Introduction Ain Shams University
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"The impact of Using Artificial Intelligence on Enhancing EFL Language Fluency and self-regulation for The Preparatory Stage Students in Distinguished Governmental Language Schools."

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Abstract

This study aimed to investigate the effect of using some proposed artificial intelligence activities on enhancing EFL writing fluency and self-regulation for the preparatory stage students in Distinguished Governmental Language Schools. Participants of the study were 33 students in preparatory three from Hassan Abu Bakr governmental language school, Qaluibia, Egypt in the academic year 2021– 2022. The researcher`s instruments included a writing fluency components checklist, a rating scoring rubric, a pre/post writing fluency test, and a self – regulation scale. The researcher designed and taught a program that included some relevant AI applications such as Minecraft game with grammarly mood, Semantris AI vocabulary game, virtual reality in AI mood, and some relevant Chatbots that enabled the students to practise using English in vivid situations. Participants' scores of the pre and posttest were statistically analyzed using T- test and effect size. The researcher also analyzed the students` writing fluency level qualitatively. Findings revealed the positive effect of using AI applications on enhancing third preparatory stage students` writing fluency and self- regulation.

Keywords: Artificial intelligence, writing fluency, self – regulation

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1.1 Introduction

Learning English is an indispensable process all over the world. It is widely spoken among thousands of different languages. People tend to dedicate time, effort, and money to adopt different programs for language learning. This enables them to communicate, share ideas, find job opportunities, explore the world and identify different cultures, in addition to many scholarships that require a high level of mastering the English language. Moreover, learning English language is essential in most countries as it is used in all life aspects such as industry, economy, medicine, education, and policy. It helps people to join international businesses, which leads to economic and individual development.

In learning English, learners encounter many challenges throughout the learning process. According to William et al. (2019), these challenges may be due to many reasons, such as using old methods in teaching that are not equivalent to current needs, or motivating learners to learn, focus on mere learning grammar and vocabulary apart from any natural authentic context. The lack of chances for learners to practise English, which is restricted to the classroom, does not allow them to use the language sufficiently. Such challenges affect EFL learners' language fluency. Instead, there is an urgent need for recent methods regarding learning language as a medium for learners to construct meanings and contribute to their active interaction with their teachers and mates.

Tavakoli et al. (2020) explained that there has been an increasing amount of research over the past decades on language fluency due to its significant role in developing communication abilities and its significant contributions to the assessment of learners` proficiency. Fluency plays a significant role in language

production. It provides learners with the opportunity to interact, collaborate, share ideas, and produce a clear and smooth language.

According to Alisaari and Heikkola (2016), if language learners can use their second language smoothly and naturally, they are usually regarded as fluent users of language. This denotes that fluency focuses on automaticity and communication of language in a fast productive way rather than focusing on language forms. That is why its activities depend on producing messages rather than language correction since correction will slow down fluency.

Fluency was defined by many linguists. Jones (2020) described it as being able to string words together, like pearls on a chain, into sentences and make them comprehensible. In other words, it is a meaningful flow of words. Hunter (2017) defined fluency as the ability of the learner to use and incorporate, in a simultaneous way, the fundamental processes of preparing and producing an utterance to achieve acceptable and productive speech.

Although the term fluency was defined and discussed by many linguists, it is difficult for many of foreign language learners to use it fluently. According to Derwing (2017), some reasons for the fluency gap among learners may include large classes, instructors` preference of teaching other skills, time restrictions in addition to a lack of awareness about the kinds of activities which may contribute to enhancing fluency all affect the level of fluency development classrooms.

Waes and Leijten (2015) indicate that despite the importance of English fluency in general, there is a lack in writing fluency research. Rouhani, et al. (2016) also explain that writing is a common process of communicating and explaining information in fast written forms. Being a fluent writer requires the ability to write quickly without remarkable pauses or hesitation so it could be an

essential factor for success throughout one's life. Writing fluency is necessary for English learners to be successful both in the classroom and in the workforce. Moreover, being fluent in writing is an essential key factor for progress in language learning, whether in the classroom or in different aspects of life.

Writing fluency definitions differ according to the perspective of researchers. According to Atasoy and Temizkan (2016), fluency is the most distinguishing features of a well-organized, functional, and comprehended text, so writing fluency can be defined as the ability to write the topic in a well-organized manner that does not affect the reader's perception of the writer's intended meaning. It is a way of expressing opinions, ideas, and thoughts automatically in written forms. Nevertheless, a lot of research such as Gayed et al. (2022) confirm that English learners all over the world face a lot of challenges to achieve a high level of mastering writing activities such as organization, reflection and the learning process only concentrates on lower- writing activities such as memorizing words and translation.

Writing fluency represents an essential communicative requirement for any academic discipline. This is extremely crucial for language learners as it allows them to express their opinions and reflect on their own experiences in writing. The researcher believes that writing practice is an excellent chance for learners to enrich their vocabulary, improve sentence structure, and produce correct punctuation, and organization so it will contribute to developing both of language fluency and accuracy at the same time. Nevertheless, many researchers such as Rahimi and Zhang (2018) noticed that many learners suffer from their inability to communicate their thoughts due to their poor writing fluency. This insufficiency of writing fluency affects learners` academic success badly.

On the other hand, while improving writing fluency is one of the aims of using Artificial intelligence applications in this research, self-regulation (SR) is of

equal importance. It represents an expected and a remarkable outcome of the independent variable. SR necessitates giving due attention in the learning process. It is the ability to monitor thoughts, behavior, and learning. The researcher believes that people regulate their behavior when they set their goals, actively try to integrate learning process to achieve these goals, observe performance, and adjust their behavior according to the surrounded environment.

Koçdar (2015) explains the concept of self-regulated learning, that emphasizes the responsibilities of learners in their own learning processes and autonomy, was first noted in the 1980s and it is one of the key concepts in Bandura's Social Learning Theory. Kocdar et al. (2018) and Frazier et al. (2021) present it as an essential concept for lifelong learning and an operation in which the learner controls, observes, and influences his or her own thinking process that needs awareness and insight.

Ghonsooly and Ghanizadeh (2013) showed a significant positive relationship between EFL teachers' self-regulation and their teaching efficiency. Consequently, it is logical to suppose that teachers who lack self-regulation will face inability or even difficulty in establishing the self-regulation of their students. Furthermore, Erdogan (2019) confirmed that successful learning includes the desire of learners that motivates them to use effective strategies included in self-regulation.

Hanno and Surrain (2019) also asserted that self-regulation promotes language skills by increasing learner's engagement and opportunities for language exposure and use. Thus, self-regulation not only includes cognitive skills but also involves motivational factors such as self-efficacy, goal orientations, anxiety, etc.

Muis et al. (2018) defined self-regulated learning (SRL) as a complex event that occurs during learning. This multi-dimensional event is intentional and goal-directed. It contains cognitive, metacognitive, motivational, affective, emotional,

and social components. The same definition was discussed by Oppong et al. (2019) as a complicated process that is associated with the learning process, characterized by self-monitoring, goal-setting; consists of cognition, metacognition, and motivation.

Ekhlasa, & Shangarffam (2013) examined the relationship between the main factors of self-regulation strategies, language components, and overall proficiency. Due to a notable paucity of research investigating the relationship between students' second language acquisition and their SRL levels, the researchers came to a conclusion that there is a direct positive correlation between learners` language acquisition and their self–regulation. According to modern self-regulation theory (SRT); Ackerman (2022) shows that the four main components of self–regulation include standards of desirable behavior; motivation to fulfill standards; monitoring of situations , thoughts that precede breaking standards; and willpower, which allows one's internal strength to control desires.

Chassignol et al. (2018) clarified that Digital technologies are clearly considered an essential part of our daily lives. They are regarded as effective tools in searching for information, facilitating communication among people, and even between people`s relationships with one another. Consequently, the educational field has also begun to witness colossal changes. These changes made the educational process more productive and engaging.

Connectivism theory was established by George Siemens and Stephen Downes for the digital age, avoiding the restrictions of behaviorism, cognitivism, and constructivism. Yeh and Singhateh (2013) believe that in connectivism, learning is a process of exchanging informal information that is arranged into networks and supported by electronic tools such as social networks. As a result, a consideration of connectivism must be preceded by a consideration of networks.

Connectivism is regarded as one of the most prominent and modern theories in education. Siemens (2017) introduced Connectivism as a learning model that integrates insight into learning competencies and tasks required for learners to succeed in a digital era. Corbett and Spinello (2020) also asserted that " since the early development of connectivism, it was considered as an alternative learning theory more consistent with the changing environment and technological shifts affecting learning and the nature of knowledge and its sources" (p.2).

According to Bozkurt and Ataizi (2015) relating to the digital-age learning theory, connectivism indicates how learning happens through networks. In contrast to traditional learning theories, connectivism, emerged in the digital era, asserts that information is organized over a network of connections, and consequently, learning includes the ability to establish and navigate such networks. According to it, learning happens as a result of individuals' interaction on networks.

Furthermore, connectivism sheds light on the abilities and activities necessary for learners to succeed in the digital age. Moreover, results indicated that active participation in group discussions and collaborative learning enhance connectivism knowledge, negotiation, and reflection. Sozudogru, O. et al. (2019) clarify that online communication tools can be a valuable addition to instructional materials. So learners who are self-directed, self-regulated, and autonomous construct their own learning environment based on their own learning requirements and objectives. That is why artificial intelligence (AI) is considered one of its remarkable applications and recent trends; broadening Vygotsky's concept of the zone of proximal development (ZPD) to encompass learning that occurs outside the learners` environment, such as through social networking sites and software applications. AI learning applications are greatly connected to the connectivism theory.

Moreover, Borna and Fouladchang (2018), and Rosas & Esquivel (2016) discussed the role of educational approaches as one of the most important elements affecting motivational outcomes. Prince (2017) points out that one of the most important outcomes of effective education is to achieve positive motivational productions such as academic self-efficacy and task value in learners. One of the most prominent technology applications that help to achieve this target is AI.

