



*Dedication*

*This work is dedicated to all those who made this journey worthwhile:*

In fond memory of my dear grandpa.

To my precious parents and beloved siblings.

To my forever treasures, Manel and Nihad.

And to all my cherished friends.

**Kamelia LACETE**

To everyone who, in one way or another, helped me build myself up,

but mostly to my father and mother.

**Lynda CHELLI**

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## ***Abstract***

Algerian EFL learners, like their counterparts across the globe, embrace the technological advancements which are marking our era, notably artificial intelligence. In this regard, the present study probes into the role of AI in promoting self-regulated learning skills, particularly cognition and metacognition, of EFL learners enrolled in a Master's degree in language studies at the Department of English at Mouloud Mammeri University of Tizi- Ouzou. This research seeks two main objectives. First, it aims to investigate the way these students cognitively engage with AI to perform academic tasks. Second, it attempts to measure the extent to which this technology assists them to metacognize about their performances. To meet these aims, this research builds upon Zimmerman's Cyclical Model of Self-regulated Learning (2000) and adopts a mixed-methods approach. A questionnaire and the think-aloud protocol have been designed to collect data that have been analyzed using descriptive statistical analysis and qualitative content analysis. The findings reveal that students cognitively engage using AI by analyzing their tasks, designing plans, setting goals and self-reacting to their performances; they also demonstrate that AI helps students in metacognition to a considerable extent. Ultimately, the findings suggest that AI helps EFL learners to regulate their learning.

**Key words:** Academic tasks, Algerian EFL learners, Artificial intelligence, cognition, metacognition, the think-aloud protocol.

## **List of Abbreviations**

- **AI:** Artificial Intelligence
- **AWE:** Automated Writing Evaluation
- **CAMM:** Cognition, Affect, Metacognition and Motivation
- **EFL:** English as a Foreign Language
- **GPT:** Generative Pre-trained Transformer
- **MCQ:** Multiple Choice Question
- **MMUTO:** Mouloud Mammeri University of Tizi-Ouzou
- **SRL:** Self-regulated Learning
- **TAP:** Think-aloud Protocol

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### Statement of the problem

In the era of accelerated technological advancements, Artificial Intelligence (AI) is persistently gaining prominence and becoming an integral part within people's lives. It is defined as *"the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings"* (Copeland, 2023). This revolutionary technology was officially considered as a field of study in the conference *"A Proposal of The Dartmouth Summer Research Project on Artificial Intelligence"* held by John McCarthy in 1956. Since then, its use evolved into a fundamental aspect across various domains, notably education.

In a correlated setting, higher education provides students with opportunities for self-reflection and cognitive awareness, preparing them to deal with real-life situations by putting into practice the skills they developed during their educational journey. As indicated by Jōgi, Karu, and Krabi (2015), *"learning experiences and teaching practices at university influence further choices and support continuing lifelong learning of university students."* Indeed, students find themselves in different real-world contexts that necessitate the application of the skills they gained at university. For instance, newly graduated teachers need not only to demonstrate a critical sense of decision-making regarding the curricula and the teaching methods to adapt, but also to engage in self-reflection in order to assess the teaching practices and make adjustments in a way that would improve students' outcomes. These formed skills, particularly cognition and metacognition, fall under the umbrella of a nexus that is Self-Regulated Learning (SRL). The latter is *"a form of acquiring knowledge and skills in which the learners are independent and self-motivated"* (Goetz, Nett, & Hall, 2013, p. 126).

Different studies have been carried out at the international level regarding both AI and SRL, namely *"Supporting Students' Self-Regulated Learning in Online Learning Using*

*Artificial Intelligence Applications*” which has been conducted by Jin Sung-Hee, Im Kwoon et al in 2023, in Korea, with 16 university students from different majors. The results showed the perception of AI applications as useful for supporting metacognitive, cognitive and behavioral regulations, but not for motivation. The interviews revealed that the learners wanted more consideration of learner’s identity, learner’s activeness and learner’s position. Another study entitled “The Concept of Hybrid Human-AI Regulation: Exemplifying How to Support Young Learners’ Self-regulated Learning” was carried out in the Netherlands at Radboud University by Inge Molenaar in 2022. It targeted young learners aged from 10 to 14 years old and investigated how adaptive learning technologies optimize their SRL. It concluded that the use of adaptive learning technologies is beneficial in primary education, and encouraged the integration of advanced technologies into educational practices.

All of the aforementioned studies as well as many others which have dealt with AI and SRL have been conducted in foreign countries; however, in the Algerian context, the exploration of AI’s contributions to EFL learners’ self-regulation went unnoticed. That is why our study narrows down this gap to the national level, particularly with Master’s Students at the department of English at Mouloud Mammeri University in Tizi-Ouzou.

### **Aims and significance of the study**

The overall aim of this research is to investigate the role that AI plays in promoting self-regulated learning skills of EFL learners engaged in Master’s degree in language studies at the department of English at MMUTO.

This study has two main objectives; first, to examine how Algerian EFL students cognitively engage with AI to perform academic tasks. Second, to measure the extent to which AI assists Algerian EFL learners in deploying their metacognitive abilities to perform academic tasks.

The significance of this study lies in its contribution to the field of EFL. That is, exploring the role that AI plays in building self-regulated learners able to academically succeed in a technology-driven world. Besides, teachers can make use of this tool to provide more innovative ways for students to learn. Additionally, this research paves the way for syllabus designers to advance strategies to integrate AI in academic settings; especially that learners' interests in the use of AI are constantly growing. It also demonstrates that the use of AI in education is not to be restricted due to ethical concerns like plagiarism, as it can, in reality, be explored for its potential to enhance various aspects, holding a great promise for supporting revolutionary learning experiences.

### Research questions and hypotheses

In an attempt to reach the objectives mentioned previously, our research seeks to answer the following major questions:

- **Q1:** How do Algerian EFL students enrolled in Master's degree in language studies at the department of English at MMUTO cognitively engage with AI to perform academic tasks?
- **Q2:** To what extent does AI assist Algerian EFL students engaged in Master's degree in language studies at the department of English at MMUTO in deploying their metacognitive abilities to perform academic tasks?

The following hypotheses are suggested as answers to the previously mentioned research questions:

- **Hp 1:** Algerian EFL students engaged in Master's degree in language studies at the Department of English at MMUTO cognitively engage with AI to perform academic tasks by thinking about the information that are relevant to the assignment before retrieving them from the AI-tools;

- **Hp 2:** AI is likely to assist Algerian EFL students engaged in Master's degree in language studies at the Department of English at MMUTO in metacognition to perform their academic tasks.

### **Research techniques and methodology**

This current research investigates how AI contributes to the enhancement of SRL among both Master one and Master two students engaged in language studies (Didactics of Foreign Languages and Language and Communication) at the Department of English at MMUTO. A mixed-methods approach has been adopted to conduct this study. It uses both quantitative and qualitative designs to collect and analyze data. The think aloud protocol and questionnaire are employed to report on student's thoughts, assumptions, perceptions, and decisions with regards to the use of AI to promote their cognitive and metacognitive thinking. The data collected are analyzed quantitatively using descriptive statistical methods and qualitatively using qualitative content analysis.

Zimmerman's Cyclical Model of Self-regulated Learning (2000) underpins this study. It posits that a learner has to go through three phases to achieve a goal: forethought (planning), performance (doing) and self-reflection (reflecting). It is important to mention that this model allows starting from any phase and iteration through the process until the goal is reached. The choice of this model results from the fact that it allows an effective self-regulation of the learning experiences and guarantees better outcomes.

### **The structure of the dissertation**

The dissertation follows the simple traditional model which consists of a general introduction, four chapters and a general conclusion. The general introduction includes the statement of the problem, the aim of this study and its significance, research questions and hypotheses, research techniques and methodology, and the structure of the dissertation. The

first chapter is entitled Review of the Literature. It reviews the main theoretical concepts related to our study. The second chapter is named Research Design and Methodology. It provides a thorough explanation of the data collection and analysis procedures that have been adopted during the study. The third chapter is the Presentation of the Findings, which covers all the results revealed from the data collection and analysis tools. The fourth chapter, that is the Discussion of the Findings, has to do with the analysis and interpretation of the presented results, and provides explicit answers to the research questions. Lastly, the general conclusion, that summarizes the key elements of the presented research, demonstrates the contributions of the latter but also the limitations it has faced, and finally suggests further research.



**Review of the Literature**

### Introduction

This chapter reviews the core concepts that underlie this research. It incorporates two major sections; the first one provides some definitions of “artificial intelligence” and highlights its integration in education, outlining its benefits in this field. The second section is devoted to “self-regulated learning”. It first explains the concept of SRL, presents definitions of “cognition” and “metacognition”, then establishes the connection between AI and SRL. Lastly, it examines in detail Zimmerman’s Cyclical Model of Self-Regulated Learning (2000) which serves as the theoretical framework of our study.

### 1.1. Artificial Intelligence in Education

#### 1.1.1 Background and Definition

The term “artificial intelligence” (AI) was first coined in 1956 by a computer scientist named John McCarthy in “The Dartmouth Summer Research Project on Artificial Intelligence” which became a turning point in the growth of AI as a field. AI is defined as being “*a set of computational systems that can learn, adapt, synthesize, self-correct, and use data for complicated processing tasks in the same way as humans can*” (Popenici & Kerr, 2017, as cited in Ezzaim, Kharroubi, Dahbi, et al. 2022, p. 2). Put differently, AI refers to smart machines capable of acquiring knowledge, identifying errors, making adjustments, and solving complex and challenging tasks.

Additionally, Bhbosale, Pujari, and Multani (2020, p. 227) assert that, “*AI refers to the similarity of human intelligence in machines that are programmed to think like humans and copy their steps.*” That is to say, AI is some sort of association of human characteristics to intelligent machines that mimic humans and efficiently perform tasks, simply by using the algorithm and commanding the computer. On a related note, El-Had (2023, p. 5) added “*AI is*

*like a human brain*". To expound, AI behaves similarly to how humans do in terms of processing information and making informed decisions.

Furthermore, AI comprises computational systems able to detect different contexts and react intelligently to any input (data or information) (Cordeiro & Cozman, 2014, as cited in Elliot, 2019). According to them, AI is capable of processing any given information and directly sensing its relevant environment.

AI has grown stronger as it is witnessed in a wide range of life spheres. Indeed, *"this branch of computer engineering is implemented in various fields namely finance, health, security, geolocation..."* (Ezzaim, Kharroubi, Dahbi, et al., 2022, p. 1). It is, in reality, considered as a game changer that develops every industry effectively (Bhbosale, Pujari & Multani, 2020). They exemplified with healthcare centers which make use of AI to assist both the doctor and the patient by analyzing medical information. In business, moreover, AI provides quick and smooth service to customers through chatbots which process large quantity of significant data to reach important results. In addition to the abovementioned domains, the use of AI in education is also brought to light.

### **1.1.2 The Integration of AI in Education**

The traditional teaching methods have drastically been transformed as AI is incorporated within educational practices. Indeed, AI holds a transformative potential in facilitating the shift from standardized education to personalized learning experiences (Buckingham Shum and Ferguson, 2016, as cited in Olatunde-Aiyedun, 2024), making this smart technology and the field of education interconnected. In fact, Woolf, Lane, Chaudhri et al. (2013, p. 67) state that:

Education and AI can be seen as two sides of the same coin: education helps students learn and extend the accumulated knowledge of a society, and AI provides techniques to better understand the mechanisms underlying thought, knowledge, and intelligent behavior.

That is to say, the field of education plays a crucial role in learners' acquisition of knowledge. In parallel, AI facilitates the understanding of human intelligence through the different methods it proffers. To illustrate, higher education offers the opportunity for learners to conduct research, thus contributes to the existing body of knowledge. Simultaneously, AI assists them with feedback and explanations; therefore, it enhances their comprehension of the content they deal with and facilitates the way they proceed to acquire knowledge.

Along the same lines, Tafazoli et al. (2019) affirm that, "*educators have integrated AI-assisted language learning tools into education to support learners in enhancing their language skills*" (as cited in Wei, 2023, p. 2). Indeed, students make use of numerous AI- assisted tools which are accessible on computers and mobile devices with the purpose of facilitating their language learning process. For instance, the use of ChatGPT which is "*an AI-based tool developed by OpenAI...designed to understand natural language and generate intelligent and relevant responses to user queries*" (Halaweh, 2023, p. 1).

Relatedly, a study entitled "Artificial intelligence in higher education: Opportunities and challenges" revealed that, "*89% of higher education graduates have used artificial intelligence in higher education at least once, and a third of these respondents do so at least weekly*" (Ryzheva, Nefodov, Romanyuk et al., 2024, p. 293), demonstrating the preeminence of AI within the realm of education.

However, the implementation of AI is inevitably debated in every area, and higher education is no exception (Pisica, Edu, Zaharia et al., 2023). Effectively, even though AI plays a central role in facilitating the learning experience (Fitria, 2021), there is also fear that learners misuse it, which may have repercussions on their ability to learn (González Tigrero, 2024). Indeed, despite the fact that AI makes learning easier for students, the latter may violate ethical guidelines as this technology provides them with a large amount of information, allowing them to copy-paste them without mentioning their sources (plagiarism).

### 1.1.3 Benefits of AI in Education

The incorporation of AI in the field of education has yielded significant advantages. In this regard, Olatunde-Aiyedun (2024, p. 4) asserts that, *“the infusion of AI into higher education is seen as a proactive measure to arm students with the essential skills for success”*.

Additionally, the educational sector benefits from AI as the latter provides students with different resources such as translation tools, voice assistants, chatbots, personalized tutoring programs and such, thanks to which they progress faster and more efficiently; henceforth, they get to achieve their learning goals (Pisica et al., 2023). Moreover, using AI feedback materials improves the linguistic competence of the students. (Alsadoom, 2021, as cited in Alshaikhi & Khasawneh, 2024). Correspondingly, Thinh et al., (2020) maintain that EFL learners can enhance their written communication skills, for instance, by relying on an Automated Writing Evaluation (AWE) program such as Grammarly (as cited in Alshaikhi & Khasawneh 2024).

Another advantage of integrating AI within educational practices is that it *“opens up exciting avenues for research and development in language pedagogy”* (Wei, 2023, p. 11). Put another way, AI offers the ability for educators to look for innovative ways of improving the language teaching and learning process. Not only that, but it also considers students with visual or hearing impairments and offers help to those who cannot attend classes due to illnesses (Yazadzhiyan, 2023). Accordingly, it provides learning experiences that are tailored to every student’s needs, abilities, and preferences.

### 1.2 Self-regulated Learning

#### 1.2.1. Definition

Self-regulated learning is stated to be a complex process involving skills that guarantee students' achievement of their learning goals (Efklides, 2019), indicating that SRL is a goal-oriented process which requires learners to employ certain skills so as to attain their learning objectives. Zimmerman and Schunk (1989, as cited in Zimmerman, 1990, p. 4) describe self-regulated learning as learners becoming "*masters of their own learning*", emphasizing their active role in the learning process and capability to carry "*the burden of pursuing [their] own education*" (Gardner, 1963, as cited in Nodoushan, 2012, p. 1). This signifies that self-regulated learners are individuals who take responsibility for carrying their own learning experience.

The intensive attempts to elucidate self-regulated learning culminated in several perspectives on this latter. Philip Winne, a pioneer in the field of self-regulated learning, holds the view that the term "self-regulated" is intertwined with forms of learning that are metacognitively guided and intrinsically motivated and strategic (Winne, 1995, 1997, Zimmerman, 1990, as cited in Winne, 2000), meaning that learning is not "self-regulated" unless it is directed by one's reflection, motivation and use of strategies.

Besides, Paul R. Pintrich, another paramount figure in the field of self-regulated learning, defines it as being "*an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate and control their cognition, motivation, and behavior, guided and constrained by their goals and the contextual features in the environment*" (Pintrich, 2000, as cited in Peel, 2019, p. 27). Put differently, SRL refers to when learners actively establish objectives for their learning, control their cognition, motivation, and behavior accordingly, all while taking into consideration the environment that guides their goals.

