reliance, linguistic imbalance, student resistance, curriculum constraints, and community perceptions to ensure that code-

switching practices promote cognitive flexibility and linguistic development in a balanced and inclusive manner.

The recommendations offer practical guidance to educators interested in utilizing code-switching as a means to enhance cognitive flexibility. By making code-switching relatable, promoting inclusivity, providing necessary resources, and considering individual linguistic abilities, educators can create an environment that supports students' cognitive development, language acquisition, and overall learning experience.

Overall, the findings suggest that code-switching is a dynamic and context-dependent practice in education. It can have positive effects on cognitive flexibility but also presents challenges that need to be addressed. Educators can benefit from understanding student motivations, employing effective strategies, and receiving appropriate training to leverage the potential of code-switching in enhancing cognitive flexibility in the classroom.

5.1. Conclusion

In summary, this chapter focused on analyzing and presenting the data collected through a questionnaire administered to Master two students of applied linguistics and interviews conducted with teachers at the English department of the University of Mohamed Khider – Biskra. The questionnaire aimed to assess the students' level of cognitive flexibility and their attitudes towards code-switching and cognitive flexibility. On the other hand, the teacher's interviews aimed to gain a deeper understanding of the potential effects of code-switching on cognitive flexibility among EFL learners and address challenges related to implementing code-switching in classroom discussions.

General Conclusion

1. General Conclusion

The primary objective of this study was to explore the impact of code-switching on the cognitive flexibility of EFL learners. It aimed to investigate the significance of code-switching among students studying English as a Foreign Language and its potential role in enhancing their cognitive control. Additionally, the study sought to provide insights into how EFL students can improve their language skills and cognitive abilities simultaneously.

The study consisted of three chapters. The first two chapters provided a theoretical background on the two variables of interest. The first chapter offered a comprehensive overview of cognitive flexibility research in the field of linguistics, covering topics such as cognition, executive functions, and a detailed explanation of cognitive flexibility. The second chapter focused on code-switching, providing an overview of bilingualism and an exploration of code-switching in terms of its definition, forms, and functions from a psycholinguistic perspective, aiming to define code-switching as a mental process.

The third chapter was dedicated to the empirical work of the study. It outlined the research design, described the sample and population, and explained the data collection methods. Furthermore, it presented and discussed the findings obtained from the students' questionnaire and the teachers' interviews.

Overall, the findings of this study indicated that code-switching can serve as a useful tool in improving the cognitive flexibility of EFL learners. It was found to enhance their cognitive control, optimize cognitive response, and target the cognitive flexibility needed by students in contemporary educational contexts.

Our study compared the findings of our study with existing literature regarding the positive impact of code-switching on cognitive flexibility among EFL learners. The findings

supported the notion that code-switching can serve as a valuable tool for enhancing cognitive control and promoting language development. However, our findings indicated that certain limitations exist in the implementation and utilization of code-switching in the classroom, such as linguistic imbalances and student resistance. Overall, our study contributed to the existing body of literature by providing additional insights and nuances regarding the relationship between code-switching and cognitive flexibility, offering a more comprehensive understanding of its role in enhancing language skills and cognitive abilities among EFL learners.

2. Limitations of the Study

The study conducted within the field of psycholinguistics has a few limitations that should be acknowledged:

Small Sample Size: The study had a limited number of participants, with only 18 respondents completing the questionnaire and two teachers participating in the interviews. This small sample size may limit the generalization of the findings to a larger population. The results should be interpreted with caution and may not fully represent the perceptions and experiences of all Master Two EFL students at Biskra University.

Time and Resource Constraints: The study may have been limited by time and resource constraints, affecting the depth and scope of data collection and analysis. The researchers may not have had sufficient time or resources to explore all relevant aspects or conduct a more extensive study.

Participant Bias: The participants, both students and teachers, may not have been fully aware of or considered the psycholinguistic aspects of code-switching and its impact on cognitive flexibility. This lack of awareness or understanding could have influenced their

responses or behaviour, potentially limiting the depth of insight into the specific psycholinguistic mechanisms at play.

Limited Representation of Teachers' Perspectives: The study only included interviews with two teachers, which may not fully capture the range of perspectives and experiences of teachers regarding code-switching and its impact on cognitive flexibility. A broader sample of teachers would have provided a more comprehensive understanding of the challenges and benefits associated with code-switching in the classroom.

3. Pedagogical Implications and Recommendations

The study has several pedagogical implications and recommendations that can inform teaching practices and educational approaches:

Incorporating Code-Switching as a Teaching Strategy: The findings suggest that code-switching can be an effective pedagogical tool to enhance cognitive flexibility among EFL students. Educators can consider integrating code-switching techniques in their classroom instruction to help students bridge language gaps, improve comprehension, and develop a multicultural perspective.