For a long time, science fiction authors, futurists, and movie makers have been anticipating the astonishing transformation that occurs due to the emergence of AI. (Duuren & de Pous, 2020). All kinds of AI continuously became around us, and AI applications, in particular, achieved remarkable progress in the intelligent teaching system. Moreover, Hwang et al., (2020) indicate that it is remarkable in the last decade that a lot of research was done regarding the significance of using AI in education.

Harkut and Kasat (2019) define AI as using machines to carry out human-like thinking activities through simulation of human intelligence processes such as thinking, reasoning, learning, and self-correction through machines, especially computer systems. Therefore, it is a set of computational techniques inspired by the way humans use their nervous system and their body to feel, learn, and act. According to Barrio (2018), the most significant distinction between human and artificial intelligence is the computer`s limitation of using "signals" (logical programming language) with a greater memory capacity than human intelligence although, unlike the latter, it is unable to interpret meanings.

AI makes use of algorithms, which are logical sequences of processes, as well as developed cognitive electronic systems. It is highly expected to have a significant effect on the topics we teach, as well as having a significant impact on many other fields of life. According to Zhu (2017), the concept of AI refers to an

automated application that imitates human intelligence thought such as analyzing, learning, and self - correction. It includes computer science, cybernetics, information theory, linguistics, and other disciplines. In AI, humans can live, touch, hear, and think through a simulation environment. This process enables people to solve problems in life and at work.

"It would be naive to think that AI will not have an impact on Education" (Holmes et al., 2019). Clark, (2017) describes (AI) as a new trend in online learning that seeks to evolve and flourish in the teaching of English as a second language. Moreover, it is educational software that can be adapted to students` requirements, asserting specific topics, repeating things they haven't mastered, and assisting their work at their own pace. One of the most effective ways AI will affect education is through the application of greater levels of individualized learning. Some of this is already used in adaptive learning programs, games, and software.

Recently, a number of researchers have emphasized the significance of using AI systems in learning (e.g., Luckin et al., 2016; Woolf et al., 2014). According to Salas-Pilco et al., (2022), AI has become an integral component of the learning and training process. This type of technology has the ability to make learning English easier and more enjoyable. Nevertheless, it can be regarded as a natural development for computerized media as Karkera (2018), Yoestara, and Putri (2019) explain that learners made several attempts at using various computerized media to improve their language abilities before the widespread usage of AI, such as radio applications, YouTube, and podcasts. AI increases the value of these media, for example, self-correction and contact with human-like native speakers or writers, (humanoids).

Aldosari (2020) defines AI as a programmed system that is able to simulate and implement smart applications on computers or smartphones to interact with the world, doing many tasks normally instead of humans. This implies that AI is based on both information about the world and algorithms that intelligently

analyze that information. Such information about the world is reflected in the form of models. These models are: The pedagogical model, the domain model, and the learner model. These three core models are at the heart of AI in education (AIEd). To accomplish this, the AIEd system should include:

- Effective teaching methods (represented in a pedagogical model).
- The topic being studied (represented in the domain model).
- The learner (represented in the learner model).

AI Luckin et al., (2016). Intelligence Unleashed: An Argument for AI in Education Intelligent Tutoring Systems (ITS) employ AI applications to simulate human tutoring by supplying learning experiences that are best suited to a learner's cognitive needs and affording focused and appropriate feedback, all without the need for a single teacher. ITS enable learners to provide the system with information about their problem step by step in the same way of dealing with paper. Then the system presents feedback based on all the students' answers. Therefore, ITS have the ability to interact with learners at the step-level, rather than mere giving feedback after completing the task. Some ITS make the learners in charge of their own learning to aid in the development of self-regulation abilities, while others employ pedagogical techniques to organize learning to sufficiently support and stimulate the learner.

According to Luckin et al. (2016), the future effectiveness of AIEd to deal with real-life issues in education is based on the ability to tackle these three factors, namely:

(i) intelligent technologies that integrate experience about excellent teaching and learning in (ii) attractive consumer-grade devices, that (iii) are then successfully implemented in real-life contexts that combine the best of human and machine intelligence.

AIEd will need to work in hybrid learning environments where digital technology and typical classroom activities support each other. Teachers and students will be engaged in AIEd's co-design. It can be an effective intelligent tool that develops cooperative learning. According to research, the process of collaboration among learners is not an automatic situation that occurs spontaneously. Team members, for instance, may lack the required social interaction skills to achieve effective collaboration. This could be particularly challenging in the context of online collaborations, as group members rarely meet face-to-face. This is the area where AIEd can contribute to overcoming this problem. Numerous approaches were investigated in this area, but the researcher in this study sheds the light on virtual agents, and AI educational applications.

Suh & Prophet (2018) indicate that virtual reality has recently gained a remarkable interest in educational research. It is an effective medium for learning that simulates some features of the real world. This simulating medium allows users to be engaged in different environments such as dangerous ones or somewhere geographically or historically inaccessible. Consequently, it can significantly improve educational outcomes for learners. However, for virtual reality, learners would not have the ability to access such environments or have the feeling of being participants in realistic activities.

According to Yang et al. (2020), this immersion in a virtual world helps learners to experience different situations and environments and enables them to construct their own points of view and their own understanding of these worlds and environments. Engaging learners in virtual world activities enable them to improve communicative ability to get rid of the so-called “trapped intelligence”. That is, they manage poor- achieving learners to have self-confidence by

replacing their self-image from being low - academic performers into, for instance, successful virtual scientists.

Mondly VR app is an example of this kind of program but what makes it different is its integration with AI, which creates an outstanding learning environment that combines both the merits of VR and AI at the same time. Moreover, Chatbots and Duolingo are marvellous AI applications in learning that allow learners to communicate with an application online via text or speech, as they bring dialogue to teaching and provide learners with a naturalistic learning style.

Kukulska-Hulme (2019) asserted that AI Mobile application tools is a modern technology, characterized by their high influence on students' learning, and appropriately integrate technology to boost learners' motivation and autonomy. Alamer & Al Khateeb (2021) added that Mobile devices encourage students to have autonomy and freedom in order to expand the amount of time, place, and speed at which they can learn.

This broadening of time, place, and pace enables learners to have continual exposure and practise literacy skills and allows learners to receive continuous rather than delayed correction and feedback on their learning topics. Osman (2020) also emphasized that Mobile apps and technology can motivate learners to develop self-control and responsibility. When learners use apps in learning, they are more likely to have the opportunity to perform their study activities independently.

Grammarly AI app, integrated with Minecraft virtual world; a very popular virtual game for children and instructors is a well-known game. It interestingly integrates the aspects of excitement, perception, mechanics, ongoing

development, and innovation in a fascinating way. According to Chiang (2020), Minecraft can be described as a virtual community that allows players to move and interact with the world constructed of blocks. Since its release in 2011, the game has become a cultural phenomenon. More than 200 million units were sold worldwide. Duncan (2011) stated that as a result of its popularity, Minecraft: Education Edition (EDU) was specifically developed for educational purposes. It is not only considered a game but also a platform designed for brand - new meaningful experiences.

According to Boreham (2022), a lot of teachers who tried using Minecraft's game-based learnings` approach in the classroom assured that the most significant outcomes were the remarkable development of problem-solving skills and team building. The Minecraft training edition presents an educational platform supporting the development of 21st-century skills for learning environments. According to Fedorenko et al., (2021), the pedagogical and gaming operation using Minecraft EDU is based on the following framework: the instructor administers the virtual environment where his learners play; the instructor ability to incorporate the essential topics and assignments into this card.

The game provides a big library of previous worlds constructed by players in addition to the ability to develop previously created lessons to help the instructors to save time. There are many chances in the educational realms of Minecraft EDU. Identify the area's boundary, for instance, or differentiate a dinosaur's skeleton from other materials. Each student is provided with access to specific places in a virtual environment by the teacher, who deliberately does this to assess and provide feedback about his learners` performance. This also enables teachers to educate several students simultaneously. For academic

institutions, the game now includes tools like cameras and portfolios which assist students to document progress and capture photos.

The previously mentioned AI applications can be effective in reducing the learners` intimidating feeling of trial and making mistakes that are considered a crucial aspect of learning. The idea of failing, or the inability to answer questions, is a major hindrance to the learning process. Some learners cannot bear the idea of being put on the spot in front of their mates or authority figures like teachers. Intelligent computer systems, developed to help learners in their learning process, are a significantly less intimidating way to deal with trial and error.

Furthermore, thanks to AI applications, students could experiment and learn in a relatively judgment-free context, in particular when AI instructors are able to provide solutions for improvement, such as Grammarly application. In fact, AI is the ideal format for promoting this kind of learning, as AI systems themselves usually learn by a trial-and-error way.

Isaksson, (2018) focused on the impact of the possibility of having a vital role of AI in learning, motivating, creating suitable and distinguished curriculum materials, and achieving adaptive learning. He also believes in the ability of AI to provide individual learners with unique learning ways.

1.2. Context of the Problem

The researcher observed that third preparatory students often lack enough ideas or information to produce organized and cohesive writing. They need to enhance the lack of their cognitive and linguistic abilities which negatively affects their writing production.

Throughout the researcher`s experience as an English language teacher, reviewing of literature, and the pilot study, it was observed that there is a common complaint among preparatory stage Egyptian learners, i.e. Most of the students have difficulty to find the needed words for their writings or to organize their thoughts in a cohesive way which leads them to give up writing or try to postpone it as much as possible. This could be due to the mechanical way of teaching which causes this problem in addition to time limitations which do not allow teachers to give immediate and continuous feedback, so there is an urgent need to aid learners find ideas, and to increase their ability to express their thoughts in a correct written form, organize these thoughts, and reflect them in their writings. Nevertheless, the main target of the researcher in this study is not restricted to the learners` writing ability but is expanded to include their writing fluency as well.