In one of his prolific works, Zimmerman (2001, p. 1) postulates that SRL is “*a self-directive process through which learners transform their mental abilities into task-related academic skills*”. For him, learning is a proactive process that requires learners to intentionally leverage their cognitive abilities to develop their academic skills. He further explains that this type of learning entails “*processes whereby learners personally activate and sustain cognitions, affects and behaviors that are systematically oriented toward the attainment of personal goals*” (Zimmerman & Schunk, 2011, p.1), indicating that a self-regulated learning experience is one wherein learners deliberately propel their thoughts, feelings and behaviors to achieve some goal. Besides, Bandura (1986, as cited in Zimmerman & Schunk, 2011) affirms that self-regulation involves three processes: self-observations, self-judgments, and self-reactions. These processes allow learners to observe the progress of their work, evaluate it, and deduce reasons for their performance.

Taken together, SRL is a process that leaves much room for learners to be in control of their learning, for they “*view acquisition as a systematic and controllable process, and they accept greater responsibility for their achievement outcomes*” (Borkowski, Carr, Rellinger, & Pressly, in press; Zimmerman & Martinez-Pons, 1986, 1990, as cited in Zimmerman, 1990, p. 4). In simpler terms, SRL is about learners being in charge of their learning by making decisions on how to acquire knowledge and achieve goals.

Ultimately, it is worth mentioning that SRL encompasses a variety of key components of which cognition and metacognition are a part. Indeed, “*SRL is considered to be incomplete without the use of cognitive learning strategies and metacognition, which entail the ability to organize, monitor, control, and assess one’s own learning*” (Dillah et al., 2023, p.1187).

### **1.2.2. Cognition**

Winne (2018, p. 36) explains that the term ‘cognition’ is derived from the Latin word “*cognoscere*” meaning “*to come to know*”. He elaborates, “*coming to know is a process that*

*takes in information –input- and produces information-output*” (Winne, 2018, p. 36), implying that “cognition” is a process through which one acquires knowledge by receiving and transforming information into meaningful output, that is understanding. Alternatively, cognition is described as “*the mental action of representing and processing information*” (Sternberg, 1981, as cited in van der Graaf, Lim, Fan, et.al., 2022, p. 746). This suggests that cognition subsumes mental activities aimed at treating information and constructing both knowledge and understanding.

As further put by Neisser (1967), cognition entails “*all the processes by which the sensory input is transformed, reduced, elaborated, stored, recovered, and used*” (as cited in de Houwer, Barnes-Holmes & Barnes-Homes, in press, p. 3). This conceptualization indicates that cognition encompasses the interplay of a number of cognitive processes such as the interpretation and storage of informational input to help humans understand and make use of their knowledge. These cognitive processes can be categorized into two subsets according to the goal they serve; reading and repeating information, for instance, are low-level cognitive activities, for they serve to process and understand the provided information (van der Graaf et al., 2022), but organization and elaboration, as another example, are high-level cognitive activities as they help learners deepen their understanding (King, 2002, Molenaar & Chiu, 2017, Volet et al., 2009, as cited in van der Graaf et al., 2022).

As far as SRL is concerned, different theoretical perspectives identify cognition as an important component of this former. In this instance, Zimmerman and Schunk (2011) corroborate that SRL is a process in which learners activate and sustain cognitions to attain some goal; that is, SRL is a process in which students steer and nurture their thoughts and mental abilities such as memory, to reach a goal. In the same line, Azevedo et al., (2018) explain that models of SRL include “CAMM” activities that are, cognition, affect, metacognition, and motivation (as cited in van der Graaf, Lim, Fan, et al. 2022).

### 1.2.3 Metacognition

Metacognition is a complex construct often referred to as “fuzzy” by many scholars as it encompasses diverse meanings (Akturk & Sahin, 2011). John Flavell coined the term “metacognition” in the early 1970’s (Akturk & Sahin, 2011) and described it as “*one’s knowledge concerning one’s own cognitive processes and products*” (Flavell, 1976, as cited in Chaterdon, 2019, p.50).

More recent interpretations explain “metacognition” as, “*the combination of two words – Meta and Cognition. Meta means beyond and Cognition refers [to] the process of getting environmental information through sense organs. Thus, metacognition means self- knowledge of cognitive processes*” (Kumari, 2021, p. 66) or simply as, “*thinking about thinking*” (Dawson, 2008, p. 3).

Besides, Winne (2000, p. 533) states that metacognition is, “*the awareness learners have about their general academic strengths and weaknesses, cognitive resources they can apply to meet the demands of particular tasks, and their knowledge about how to regulate engagement in tasks to optimize learning processes and outcomes*”. This underscores that learners who have a clear understanding of their cognitive abilities can better complete tasks and eventually enhance their learning experiences and outcomes.

In a similar vein, metacognition is considered as an important component of SRL (Winne & Hadwin, 1998; Zimmerman & Moylan, 2009, as cited in Panadero and Alonso-Tapia, 2014) in such a way that it is a prerequisite for self-regulated learning. In this regard, Zimmerman (1990) contends that it is the drive behind learners’ decisiveness and self-awareness in the learning process (as cited in Nodoushan, 2012). This means that students who are aware of their metacognitive skills are more likely to make informed decisions concerning their learning as they are perceptive of their abilities such as memory, critical thinking, sense of decisions making, and so on. With respect to this, he indicates that self-

regulated students are metacognitively active participant in their own learning (Zimmerman, 1990).

### 1.3 The Relationship between SRL and AI

The evolution of AI, particularly in education, has elicited notable considerations of SRL. In connection with this, Caswell and LaBrie (2017, as cited in Olatunde-Aiyedun, 2024, pp. 1-2) affirm that, *“there is a growing agreement that integrating AI technology into education can enable teachers to support students’ self-directed learning”*. To illustrate, intelligent tutoring systems support learners through feedback and recommendations, which allows them to build their competencies according to their own pace without waiting for teachers’ assistance, providing a better digital environment for SRL (Xia, Chiu, Chai, 2023).

Additionally, Xia, Chiu and Chai (2023) maintain that SRL has intensively integrated the field of education raising the need for personalized support to sustain self-regulated learning. By that, the role of AI technologies is put forward as they encourage learners to take control over their learning process.

Furthermore, it is claimed that the need for SRL skills is intensively emphasized on in the age of AI, due to the necessity to adapt to the rapid life changes, and to maintain agency in decision-making (Markauskaite et al., 2022). That is to say, in order to cope with the rapidly evolving technologies, essentially AI, it is fundamental for learners to be able to direct their own learning.

In essence, AI provides customized learning experiences that meet learners’ needs and expectations, raising the likelihood for SRL to be maintained. In much the same way, being self-regulated implies seeking activeness in the learning process, and the use of AI proffers opportunities to take active roles in one’s education.

### **1.4 Zimmerman’s Cyclical Model of Self-regulated Learning (2000): The Analytical Framework**

To provide a clearer picture of the different views held regarding SRL, several conceptual models have been proposed to explain how learners engage in self-regulatory processes. Zimmerman’s Cyclical Model of SRL (2000) is one of the three models proposed by Barry J. Zimmerman, an educational researcher whose numerous works are of the first in the arena of SRL (Panadero, 2017). It underlies the premise of this research as it outlines three recursive phases that support self-regulated learning: the forethought phase (planning), the performance phase (doing) and the self-reflection phase (reflecting) (see figure 1), making it in accordance with the aim of this study, which is to investigate the way EFL learners engaged in a Master’s degree at the Department of English at MMUTO promote their self- regulation skills, mainly cognition and metacognition, through the use of AI.

This model is cyclical as feedback obtained from each phase impacts the following one and helps alter future tasks (Zimmerman, 2000, as cited in Hope Johnson, 2013), particularly conclusions drawn at the self-reflection phase, as they directly influence engagement in the forethought phase of a new task or maybe the same completed task. This creates an ongoing cycle (Zimmerman, 1986, 1994; Butler, 2002, as cited in Hope Johnson, 2013).

#### **1.4.1 The Forethought phase**

This phase includes processes that precede efforts to learn and perform (Zimmerman, 2000, as cited in Cleary & Zimmerman, 2012). In other words, it is during this phase that students undertake the learning activity. Zimmerman and Moylan (2009, as cited in Panadero & Alonso-Tapia, 2014) elaborate that learners start the self-regulatory cycle by analyzing the task (breaking it into key components) and choosing the learning strategies to implement based on their previous knowledge, a process referred to as “strategic planning”. This means

that, at this stage, learners engage with the task by recalling their background knowledge so as to make effective decisions concerning the different ways or steps to follow in order to complete the activity (making an action plan).

Along with task analysis, learners set goals considering the assessment criteria and the performance level they want to reach (Panadero & Alonso-Tapia, 2014). Put differently, at this same stage, learners determine a number of objectives that they want to attain based on their understanding of task implications and standards of evaluation or the level they want to reach. To illustrate, a Master's two student about to start writing their dissertation may consider producing a written work of about 50 pages following the Simple Traditional Model (assessment criteria) and may want to achieve proficiency (performance level).

In addition, learners foster their motivation by addressing variables such as self-efficacy and outcomes expectations (Zimmerman, 2013). The first refers to the individuals' convictions about their ability to succeed in completing tasks (Bandura, 1977, as cited in Wilde and Hsu, 2019), and the second entails expectations about the success of a learning activity (Zimmerman, 2011, as cited in Panadero & Alonso-Tapia, 2014). In a word, the higher these convictions and expectations, the more a learner becomes motivated to make the necessary efforts to deal with the task.

### **1.4.2 The Performance phase**

It includes processes which take place during learning efforts (Zimmerman, 2000, as cited in Cleary and Zimmerman, 2012) i.e., it is the phase during which learners perform or actually do the task by deploying all the necessary means to fulfill it. They specifically implement the plans which they designed in the Forethought phase following two main processes that are self-observation and self-control (Zimmerman, 2013).

### **a. Self-observation**

Self-observation entails “self-monitoring” that is comparing what is being done against criteria that assess the quality of the process being followed (Winne & Hadwin, 1998, as cited in Panadero & Alonso-Tapia, 2014) and “self-recording” that is “*creating formal records of learning processes*” (Zimmerman, 2013) or registering the actions being performed e.g., registering how much time one spends while reading a text (Panadero & Alonso-Tapia, 2014). To do so, an EFL learner assigned to write a narrative essay, for example, may constantly compare the text they are writing to the structure of such a genre: they may verify if their text contains a hook and a thesis statement, or a climax for instance, or they may check if they have used the show-don’t-tell technique. They may also create checklists in order to have written records of the actions they have done while performing their task.

### **b. Self-control**

Self-control includes metacognitive and motivational strategies aimed at maintaining concentration and motivation such as self-instructions, help seeking, (Zimmerman, 2013). In simpler terms, learners need to remain motivated and focused to accomplish their goals; thereby, they may give themselves instructions in order to raise their interest in the task and focus on their goals. Further, they may consult a more knowledgeable source for assistance (e.g., instructor, peer, parent...). As can be exemplified by a Master’s two student writing the Discussion Chapter, they may, at different stages of the writing process, utter sentences like “I need to reflect the theoretical framework underlying my work as I discuss my findings”, as they can ask their supervisor for pieces of advice to succeed in writing it.

### **1.4.3 The Self-reflection phase**

This phase highlights an engagement in self-reflection after performance (Zimmerman, 1998, 2002, as cited in Alvi, Iqbal, et al., 2016), through which learners judge their work, formulate reasons for their results (Panadero and Alonso-Tapia, 2014) and

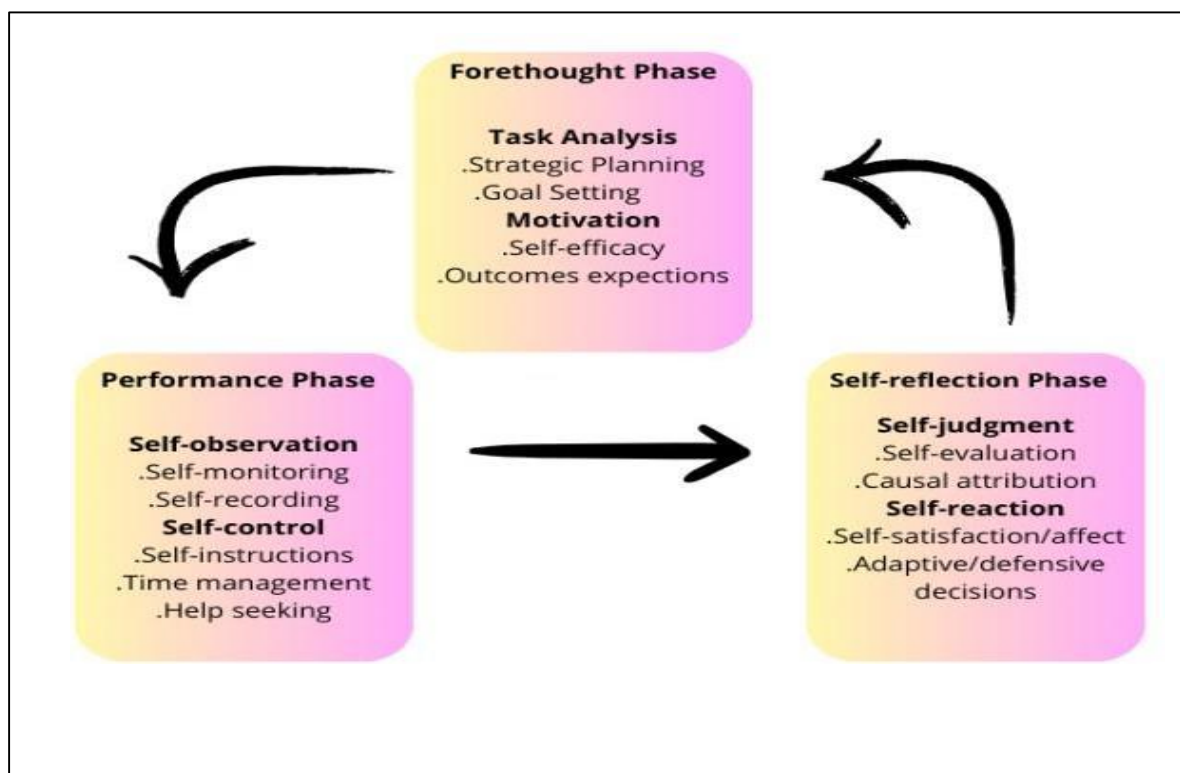
regulate decisions regarding the upcoming task (Zimmerman, 1986, 2000, as cited in Hope Johnson, 2013). It includes two processes, “self-judgment” and “self-reaction” (Zimmerman, 2013).

### **a- Self-judgment**

It refers to the process of assessing one’s performance, and it can be done through “self-evaluation”, which is the student’s evaluation of their own performance based on the assessment criteria determined by their performance level goal (Panadero, 2011, cited in Panadero & Alonso-Tapia, 2014), and “causal attributions” that are identified causes of success or failure (Zimmerman, 2013). These criteria can be determined by teachers (e.g., the structure of an essay, the relevance of the content of an essay...), but also by students based on the goals they set in the forethought phase (Zimmerman, 2013), for instance by wanting to improve their writing style.

### **b- Self-reaction**

It refers to students’ cognitive and emotional reactions to their attributions either through self-satisfaction and adaptive or defensive inferences (Zimmerman, 2013). Self-satisfaction reactions are feelings of satisfaction or dissatisfaction regarding the performance, and adaptive or defensive inferences that refer, in turn, to decisions to adapt one’s approach for future tasks or to reject it (Zimmerman, 2013). Simply put, if a learner is satisfied with their performance, they will adopt the same procedure to deal with future tasks; if they are not, they will decide to modify the procedure or to reject it.



**Figure 1:** A summary of Zimmerman's Cyclical Model of SRL (2000)

**Remark:** The scheme is our own realization

## Conclusion

This chapter has been devoted to the review of all the relevant literature that explains the major concepts of our study. At the beginning, it has provided definitions of “artificial intelligence”, discussed its integration to education, along with its advantages in this domain. Next, it has explained the concepts of “self-regulated learning”, “cognition”, and “metacognition” according to some major figures in the field. After that, it has established the link between AI and SRL. Eventually, it has thoroughly explained Zimmerman's Cyclical Model of Self-Regulation (2000), which is the analytical framework on which this study is based.