Creating a Supportive Learning Environment: It is crucial to establish an inclusive and supportive learning environment that encourages code-switching. Teachers can promote a positive attitude towards code-switching and foster a classroom culture that values linguistic diversity. This can help students feel more comfortable and confident in using code-switching as a means to enhance their cognitive flexibility.

Professional Development and Training: To effectively utilize code-switching in the classroom, educators would benefit from professional development and training. Workshops, seminars, and courses can provide teachers with the necessary knowledge, strategies, and

skills to integrate code-switching effectively into their teaching practices. This can also help teachers address challenges and maximize the potential benefits of code-switching.

Language Proficiency Development: Enhancing students' language proficiency in both their native language and the target language (in this case, English) is crucial. Educators should focus on developing students' vocabulary, grammar, and language skills to minimize the limitations that lead to code-switching. Providing targeted language instruction and supporting students' language development can contribute to their cognitive flexibility.

Longitudinal Studies: Further research is needed to explore the long-term effects of code-switching on cognitive flexibility and academic performance. Conducting longitudinal studies can provide a deeper understanding of the sustained benefits and potential challenges associated with code-switching in different educational contexts.

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Appendices

University of Mohamed Khider Biskra

Department of literature and foreign languages

English Division

Appendix A
Students' Questionnaire

Dear respondents;

You are kindly invited to take these three quick tests regarding code-switching and cognitive flexibility.This questionnaire is designed to explore the potential positive correlation between code-switching and cognitive flexibility among EFL learners in Biskra University. The survey should take approximately 10-15 minutes to complete. Thank you for your time and participation.

Section 1: Demographic Information

.1Age_____ :

.2Gender:

- Male

- Female

.3Native Language_____ :

.4How long have you been studying English? _____ (In years)

.5Current English proficiency level:

- Beginner

- Elementary

- Intermediate

- Advanced

- Fluent/Native-like

Section 2: Code-Switching

Code-switching is the practice of alternating between two or more languages or language varieties in a single conversation or utterance .

.1How frequently do you use your native language in everyday conversations?

- Rarely
- Occasionally
- Frequently
- Always

.2How frequently do you use English in everyday conversations?

- Rarely
- Occasionally
- Frequently
- Always

.3How frequently do you engage in code-switching (switching between languages) during conversations?

- Rarely
- Occasionally
- Frequently
- Always

.4In which situations do you typically code-switch? (Check all that apply)

- At home
- With friends
- In the classroom
- Outside

.5How frequently do you face any problems when you had to adjust your communication style or language use based on the formality or informality of the situation?

- Rarely
- Occasionally
- Frequently
- Always

.6How frequently do you find it challenging to switch between different registers of language?

- Rarely

- Occasionally

- Frequently

- Always

7.What are the reasons for code-switching in your conversations? (Check all that apply)

- Expressing a concept more effectively

- Showing cultural identity

- Filling in vocabulary gaps

- Clarifying meaning

- Socializing with bilingual peers

- Other (please specify)_____ :

.2How comfortable do you feel when code-switching between languages in a conversation?

- Very uncomfortable

- Somewhat uncomfortable

- Neutral

- Somewhat comfortable

- Very comfortable

Section 4: Cognitive Flexibility

Cognitive flexibility is the ability to switch between different mental tasks, processes or strategies in response to changing environmental demands. It is an essential aspect of human cognition that enables individuals to adapt and adjust to new situations, learn and acquire new skills, and solve problems effectively

1 .How often do you find yourself switching between tasks in your daily life?

- Rarely

- Occasionally

- Frequently

- Always

2 .How do you usually handle misunderstandings or communication breakdowns in English?

- Use code-switching to Arabic

- Use Simple English

- Body language

- Others (please specify)_____ :

3 .How do you handle situations where you need to navigate between different English-speaking cultures or contexts, each with their own linguistic norms and practices?

- Switching easily between them

- Switching with difficulties

- It depends

4 .How effectively do you transition between different language skills (e.g., reading, writing, listening, speaking) during language learning or communication?

- Very effectively

- Somewhat effectively

- Neutral

- Somewhat effectively

- Very effectively

5 .Have you ever faced challenges in comprehending or producing language in a multilingual environment?

- Yes (justify)

- No

6. How do you perceive the impact of code-switching on your language proficiency in English?

- Improves my language proficiency

- Does not affect my language proficiency

- Hampers my language proficiency

7 .In your opinion, does code-switching enhance or hinder your cognitive flexibility?