In addition to achieving the target of having development in writing fluency for learners, there is an equally important field in psychological and other educational studies which is self-regulation which its importance has recently attracted and drawn the attention of researchers in the field of teaching a foreign language. Numerous studies have been conducted to show the effectiveness of SRL in improving foreign language acquisition. To become self-regulated, autonomous, and have the ability to make decisions, learners require help in planning, goal-setting, work control, understanding, observation, assessment, and determination throughout the learning process.

Boraie et al. (2019) believe that there is a common call all over the world to use alternative methods of teaching and learning English that can achieve effectiveness in providing the learners with real world’s requirements such as problem-solving, cooperation and collaboration.

1.3. The Pilot Study

The researcher designed a diagnostic test in writing fluency for a group of preparatory school learners (n = 36), to assess their writing fluency. The researcher aimed at measuring the learners` logical organization of different ideas, their writing fluency in expressing different thoughts, and their ability to build well-structured sentences.

Some of the following questions were:

1- Write a paragraph to introduce yourself.
2- What are the technological devices you prefer in learning? Why?
3- What causes do you think that lead to a lack of your English language practice inside your classroom?

Results showed a general lack of the students ` writing fluency as follows:

1- The results showed that 20% of the students were excellent and very good, while 80%of them were between average and weak levels, as most of them could not write fluently and lacked the ability to master fundamental writing fluency components.
2- 80% of the students could not construct meaning. They could not organize their ideas logically or stick to the main topic they were writing about. They had difficulty in communicating their ideas and expressing their thoughts in a cohesive and organized manner.
3- 92% of the students made grammatical mistakes which affected the reader`s comprehension of the intended meaning.
4- 88% of the students had difficulty in showing writing fluency. They could not express their ideas smoothly and kept repeating the same words and ideas.
5- Most students expressed their admiration and desire to use different ways of technology specifically those which focus on challenge and motivation.

The general aims for teaching English as a Foreign Language in the Preparatory Governmental Language Schools stage are:

- Enhancing students` interaction with each other in various ways.
- Participation in meaningful discussions.
- Increasing the ability to realize what occurs around them using the English language.
- Increasing pupils` engagement in what goes on among them to be able to communicate in various ways whether face-to-face or in online writing and to be concerned with learning literature.

The researcher also designed an unstructured self-regulation questionnaire (Appendix E) that included questions about (Self-Efficacy -Test Anxiety - Intrinsic Value- Cognitive Strategy- self-regulation) to measure students' motivational beliefs and self-regulated learning.

Results showed the following:

- 70% of the students were not motivated to learn English.
- 77% of the students lacked the appropriate ability to organize their learning process. However, they were all preparing themselves for mere testing.

In light of the previously mentioned considerations, the current study aimed at solving the students` learning English language problems. Several studies investigated the educational implications of artificial intelligence, such as Corvalán (2017), Habeeb (2017), Miailhe (2018), and Ocaña-Fernandez (2019). As a result, it is hoped that the current study would fill a gap in the literature and have possible implications for future educational applications of artificial intelligence to enhance learners` English fluency in general, and writing fluency in particular, in addition to self-regulation.

1.4. Statement of the Problem:

Throughout the researcher`s pilot study and observation, it was clear that preparatory three students has apparent weakness in their ability to express themselves in various ways specifically in writing fluency situations. They also lack the ability to create ideas, reflect and construct meanings. This results in having difficulty in using the language as one entity. They also lack the necessary self-regulation and objectives for learning the English language.

To address and attempt to overcome this problem, the researcher aims to design a program based on artificial intelligence to increase students` writing fluency and self-regulation in learning English.

1.5. Study Questions:

The current study tried to answer the following main question:

How can a program based on AI applications in education be designed to enhance EFL students` language writing fluency and self-regulation?

To answer this main question, the researcher tried to answer the following sub-questions:

1- What is the status quo of the third preparatory stage students' governmental language schools pupils' writing fluency?
2- What are the components of self-regulation needed for the third year preparatory stage students at governmental language schools?
3- What is the suggested program based on using AI applications to enhance the students` self-regulation and language writing fluency?
4- What is the impact of using AI applications on the students` self-regulation and language writing fluency?

1.6. Hypotheses of the study

The researcher tried to verify the following hypothesis:

1-"There is a statistically significant difference at the level of ($0.05 \geq \alpha$)

between the mean scores of the experimental group on the pre and post- writing fluency test administrations for the total degree in favor of the post-test."

2- "There is a statistically significant difference at the level of ($0.05 \geq \alpha$) between the mean scores of the experimental group on the pre and post -writing fluency test administrations for the sub linguistic components` degree in favor of the post-test."

3- "There is a statistically significant difference at the level of ($0.05 \geq \alpha$) between the mean scores of the experimental group on the pre and post-self-regulation questionnaire for the total degree in favor of the post-test."

4- "There is a statistically significant difference at the level of ($0.05 \geq \alpha$) between the mean scores of the experimental group on the pre and post-self-regulation questionnaire for the sub-components degree in favor of the post-test."

1.7. Significance of the study

The study is significant;

For Learners: Emphasizing the importance of AI applications in learning that achieved the development of English writing fluency, satisfaction, self-efficacy levels development, and increasing motivation for learning.

For instructors: Using the suggested educational AI applications on the English learning model to enable them to improve the learners' language fluency and self-regulation.

For Curricula Developers: putting the results of the research into consideration when they design activities for students.

For Researchers: Adopt up-to-date strategies that focus on the learner, and the learning environment and assist the learning process.

The Field of EFL:

The study tried to confirm the importance of applying AI in the field of education as it can help to decode students` difficulties and be flexible enough to assist them, to improve the imagination of a collectivity, get an even higher quality of education, and design a new educational experience. It also tried to regain trust and passion for learning English and going to school specifically preparatory three students who lost desire and motivation for attending EFL classes and tended to abandon school learning.

1.8. Delimitations of the Study:

- A group of the third Year Preparatory Governmental Language Stage students in one of the Governmental Language Schools in Qaliobia Governorate. "Hassan Abu Bakr distinguished Governmental Language School."(n=33).
- Some AI -based applications appropriate for developing language fluency levels and self – regulation including Chatbots, Semantris AI game, and virtual reality worlds with AI mode.
- Some basic writing fluency components for the target students.
- Psychological domain (self-regulation) resulting from applying the suggested program.
- Language fluency was assessed as a whole through writing fluency.
- Duration of the treatment was two-months, three sessions a week.

1.9. Definition of Terms

Artificial Intelligence (AI)

According to Lu & Harris (2018), AI programs can be defined as Intelligent Tutoring Systems (ITS) or adaptive tutors that can simulate human thinking, making decisions, involve learners in conversation, respond to questions and provide feedback.

AI is also defined as “the field of computer science dedicated to solving cognitive problems commonly associated with human intelligence, such as learning, problem-solving, and pattern recognition”. It is also “the theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.” (Ma et al., 2018).

In this study, it is operationally defined as a new trend in EFL that copes with today`s tendency to use technology in all life areas. It can perform tasks that simulate human intelligence and carry out human-like thinking activities such as thinking, reasoning, learning, and self-correction through machines for the purpose of improving writing fluency, self-regulation, individualized learning, problem - solving and having an eagerness for life-long.

Self-regulation (SR)

According to (Wijaya, 2021), Self-regulation is one of the main features of learning autonomy that can help EFL students to become more independent, flexible, and lifelong learners.

SR is defined by Carver and Scheier (2016) as a behaviour that is guided by goals and regulated by feedback. Goals and feedback affect learners to be able to regulate, monitor and impact their own thinking.

In this study, it is operationally defined as the process of learning that asserts the responsibilities of learners in their own learning process, encourages them to express themselves and reflect deep meanings. It helps them to regulate reactions, and become independent learners. To achieve this target, the learners set precise learning goals and monitor their development to enhance their learning abilities.

Writing Fluency

Atasoy & Temizkan (2016) define writing fluency as “The act of writing the maximum number of language units in a short period of time while also paying attention to accuracy, the coherent and consistent organization of ideas within the text, and the usage of words and sentences in a complex manner.”

In this study, writing fluency is operationally defined as:

The ability to use a language in a written form easily, smoothly, willingly, and readily in an organized, flexible, and adaptive way through AI applications.

The remainder of this dissertation will be organized as follows:
Chapter 2 is a review of the literature and related studies.
Chapter 3 represents the methodology of the study.
Chapters 4 reports the results and discussion.
Chapter 5 represents summary, conclusion and recommendations.

Chapter Two
Review of Literature and Previous Studies

Chapter Two
Review of Literature and Previous Studies

This chapter presents a review of literature and previous studies. It deals with writing fluency in EFL, self-regulation, as well as artificial intelligence.

2.1 fluency in EFL

Fluency in general is one of the significant perspectives in language use. It is identified with the ability to manage numerous languages` lexical and grammatical tools and having the option to promptly choose the language when it is proper and proficient to utilize them (Derwing, 2017). Grown-up students likewise need to use language fluently as it will be an integral part of the evaluation of English language ability in workplaces. Educational systems currently focus on creativity and divergent thinking, as a result, students must be self-directed, have the ability to express themselves more clearly and appropriately in different situations. In this context, Widdowson (2015) stated that in order to master using the language meaningfully, learners need to move beyond the level of language usage to the level of mastering the language meaningfully.