**Research Design and  
Methodology**

### Introduction

The present chapter is devoted to the methodology adopted for this study aiming at investigating the role that AI plays in promoting EFL learners' self-regulated skills, at the department of English at MMUTO. It is sectioned into three major headings: the first covers the research method and design on which the research relies. The second one entitled "data collection procedure" comprises all the processes followed to collect data. It includes the context, sample, as well as the tools through which the data have been collected, notably a questionnaire and the think-aloud protocol. The third and last section is "data analysis procedure", which explains how the data have been analyzed and interpreted both quantitatively and qualitatively.

### 2.1 Research Method and Design

#### 2.1.1 Mixed-Methods Research

The present study is based on a mixed-methods research. It is a type of research where the researcher combines elements of qualitative and quantitative research approaches for the purpose of breadth and depth of understanding and corroboration (Gunasekare, 2015). This approach provides a richer understanding and a fuller picture of how AI contributes to the promotion of EFL learners' self-regulated learning skills, namely cognition and metacognition. It aligns with the principle that, *"the use of quantitative and qualitative approaches in combination provides a better understanding of research problems than either approach alone"* (Creswell & Plano Clark, 2007, as cited in Cameron, 2011, p. 96). That is to say, it addresses the research questions from different angles as it considers both quantitative and qualitative perspectives, improving the validity of the research outcomes.

The present research is an exploratory one as it investigates a novel area of inquiry, seeks familiarity with it and attempts to gain sound insights into it. In relation to this context, it investigates how AI promotes self-regulated learning skills of EFL learners. It is also

survey-based, for its data collection instrument is the questionnaire consisting of structured questions to gather specific information from the participants, providing a representative view of their experiences with AI-assisted learning. In addition, the think-aloud protocol is relied upon in order to report the respondents' thoughts, providing possibilities for rigorous interpretation of their perspectives.

### **2.2 Data Collection Procedure**

This section entails all the methodological instruments used in order to gather data pertinent to our study that investigates the role of AI in promoting EFL learners' self-regulated learning skills, at the department of English at MMUTO. To meet this aim, a questionnaire as well as the think-aloud protocol have been used.

#### **2.2.1 Context and Sample**

This research is carried out at the department of English at MMUTO during the 2023-2024 academic year. The study population consists of sixty-three (63) respondents from the previously mentioned setting, who are students engaged in Master's course in language studies (Didactics of Foreign Languages and Language and Communication). This selection results from the fact that Master's students are better equipped with background knowledge thanks to their years of experience at university, as well as from their motivation to participate in research studies that are in accordance with their fields of interests.

In this research, both random and convenience sampling are adopted. Fifty-five (55) students have been randomly selected among Master's one and Master's two students of the previously mentioned specialisms in order to fulfill an online questionnaire. This type of sampling permits every single individual to have an equal chance of presence in the sample (Etikan and Bala, 2017). That is, any student engaged in a Master's degree in language studies at the department of English at MMUTO can be selected regardless of their characteristics (gender, race...). As for the eight (08) other respondents, they have been selected based on

their convenient availability, as well as on their motivation to participate in the think-aloud protocol. This convenience sampling is known to be simple and time-saving unlike other sampling strategies (Simkus, 2022).

### **2.2.2 Data Collection Tools**

#### **2.2.2.1 Definition of the Questionnaire**

A questionnaire is a data collection instrument that encompasses a number of clear and purposeful questions addressed to a cohort in order to obtain their answers regarding a phenomenon that is being investigated. Ranganthan and Caduff (2023, p. 152) define it as, “*a data collection tool consisting of a series of questions or items that are used to collect information from respondents and thus learn about their knowledge, opinions, attitudes, beliefs, and behavior*”; it is also defined in Merriam Webster (n.d) as, “*a set of questions for obtaining statistically useful or personal information from individuals*”. Hence, it can be stated that this tool includes differentiated items that permit the researcher to gain insights into their respondents’ opinions, perceptions, attitudes, or behaviors and allows the obtention of both quantitative (statistical) and qualitative (textual) data.

#### **2.2.2.2. Description of the Questionnaire**

The questionnaire is addressed to Master’s students enrolled in language studies at the department of English at MMUTO and includes a total of 15 items aimed at depicting learners’ engagement with AI-tools to perform academic tasks. It combines a series of closed- ended and open-ended items which, in turn, require the respondents to select one or more pre- determined answer(s) and to elaborate according to their personal experiences.

The closed-ended items come in the form of dichotomous questions (yes/no questions) such as question 4, 5, and 13, frequency questions such as question 3 and 8, multiple-choice questions (MCQ) such as question 6, 7, 11, 12, and 14, in addition to Likert Scale questions

such as question 9 and 10. As for the open-ended questions such as the follow-up of question 4 or question 15, they give the respondents the freedom to answer using their own words.

In terms of layout, this questionnaire is organized into three parts: an introductory paragraph and two sections. The introductory paragraph explains the objective of the research, promises anonymity, and indicates to the students how to answer the items. The first section is entitled “Students’ Background Information”; it comprises five (04) items investigating the informants’ level, specialism and familiarity with the use of AI in their educational practices. “Students’ Engagement with AI to Perform Academic Tasks” is the second section; it is made up of twelve (11) items and delves into exploring the different processes through which students engage with AI to complete tasks. Lastly, the questionnaire is concluded with a final item that inquires students’ remarks or comments concerning the study.

### **2.2.2.3. Piloting the Questionnaire**

In order to prevent any potential issues of wording, structure, clarity and understanding regarding the questionnaire, the latter has first been distributed as a pretest to four (04) EFL students engaged in Master’s degree in different specialisms. On the whole, the four students have found the questionnaire’s items intelligible and straightforward and estimated that its design is user-friendly. However, one of them has raised attention to question ten (Q10) formulated as “On a scale of 1 to 5, how much do you think AI influences your expectations of success and ultimately fosters your motivation?” and has preferred to extend the scale to 10 as they have assumed it would be easier for them to select number 5 in case they wanted to provide an average rating, and so the question has been rendered “On a scale of 1 to 10, how much do you think AI influences your expectations of success and ultimately fosters your motivation?”. In sum, this pilot study has allowed us to refine our questionnaire in a way that meets our respondents’ preferences.

### **2.2.2.2. Definition of the Think-Aloud Protocol (TAP)**

The Think-Aloud Protocol is known to be “*A technique whereby participants state (think aloud) whatever they are thinking, feeling, or doing as they complete a task*” (Ericsson & Simon, 1987, as cited in Durning, S, et al., 2013 p. 725). It is, in other words, a data collection method where participants are asked to talk aloud while thinking, as a way of verbalizing their thoughts. One of its major benefits is that “*readers can report their thoughts while simultaneously being involved in the target task*” (Yoshida, 2008n p. 200), highlighting its important role in reflecting cognitive and metacognitive practices as key aspects of SRL, the ones on which this study has focused.

#### **2.2.2.2.1. Description of the TAP**

The protocol consists of eight (08) questions designed for the eight (08) other selected respondents for the purpose of reflecting the way students think when they perform tasks using AI. To better explain, the participants have been assigned a task which they had to complete with the help of an AI-assisted tool and have been asked some face-to-face questions before, during, and after completing it, which allowed them to describe the steps they followed, express themselves freely, and share all the thoughts they have in relation to the task.

### **2.3. Data Analysis Procedure**

Given the data collection procedure, both quantitative and qualitative data are gathered; consequently, the nature of these latter determines the data analysis procedure to adopt. While the quantitative data collected through the questionnaire are analyzed following the descriptive statistical analysis, the qualitative data gathered using the same tool and the TAP are interpreted using qualitative content analysis.

### 2.3.1 Descriptive Statistical Analysis

Descriptive statistical analysis is “*a tool to help people organize and summarize the inevitable variability in collections of actual observations or scores*” (Dong, 2023, p. 16), that is to say, this type of analysis allows researchers to quantify the sets of data collected via quantitative procedures and turn them into statistics and visual representations such as figures.

In order to examine the quantitative data gathered from the closed-ended items of the questionnaire, the percentages are calculated manually following this equation:  $X = Y \times 100 / Z$  (X is the calculated percentage, Y stands for the number of the obtained responses, and Z refers to the number of the informants). The findings are represented in the form of pie charts, bar graphs, and tables.

### 2.3.2 Qualitative Content Analysis

Qualitative data analysis is “*a method for systematically describing the meaning of qualitative material. It is done by classifying material as instances of the categories of a coding frame*” (Schreier, 2012, p. 1). In this study, this method is adopted to analyze the qualitative data obtained from the open-ended items of the questionnaire as well as the answers to the TAP. The gathered responses have been organized into categories that correspond to the processes through which learners go to perform academic tasks. The interpretations are made in the form of text.

## Conclusion

This three sections chapter has provided an overview of the research design and methodology adopted for this study. First, it has described the approach followed to carry out this research, which is the mixed-methods approach. Second, it has described the data collection procedure, context and sample, and the methodological tools utilized to gather data, which consist of a questionnaire and the think-aloud protocol (TAP). Finally, it has explained the data analysis procedure.



**Presentation of the Findings**

### Introduction

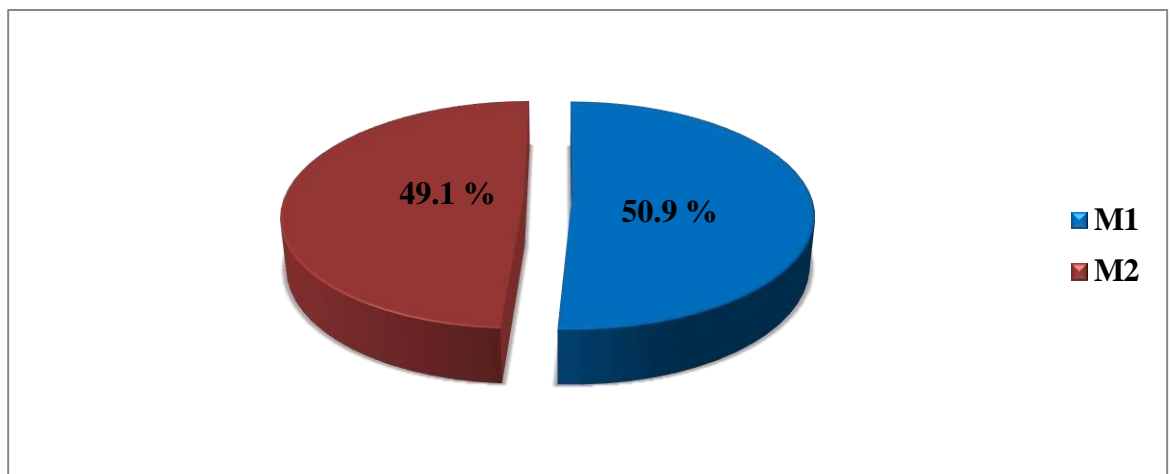
This chapter presents all the findings obtained from our investigation at the Department of English at MMUTO. It contains two main sections. The first section displays the results of the online questionnaire which has been answered by fifty-five (55) students. The second one discloses the results of the think-aloud protocol conducted with eight (08) master's students in language studies of the same department.

### 3.1 Results of the Questionnaire

The questionnaire is divided into two main sections; the first one is entitled "Students' Background Information" and the second is "Learners' Engagement with AI to Perform Academic Tasks".

#### 3.1.1 Results of Section One: Students' Background Information

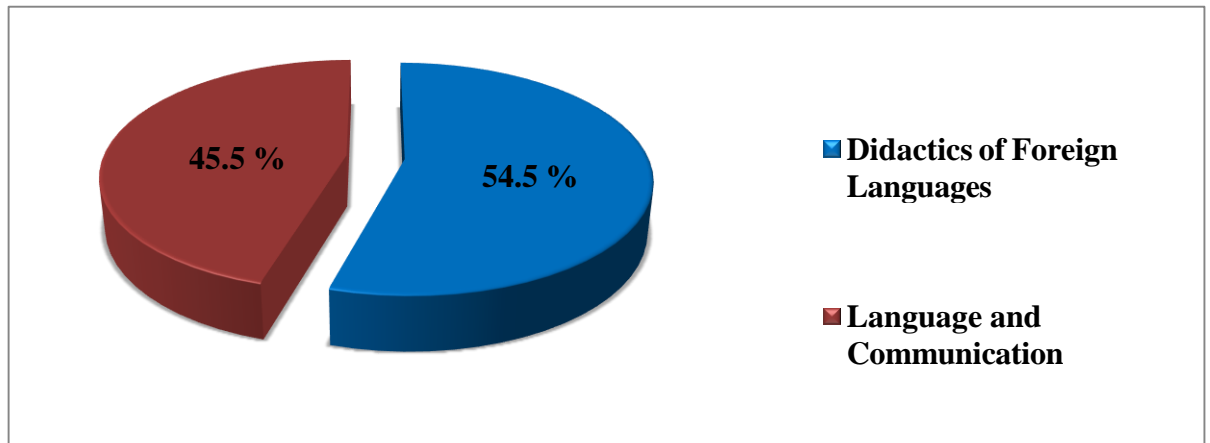
**Question (01):** Please specify your level of study



*Diagram 1.* Students' level of study

Diagram 1 indicates the participants' study level. Half of them (50.9%) are M1 students, and the other participants (49.1%) are M2 students.

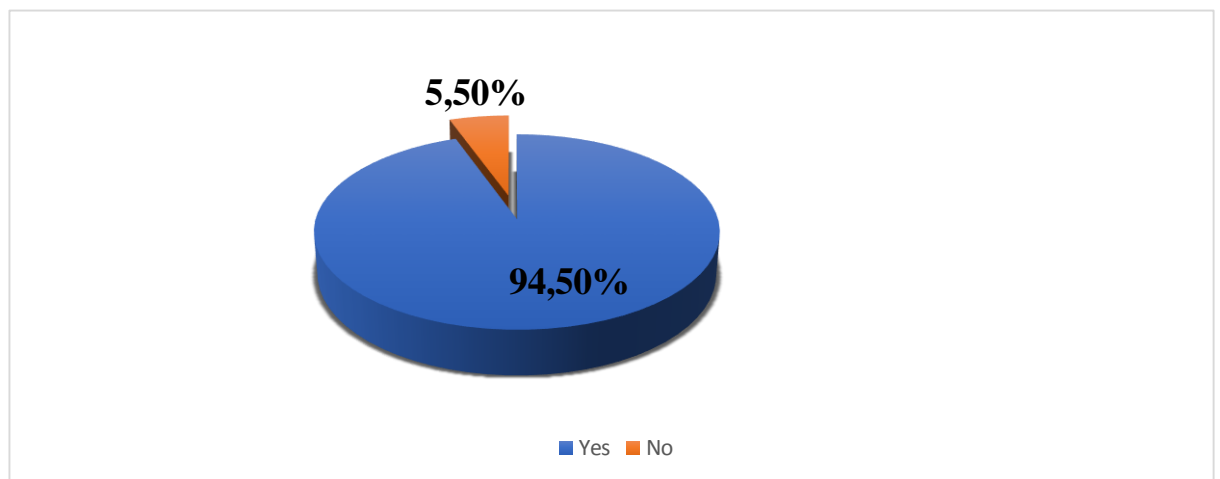
**Question (02):** Please specify your specialism



*Diagram 2.* Students' Specialism

This figure indicates that the major part of the participants (54.5%) are specialized in Language and Communication, while 45.5% of them are Didactics' students.

**Question (03):** Do you use it for educational/ language learning purposes?



*Diagram 3.* Students' Use of AI for Educational Purposes

The results of the diagram above reveal that the majority of the participants (94.5%) use AI for educational or language learning purposes. Only (5.5 %) respond with "No".

\*If yes, how often do you use it?