- Enhance

- Hinder

- No effect

8. Have you noticed any changes in your cognitive flexibility as a result of code-switching?

- Yes, it has positively impacted my cognitive flexibility.

- No, there has been no noticeable impact on my cognitive flexibility.

- No, it has negatively impacted my cognitive flexibility.

9. Do you find it easier to switch between languages when engaging in tasks that require cognitive flexibility?

- Yes, code-switching comes naturally and facilitates cognitive flexibility.

- No, code-switching hinders my cognitive flexibility.

- It depends on the task or situation.

10. How confident are you in your ability to maintain cognitive flexibility while code-switching?

- Very confident

- Somewhat confident

- Neutral

- Somewhat unsure

- Very unsure

Appendix B
Teachers' Interview

Introduction:

Thank you for participating in this interview .

The purpose of this semi-structured interview is to explore the Effect of Code-Switching on Cognitive Flexibility. The case of Master Two EFL students at Biskra University. Your insights and experiences as an educator are valuable for understanding the relationship between code-switching and cognitive flexibility. I'm interested about your thoughts on the impacts of code-switching on cognitive flexibility. Thank you for your valuable input and sharing your perspectives on the impacts of code-switching on cognitive flexibility in teachers. Your insights will contribute to a better understanding of this topic. Your participation is greatly appreciated.

Teacher Name.…………………………………:

specify your age...……:

Specify the years of experience:

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How would you define code-switching in the context of education ?

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How often do you engage in code-switching in your teaching environment?

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What are some of the reasons why your students code-switch?

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From your perspective, what is the potential impact of code-switching on cognitive flexibility in teachers ?

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Have you noticed any specific effects or benefits in relation to cognitive flexibility?

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To what extent do you think code-switching impacts a teacher's capacity to adjust to various instructional strategies or approaches? Can it potentially improve or impede cognitive flexibility in this context ?

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What strategies or techniques do you employ to balance the use of code-switching while maintaining a conducive learning environment for cognitive flexibility?

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Have you received any formal training or professional development related to code-switching and its impact on cognitive flexibility? If so, how has this training influenced your teaching practices?

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Are there any challenges or limitations you have encountered when using code-switching as a tool for enhancing cognitive flexibility? How do you address or overcome these challenges?

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In your opinion, do you believe code-switching should be encouraged as a pedagogical practice to foster cognitive flexibility in both teachers and students? Why or why not?

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Based on your experiences and observations, what recommendations or suggestions would you offer to educators who are interested in exploring code-switching as a means to enhance cognitive flexibility?

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Is there anything else you would like to share or any additional insights you believe are important regarding the impacts of code-switching on cognitive flexibility?

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Note:

Cognitive flexibility refers to the ability to switch one's thinking and adapt to new or changing situations or tasks. It involves the ability to shift attention between different stimuli, switch between different mental sets or perspectives, and adapt to new or unexpected situations.

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الملخص

تحاول الدراسة الحالية استكشاف تأثير تبديل الشفرة على المرونة الإدراكية لمتعلمي اللغة الإنجليزية كلغة أجنبية. تم اعتماد أسلوب البحث بطريقة مختلطة لإجراء هذه الدراسة. علاوة على ذلك ، تكونت عينة الدراسة من طلبة ماجستير لغة انجليزية بجامعة محمد خيضر بسكرة. استخدم استبيان مع الطلاب ومقابلة مع المعلمين أدوات جمع البيانات المستخدمة في هذه الدراسة بعد جمع البيانات وتحليلها ، أظهرت النتائج التأثير الكبير لتحويل الشفرة على المرونة المعرفية للطلاب. تتعلق الدراسة بتبديل الشفرة بمرونة معرفية. لذلك ، تدعم نتائج الدراسة أن استخدام تبديل الشفرة له تأثير كبير على تحسين المرونة المعرفية للطل

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Résumé

La présente étude tente d'explorer l'effet du changement de code sur la flexibilité cognitive des apprenants EFL. La méthode de recherche a été adoptée méthode mixte pour mener à bien cette étude. Par ailleurs, l'échantillon de cette étude était composé d'étudiants en Master Deux d'anglais à l'Université Mohamed Kheider de Biskra. Un questionnaire avec les étudiants et un entretien avec les enseignants ont été les outils de collecte de données utilisés dans cette étude. Après la collecte et l'analyse des données, les résultats ont montré le grand effet du changement de code sur la flexibilité cognitive des étudiants. L'étude a lié le changement de code à la flexibilité cognitive. Par conséquent, les résultats de l'étude soutiennent que l'utilisation du changement de code a une grande influence sur l'amélioration de la flexibilité cognitive des élèves.