Gandimathi and Zarei (2018) further showed that the ability of learners to process the language through critical thinking enables them to develop their communication abilities via speaking or writing and reflect on their ideas effectively. The fundamental goal for any language learner is to be proficient in using this language. Goh and Burns (2012) contended that different levels of students need to be fluent. Good perception of fluency could be helpful in arranging the different subjective meanings of L2 fluency into a solitary model which regards fluency in three different fields: cognitive, perceived, and utterance fluency. Segalowitz (2010) define them as follows:

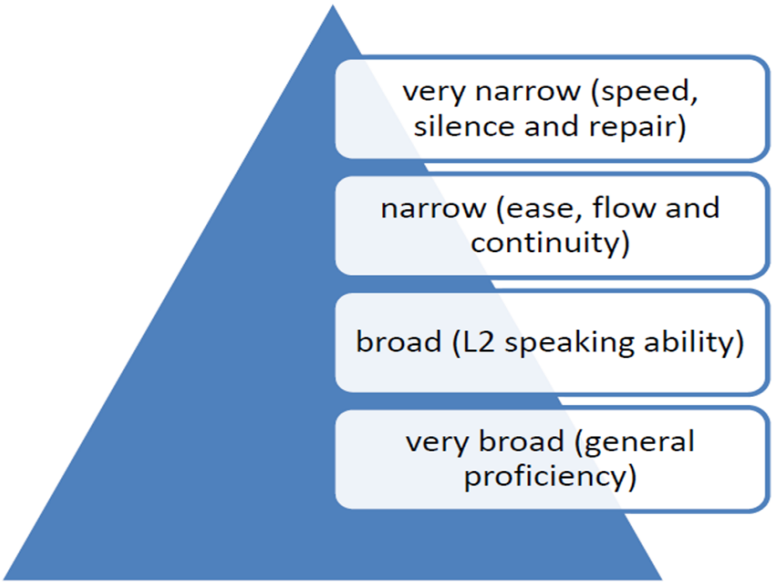
Cognitive fluency: refers to the efficacy of the speaker`s underlying processes responsible for fluency- relevant features of utterances.

- Utterance fluency: refers to the oral features of utterances that reflect the operation of underlying cognitive processes.
- Perceived fluency: refers to the inferences that listeners make about a speaker`s cognitive fluency based on perception of the utterance fluency features of the speaker`s speech output.

Nevertheless, Tavakoli and Hunter (2017) have recommended that meanings of fluency are not really dichotomous (for example, either wide or limited) and rather occupy space along a continuum from expansive (for example, fluency as the excellence of L2) to the limited (for example fluency as the pace of discourse, for instance) (see Figure 5). This finding was based on research results where ESL instructors of English answered a questionnaire that evoked their perspectives on L2 fluency and related classroom activities (for example how they reached fluency development in their classes). Several inquiries were planned for building up how these educators really interpreted fluency (for example, on the off chance that they have an expansive or restricted definition as a main priority). The greater part (however, not the entirety) of the educators appeared to define 'fluency' as general capability or as how smoothly the discourse streams and how much that stream is hindered by stops, dithering, incorrect beginnings, etc."(Derwing, 2017, p. 246).

Figure 5

A framework for definitions of fluency (from Tavakoli & Hunter, 2017)



Tavakoli and Hunter, (2017) discussed various qualitative definitions of fluency in second language acquisition (SLA) literature. These definitions present fluency as illustrative of speed, perfection, and ease and consequently requires less explanation than either the lay definition or the instructors' definition.

Fluency refers to the learner`s ability to use the language spontaneously and naturally. Fluent learners utilize grade-proper word manners, vocabulary, and content. In addition, Fluency has regularly been investigated throughout the structure of CAF; complexity, accuracy, and fluency (Al-Hawamdeh et al., 2023). Most researchers base their implementation on the model of reforms, pauses (stops), and speed, as stopping and speed have shown the most powerful outcomes and are viewed as great signs of (dis)fluency (Bosker, et al., 2013; Kahng, 2014). Moreover, De Jong et al. (2015) illustrated that what matters is not really the duration of pauses but the quantity of them (both filled and quiet) which is greatly connected with proficiency.

2.2 Importance of fluency enhancement

Good fluency is a key element for good comprehension. Considering the importance of English language urges people of different ages to have the ability to use English properly and in particular the students who need that for academic purposes. Kayi-Aydar (2018) indicated that learners may be learning and using English for social purposes such as travelling, using social media, doing business, etc. Maisa (2018) regards fluency as the feeling of an efficient outcome reflected in the written content. It is the proficiency of having a diverse linguistic information base and restoring recommended thoughts and text proficiently or the speed of lexical recovery during the process of writing.

Despite the importance of writing, some students have problems in writing, These problems are existent among all levels of education, starting from Kindergarten (Gottfried, 2017); Primary school (Dennis et al.,2016), Middle school and High school (Brown, & Cinamon, 2016), and in the university (Harkin, Doyle & Mc Guckin, 2015).

2.3 EFL writing fluency.

One of the main features of precise, successful, and comprehensible content is fluency. Fluency can be characterized as composing the content in a simple-to-peruse way in which no factor exists to stop the reader while reading (Atasoy and Temizkan, 2016). Writing is the technique a student unconsciously uses to create written content and that the construction of this written content incorporates both content construction (making an interpretation of thoughts into words, sentences, passages, etc) and reflection (interpreting words, sentences, and progressed levels of conversations). Thus, fluent writing includes the simplicity with which a student both produces and interprets the text.

Numerous investigations concede the significance of WF, yet there are undeniably fewer researchers who realize how to encourage students to foster their WF. Tiawati et al. (2022) illustrated the significance of excellent composing guidance and examined various systems to help with giving this guidance to the students. Limpo et al. (2020) also asserted that composing and expanding students` inspiration and commitment to writing is essential to upgrade their writing fluency.

Writing is probably the most significant and desired objective which includes a confounded interaction of producing thoughts and making an interpretation of them into written images. For specialists, characterizing and operationalizing writing fluency is an essential initial step. Abdel Latif (2013) explains the different methods researchers have decided to characterize and evaluate writing fluency, starting with dividing the number of words in the content by the time spent in composition to estimate bursts of writing "chunks". Moreover, thoughts of lexical and syntactic complexity are regularly included. Writing fluency proposes a consistent progression of language for a short time with no self or other amendment. It has been defined by researchers in various ways (Maisa, 2018).

McKinley (2013) described writing as a troublesome and complicated target to learn. Accomplishing dominance is not just linguistic examples, yet additionally the standard of writing, like an advanced level of arranging thoughts and furthermore, picking the proper vocabulary and sentence structure to make a style that fits a topic. Writing involves more than just turning ideas into written symbols. It necessitates the acquisition and integration of further abilities including planning, problem-solving, and decision-making.

Yu & Reynolds (2018) added to those abilities some additional skills, such as creating detailed descriptions, express viewpoints and attitudes, construct meaning, and analyze data and textual diagrams in their own writing.

Atasoy and Temizkan, (2016) stated that writing fluency is the process of imparting opinions, plans, vision, and interaction through writing from one perspective, and the depiction of sentiments, thoughts, needs, and occasions with a specific number of images while considering specific standards from the other perspective. Writing does not mean a simple arrangement of words or sentences on top of one another randomly. Writing is to communicate one's sentiments, hopes, views, and thoughts in a specific organization, control, and unity. This viewpoint brings into question those qualities that should be available in finely written language. This is consistent with Johnson and Road (2013), in their brief definition to writing fluency as writing with accuracy and speed.

Knoch et al. (2015) alluded in their study about writing fluency to the number of words, Terminable Units (T-units), and clauses. They also assert that the language and style properties of expressing the text, as well as the selected topic, the topic limit, and each of the writer`s target and viewpoint, form a criterion in indicating the validity of a text regarding expression. Moreover, having efficient content, words should be utilized in the appropriate form with correct significance, and with no mistakes that deviate the reader from correct understanding of the content. Furthermore, the importance of having a brief use of sentiments and thoughts, the presence of congruity, and removing any useless words and sentences from the content should be put into consideration. Likewise, significance should be appended to such attributes as lucidity, clarity, coherence, and fluency so as to have an acceptable text.

Taking the literature into consideration, it is feasible to state some points of view that have been discussed on the meaning of fluent writing. These viewpoints can be illustrated as "automaticity" and "ratio/time." So fluent writing can be characterized as an ability that is done spontaneously in which the content is both coherent and the reader does not exert a lot of time deducing the author's intended meaning (Peng et al., 2018). As for those who have implemented the other point of view such as (Ong et al., 2010), the amount and time are viewed as significant as automaticity in fluent writing. Writers who have the ability to utilize many syllables, words, sentences, and language structures during the indicated time are viewed as fluent writers.

Atasoy and Temizkan (2016) stated in the light of the fact that fluent writers have considerable involvement in writing, fluent writing in this way depends on a mechanical procedure that does not require exerting a lot of effort. Those writers do not spend much time thinking about words, sentences, thoughts, or the organization used in the content. These procedures have become a habit for fluent writers. Non-fluent writers, on the other hand, must focus intensely on what, where, when, and how to write. Non-fluent writers often struggle in their writing process as they are usually interrupted and require significant correction. Writings lacking coherence arise accordingly. Having proficient language experience helps to avoid this struggle.

According to the second perspective of fluent writing which is the rate/time approach, writers need to acquire the most noteworthy rate conceivable regarding the amount of writing throughout the devoted time.WF deals with the capacity to rapidly and precisely compose words and basic sentences. As indicated by Eggleston (2017), writing fluency is a notion associated with the ability of the writer to automatically transcribe a topic easily in an orderly,

significant, and comprehendible way attached to such characteristics as keeping the level of agreement and consistency of thoughts.

2.3.1 Components of EFL writing fluency.

Intermediate learners need to practise using the language in order to be able to analyze, visualize, interpret, think critically, reflect on thoughts and interpret thoughts (El Sayed, 2020). According to Atasoy and Temizkan, (2016), in their research, quantity and quality are the main dimensions to be discussed in writing fluency. The dimension of quantity includes the average number of words composed each moment, whereas the dimension of quality includes the following sub-dimensions:

(1) Text accuracy, (2) word and sentence complexity, and (3) the organization of ideas. Bukhari (2016) asserts that the process of writing requires considering some important aspects including organization of thoughts, connecting these thoughts in a systematic way with relevant details to consider structure, and express opinions cohesively and coherently to connect all the ideas to the main topic.

Based on the previously mentioned interpretation of fluency and its components, the researcher finds that learners need to be able to reflect on their ideas and thoughts as well as construct meaning through this reflection. They also have to make use of visual items to organize sequenced ideas, relate them to their prior knowledge and avoid any unnecessary repetition. Moreover, learners have to produce well written explanation of pictures or videos and use various coherent sentences in writing smoothly in correct punctuation and maintain grammar rules.