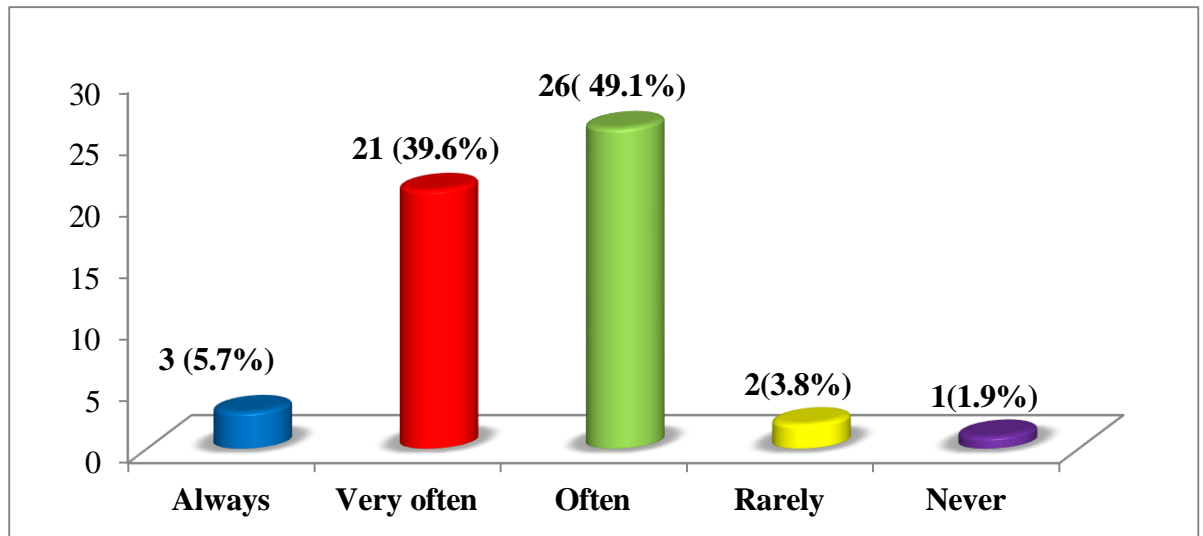


Diagram 4. AI's Frequency Use among Students

The diagram above shows how often students utilize AI for educational or language learning purposes. From their responses, 49.1% say they “often” use it for such purposes, followed by (39.6%) of them who have opted for “very often”, along with 5.7% who affirm that they “always” do. On the other hand, 3.8% of the participants assert that they “rarely” use AI in education, and only 1 participant (1.8%) has chosen the option “never”.

**Question (04):** In your opinion, is AI beneficial in education?

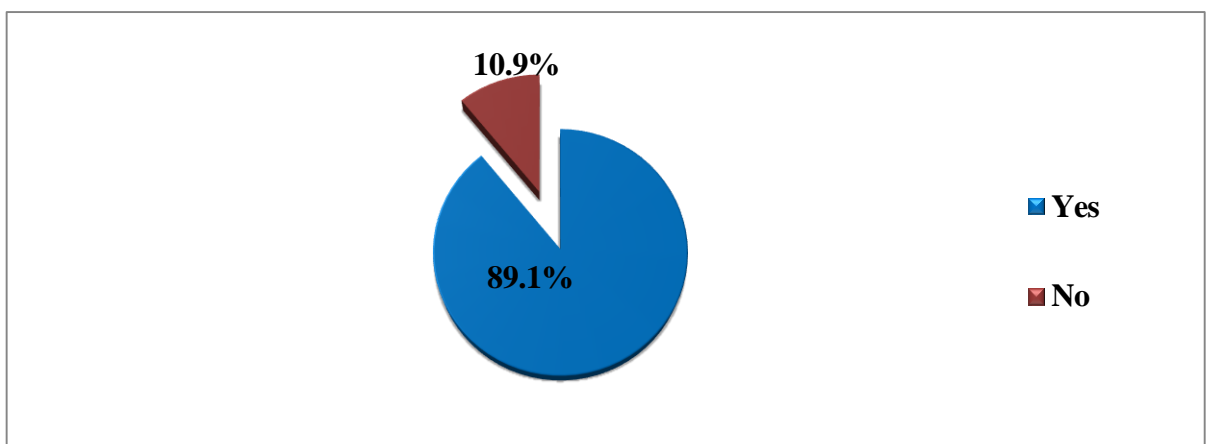


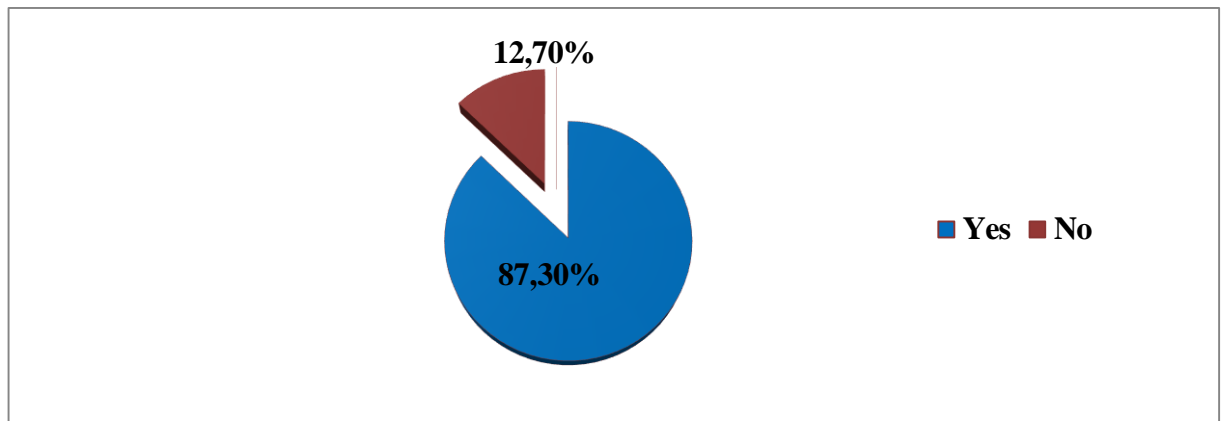
Diagram 5. Students' Perception of AI in Education

This diagram reveals that the predominant part of the participants (89.1%) believe that AI is beneficial in education, while 10.9% of them assume that it is not.

-If yes, please elaborate according to your personal experience.

The forty-four (44) participants out of fifty-five (55), who have answered this question, consider AI to be beneficial in education. Some of them assume to always seek help from AI whenever they encounter difficulties during their learning process as it clarifies complex concepts for them. Other participants, moreover, state that AI provides immediate feedback about their performances by correcting grammatical errors and improving vocabulary. Another provided explanation is that AI is not only time-saving and interactive, but it also suggests different learning resources and platforms. Lastly, some respondents have added that AI allows them to gain new information and develop their critical thinking.

**Question (05):** When you come across a challenging task, do you think of analyzing it using AI-tools (breaking it down into small manageable parts)?



*Diagram 6. Students' Analysis of Tasks Using AI*

As indicated in this diagram, a large number of forty-eight (48) participants representing (87.3 %) think of analyzing their academic tasks using an AI-tool, whereas 12.7% do not.

**Question (06):** If yes, how do you do so? (Select all that apply)

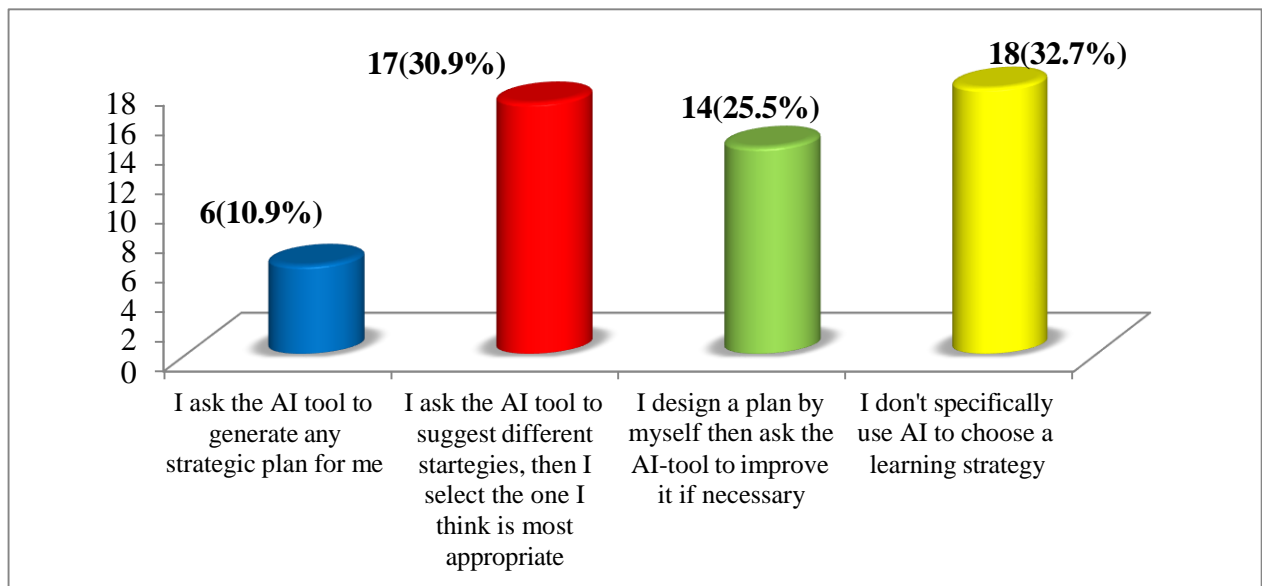
Table 01:

*Students' Strategies of Task Analysis*

<b>Options</b>	<b>Number of selections</b>	<b>Percentages</b>
<b>Asking AI to identify the key components/ instructions of the task.</b>	11	22.9%
<b>Asking AI to explain the overall aim of the task.</b>	21	43.7%
<b>Asking AI how the answer to the task should be.</b>	12	25%
<b>All of the above.</b>	4	8.3%
<b>Total</b>	48	100%

This table puts into view the strategies adapted by learners to analyze tasks. It shows that the most used strategy, with a total of 21 selections, is asking AI to explain the overall aim of the task. In the second position, with a proportion of (25%), comes asking AI how the answer to the task should be. With 11 selections equal to (22.9%), asking AI to identify the key components or instructions of the task is third. Finally, four is the number of selections that the last option has received.

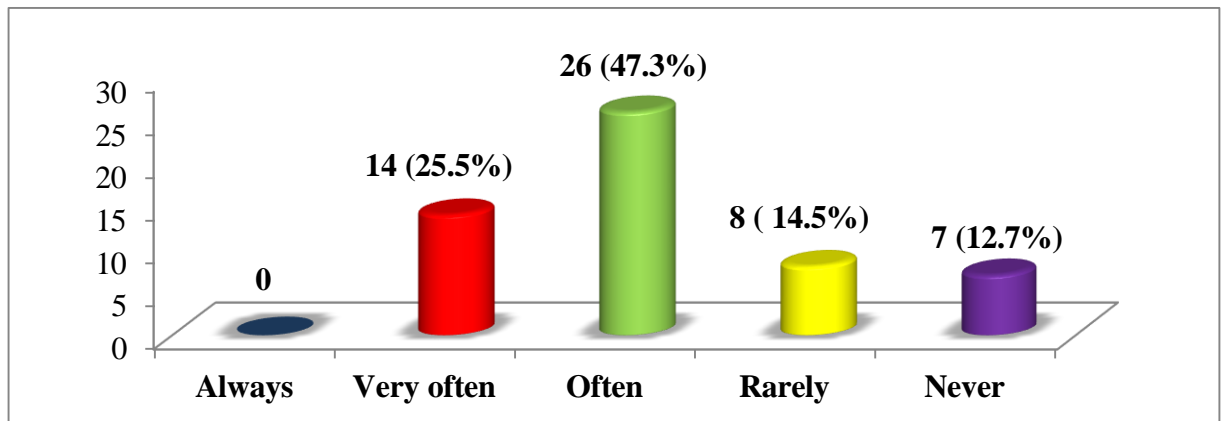
**Question (07):** How do you use AI-tools to define a learning strategy/plan to approach a task?



*Diagram 7. Students' Use of AI to Define Learning Strategies*

Diagram 7 unveils how students employ AI in order to set a learning plan to approach a task. 18 participants which represent (32.7%) do not use AI to choose a learning strategy. 30.9% of them ask AI to suggest a plan for them, then select the most suitable one, alongside 25.5% of the participants who design their own plans, then ask AI to improve them. Lastly, only 6 participants (10.9%) directly ask AI to provide them with any learning plan.

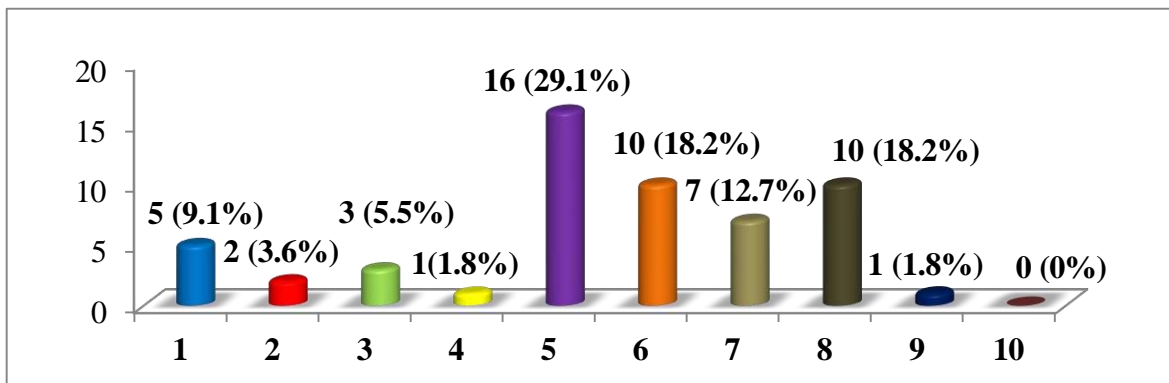
**Question (08):** One effective way of learning is setting goals (SMART). How often do you use AI to set goals based on the assessment criteria of the given task? (Criteria like the length or structure of an essay, the verb tense of a given text genre...)



*Diagram 8.* Students' Frequency of Setting Goals Based on Assessment Criteria Using AI

This diagram exhibits the frequencies at which learners tend to set goals using AI, all by considering assessment criteria. While no learner tends to **always** set goals this way, fourteen (14) others, standing for (25.5%) of the sample, do that **very often**. Twenty-six (26) learners, representing a proportion of (47.3%), **often** set goals considering standards of assessment. Last, 14.5% of the sample explained that they **rarely** define objective this way; whereas seven (7) others make it evident that they **never** do that.

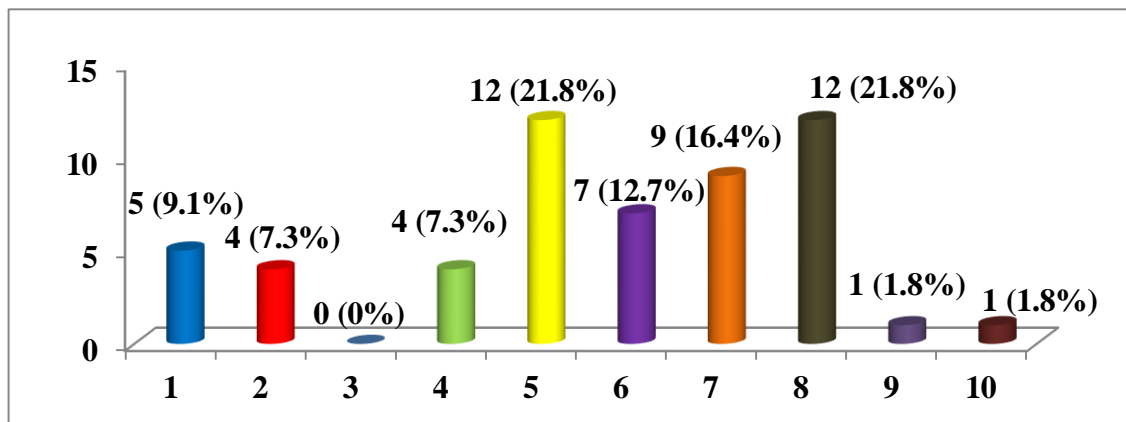
**Question (9):** On a scale of 1 to 10, how much do you think AI contributes to your self-efficacy, eventually your motivation?