Due to reviewing previous research and literature, the researcher suggested some writing fluency components. These components included:

Reflection, organization, Detecting and producing interpretations, text smoothness, and mechanics. These components are used as measuring scales based on the levels of the learners' writing fluency.

2.5 21st century requirements and language fluency

Teaching and learning in the 21st century face a lot of challenges and novelties. Today's world is completely and continuously changing. Classrooms are not the same traditional ones that learners have been accustomed to. Consequently, today's students have been altered. Their relationships with their mates and teachers are no longer the same as the previous ones too, they have different learning styles that need to be regarded. They belong to their own world and they need to have convenient learning methods for their own age. They must be regarded as active participants in the process of learning rather than considering them as passive recipients of it (Nissim et al. 2016, p.29).

Learners today will face a world where the requirements of social, economic, and working lives become highly complicated every day. Learners today ought to develop exceptional abilities to be effective in an evolving and complicated, world. 21st - century instructions should fulfil the prerequisites of a future controlled by non-stop modernity and progress (Pearson, 2015). Teaching students who learn English as a foreign language in the 21- st century includes a lot of challenges and prospects, (Ashraf et al.,2017). Nissim et al. (2016) state that the 21st-century learning environment might be "a process-supporting system" that builds up a setting where learners learn more productively. Ashraf, Motallebzadeh, and Arabshahi in their endeavor planned and approved a survey that could be utilized to assess EFL students in an EFL context in the 21st-century skills. In this way, considering the significance of 21st-century skills for

today`s learners, they found out the urgent need for today`s learners to have such skills.

Long time ago, an example of a contemporary framework for innovation in education (P21) was established by the Partnership for 21st Century Learning, of the US Department of Education, Apple, American Online Inc. (AOL), Microsoft, Cisco, and Student Assistance Program (SAP) as well as educational associations such as the National Education Association (NEA). This model integrates 21st-century skills into learning to encourage active engagement, appropriate, and sustainable learning activities. Moreover, it provides life and career skills, learning and innovation skills, and information and media skills through applying essential academic disciplines. These skills assist students to be more equipped for the extremely innovative and collaborative workplace of today. In addition to assisting teachers in teaching those skills. Due to this, students` achievements in this approach are usually characterized in terms of how they will affect students' ability to find job opportunities in the future.

Orsi et al. (2020) describe 21st-century skills as certain essential capabilities like cooperation, computerized education, critical thinking, and problem-solving that support the needs the school has to provide the students with, so as to be able to thrive in today's world. According to Farisi (2016), they are considered essential criteria that ought to be incorporated into any educational organization, such as creativity, information, media, technology, life, and work skills.

Quieng et al. (2015) believe that the core of 21stcentury skills is engaging the learners in real-life situations and problems and preparing them to deal with these situations and problems to keep the development of the world and change it into a better and more advanced one. They also argued that the aim of education in the 21st century is to qualify learners in “content knowledge,

specific abilities, and literacy, numeracy, and technological uses".Pearson (2013) has pointed out that 21st century skills are divided into three categories: learning and innovation skills, information, media, and technology skills, in addition to life and career skills. The Partnership for 21st Century Skills (www.21stcenturyskills.com) has also promoted a discipline for 21st-century learning, presenting the skills that learners need to succeed in today's global economy. According to the Partnership, every learner must have critical thinking, innovation, ability to solve problems, effective communication, information and media literacy, global awareness and civic engagement, and also financial and economical literacy.

Andrade (2016) in his study indicated educational components for the students` performance, just as the flipped classroom, course redesign, and high effect procedures, and connects these to self-regulated learning to increase learners` responsibility to accomplish the required higher education outcomes as 21st-century skills. Farisi (2016) explored and illustrated academics' progress toward involvement and further research developments, as well as the 21st-century skills map for the students; and the consequences for developing teachers' competencies and teachers' education curriculum.

Suto (2013) discussed in his study some practical approaches for developing 21st-century skills such as continuing with long-standing approaches to teaching 21st-century skills, establishing curricula that directly support and help in developing them, adopting a skills-centered pedagogy in schools and colleges, nurturing 21st-century skills through extra-curricular activities, cultivate 21st-century skills through independent research projects, and develop 21st-century skills in the workplace (p. 18). In another study, Quieng et al. (2015) distinguished the recognized range of "integration of 21st century-based soft skills in the cognitive-laden dentistry curriculum", and investigated the

recognized "21st century-based soft skills of the student participants to serve as baseline data for future research."

Motallebzadeh et al. (2020) also discussed in their study the significance of implementing recent methods in teaching that incorporate using 21st-century skills in EFL classes, and they asserted that this implementation will achieve remarkable improvement in the learning process by creating attractive and engaging environments, teachers need to provide better opportunities to expand the broad application of 21st-century skills implemented in recent educational means of technology at any stage of the language acquisition process. Thus, the first step should be increasing teachers` awareness of the benefits of applying 21st-century skills in their teaching, their various processes, and different practices. Skillful teachers will efficiently convey these skills to the students. Consequently, teachers can not only benefit from the application of skills in their teaching process and expand their experience of teaching by means of "new technologies or the other skill areas like problem - solving, creativity, cooperation, critical thinking, etc., but they can also get proficiency and mastery in preparing and revising the best way to teach these kinds of skills" (Arabshahi et al. 2015, p.76).

It is not surprising that problem-solving, creativity, and innovation are superior skill areas in the list of 21st-century, regarding the inevitability that the 21st century requires continuously innovating new services, better processes, and improved products for the world's global economy. Erstad (2008) states that creative practices challenge the traditional relationship between teachers and students in providing information and content for learning, and the role of the school book. Such creative practices encompass Web 2.0 technology, enabling users to produce and share content in new ways, like user-generated content creation and remixing (Lessig, 2008). Therefore, the results of different

studies have shown the significant effect of 21st-century skills on language skills. So, the result of this study confirms the findings of those studies.

2.6. Artificial Intelligence (AI) in Education

"In education, there are two major issues: what we teach and how we teach it." (Holmes et al. 2019). *We're headed for a world where you're either going to be able to write algorithms … or be replaced by algorithms.*

AI is used in education in different ways, especially to help in improving the learning process and assessment tools. According to Holmes (2018), AI can contribute to developing the learning and teaching process through increasing productivity, creativity, and regulating administrative procedures. (AIED) has considered a variety of ways in which AI systems might be used to support both formal and informal learning. It has entailed the construction of numerous online learning tools that assist in supporting learning and at the same time, being adaptable, inclusive, customized, engaging, and effective (Holmes et al. 2018).

AIED combines AI with learning sciences, including two key complementary strands: constructing AI-based tools to support learning and applying these tools to explain the learning process (how learning happens). AIED is not only an effective tool for being a much smarter engine, but it is also a powerful tool for unlocking what is sometimes referred to as the "black box of learning", providing us with deeper, and better understanding of how learning actually takes place. (Luckin et al., 2016, p. 18).

Researchers also investigated the impact of AI on education. For instance, the study of Khare et al. (2018) asserted the positive effect of AI applications on students` achievement. The study of Tuomi (2018) also emphasized the

significance of AI in providing rich educational environments and the possibilities of solving common problems of education using AI applications. Moreover, Fryer (2019) asserted the significant role of robots in increasing students` desire to learn other languages. In addition, Ma and Siau (2018) indicated the positive role of artificial intelligence in developing higher education and replacing the traditional methods of education with machine learning environments.

Rosé et al. (2018) explain that AI is also being used to assess students` attention, feelings, and interaction dynamics, for instance in subject development and monitoring, in an endeavor to create ideal groups for collaborative learning activities and understand trends that predict students` satisfaction and drop-out. According to Zhang and Chen (2021), AI applications could increase students` satisfaction by 80%, consequently, the quality and the level of the learning process would increase and develop as a result of this satisfaction.

Akerkar (2014) and Ginsenberg (2012) define AI applications as systems that have the ability to produce reasoning and educational decisions similar to those of humans. Malik et al., (2019) assert that (AI) has greatly contributed to the development of the learning process. Moreover, it can contribute to the development of teaching and learning by helping both teachers and students to improve their teaching and learning skills. AI is also the main component of all neuro-linguistic programming (NLP) enabled tutoring systems. Neural AI can also identify patterns of interaction and correlate them with pedagogically meaningful patterns, allowing instructors to be more aware of how pupils perceive and where they could be instructed more effectively. AI systems can also supply diagnostic information to learners, allowing them to focus on their metacognitive techniques and potential development sectors. As a result,

learning assessments, analytics, and educational data mining will all benefit from neural AI. (Ilkka, 2018).

Furthermore, it plays a vital role in establishing the aspects of self-reflection and raising students' awareness to produce intelligent relevant answers to questions. In short, AI is an outstanding tool for providing more chances and motivation for interaction to improve language fluency. According to Chaudhary (2017), AI is beneficial for both students and teachers as it creates an educational environment with collaborative learning. Fernández et al. (2019) emphasize that using AI applications is significantly effective in assisting both teachers and students to gain more educational experience and consequently achieve more excellence in learning.

Han (2012) adds that AI applications provide pupils with better opportunities to pay more attention in large classes and enable them to make inferences and predictions through having pleasure and enjoyment dealing with robots and feeling more comfortable to pracstise speaking a foreign language with machines than with humans. Furthermore, AI has the ability to increase the pupils` motivation and provide them with more opportunities to use a foreign language and making interaction with one another. This occurs through the advanced technology of AI which involves voice interaction, word error rate for voice-recognition systems, which is now on par with humans" (Nordrum, 2017).

According to Khare et al. (2018), AI applications proved their ability to achieve a substantial effect on learners` achievement. Tuomi (2018) also asserted the significance of artificial intelligence applications in providing productive learning environments and the ability to solve educational problems. Furthermore, Ma and Siau (2018) asserted the positive effect of artificial

intelligence in developing higher education and replacing traditional methods of education with modern, preferable, and practical ones.

It is important to focus on a broad, deep, and versatile education as a hedge against uncertain futures, which in turn means a reinvigorated focus on the deeper learning goals of modern education:

- Versatility, for robustness, to face life and work.
- Relevance, applicability, and student motivation.
- Transfer, for broad future actionability.

All of which is to be developed via:

- Selective emphasis on important areas of traditional knowledge.
- The addition of modern knowledge.
- A focus on essential content and core concepts.
- Interdisciplinary, using real-world applications.
- Embedded skills, character, and meta-learning into the knowledge domain.

AI is currently being introduced into some conventional schools as a curriculum in its own right, is being developed to enhance online learning, and is being researched as a means of improving professional development for teachers. In brief, using AI applications in educational contexts is highly increasing, for instance, by 2026, it is expected to become a market worth about $6 billion.

According to Holmes (2019), there are many ways that AI systems in education research (AIED) could be used to support both formal and informal learning. These ways included the development of various online tools that aim to support learning while being flexible, comprehensive, individualized, cooperative, and efficient. AIED combines AI with learning fields, so it includes two fundamental integrated axes: developing AI learning applications

and employing these applications to facilitate and explain learning (how learning happens).
The most common types of AIED are so-called intelligent tutoring systems (ITS), with Cognitive tutors being a leading example.

iTalk2Learn, an AIED system for children aged 8–12 years old studying fractions, is a popular alternative to ITS. Rummel et al. (2016) indicate that it was created to recognize, evaluate, and react to speech in real time in order to enhance learning. The platform mainly facilitated the effective learning of fractions by providing tasks that helped learners gain both conceptual and procedural knowledge of fractions.

Mazziotti et al. (2015) claim that a student's unique sequence of interleaved exploratory and structured practice activities is determined by an overarching intervention model (The aim is to achieve optimum conditions for learning (avoiding students being under or over-challenged, which may trigger either boredom or anxiety). Sequencing decisions are made according to the student's level of challenge and their affective state, both of which are inferred from the student's interaction (what they click and the actions they take on the screen) and their speech (including keywords and prosodic features such as "um's" and pauses) and all of which are recorded in the student model.

Holmes et al. (2015) explain that the system uses a Bayesian network approach to deliver targeted formative feedback at three levels: Socratic, guidance, and didactic (Socratic feedback draws on the dialogic approach to teaching which emphasizes the benefits of open questioning to encourage students to consider and verbalize possible solutions. The second level, "guidance", reminds students of key domain-specific rules and the system's affordances. The third level, didactic specifies the next step that needs to be

undertaken in order to move forward (this rarely-delivered final feedback also operates as a backstop, ensuring that the student is not left floundering).

Goel and Polepeddi (2018) explain that Virtual Teaching Assistant known as Jill Watson (JW), developed at Georgia Tech is another application of AI in education which concentrates on helping teachers to guide students, instead of directly instruct them and allows them to deal with obstacles through affording automatic online assistance for large groups of learners, specifically in online courses. JW was designed to establish the online platform of a computer science course to identify common questions asked by the students, and to produce accurate and fast responses. Instead of replacing the human teaching assistants, JW meant to free them of having to respond to low-level questions (such as inquiries about assignment length, submission deadlines, and required readings), which can be long, complicated, and boring, so that they could focus on higher-level and therefore, generally more exciting questions and other learning activities.

The students` enquires were correlated to be marked by the responses provided by the human teaching instructors. As a result of this training, the system assesses students` new responses so as to indicate if they can be divided into question/ answer pairs in which the system has confidence (because typical questions have been made and answered several times). Suitable answers are then verified and provided to the students immediately. On the other hand, when there is not a certain suitable response, the question is introduced to a human teaching assistant without causing any obvious delay.

2.6.1 Artificial Intelligence in EFL

AI is one of the most innovative technologies used to develop English fluency. Utilizing AI applications in the classroom is critical for language fluency development since these applications offer rapid developmental assessment and quick updates; obviously, learning to practise a foreign language requires using different approaches. Kim, (2018) believes that students need to be exposed to authentic and appropriate listening sources so as to develop their listening skills. Dealing and communicating with robots, allow to support and achieve this viewpoint; they provide learners with correct models of language input, whether in spelling or pronunciation. According to Fryer (2019), robots play a vital role in increasing learners' awareness of the importance of learning other languages.

Furthermore, Nordrum (2017) explains that since AI technology incorporates voice interaction and word error rate for speech-recognition systems on pace with humans, AI has the ability to create additional, and more stimulating, chances for learners to be active participants in spoken engagement in the target language. Open Essayist according to (Whitlock et al. 2013) is another AIED example, which incorporates Natural Language Processing to afford automatic meaningful input on draft writings. Unlike previous AIED systems that were designed to grade essays and to guide students on ways of solving problems (such as Street, et al. 2006), Open Essayist stimulates learners to reflect on the content of their essay so as to develop self-regulated learning, self-knowledge, and self-awareness.

AI learning applications make use of linguistic technology, visuals, simulations, and interactive activities to allow users to determine if their essay effectively reflects the intended meaning and to self-correct before presenting it for authentic evaluation. The system was designed according to the notion that

the content and placement of relevant phrases in an essay indicate how coherent and well-structured it is, which was determined by key phrase extraction, detecting which short phrases are most suggestive of an essay's content, and extracting summarization.

Nevertheless, other studies (e.g., (Hernández-Sellés et al., 2019) indicate, that cooperation among learners rarely occurs without relevant assistance. AI utilizes information about the participants, especially in learner models, and self-learning algorithms to construct the ideal group for a certain collaborative task. Students may be all at the same cognitive level and have mutual interests. Expert facilitation, on the other hand, can include training programs that assist students in working collaboratively besides, exchanging information and knowledge. As a result, several AI-assisted collaborative learning systems have been investigated.

2.6.2 Applications of Artificial Intelligence in EFL

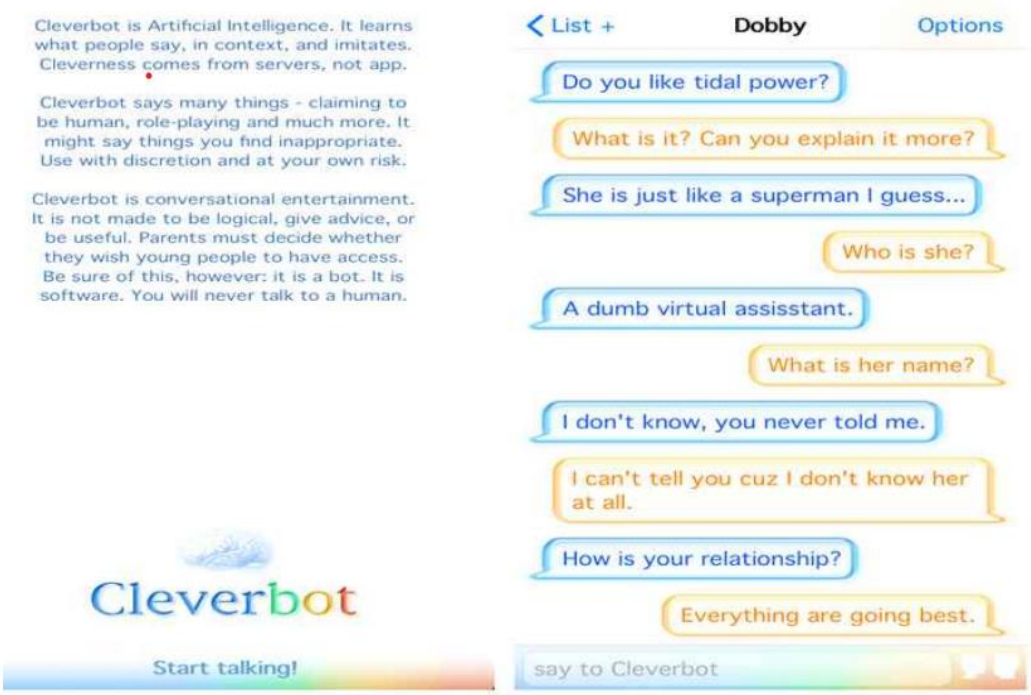
Companies are competing nowadays to present numerous AI applications in EFL, for example, Alexa, Siri, Cortana, and chatbots are AI assistants that have attracted millions of users and their popularity depends on deep learning and neural networks. In the study of Kim (2020) to investigate the effects of artificial intelligence chatbots on improving Korean college students' English grammar skills. The study included 70 participants for 16 weeks. Results showed that the grammar skills of the participants were improved in a remarkable way after using AI chatbots.

Cleverbot is also an AI meant to simulate human-like conversation (See Figure 1). Developed by Rollo Carpenter, this chatbot has a successful artificial dialogue system, according to Shah et al. (2016), it acts like a human interlocutor. According to Torrey, et al., (2016), Cleverbot learns from real people and has no trouble responding appropriately.

Daniels (2015) confirms that Cleverbot is one of the most famous chatbot programs. It includes 200 questions. When the chatbot receives the texted input, the chatbot analyzes the given texts, relates them to the possible responses, and then replies in the form of a text. The whole procedure happens automatically that it looks like as though the user is talking to a real person. In a related study, Kim (2017) asserted that students' writing performance can improve via interactions with Cleverbot. That is, text with this chatbot can be beneficial for English writing.