*Diagram 9.* Student's Perceptions of AI's Contribution to Their Self-Efficacy and Motivation

Diagram 9 illustrates the extent to which students assume that the use of AI contributes to their self-efficacy and motivation measured on a scale of 1 to 10. The data reveal that 29.1% of the sample have rated the impact of AI as a 5 on the scale; while, ten (10) students have selected the 6<sup>th</sup> rating and ten (10) others have chosen the 8<sup>th</sup>. Meanwhile, 9.1% of the respondents have opted for the lowest rating of 1. Moreover, 3.6% of the group have chosen the rating 2, and three (3) others (5.5%) have selected the rating 3. Only one (1) participant each has selected the ratings 4 and 9. Ultimately, no student has opted for the highest rating of 10.

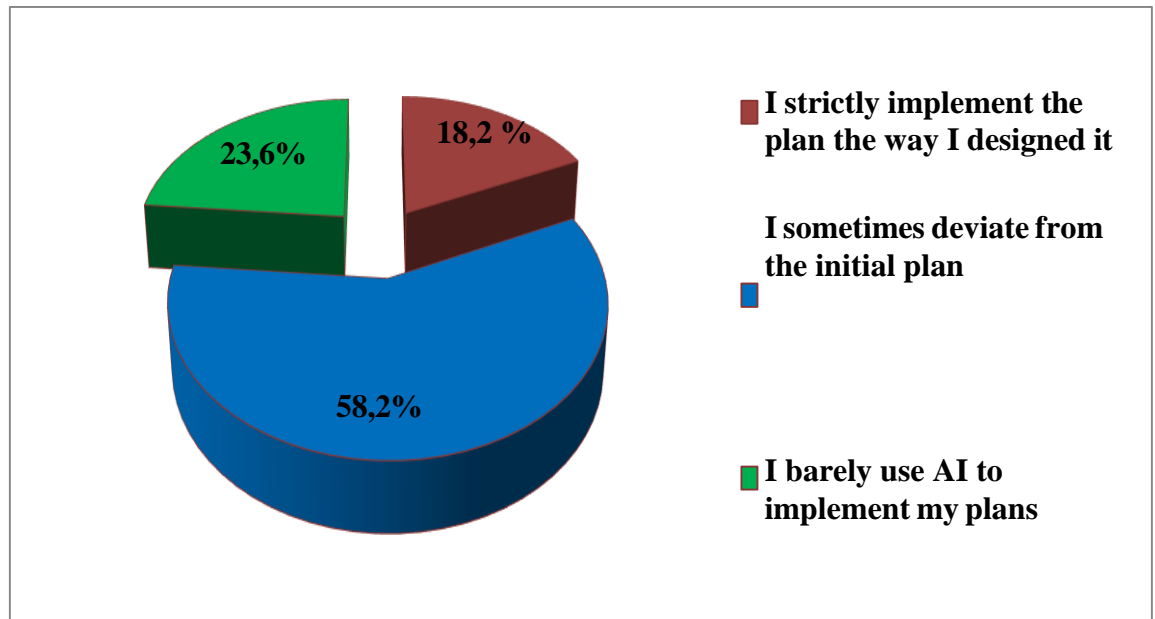
**Question (10):** On a scale of 1 to 10, how much do you think AI influences your expectations of success and ultimately fosters your motivation?



*Diagram 10.* Students' Rating of AI's Influence on Their Expectations of Success and Motivation

Diagram 10 reflects the degrees to which the participants perceive that the use of AI fosters their expectations of success and motivation. The data show that twelve (12) participants have estimated that AI's impact on their beliefs in their ability to succeed is 8 on a scale of 1 to 10. 21.8% of the sample have attributed the rating 5 to AI's influence on self- expectations and motivation, while 16.4% have rated it 7. Notably, seven (7) learners or 12.7% of the cohort have chosen the 6<sup>th</sup> rating, whereas 9.1% of them have opted for the lowest rating of 1. Conversely, one (01) participant each has selected the highest ratings of 9 and 10. Besides, the ratings 2 and 4 were selected each by 7.3% of the students; the 3<sup>rd</sup> rating has no selections.

**Question (11):** When you are doing a task, do you make sure to implement the plan which you have designed at the beginning using AI?



*Diagram11.* Students' Implementation of Their Initial Plans Using AI

Diagram 11 depicts students' implementation of the initial plans they designed using AI. The results show that 18.2% of the students adhere to their initial plans; when in fact, the majority of the learners 58.2% tend to deviate from them and 23.6% barely use AI to enact them.

**Question (12):** In case you do implement that plan, how do you do so using AI?

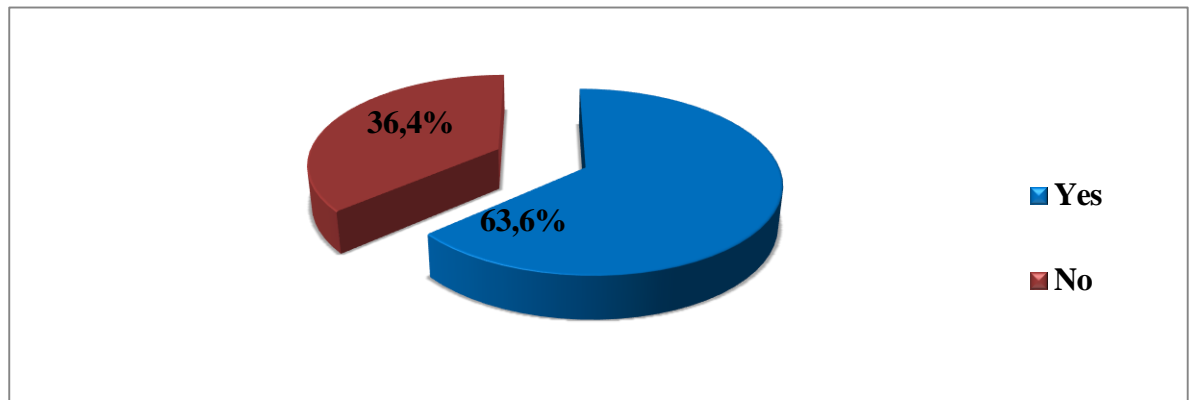
Table 2.

*Students' Techniques of Implementing Plans Using AI*

Options	Number of respondents	Percentages
<b>By asking the AI tool to compare the progress of my work to the designed outline.</b>	14	34.1%
<b>By using AI-tools to record my performance in order to assess my progress.</b>	15	36.6%
<b>Both</b>	10	24.4%
<b>Other</b>	2	4.8%
<b>Total</b>	41	100%

Table (02) displays the techniques adopted by students so as to put their plans into practice using AI-tools. It demonstrates that 34.1% of the students who have answered this question ask the AI-tool to compare their work to the designed outline. Relatedly, 36.6% of them use AI to record their performances in order to assess their progress while 24.4% rely on both techniques. Finally, two students, accounting for (4.8%), have suggested that they don't use AI to implement their plans.

**Question (13):** Once you have completed the task, do you utilize the AI-tool to evaluate the quality of your work?



*Diagram 12. Students' Utilization of AI-tools for Work Quality Assessment*

Diagram 12 pictures the proportions of students engaging in a post-task evaluation of their work using AI-tools. It reveals that 63.6% of the informants use this technology to assess their work as 36.4% do not.

**Question (14):** If yes, how do you allow it to assess your performance? (Select all that apply)

Table 3

*Students' Techniques of Work Quality Assessment Using AI*

Options	Number of selections	Percentage
By asking it to identify grammar and spelling mistakes	8	20%
By asking it to verify the coherence and cohesion of my ideas.	12	30%
By asking it to check the relevance of my ideas to the task.	8	20%
All of the above.	11	27.5%
Other:	1	2.5%
<b>Total</b>	<b>40</b>	<b>100%</b>

Table 3 portrays that the use of AI to identify grammar and spelling mistakes represents a proportion of (20%) of all the responses to this question. Similarly, the third option has been selected by eight (8) respondents. The table also shows that the use of AI to verify the coherence and cohesion of students' ideas when performing a task accounts for 30% of the total responses, with 12 selections. The fourth suggestion, that is, "All of the above" has received 11 selections, equal to (27.5%) of the selections. Besides, the option "other" has been selected by one student who indicated that they don't ask AI to evaluate their work.

**Question (15):** What are your overall assumptions vis-à-vis your performance after you have used AI to complete the tasks (effective, reliable, successful...)?

The majority of the students judge their performances using AI to be effective as it helps them overcome their difficulties and facilitates tasks for them by providing them with timely and accurate feedback, improving the quality of their work. Additionally, they argue that the use of AI promotes their feelings of self-efficacy and satisfaction. In stark contrast, a minority of students considers that their performances using AI are ineffective and unreliable given the fact that this technology fails to be accurate and flexible in terms of answers and, most of the time, causes them to become lazy and dependent.

-Please elaborate.

The findings demonstrate that the bulk of the students feel that the control they have over their learning is optimized because AI provides them with personalized learning experiences, adaptive learning environments and instant feedback. Furthermore, they have explained that AI-tools allow them to easily access various sources, improving their time management skills and critical thinking. Conversely, students who share an opposing point of view, corroborate that using AI only limits their' learning competencies and makes them

dependent and lazy. They have elaborated that AI-tools restrict their opportunities for independent exploration and critical thinking.

### 3.2. Presentation of the Findings of the Think-Aloud Protocol

This part of the chapter is devoted for the presentation of the data obtained through the think-aloud protocol (TAP) carried out with eight (08) students selected on the basis of their availability and willingness to participate and complete a task consisting in writing an essay that supports e-learning.

**Question (01):** As you are reading the task instructions, you are most probably thinking of different ways of approaching the task and covering all of its requirements. Could you please explain how you think you would manage to do so using the AI-tool you opted for?

This question seeks to picture the different ways whereby learners think to approach the activity. The findings can be presented as follows: Two students have chosen to ask ChatGPT to reformulate and simplify the task instruction for them in order to better understand its requirements. Similarly, two others expressed their intentions to use AI not only to have the instruction reformulated, but also to have the most important aspects that they need to cover listed, in addition to the steps to follow so as to complete the task. Concurrently, two other respondents have considered asking ChatGPT to provide them with definitions of e-learning and other details that need to be included based on the task instruction. In contrast, two others have decided to simply ask the AI-tool to write an argumentative essay about e-learning.

**Question (02):** Do you think of adapting a specific strategy using AI in order to direct yourself to complete this task?

The answers to this question unfold that all the respondents have planned to adapt a strategy to complete the activity, except two who have not considered following any. Two

learners have decided to use the AI-tools of their choice to look for the structure of an argumentative essay, either by asking the chatbot to provide them with a model or by asking it to enumerate the steps to follow. Three others have explained that their plans consist in asking ChatGPT for arguments, vocabulary and examples that are relevant to the topic. They have intended to write down that output on their drafts to compose an essay by themselves following the structure of an argumentative essay, which they already know. The remaining participant has thought of writing the structure of an argumentative essay on their draft, then asking AI to suggest websites or YouTube videos which discuss the topic in question. As a following step, they have decided to take notes of the information available on the sources which they have consulted; they have explained that, after that, they will write the essay and ask the AI-tool to correct it.

**Question (03):** In what way do you intend to use AI to help you define goals you want to achieve based on the task requirements?

Even though the question explores the way learners use AI to define goals, the informants have rather explained how they intend to use AI to achieve the objectives which they have thought of as they understood the task. Only one student has clearly stated that they are not going to use AI to define goals because they have already set them the moment they understood the task instruction.

**Question (04):** How do you plan to formulate your prompts so that you guide AI to help you undertake these steps?

The majority of the students have stated that they will form their prompts in the form of direct questions. Two students have mentioned that they plan to make their prompts as brief and straightforward as possible. Only one student has explained that they will focus on including key words in the prompt to ensure that the AI-tool interprets it well.

**Question (05):** As you are working on the task, how are you going to use AI to track progress of your work compared to the pre-established plan?

Half of the participants who have taken part in the protocol have asked ChatGPT for explanations or similar works, then they have compared them with the work they have been doing. Additionally, three respondents have asked for AI's feedback regarding the necessary steps to write a good argumentative paragraph, including the grammar and structure they have used. However, one of the participants has not specifically used AI to track progress of their work.

**Question (06):** At this stage (the performance stage), you may seek help or try to guide yourself to remain focused and aware of your goals. Explain how you are going to do so using this AI-tool.

As their goal is to write a paragraph with relevant information, three participants out of eight have asked AI to check the credibility of their works to ensure they align with their objective. Adding to this, three other respondents have questioned AI to reformulate their statements and provide them with illustrations to use as supporting sentences, for their goal is to write a good paragraph with a good structure. As for the remaining participants, they have requested from AI coherent and cohesive samples related to the task topic, and have kept comparing them to their paragraphs to reach coherence and cohesion.

**Question (07):** Now that you completed your task, are you going to use AI to assess your overall performance?

The respondents' answers to this question are divided into two categories: those who do assess their works using AI, and those who do not. Half of the participants have written their works to AI and asked it to identify the mistakes they have made and correct them. Oppositely, the other half have not specifically used AI as an assessment tool of their performances. One respondent among those four has decided to evaluate their work on their

own, and another one has claimed that AI was not a trustworthy tool, for, according to them, it makes mistakes too.

**Question (08):** To what extent are you satisfied with the way you managed to use AI to assist you in doing the task? Do you intend to do follow the same procedure for future assignments?

Almost all the participants are extremely satisfied after having used AI in completing the assigned task, and have decided to follow the same procedure for their future assignments. However, the remaining respondents have claimed to be dissatisfied. One of them has stated that AI has provided them with additional information that were needless, and the other has complained about AI's words choice and their unfamiliarity with it, and has refused to go through the same processes as they feel they can complete their tasks on their own.

### **Conclusion**

This chapter has presented the key findings of the study conducted with a total of 63 participants at the Department of English at Mouloud Mammeri University of Tizi-Ouzou by means of a questionnaire and the think aloud protocol. The results provide insights into students' cognitive engagement with AI-tools to perform tasks and delve into their metacognitive awareness of the processes they undergo to accomplish the activity.



**Discussion of the Findings**

### Introduction

This chapter is concerned with answering the research questions outlined in the general introduction. It gives account of the findings of this study, which are obtained through a questionnaire and the think-aloud protocol, discusses and interprets them in light of our literature review as well as the analytical framework on which this study is based. Additionally, it checks the validity of the hypotheses set forth at the beginning of this inquiry. It is organized according to the two research questions; thus, it first discusses the way Algerian EFL students engaged in Master's degree in language studies at the department of English at MMUTO cognitively engage with AI to perform academic tasks; second, it addresses the extent to which the same students control, and evaluate their academic tasks through AI's assistance, or simply the extent to which they engage in metacognition.

#### **4.1 Answer to Research Question N#1: EFL Learners' Cognitive Engagement with AI to Perform Academic Tasks.**

This section answers research question n#1 by discussing elements from the questionnaire and the TAP. It reflects students' familiarity with AI and their engagement in task analysis, goal setting, and self-reaction through the use of AI-assisted tools.

##### **4.1.1 Students' Familiarity with AI.**

The findings obtained from questions 1, 2, and 3 disclose that the stark majority estimated at 94.5% of Master's one and Mater's two students enrolled in both Didactics of Foreign Languages and Language and Communication at the Department of English at MMUTO, who have participated in this study, use AI at substantial rates (see diagram 4) for educational purposes (see diagrams 2 and 3). Furthermore, the results of question 4 indicate that these students believe that AI is beneficial in education thanks to its ability to provide immediate feedback and to clarify complex concepts, in addition to its interactive nature that

makes it time saving. This denotes that Algerian EFL learners are, like their peers around the world, coping with the latest technologies and are familiar with AI. In addition, they have integrated this technology into their education: they use it as a tool to facilitate their learning and to promote their language skills, creating personalized experiences wherein they take in hand their learning as they make decisions of every single step to take so as to fulfill their objectives. Indeed, they can make use of AI- assisted tools to easily access and explore a wide range of information inherent to their fields of interest, to prepare for exams, or to improve their language skills by using specialized AI-tools that can provide them with practice tasks or identify areas of improvement for them.