Figure 8:

A screenshot of Cleverbot



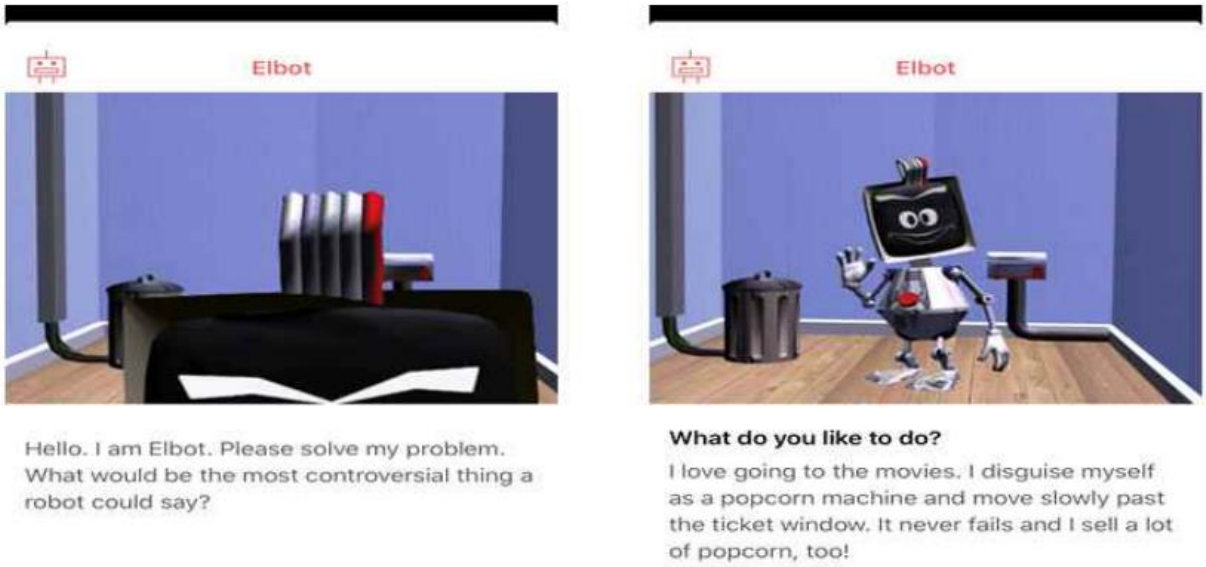
Source: online AI chatbot

One of the key features of Cleverbot is that it puts the flow of the whole conversation above that of individual responses. Since it looks at the whole conversation, small textual clues are put together to give the best possible answer. However, it learns only from the people it chats with and acquires their

illogical or nonsensical patterns of thought. This is expressed in future exchanges with other individuals, coming up with a response from the last encounter. The following is another chatbot called Elbot (See Figure 9):

Figure 9

Elbot chatbot



Source: online chatbot

Another widely used chatbot is called Elbot (See Figure 8, the winner of the Loebner Prize 2008 AI Contest (Shah et al., 2016) for its successes in human-machine interaction. According to Floridi, et al., (2009), Elbot deserved the prize given that interrogators were convinced that it was a human. Developed by Fred Roberts, this chatbot uses natural language interaction (NLI) to converse with its users about many different topics, rather than just offering up a self-contained and specialized set of FAQs. Moreover, Elbot took on the challenging task of being conversant on a variety of topics. However, Shah et al. (2016) noted that it still remains machinelike with robotic themes.

Nowadays, Chat GPT is the most advanced chatbot, capable of answering complex questions and carrying out many advanced tasks. This revolutionary chatbot goes above and beyond what is expected when it comes to generative AI. Chat GPT can help enhance writing fluency for EFL (English as a Foreign Language) learners in several ways:

1. Vocabulary expansion: Chat GPT can introduce EFL learners to a wide range of vocabulary words and phrases that they may not have encountered before. By conversing with Chat GPT, learners can learn how to use new words in context, which can help them improve their writing fluency.
2. Grammar and syntax: Chat GPT is trained on a vast amount of text data, which means it has a strong understanding of English grammar and syntax. By conversing with Chat GPT, learners can learn how to structure their sentences and use proper grammar and syntax in their writing.
3. Feedback and corrections: Chat GPT can provide instant feedback and corrections on learners' writing, helping them identify errors and improve their writing skills. Chat GPT can also provide suggestions for alternative phrasing or word choices that may improve the clarity and fluency of learners' writing.
4. Writing prompts: Chat GPT can provide writing prompts and suggestions to help EFL learners practice their writing skills. These prompts can be tailored to the learner's level and interests, and can help them build their confidence and fluency in writing.

Grammarly is an AI-powered product. Taguma et al. (2018) state that is a powerful digital writing tool with more than 20 million international users. Grammarly is also available for tablets, and smartphones with different operating systems. Furthermore, Grammarly can automatically support computers, internet browsers, and social media sites. It is offered in two

versions free version and the premium one. The researcher in the current study used the free one.

In a related study by Nazari et al. (2021), 120 non-native postgraduate students in the English academic writing context. Participants in the study included120 students who were randomly selected. 60 students practised learning English through Grammarly AI application equipped with their learning material (experimental group), whereas 60 students did not receive the same AI application in their learning process (control group). After the treatment, an analyzing test was done to assess the participants` levels. The results showed that the students who participated in the AI intervention group showed more statistically significant enhancements in their behavioral engagement levels than those who did not receive the same treatment. The findings imply that AI-powered writing tools are useful for encouraging learning behavior and attitudes towards technology through providing learners with formative feedback and assessment to their academic writing.

In another study by Cavaleri and Dianati (2016), the researchers made a survey at two Navitas colleges, the Australian College of Applied Psychology (ACAP) and Navitas College of Public Safety (NCPS). The researchers did an online questionnaire to collect the students` opinions and comments regarding using *Grammarly* tool in their writing. The findings showed the students` satisfaction of using *Grammarly* app in their writing and reported that they could benefit from its instruction and the simple way of access to the tool. Moreover, the feedback provided by the tool to students to deal with their grammatical issues, can overcome some common problems such as lack of time, therefore, it can save more time for instructors to concentrate on higher – levels writing issues.

In line with the previous findings Parra and Calero (2019), Schindler et al. (2017) confirm that *Grammarly* offers instant correction and feedback. Instant feedback is highly affecting positive engagement in web-based courses. This engagement is a key component of a technology instructional assessment.
This authentic formative feedback provides new opportunities for learners to have more individualized learning experiences. Li et al. (2014) add that there is evidence that instructional feedbacks may enhance writing problem-solving.

Minecraft game as an educational tool integrated with Grammarly (AI) application are both being developed as learning tools. Minecraft allows learners to explore blocky, realistic world and interact with its incidents. The game has two main modes: survival and creative. In survival mode, players try to survive by having natural resources such as trees, animals, mining, and farming, investing these resources in achieving useful missions. Players also can use blocks to create people or places from their imagination. In the creative mode, players can play freely without any attacks.

According to Roscoe et al. (2014): "One of the exciting aspects of Minecraft as an educational tool, is that it brings with a culture of collaborative learning and knowledge sharing. Mojang, the creators of Minecraft, have never published instructions to their complex multiplayer game. Instead. Children over the world are using chat, YouTube tutorials, and wikis to teach themselves, and each other… Minecraft encourages creativity, Printcraft's 3D printing option provides a means for teaching fundamental computational, science, technology and engineering concepts".

Minecraft game integrated with Grammarly AI mode while teachers are controlling the game server, both can enable teachers to view the overall image of pupils' activity and provide them with simultaneous feedback on their writing

topics. So Minecraft helps teachers to discuss the content they generate with people involved in their learning communities. In this way, they can exchange experiences about learning objectives regarding courses, student activities, and performance expectations in learning communities.

This type of custom-tailored education could be machine-solving to assist learners at different levels to work collaboratively in one classroom while teachers work as facilitators, and provide learners with assistance and support. Adaptive learning has already proved its positive effect on the learning process all over the world (particularly via programs such as Khan Academy), and while AI develops in the future, such adaptive systems will probably improve and grow. J., & Han, J. (2016) clarify that the common component in all AI-learning is the software's requirements, which depend on four factors:

- The component that needs improvement.
- The prior knowledge which the learner has.
- The kind of representation given to the data and the component.
- The available feedback to benefit from. (Allam,2021).

The researcher adopted using this game because of its rich and various environments that allow learners to practise writing about different topics. In a related study of Davis et al. (2018) investigated the students' practices in using Minecraft. Ten students aged 11-13 from a middle school participated in this research. Findings showed that using Minecraft greatly increased the students` active and engaging participation. In addition to improving collaboration and communication.

In a related study by Šajben et al. (2021), the researchers investigated the outcomes of using Minecraft as an educational tool. The study included 20 participants aged 10- 14 years. The result showed that the learners became more devoted to their learning process. The information provided to them through Minecraft was found to be more useful and fruitful. The students shared in the interview assured that Minecraft was excellent, and could be superior to teacher. They also agreed that the game encourage active participation.

Some researchers (e.g., Hassani et al. (2013) have also explained that learning in virtual environments can enable the learner to effectively integrate that learning with the real world (learning integration with the real world has long been known to be a challenge. Mondly; AI application is a marvelous tool that allows the learners to engage in virtual worlds and deal with robots or people in these worlds.

AI technology is not separated from 21st-century skills, which have been constantly recognized as being fundamental for future students, future jobs, and future economies (e.g., World Economic Forum and The Boston Consulting Group 2016). These skills involve critical thinking, problem-solving, innovation, communication, and collaboration, as well as personal traits including curiosity, perseverance, flexibility, leadership, social and cultural awareness, and entrepreneurship. Despite the importance of these main skills and character attributes, it is not clear how they could best be developed or fostered. AIED could help students improve their twenty-first-century skills by providing dynamic, continuously developing tools. For example, while students are engaged in collaborative problem-solving tasks in a specific environment, the tools may detect student performance (who is engaging with whom, etc.). (How are students engaged with accessible learning resources?), eye contact (What are students concentrating on at any specific time?) and group

conversations (Who is saying what and to whom?). Over time, signs of the most effective collaborative problem-solving procedures will be identified to help students to be guided in those directions (possibly through automated feedback). Monitoring and interpreting discussions can also be used to integrate students who have similar discussions, whether on the same side of the room or in other countries, allowing AIED-supported communities of practice to emerge.

Another important aspect to consider is that intelligent tutoring systems actually establish a digital profile of a student and supply him with a customized instructor. This could improve productivity both inside and outside of the classroom. Organizations might also benefit from such digital portfolios of learned courses and themes. Not only does this form of a customized learning environment improve the quality of the educational process, but it also allows schoolchildren and learners with disabilities such as dyslexia or any other health problems to learn more efficiently. It will also aid in adopting learning strategies that serve the needs of learners, leading to more personalized study programs.