These findings align with those of an empirical study entitled “Artificial Intelligence in Higher Education: Opportunities and Challenges” (see section 1.2 in chapter 1). In brief, Ryzheva, Nefodov, Romanyuk and others (2024) have aimed to demonstrate the significance of artificial intelligence as a toolkit for edutainment in higher education. Their results reveal that 76% of higher education students have used AI at least once, and more than half of them had positive experiences with it making them believe that it will reshape education in the future.

In light of these statistical findings, we are led to the conclusion that AI is ascendant in the Algerian educational landscape. Furthermore, it can be concluded that Algerian EFL learners communicate a predisposition to take active roles in their educational journey.

### **4.1.2 Students’ Engagement in Task Analysis Using AI**

Students’ engagement in task analysis means that learners are involved in the learning process by trying to understand the activity they are dealing with. Question 5 and 6 of the questionnaire and question 1 of the think-aloud protocol seek to unveil whether the learners engage in task analysis before commencing their tasks.

On the one hand, when asked whether they think of analyzing the challenging tasks they come across using AI, forty-eight (48) participants have responded with “yes”. They have further elaborated that, in order to do so, they ask the AI- tool to explain the overall aim of the task or to identify its key components or instructions and even to elucidate how the answer to the activity should be, meaning, how they are supposed to answer it (see table 1).

On the other hand, two of the students who have participated in the TAP have stated, in response to the first question, that they would ask the AI-tool to reformulate and simplify the task instruction for them in order to understand its requirements. One of them has declared, *“I will ask it to reformulate this question in a way that I can understand it”*. Two others have mentioned that, apart from reformulation, they would inquire AI to list the most important aspects needed to be covered and the steps to be followed. One of them has explained, *“when I first read the task instruction, I immediately understood it, but the only struggle that I found was to know what details to include ... I will ask AI for help”*, the other has added, *“I think of asking it a question to give me the most important aspects to highlight and steps to follow”*.

In light of the results above, it can be inferred that the learners in question seek AI’s assistance to understand or to further comprehend their activities. This reflects their perception of AI as a helpful means that clarifies and simplifies things, aiding them to direct themselves toward their intended ends. This supports the claim that, *“the infusion of AI into higher education is seen as a proactive measure to arm students with the essential skills for success”* (Olatunde-Aiyedun, 2024, p. 4). As a case in point, they may use AI to spot grammatical errors present in their written productions, correct them, and end up generating a text that is error-free.

Moreover, these findings suggest that these students make the necessary efforts to start dealing with their academic tasks. Their resolution to use such tools to get the overall aim of

the task, its key components as well as the necessary steps to follow indicates their engagement in task analysis with the purpose of completing the task. This process of task analysis, as described in the analytical framework, is the starting point toward the completion of any activity, for it involves identifying the components or structure of the activity with the aim of gaining insights into its requirements, enabling learners to decide on the appropriate strategies to adapt in order to accomplish it (Zimmerman and Moylan 2009, referred to in Panadero and Alonso-Tapia, 2014). Indeed, the different AI chatbots used by the participants in the TAP, including ChatGPT, Perplexity, Cloud, and SnapChat AI, have helped them understand the implications of the task and decide how to proceed to respond to the instruction. One of them has clarified, *“I wrote ‘can you reformulate this question for me? Write a paragraph that supports e-learning’ ... the answer is “compose a paragraph advocating for e-learning” ...the verb “advocate” means “defend”, so I will write an argumentative paragraph”*.

Further scrutiny of the data also uncovers that, by doing so, the students initiate the forethought phase that entails processes which precede efforts to learn and perform (Zimmerman, 2000, cited in Cleary and Zimmerman, 2012). Therefore, the learners start a self-regulatory cycle.

These findings leave us with the conclusion that AI is an effective tool that contributes to students’ efficiency by helping them better understand their academic tasks. Adding to this, these results prove AI to be a means that supports SRL because it sustains learners’ engagement in task analysis; thus, the forethought phase.

### **4.1.3 Students’ Engagement in Strategic Planning**

The results of question 7 of the questionnaire reveal how students use AI to define a learning plan in order to approach a task. While 32.7% choose not to use AI to set any learning plan, 67.3% adapt different strategies through AI’s assistance so that they can deal

with a given task. Some of them ask AI to propose different plans and then choose the most appropriate one. Others ask it to improve the plans they have designed themselves. Lastly, a few participants from those who adapt learning strategies request AI to suggest any plan for them.

The findings above indicate that students do go through the process of planning through AI whenever they undertake an academic task either by trusting AI to generate a strategic plan for them or by using it to refine plans they establish themselves. This further highlights students' adoption of AI as a means to facilitate their education because of its ability to *"use data for complicated processing tasks in the same way as humans can"* (Popenici and Kerr, 2017, as cited in Ezzaaim, Kharroubi, Dahbi, 2022, p. 2) (see section 1.1 in chapter 1), as well as their use of AI to get feedback and recommendations without the constant help of a teacher, creating environment for self-regulated learning (Xia, Chiu, Chai, 2023).

Question 2 of the think-aloud protocol is asked to know whether students use AI to adapt a specific strategy so as to complete the task they have been assigned, which is to write a paragraph supporting e-learning. Almost all the participants have planned a certain strategy. For instance, one informant has explained that their plan contains five steps. The first one consists of writing down the structure of an argumentative paragraph on a sheet of paper; the second is to ask ChatGPT to list websites or YouTube videos that have discussed the topic (e-learning). As a next step, the learner has planned to take notes from the content they have consulted, then they have programmed to write the paragraph using their notes, and finally ask ChatGPT to assess the production. Another student has elaborated, *"the first thing in my plan is to directly ask SnapChat AI about the steps to follow in order to write an argumentative paragraph. After that, I will analyze and understand those steps, then write my paragraph"*.

These findings clearly demonstrate that students organize their learning process and design action-plans based on their understanding of the task and decide on each step to take so as to fulfill it. They, moreover, bring to the fore learners' varied and flexible ways of using AI as they have not restricted themselves to using it to have the activity completed; rather they have generated plans that allow them to put into use skills that they have developed at university such as planning, note taking and paraphrasing.

This procedure of organizing one's learning process and designing action-plans equates 'strategic planning', a process entailed in Zimmerman's Cyclical Model of SRL (2000). It implies choosing the learning strategies to implement based on the students' prior knowledge (Zimmerman and Moylan, 2009, as cited in Panadero and Alonso-Tapia, 2014). It also displays a further engagement in the Forethought phase of a self-regulatory cycle initiated through task analysis.

In sum, the incorporation of AI into education holds a promising potential to foster students' acquired skills and to promote their self-regulation by helping them plan their learning experiences.

### **4.1.4 Students' Use of AI in Goal Setting and Achievement**

Given the responses obtained from question 8 of the questionnaire and question 3 of the think-aloud protocol, it is determined that a considerable number of our participants set goals considering the assessment criteria of the activity they perform; however, their answers to the third question of the TAP further reveal that they tend to use AI more to achieve the goals rather than to set them.

More to the point, twenty-six (26) students, accounting for 47.3% of the sample, who have been asked how often they use AI to set goals based on the assessment criteria of the given task, have indicated that they often do that whereas fourteen others, representing a proportion equal to 25.5%, have suggested that they very often define goals that way (see

diagram 9). This implies that using AI to set goals based on the standards of evaluation of a given activity is a prevalent practice among these students. Moreover, the integration of AI into their goal-setting process highlights learners' adoption of technology as a means to better lead their learning journeys; especially that one's objectives determine their path. In accordance with this, Zimmerman and Schunk (2011) point to the fact that learners have to activate and sustain their thoughts and behaviors to achieve their objectives: a student seeking to improve their vocabulary, for example, may resolve to reading books on a daily basis.

These findings also exhibit students' sense of effective decision-making, in the sense that they have considered harnessing this technology to facilitate their learning, simulating learning situations wherein they are proactive and masters of their own learning (Zimmerman and Schunk, 1989, cited in Zimmerman, 1990).

Nevertheless, the answers of the eight (08) participants in the TAP display that they set goals by themselves and only use AI to achieve them. As overtly put by one of them, *"My goal in this task is to gain accurate info about this topic and enlarge my knowledge about e-learning. I will ask AI to provide me with ideas I'm not sure about, but not to define goals for me because I already set them in my mind"*.

As illustrated, the learner has preferred not to rely on AI to define goals; instead, they have expressed their intention to use it to access information which will enlarge their knowledge about the topic i.e., to achieve their objective. Similarly, another informant has explained that they aim to generate a coherent written production with no grammatical errors while adhering to the structure of an argumentative paragraph; they have expounded, *"to do so, I will ask ChatGPT 'correct or check whether my grammar is correct or not', the same thing for the structure"*. In much the same way, another student who has opted for SnapChat AI has elaborated, *"I will ask it to provide me with ideas about the topic, then ask it if I made grammatical errors so to achieve another goal which is avoiding grammatical errors"*.

Likewise, these findings indicate that setting goal is a common procedure among these EFL learners even though they do not specifically utilize artificial intelligence to define them. In this instance, as they have assimilated the task requirements, our participant have understood that the assessment criteria of an argumentative paragraph are mainly the structure, coherence and cohesion, grammar, and the information to include; thereby they have employed AI in such ways to match them. On the basis of Zimmerman's model (2000), learners who engage in effective task analysis set task-specific goals. Besides, their ongoing engagement in the Forethought phase and persistence in the self-regulatory cycle (Zimmerman, 2000) are maintained.

This analysis leads us to the conclusion that AI-assisted tools have the potential to meet learners' preferences and tailor their learning experiences to their needs. The AI- tool either helps them in setting or achieving them.

### **4.1.5 Students' Engagement in Self-reaction Using AI**

Question 15 of the questionnaire and question 8 of the think-aloud protocol probe students' self-reaction to their overall performances using AI. The results convey that the majority of the participants find their performances so "effective and "successful" that they decide to adhere to the same procedure to complete the up-coming tasks. This demonstrates a noteworthy degree of satisfaction on the part of students regarding to their performances.

Students' answers suggest that AI has played an important role in improving their performance and satisfaction because of its resourceful nature. To rephrase, they have contended that it provides "helpful responses to a variety of queries", "improves [their] knowledge about any task", and helps them save time. In Woolf, Lane, Chaudri et al. words (2013; p. 67), this smart technology helps students "*better understand the mechanisms underlying thought, knowledge, and intelligent behavior*". Concretely, the eight participants in the TAP have utilized AI to analyze the task instruction; therefore, they have understood its

implications, designed plans and set goals in order to cover them. After defining goals based on their comprehension of the task requirements, the students have deployed AI to achieve them. They have specifically used it to detect grammatical errors and correct them as well as to check the coherence and cohesion of their texts and address any issues related to them. This has constituted another reason for their satisfaction.

Simultaneously, it comes as no surprise that deeming one's performance to be successful after the completion of a task causes the person to decide to stick to the same procedure in the hopes of ensuring the same desirable outcome. Stated differently, by perceiving their performance as successful, the students become eager to achieve the same positive outcome, so they decide to maintain the same approach that led them to that end. In this regards, one participant has clarified, *"I am fairly satisfied, and yes, I think I will follow the same procedure for my future tasks"*; another has detailed, *"I am satisfied with my experience with AI because it is time saving and it provided me with answers to all my questions, so I think I will do the same for future performances and keep the same procedure to answer my future tasks"*

These results correspond to the process of self-reaction identified in Zimmerman's Cyclical model of SRL (2000), which occurs in the Self-reflection phase. It includes self-satisfaction and adaptive inferences that, respectively, refer to their feelings of satisfaction with their performance and decision to adapt the same procedure for future tasks (Zimmerman, 2013). Adding to this, the findings reveal that students have gone through the Performance phase, continuing the self-regulatory cycle they have initiated through task analysis and finish it by deciding to adopt a similar procedure to deal with future tasks.

Put all together, Master's students enrolled in language studies at the department of English at Mouloud Mammeri University of Tizi- Ouzou cognitively engage with AI to perform tasks by analyzing their activities, designing strategic plans, setting goals, and self- reacting to their performances. Indeed, all these processes require students to leverage a

number of mental processes that consist in processing and representing information i.e., constructing understanding and knowledge in the mind (Sternberg, 1981, cited in van der Graaf, Lim, Fan, et.al., 2022) then making decisions based on that. Hence, this section answers the first research question raised in the General Introduction which is “How do Algerian EFL students engaged in Master’s degree in language studies cognitively engage with AI to perform academic tasks?”; thus, the first hypothesis is confirmed.

### **4.2 Answers to Research Question N# Two: AI’s assistance of EFL learners in metacognition**

This section answers research question n# 2. It pictures students’ positive perceptions of AI’s contribution to their self-efficacy, success expectations, and motivation. Along with this, it discusses learners’ self-observation using AI, their self-control, and their self- judgement using the same technology.

#### **4.2.1 Students’ positive perceptions of AI’s contribution to their self-efficacy, success expectations, and motivation**

As shown in the previous chapter, the results of question nine (9) that is about students’ opinions regarding the contribution of AI to their self-efficacy and eventually their motivation are more or less positive. Indeed, 29.1% of the participants have rated its impact as an average one (5 out of 10), followed by ten (10) students who have rated it 6 out of 10, ten (10) others with an 8 out of 10, and one (1) who have rated it 9, demonstrating their satisfaction with the impact of AI tools in enhancing their self-efficacy and fostering their motivation; therefore, with a total of forty-four (44) participants with positive ratings, AI is viewed as a useful tool that contributes to students’ self-efficacy, which makes them more motivated. This means that, before they start performing their academic task (the forethought phase), students believe to be self-efficient as they are convinced they can succeed in completing the assignment (Bandura, 1977, referred to in Wilde and Hsu, 2019) thanks to AI’s assistance that boosts their confidence and allows them to do the task at their own pace. For instance, when the used

AI-tool provides clear explanations of the task instructions, students understand better what they are required to do, which makes them believe they can appropriately perform the task without going out-of-topic regardless of its level of difficulty.

Additionally, the findings of question ten (10) reveal that students perceive the use of AI as a positive influence on their expectations of success. In fact, twelve (12) participants have rated AI's impact in having high expectations of success 5 out of 10, in addition to twelve (12) others with a rating of 8 out of 10, along with 12.7% who have rated it 6, and 16.4% who have attributed the rating of 7, as well as two (2) other participants with the rating of 9 and 10 out of 10 on the part of each. This demonstrates students' high expectations about the success of their learning activity, and eventually the enhancement of their motivation towards learning.

As proved in Zimmerman's model (2000), the findings above show how students address their self-efficacy and outcome expectations. In other words, they become conscious of all their areas of strengths and weaknesses regarding the task they are assigned, and ensure to make the necessary improvements, which denotes their engagement in metacognition. This idea is confirmed by Winne (2000) who defines metacognition as being the awareness that students have concerning their academic strengths and weaknesses.

These students' views regarding AI's contribution to their self-efficacy, expectations of success, as well as their motivation do not align with Jin Sung-Hee, Im Kwoon and others (2023) study's findings that AI applications are ineffective for learners' motivation (see the General Introduction).

In sum, the use of AI tools plays a crucial role not only in enhancing students' positive convictions about themselves and their abilities, but also in having high expectations of success, both which foster their motivation, allowing them to metacognize as this technological tool permits them to be aware of their strengths before performing their tasks.

### **4.2.2 Students' Self-Observation Using AI**

Question eleven (11) of the questionnaire is asked to see whether students do implement

## Discussion of the Findings

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their initial plans using AI or not. Although it is revealed that 23.6% of the participants do not utilize AI to make implementations of their plans, the remaining respondents do, either by implementing their plan the way it has been designed at the beginning, or by deviating from the initial one sometimes (see diagram 11). These results signify that the learners start doing their task by putting into use the different plans they have set using AI to assist them in fulfilling the given activity. Following Zimmerman's model (2000), this means that the students have entered the performance phase, where they begin doing the task by implementing the plans they have established in the forethought phase.

Question twelve (12) of the questionnaire shows how students make use of AI to implement those plans. In fact, different techniques of plan implementations are used through AI: 34.1% of the participants ask the AI-tool to make a comparison between the progression of their work and the plan they have designed, which denotes that the students verify their own understanding and ensure they are doing the right thing to successfully complete the task. In a similar vein, question five (5) of the TAP reveals how the participants employ AI to track progress of their work in comparison to their initial plan. Four (4) participants out of eight (8) have sought explanations from the AI-tool and started comparing the given information with what they have been doing. One of them has explained, *“At this point, I am actually confused. I will turn back to ChatGPT and ask it to better explain what I am supposed to do...Now that it provided me with more explanations regarding this topic, I will check whether it is what I am currently doing or not”*.

This suggests that the learners utilize the AI-tool to compare their work in progress with criteria relevant to the task. Three (3) other respondents to the protocol have asked for AI's feedback regarding the appropriate structure of an argumentative essay and compared it with the structure and grammar they have used. In the words of Winne and Hadwin (1998, cited in Panadero and Alonso-Tapia, 2014), this procedure is known as 'self-monitoring', where learners check their ongoing performances against standards that judge the quality of their followed process

Further results of question twelve (12) display that 36.6% of the respondents use AI to record their performances and assess the evolution of their work, implying that AI-tools enable them to keep track of their progress. For instance, a student can ask AI to register the time they spend in the completion of an activity in order to improve their time-management skills while being engaged in the learning process. Additionally, 24.4% of the participants rely on both techniques, and in line with the analytical framework, self-monitoring and self-recording constitute "self-observation". This process refers to the way learners pay attention to what they are doing whilst performing their assignments, and in parallel, to the way they are aware of their own learning process; accordingly, they engage in metacognition.

Consequently, AI can be used so that students get involved in self-observation i.e., through AI, learners can observe the way they engage in learning and notice the extent to which they understand their assignments. This occurs through two major processes, namely self-monitoring and self-recording, through which they ensure the implementation of the plans they set at the beginning, all by AI's support and guidance.

### **4.2.3 Students' Self-Control through AI**

The findings of question six (6) of the TAP indicate how students seek AI's help to remain focused on their objectives. Three (3) participants have asked AI to verify whether their work was credible and relevant to their objectives. One of them has elaborated, "*As my*

*goal is to gain accurate information, whenever I include those it provided me, I will ask it each time 'are they accurate?' to avoid any difference from what I'm expecting". Besides, three (3) others asked it to add illustrations to their statements so that they could have valid supporting sentences. Lastly, the two remaining participants have requested from AI some samples of argumentative paragraphs to use as models to imitate and eventually be able to produce cohesive and coherent writings.*

These obtained results point to the different ways through which the students seek help from AI-tools so that they sustain focus on their goals, and by this, being in agreement with Zimmerman's claim about how self-control can be achieved through help-seeking. This highlights how learners regulate their thinking processes and alter them based on the objectives they establish, which according to Zimmerman's model (2000), is a metacognitive strategy intended to uphold concentration and motivation. As a result, AI does assist these EFL learners in metacognizing as they go through the process of self-control, particularly through help-seeking from AI.

### **4.2.4 Students' Self-Judgment Using AI**

Question thirteen (13) shows students' use of AI to evaluate the quality of their performances, where the majority of the respondents (63.6%) utilize AI-tools to assess their works. Adding to this, question fourteen (14) demonstrates the different ways through which the participants employ AI for work quality assessment. Some of them ask it to detect grammar and spelling mistakes, while others use it to verify the relevance of their ideas. Besides, 33% of the respondents use it to check the coherence and cohesion of their productions, as well as eleven (11) others who do all of the above (see table 3).

It is then highlighted through these results that students evaluate their own works according to the assessment criteria they set for themselves. The fact that they assess their own performances means that they go through the process of "self-judgment". The latter

occurs in the self-reflection phase. As explained in the analytical framework, it is when learners judge their own works once they are completed, and think of how to adjust them afterwards.

Nevertheless, question seven (7) of the TAP indicates that even though four (4) participants do assess their performances using AI, as one of them has stated, *“I will copy- paste my work to ChatGPT and ask it to evaluate it by correcting any vocabulary or punctuation mistakes”*, the other half of the respondents have not necessarily asked AI to evaluate the quality of their performances or correct any exiting error in their work. One of them has claimed, *“I won’t rely on AI’s feedback regarding my performance, because sometimes it makes mistakes too, so it’s not completely trustworthy. I even doubt the answers it gives me sometimes.”* This denotes the students’ lack of awareness regarding the significance of this stage. Eventually, they miss the chance to improve their learning potentials.

As a result, it is deduced that students do self-judge but only to a certain extent. This is due to the fact that there are some students who do not consider AI as an assessment tool, or simply do not think of evaluating their works once they complete them.

While the findings of our study and those of the study of Jin Sung-Hee et al. (2023) are similar in terms of AI’s support of metacognitive regulations, their research has been carried out with 16 university students from different majors, in contrast, ours is limited to Master’s students enrolled in language studies at the Department of English at MMUTO. Consequently, with respect to Zimmerman’s Cyclical Model of Self-Regulation (2000), it is evident that AI assists EFL learners in metacognition to a considerable extent, as the learners do go through different metacognitive processes, notably self-efficacy and outcome expectations in the forethought phase, self-observation and self-control during the performance phase, as well as self-judgment in the self-reflection phase. With that being said, the second research question namely *“To what extent does AI assist Algerian EFL students engaged in Master’s degree in language studies at the Department of English at MMUTO in metacognition?”* is answered by confirming the second hypothesis advanced in the general introduction.

### Conclusion

This chapter has discussed and interpreted our findings in view of Zimmerman's Cyclical Model of SRL (2000) and the literature review . It has answered the two research questions and hypotheses advanced in the general introduction based on the findings obtained through a questionnaire and the think-aloud protocol designed for Master's one and Master's two students enrolled in both Didactics of Foreign Languages and Language and Communication at the Department of English at Mouloud Mammeri University of Tizi- Ouzou. The analysis of the results has proven that the majority of these students cognitively engage through the use of AI to perform tasks, but are also remarkably assisted by AI-tools in metacognitive practices.



## **General Conclusion**

The present dissertation has investigated the role that Artificial Intelligence plays in building EFL learners self-regulation skills, notably their cognition and metacognition. It has been carried out with Master's students enrolled in language studies at the department of English at MMUTO.

This study has sought to reach two main objectives. First, to examine how Algerian EFL learners enrolled in a Master's degree in language studies cognitively engage with AI to perform academic tasks; second, to measure the extent to which AI assists Algerian EFL learners in deploying their metacognitive abilities to perform academic tasks. In order to conduct this study, we have drawn upon Zimmerman's Cyclical Model of Self-Regulated Learning proposed in 2000. It encompasses three recursive phases, namely the forethought phase, the performance phase, and the self-reflection phase, through which learners go in order to complete their academic tasks; thus, become self-regulated.

A Mixed-Methods approach has been used, as data have been collected and analyzed both quantitatively and qualitatively. The data collection has been done using two tools: an online questionnaire answered by fifty-five (55) random students, in addition to the Think-Aloud Protocol conducted with eight (8) participants, all of whom are pursuing a Master's degree in Didactics of Foreign Languages as well as Language and Communication. As for the data analysis, it has been done through a descriptive statistical analysis of the close-ended items of the questionnaire, in addition to a qualitative content analysis for the open-ended items and for the questions of the protocol.

The analysis of the data gathered from the abovementioned instruments has demonstrated that EFL learners cognitively engage through AI in order to perform academic tasks, as they undergo several cognitive processes when using AI-tools to complete their activities. In particular, they utilize AI to analyze tasks, make strategic planning, set goals, and react to their own performances. Not only that, but the analysis of the insights provided by the participants has indicated that the different AI-tools assist EFL learners in leveraging their

metacognitive abilities. After interpretation, the results have shown a considerable extent to which AI assists students in their self-efficacy, success expectations, self-observation, self-control, and self-judgment, all of which refer to metacognition, as explained in the discussion chapter. All in all, it is obvious that both hypotheses advanced in the general introduction are confirmed.

By answering the research questions and confirming the hypotheses raised in the General Introduction, this study has proven effective the role of AI in promoting self-regulated learning skills of EFL learners, particularly their cognition and metacognition. Hence, it holds implications for both students and teachers as they can take as much profit as possible from this technology. Students may rely on its capacity to provide personalized learning experiences along with immediate feedback so as to take proactive roles in their learning. As for teachers, they may use artificial intelligence as an authentic tool capable of helping them innovate in terms of their teaching methods. It also sets the stage for syllabus designers and decision-makers to originate strategies and materials allowing the integration of AI into the educational framework all by upholding academic integrity.

Like every scientific work, ours has encountered a number of limitations mainly in the process of data collection which coincided with the exam period at our department. As it has been previously mentioned, we have opted for a questionnaire and the think-aloud protocol as data collection instruments. For this reason, we have struggled at the beginning to get the needed number of participants for each tool but mostly for the TAP, for it has necessitated the students to devote some of their time to write a paragraph helped by an AI-assisted tool of their choice and answer our questions. In addition to this, the number of respondents in the TAP, which is eight (08) students, may limit the generalization of the findings.

Notwithstanding these limitations, this study opens up new avenues for inquiry. The incorporation of AI in education is a topical issue and is garnering considerable attention worldwide, so we suggest that further research, in the Algerian context, investigate the impact of the use of AI on EFL learners' autonomy. This recommended topic may be explored in light of self-regulation theories as well, following a different methodology and data collection procedure. A case study seems appropriate to observe learners' experiences with this technology and examine its impact on their autonomy.



## **Reference List**

- Akturk, A. O., & Sahin, I. (2011). Literature review on metacognition and its measurement. *Procedia- Social and Behavioral Sciences*, 15, 3731- 3736. Retrieved from <https://www.researchgate.net/publication/251713936>
- Alshaikhi, T., & Khasawneh, M. A. S. (2024). Investigating the benefits and drawbacks of selected AI-powered instruments employed for foreign language education. *Kurdish Studies*, 12(2), 2156-2169. Retrieved from <https://kurdishstudies.net/menu-script/index.php/KS/article/view/2216>
- Alvi, E., Iqbal, Z., Masood, F., & Batool, T. (2016). A qualitative account of the nature and use of self-regulated learning (SRL) strategies employed by university students. *Australian Journal of Teacher Education*, 41(8), 40-59. Retrieved from <http://dx.doi.org/10.14221/ajte.2016v41n8.3>
- Bhosale, S., Pujari, V., & Multani, Z. (2020). Advantages and disadvantages of artificial intelligence. *Aayushi International Interdisciplinary Research Journal*, 227-230. Retrieved from <https://www.researchgate.net/publication/344584269>
- Blut, M., Wang, C., Wunderlich, N. V., & Brock, C. (2021). Understanding anthropomorphism in service provision: a meta-analysis of physical robots, chatbots, and other AI. *Journal of the Academy of Marketing Science*, 49, 632-658. Retrieved from <https://doi.org/10.1007/s11747-020-00762-y>
- Cameron, R. (2011). Mixed methods research: The five Ps framework. *Electronic journal of business research methods*, 9(2), 96-108. Retrieved from <https://academic-publishing.org/index.php/ejbrm/article/view/1272>
- Caswell, C. J., & LaBrie, D. J. (2017). Inquiry based learning from the learner's point of view: A teacher candidate's success story. *Journal of Humanistic Mathematics*, 7(2), 161-186. Doi: [10.5642/jhummath.201702.08](https://doi.org/10.5642/jhummath.201702.08)

- Chaterdon, K. (2019). Writing into awareness: How metacognitive awareness can be encouraged through contemplative teaching practices. *Across the Disciplines: A Journal of Language, Learning and Academic Writing*. 50-65. Retrieved from [https://www.academia.edu/39601763/Writing\\_Into\\_Awareness\\_How\\_Metacognitive-Awareness\\_Can\\_Be\\_Encouraged\\_Through\\_Contemplative\\_Teaching\\_Practices](https://www.academia.edu/39601763/Writing_Into_Awareness_How_Metacognitive-Awareness_Can_Be_Encouraged_Through_Contemplative_Teaching_Practices)
- Cleary, T. J., & Zimmerman, B. J. (2012). A cyclical self-regulatory account of student engagement: Theoretical foundations and applications. In: S., Christenson, A., Reschly, & C.? Wylie (Eds.), *Handbook of Research on Student Engagement*. (pp. 237-257). Boston, MA: Springer. Retrieved from [https://doi.org/10.1007/978-1-4614-2018-7\\_11](https://doi.org/10.1007/978-1-4614-2018-7_11)
- Copeland, B. J., (2023). Artificial intelligence. *Encyclopedia Britannica*. Retrieved from <https://www.britannica.com/technology/artificial-intelligence>
- Cordeiro, V. D., & Cozman, F. (2024). Artificial intelligence and everyday knowledge. In *The Palgrave Handbook of Everyday Digital Life* (pp. 23-35). Cham: Springer International Publishing. Retrieved from [https://doi.org/10.1007/978-3-031-30438-5\\_2](https://doi.org/10.1007/978-3-031-30438-5_2)
- Dawson, T. L. (2008). Metacognition and learning in adulthood. *Developmental Testing Service, LLC*. Doi: [10.13140/RG.2.1.2231.0649](https://doi.org/10.13140/RG.2.1.2231.0649)
- De Houwer, J., Barnes-Holmes, D., & Barnes-Holmes, Y. (in press). What is cognition? A functional cognitive perspective. In S. C. Hayes and S. G. Hofmann (Eds.), *Core processes of cognitive behavioral therapies*. (pp.2-27). Oakland, CA: New Harbinger. Retrieved from <https://www.researchgate.net/publication/308749950>
- Dillah, D., Subramaniam, S., Bazilah, N., Hamid, A., Subramaniam, N., Afrin, J.F., & Rahmat, N. H. (2023). Investigating pre-university students' motivation to learn and their use of self-regulated learning strategies. *International Journal of Academic Research in Business and Social Sciences*, 13(10), 1041-1057. Retrieved from [10.6007/IJARBS/v13-i10/18961](https://doi.org/10.6007/IJARBS/v13-i10/18961) - Recherche (bing.com)

- Dong, Y. (2023). Descriptive statistics and its applications. *Highlights in Science, Engineering and Technology*, 47, 1-23. Doi: <http://dx.doi.org/10.54097/hset.v47i.8159>
- Durning, S. J., Artino Jr, A. R., Beckman, T. J., Graner, J., Van Der Vleuten, C., Holmboe, E., & Schuwirth, L. (2013). Does the think-aloud protocol reflect thinking? Exploring functional neuroimaging differences with thinking (answering multiple choice questions) versus thinking aloud. *Medical teacher*, 35(9), 720-726. Retrieved from <https://doi.org/10.3109/0142159X.2013.801938>
- Efklides, A., (2019). Gifted students and self-regulated learning. The MASRL model and its implications for SRL. *High Ability Studies*, 30(1), 79-102. Retrieved from <http://dx.doi.org/10.1080/13598139.2018.1556069>
- El-Had, M. (2023). Artificial Intelligence background, definitions, challenges and benefits. *مجلة الجمعية المصرية لأنظمة المعلومات وتكنولوجيا الحاسبات*, 31(31), 124-132. Retrieved from <http://dx.doi.org/10.21608/jstc.2023.297957>
- Elliott, A. (2019). *The culture of AI: Everyday life and the digital revolution* (1st ed.). Routledge. Available at <https://doi.org/10.4324/9781315387185>
- Ellis, A. K., Denton, D. W., & Bond, J. B. (2014). An analysis of research on metacognitive teaching strategies. *Procedia-Social and Behavioral Sciences*, 116, 4015-4024. Retrieved from <https://doi.org/10.1016/j.sbspro.2014.01.883>
- Ericsson, K. A., & Simon, H. A. (1987). Verbal reports on thinking. In C. Faerch & G. Kasper (Eds.), *Introspection in second language research* (pp. 39-54). Clevedon, England: Multilingual Matters. Retrieved from <https://doi.org/10.7551/mitpress/2834.003.0039>

- Etikan, I., & Bala, K. (2017). Sampling and sampling methods. *Biometrics & Biostatistics International Journal*, 5(6), 215-217. Retrieved from <https://doi.org/10.15406/bbij.2017.05.00149>
- Ezzaim, A., Kharroubi, F., Dahbi, A., Aqqal, A., & Haidine, A. (2022). Artificial intelligence in education - State of the art. *International Journal of Computer Engineering and Data Science (IJCEDS)*, 2(2), 1-11. Retrieved from <https://www.ijceds.com/ijceds/article/view/37>
- Fitria, T. N. (2021). Artificial intelligence (AI) in education: Using AI tools for teaching and learning process. In *Prosiding Seminar Nasional & Call for Paper STIE AAS* (pp. 134-147). Retrieved from <https://www.researchgate.net/publication/357447234>
- Goetz, T., Nett, U. E., & Hall, N. C. (2013). Self-regulated learning. *Emotion, motivation, and self-regulation: A handbook for teachers*, 123-166.
- González Tigrero, R. O. (2024). *Advantages and disadvantages of artificial intelligence in the learning process in teenagers* (Bachelor's thesis, La Libertad: Universidad Estatal Península de Santa Elena. 2024). Retrieved from <https://repositorio.upse.edu.ec/handle/46000/11011>
- Gunasekare, U. L. T. P. (2016). Mixed research method as the third research paradigm: A literature review. *International Journal of Science and Research*, 4(8), 361-367. Retrieved from <https://ssrn.com/abstract=2735996>
- Halaweh, M., (2023). ChatGPT in education: Strategies for responsible implementation. *Contemporary Educational Technology*, 15(2), 1-11. Retrieved from <https://doi.org/10.30935/cedtech/13036>
- Jin, S. H., Im, K., Yoo, M., Roll, I., & Seo, K. (2023). Supporting students' self-regulated

- learning in online learning using artificial intelligence applications. *International Journal of Educational Technology in Higher Education*, 20(37), 1-21. Retrieved from <https://doi.org/10.1186/s41239-023-00406-5>
- Jōgi, L., Karu, K., & Krabi, K. (2015). Rethinking teaching and teaching practice at university in a lifelong learning context. *International Review of Education*, 61(1), 61-77. Retrieved from <https://doi.org/10.1007/s11159-015-9467-z>
- Johnson, H. (2013). *Re-engaging in a cyclical model of self-regulated learning* (Doctoral thesis, University of Memphis Digital Commons). Retrieved from <https://digitalcommons.memphis.edu/etd/693>
- Khairi, F. (2024). Exploring the impact of using AI in support of the self-regulated learning process. Doi: [10.13140/RG.2.2.34317.96481](https://doi.org/10.13140/RG.2.2.34317.96481)
- Kumari, A., (2021). Metacognition among college students. *International Journal of Creative Research Thoughts (IJCRT)*, 9(8), 65-72. Retrieved from <https://ijcrt.org/papers/IJCRT2108450.pdf>
- Lashari, A. A., & Umrani, S. (2023). Reimagining self-directed learning language in the age of artificial intelligence: A systematic review. *Grassroots*, 57(1), 92-114. Retrieved from <https://www.researchgate.net/publication/375558011>
- Marantika, J. E. R., (2021). Metacognitive ability and autonomous learning strategy in improving learning outcomes. *Journal of Education and Learning (EduLearn)*, 15(1), 88-96. Retrieved from <https://files.eric.ed.gov/fulltext/EJ1299455.pdf>
- Markauskaite, L., Marrone, R., Poquet, O., Knight, S., Martinez-Maldonado, R., Howard, S., ... Siemens, G. (2022). Rethinking the entwinement between artificial intelligence and human learning: What capabilities do learners need for a world with AI? *Computers*

- and Education: Artificial Intelligence*, 3, 1-16. Retrieved from <https://doi.org/10.1016/j.caeai.2022.100056>
- Merriam-Webster. (n.d) Questionnaire. In Merriam-Webster.com. Retrieved from <https://www.merriam-webster.com/dictionary/questionnaire>
- Molenaar, I. (2022). The Concept of hybrid human-AI regulation: Exemplifying how to support young learners' self-regulated learning. *Journal of Computers Education: Artificial Intelligence*, 3, 1-11. Retrieved from <http://doi.org/10.1016/j.caeai.2022.100070>
- Neelam, M. (2021). Aspects of artificial intelligence. In Karthikeyan, J., Ting, S.-H., & Ng, Y.-J. (Eds.), *Learning outcomes of classroom research* (pp. 250-256). Retrieved from <https://www.researchgate.net/publication/358119068>
- Nodoushan, M. A. S. (2012). Self-regulated learning (SRL): emergence of the RSRLM model. *International Journal of Language Studies*, 6(3), 1-16. Retrieved from [https://eric.ed.gov/?q=Self-regulated+learning+\(SRL\)%3a+Emergence+of+the+RSRLM+model&id=ED533138](https://eric.ed.gov/?q=Self-regulated+learning+(SRL)%3a+Emergence+of+the+RSRLM+model&id=ED533138)
- Olatunde-Aiyedun, T. G. (2024). Artificial intelligence (AI) in education: Integration of AI into science education curriculum in Nigerian universities. *International Journal of Artificial Intelligence for Digital*, 1(1), 1-14. DOI: [10.13140/RG.2.2.31699.76320](https://doi.org/10.13140/RG.2.2.31699.76320)
- Panadero, E., & Alonso-Tapia, J. (2014). How do students self-regulate? Review of Zimmerman's cyclical model of self-regulated learning. *Anales de Psicología*, 30 (2), 450-462. Retrieved from : [https://www.researchgate.net/publication/260684981\\_How\\_do\\_students\\_self-regulate\\_Review\\_of\\_Zimmerman%27s\\_cyclical\\_model\\_of\\_self-regulated\\_learning](https://www.researchgate.net/publication/260684981_How_do_students_self-regulate_Review_of_Zimmerman%27s_cyclical_model_of_self-regulated_learning)

- Panadero, E., (2017). A Review of self-regulated learning: Six models and four directions for research. *Frontiers in Psychology*, 8, 1-28. Retrieved from <https://doi.org/10.3389/fpsyg.2017.00422>
- Peel, K. (2019). The fundamentals for self-regulated learning: A framework to guide analysis and reflection. *Educational Practice and theory*, 41(1), 23-49. Retrieved from <https://doi.org/10.7459/ept/41.1.03>
- Pelau, C., Dabija, D.-C., & Ene, I. (2021). What makes an AI device human-like? The role of interaction quality, empathy and perceived psychological anthropomorphic characteristics in the acceptance of artificial intelligence in the service industry. *Computers in Human Behavior*, 122. Retrieved from <https://doi.org/10.1016/j.chb.2021.106855>
- Pisica, A. I., Edu, T., Zaharia, R. M., & Zaharia, R. (2023). Implementing artificial intelligence in higher education: Pros and cons from the perspectives of academics. *Societies*, 13(5). Retrieved from <https://doi.org/10.3390/soc13050118>
- Popenici, S. A. D., & Kerr, S. (2017). Exploring the impact of artificial intelligence on teaching and learning in higher education. *Research and Practice in Technology Enhanced Learning*, 12(22), 1-13. Retrieved from <https://doi.org/10.1186/s41039-017-0062-8>
- Ranganathan, P., Caduff, C. (2023). Designing and validating a research questionnaire-part 1. *Perspectives in Clinical Research*, 14(3), 152-155. Retrieved from [http://dx.doi.org/10.4103/picr.picr\\_140\\_23](http://dx.doi.org/10.4103/picr.picr_140_23)
- Ryzheva, N., Nefodov, D., Romanyuk, S., Marynchenko, H., & Kudla, M. (2024). Artificial intelligence in higher education: Opportunities and challenges. *Amazonia Investiga*, 13(73), 284-296. Retrieved from <https://doi.org/10.34069/AI/2024.73.01.24>

- Schreier, M. (2012). *Qualitative content analysis in practice*. Germany: SAGE Publications Ltd.
- Simkus, J. (2022). Convenience sampling: Definition, method and examples. Retrieved Oktober, 6, 2022. Retrieved from <https://www.simplypsychology.org/convenience-sampling.html>
- Van der Graaf, J., Lim, L., Fan, Y., Kilgour, J., Moore, J., Gašević, D.,...Molenaar, I. (2022). The dynamics between self-regulated learning and learning outcomes: An Exploratory Approach and Implications. *Metacognition and Learning*, 17, 745–771. Retrieved from <https://doi.org/10.1007/s11409-022-09308-9>
- Wei, L. (2023). Artificial intelligence in language instruction: Impact on English learning achievement, L2 motivation, and self-regulated learning. *Frontiers in Psychology*, 14,1-14. Doi: [10.3389/fpsyg.2023.1261955](https://doi.org/10.3389/fpsyg.2023.1261955)
- Wilde, N., & Hsu, A. (2019). The Influence of general self-efficacy on the interpretation of vicarious experience information within online learning. *International Journal of Educational Technology in Higher Education*, 16(1), 1-20. Doi: <https://doi.org/10.1186/s41239-019-0158-x>
- Winne, P. H., & Perry, N. E. (2000). Measuring self-regulated learning. *Handbook of self-regulation*. Doi: [10.1016/B978-012109890-2/50045-7](https://doi.org/10.1016/B978-012109890-2/50045-7)
- Winne, P. H. (2018). Cognition and metacognition within self-regulated learning. In D. H. Schunk & J. A. Greene (Eds.), *Handbook of self-regulation of learning and performance* (2<sup>nd</sup> ed.) (pp. 36-48). New York: Routledge.
- Woolf, B. P., Lane, H. C., Chaudhri, V. K., & Kolodner, J. L. (2013). AI grand challenges for education. *AI magazine*, 34(4), 66-84. Retrieved from <https://doi.org/10.1609/aimag.v34i4.2490>

- Xia, Q., Chiu, T. K., & Chai, C. S. (2023). The moderating effects of gender and need satisfaction on self-regulated learning through Artificial Intelligence (AI). *Education and Information Technologies*, 28(7), 8691-8713. Retrieved from <https://doi.org/10.1007/s10639-022-11547-x>
- Yoshida, M. (2008). Think-aloud protocols and type of reading task: The issue of reactivity in L2 reading research. In M. Bowles, R. Foote, S. Perpinan & R. Bhatt (eds.), *Selected proceedings of the 2008 second language research forum*, (pp. 199-209). Somerville, Ma: Cascadia Proceedings Project. Retrieved from <https://www.researchgate.net/publication/254722328>
- Zimmerman, B. J. (1990). Self-regulated learning and academic achievement: An overview. *Educational Psychologist*, 25(1), 3-17. Doi: [10.1207/s15326985ep2501\\_2](https://doi.org/10.1207/s15326985ep2501_2)
- Zimmerman, B. J., & Schunk, D. H. (Eds.). (2001). *Self-regulated learning and academic achievement: Theoretical perspectives* (2<sup>nd</sup> eds.). New York: Routledge.
- Zimmerman, B. J., & Schunk, D. H. (Eds.). (2011). *Handbook of self-regulation of learning and performance*. New York: Routledge.
- Zimmerman, B. J., & Schunk, D. H. (Eds.). (2011). *Handbook of self-regulation of learning and performance*. New York: Routledge.
- Zimmerman, B. J. (2013). From cognitive modeling to self-regulation: A social cognitive career path. *Educational Psychologist*, 48(3), 135-147. Retrieved from <https://doi.org/10.1080/00461520.2013.794676>



**Appendices**

## Appendix A : Students' Questionnaire

Dear students,

This is a questionnaire of a Master's research with the purpose of investigating the role of Artificial Intelligence (AI) in developing EFL learners' self-regulated learning (SRL). In order to achieve this aim, you are kindly requested to faithfully answer the questions below. Please note that all your answers are totally anonymous and will be used solely for academic purposes. Thank you in advance for your valuable input.

Instructions: Please select the adequate answer or provide a complete one where necessary.

### Section one: Students' Background Information

Q1- Please specify your level of study:  M1     M2

Q2- Please specify your specialism: .....

Q3- Do you use AI for educational/ language learning purposes?

Always     Very often     Often     Rarely     Never

Q4- In your opinion, is AI beneficial in education?  Yes     No

-If yes, please elaborate according to your personal experience

.....

.....

.....

### Section two: Students' Engagement with AI to Perform Academic Tasks.

**NB:** In the context of our research, 'task' refers to either an assignment or an activity of your choice such as revisions for exams or writing your lessons.

**Q5-** When you come across a challenging task, do you think of analyzing it using AI (breaking it down into small manageable parts)?

- Yes    No

**Q6-** If yes, how do you do so?

- By asking AI to identify the key components/ instructions of the task
- By asking AI to explain the overall aim of the task.

By asking it how the answer to the task is supposed to be.

- All of the above.

-You can select more than one answer.

**Q7-** How do you use AI-tools to define a learning strategy / plan to approach a task?

- I ask the AI-tool to generate a strategic plan for me.
- I ask it to suggest different strategies, then I select the one I think is most appropriate.
- I design a plan by myself then ask the AI-tool to improve it if necessary.
- I don't specifically use AI to choose any learning strategy.

**Q8-** One effective way of learning is setting goals (SMARTO). How often do you use AI to set goals based on the assessment criteria of the given task (criteria like the length or structure of an essay/ the verb tense of a given text genre...)?

Always    Very often    Often    Rarely    Never

**Q9-** On a scale of 1 to 10, how much do you think AI contributes to your self-efficacy, eventually your motivation?

1    2    3    4    5    6    7    8    9    10

**NB:** Self-efficacy is the beliefs a learner holds regarding their ability to effectively perform tasks

**Q10-** On a scale of 1 to 5, how much do you think AI influences your expectations of success and ultimately fosters your motivation?

1    2    3    4    5    6    7    8    9    10

**Q11-** When you are doing a task, do you make sure to implement the plan which you have designed at the beginning through AI?

I strictly implement the plan the same way I designed it.

I sometimes deviate from the initial plan.

I barely use AI to implement my plans.

**Q12-** In case you do implement those plans, how do you so using AI?

By asking the AI-tool to compare the progress of my work to the designed outline.

By using AI-tools to record my performance in order to assess my progress.

Both.

Other .....

**Q13-** Once you have completed the task, do you employ AI-tools to evaluate the quality of your work?

- Yes
- No

**Q14-** If yes, how do you allow it to assess your performance?

- By asking it to identify grammar and spelling mistakes.
- By asking it to verify the coherence and cohesion of my ideas.
- By asking it to check the relevance of my ideas to the task.
- All of the above.
- Others .....

-You can select more than one answer.

**Q15-** What are your overall assumptions vis-à-vis your performance after you have used AI to complete the tasks (effective, reliable, successful...)?

.....  
.....

- If there is anything you would like to add with regard to this topic , please feel free to write it down .....
- .....

### Appendix B: The Think-Aloud Protocol

**Task Instruction:** Write a paragraph that supports e-learning using a chatbot/AI site of your choice.

**Q1:** As you are reading the task instructions, you are most probably thinking of different ways of approaching the task and covering all its requirements. Could you explain how you think you could manage to do so through the AI-tool you opted for?

**Q2:** Do you think of adapting a specific strategy using AI in order to direct yourself to complete this task?

**Q3:** In what way do you intend to use AI to help you define goals you want to achieve based on your understanding of the task requirements?

**Q4:** How do you plan to formulate your prompt so that you guide AI to help you undertake these steps?

**Q5:** As you are working on the task, how are you going to use AI to track progress of your work compared to the pre-established plan?

**Q6:** At this stage (the performance stage), you may seek help or try to guide yourself to remain focused and aware of your goals. Explain how you are going to do so using this AI- tool.

**Q7:** Now that you completed your task, are you going to use AI to assess your overall performance?

**Q8:** To what extent are you satisfied with the way you managed to use AI to assist you in doing the task? Do you intend to do follow the same procedure for future assignments?