Hence, it is obvious from the previous review that AI tools are already being applied in several aspects of the educational process, including content production, pedagogical techniques, and learners' assessments as well as teacher-student communication. This work helps to add to the available information in this discipline and will be of interest to technology-enhanced learning experts, instructors, learners, and those concerned with the quality of our educational system.

2.7 Using AI to enhance language fluency

Some researchers discussed AI in the context of English language classes. For instance, Kose and Arslan (2015) research AI and how it can be used to enhance e-learning scenarios in order to improve instructional methods as well as educational activities. Their goal is to reflect on the merits of artificial intelligence, particularly in the sector of education in general and the English language in particular. Köse and Arslan (2015) also regard AI as a means of developing English language performance. Their research concentrates on the significance of using an AI e- learning software in English language. The intelligent e-learning software was used in universities in Turkey, Italy, and Romania for their English language programs. 180 students participated in the study (60 students from each university). Participants had the option to use the online learning platform in their own mother language. Results of the study showed that using intelligent e-learning software has increased students' academic success in English language classes. Moreover, Hynes (2016) asserts the effectiveness of artificial intelligence applications for improving English language fluency and highlights the advantages of adopting AI applications like Elsa to improve English speaking skills.

Finally, artificial intelligence applications like Google and Grammarly can assist people in enhancing their language skills. According to Marr, (2018) it is believed that Google and Grammarly have rescued millions of people from embarrassment due to making mistakes in practicing the language. In a related study, Dizon and Gayed (2021) used Grammarly in an 8-week study. 31 university participants were engaged in the study. Results showed that the intelligent agent reduced grammatical mistakes and improved the lexical variation of participants' writing. Ilkka, (2018) explains that in the field of learning, AI will not only result in a more efficient and productive educational environment but it will also change the context of the learning process where it turns to be suitable for the needs of the society.

Numerous research have been conducted to determine the significant role artificial intelligence plays for teaching and enhancing English skills, In a research conducted by Abilowo et al. (2020), it was found out that using chatbot for language communications can significantly contribute to improving learning languages .In similar studies, such as Su et al., (2019), it was proved that using AI could greatly develop writing fluency and reduce writing anxiety.

Here are some more examples of research studies that used AI in developing English writing fluency, along with their participants, and findings:

- Thirunarayanan & Ramakrishnan (2018) in their study involved 24 undergraduate students who used an AI-based writing partner to improve their writing skills. The findings showed that the use of AI led to improvements in writing fluency, organization, and overall quality of writing.

- Aaron , Campbell and Michael Spector. (2016) conducted a study involved 12 ESL learners who used an AI-based writing feedback tool to improve their writing fluency. The findings showed that the use of AI led to improvements in writing fluency, accuracy, and organization.

- Bojórquez-Martínez, & García-Rodríguez (2021) revealed the positive effect of using AI in a study involved 36 Spanish-speaking EFL learners who used an AI-based writing tutor to improve their writing skills. The findings showed that the use of AI led to improvements in writing fluency, complexity, and accuracy.

- Hosseini, S., & Salama, A. (2021) asserted the significance of using AI in improving writing fluency. The study involved 30 EFL learners who used an AI-based writing feedback tool to improve their writing fluency. Findings showed that the use of AI led to improvements in writing fluency, accuracy, and organization.

These studies demonstrate the potential of using AI in developing English writing fluency among learners. While more research is needed, these studies suggest that AI-powered writing tools can provide a personalized and effective way to help learners improve their writing skills.

2.8 Self-regulation in education

Self-regulation means that people select a goal from among various alternatives and then set about trying to reach their goal. Andrea Bell from GoodTherapy.org proposes a straightforward definition of self-regulation: It's "control [of oneself] by oneself" (2016). Self-regulation theory (SRT) simply outlines the process and components involved when people decide what to think, feel, say, and do. It is particularly salient in the context of making a healthy choice when we have a strong desire to do the opposite (e.g., refraining from eating an entire pizza just because it tastes good).

2.9 Self-regulated learning

Seker (2016), states that there has been a growing interest in comprehending self-regulated learning (SRL) and its role in supporting autonomous lifelong learning. Koçdar et al. (2018) also explain that this concept

which emphasizes the responsibilities of learners in their own learning processes and autonomy was first noted in the 1980s.

According to Bai and Guo (2019), students who use more SRL strategies are more likely to gain better academic achievements. When learners use self-regulation strategies, they attain the ability and skills to plan, choose appropriate cognitive and metacognitive strategies, and evaluate learning outcomes. Self-regulated learners have the necessary cognitive, behavioral, affective, and social features to become active, independent, and constructive learners. They set better learning goals, implement more effective learning strategies, monitor and assess their progress better and establish a more productive learning environment.

According to Kuo et al. (2014), blended learning is more learner-centered, adaptable, and more autonomous than the traditional one. This requires learners to be aware of the importance of self-regulation and use their self- regulated skills for the learning process. Kuo et al. (2014) assert in their study that Self-regulated learners achieve more success in distance learning than those who lack self–regulated skills. Researchers have also found that most distance learners who cannot use their self-regulated skills, struggle to manage their learning processes, and consequently, they often fail (Wong et al. 2018 and Lehmann et al. 2014). This could be common due to students studying at their own pace in the distance learning process. For example, most MOOCs are self-paced, and their effectiveness is largely dependent on the learners' ability to self-regulate their learning. Moreover, a lack of self-control skills leads to a high rate of disengagement and low retention levels (Milliganet al., 2013; Littlejohn, et al., 2016).

Furthermore, Skibbe et al. (2019) add that Self-regulation supports children in being able to manage and adjust their behaviors to environmental demands through the development of cognitive, socio-emotional, and physiological skills. Coelho et al. (2019) confirm that well-developed self-regulation leads to positive adjustment and developmental outcomes.

In addition to having an important place in psychological and other educational studies, self-regulation has gained attention in the foreign language teaching field over the last few decades. There has been significant research demonstrating SRL's efficacy in improving foreign language learning (e.g Andrade & Evans, 2013; Elabdali & Arnold, 2020 ; Thomas & Rose, 2019).

Seker, (2015) adds that as language acquisition necessitates a continuous investment of time due to the dynamic nature of language, maintaining high levels of motivation and perseverance is essential. Active involvement in curricular and extracurricular activities is required for language learners to get appropriate practice both inside and outside the classroom in order to become self-regulated and autonomous.

In a study at a foreign Languages School at a state university in Turkey, which provides English language classes to undergraduate students. At the beginning of the academic year, the school adopted the Common European Framework of Reference for Languages (CEFR) standards for preparing its curriculum and assessment to nurture autonomous and proficient learners of language and academic skills. It was found out that in foreign language learning situations, developing motivation as well as being able to regulate individual learning by efficiently deploying learning strategies will lead to learner success (Ma & Oxford, 2014). In contexts where English language learning and teaching still face big challenges, incorporating SRL into the curricula and

language teacher training programs may facilitate the creation of autonomous and lifelong language learners.

In general, most studies highlight the following characteristics that differentiate students who self-regulate their learning from those who do not do that as following:

a) They know how to use various cognitive strategies (rehearsal, elaboration and organization) that help them to process, elaborate and retain information.

b) They know how to plan, control and direct their mental processes towards achieving their personal goals (*metacognition*).

c) They present adaptive motivational beliefs and emotions such as: a high sense of academic efficacy, adoption of learning goals, development of positive emotions to tasks (enjoyment, satisfaction, enthusiasm, etc.) as well as capacity to control and modify them.

d) They plan and control the time and efforts to be used in the tasks. They know how to create and structure a favorable learning environment (appropriate place to study and help-seeking from teachers and colleagues when they have difficulties).

e) If the context so permits, they participate in the choice, control and, regulation of aspects related to academic tasks, climate and, the structure of the class.

f) They set up different volitional strategies, aimed at avoiding external and internal distractions to maintain their concentration, effort, and, motivation during the implementation of academic tasks.

In this context, Dabbagh & Kitsantas, 2012; Koçdar, 2015) assured that identification of self-regulated learning skills is important as these are learnable skills, and instructors can help learners acquire these skills. Some scales in literature guide teachers to identify the self-regulated learning skills of learners either in face-to-face or on line (Weinstein et al., 2016). Although these scales serve for face-to-face or online courses, they are not based on learner-paced or self-study. They focus on classroom activities in structured learning environments involving schedules that do not fit well into a self-paced learning environment. Consequently, Kocdar et al., (2018) assured that it is essential to determine the self-regulated learning skills that enable learners to regulate and manage their own learning processes in learner-paced open and distance learning environment.

Determining these skills will aid the teachers and instructional designers in developing new strategies, which will either enhance the learners' skills in self-regulated learning or help them acquire skills crucial for a successful distance learning experience. Kuo et al., 2014; Kocdar et al., (2018) added that the fact that distance learning is more flexible, learner-centered, and autonomous than face-to-face learning, requires learners to be self-regulated and use their self-regulated learning skills more frequently. For instance, most of the MOOCs are self-paced, and the success of the MOOCs mostly relies on the learners being self-regulated. On the other hand, the lack of self-regulated skills, results in high dropout and low retention rates (Milligan et al., 2013; Littlejohn et al., 2016)

Kocdar, (2018) also states that social context plays an important role in self-regulated learning. Hadwin et al., (2010) clarify that instructors or peers are external factors that guide learners in self-regulation activities and provide feedback. They can support their beliefs such as self-efficacy, goal-centeredness and help learners deal with their feelings such as anxiety and fear. Teachers also

have to establish relationships with students, acknowledge their opinions and feelings, and create settings in which they feel secure to explore and learn.

Social context offers important opportunities that can support the self-regulated learning process. These opportunities include practices that include guiding elements, the control of learners decreasing instructional support, and effective feedback (Hadwin et al., 2010). Because of the social processes, learners can develop their competencies to meet challenges, for content and context. Consequently, they become self-regulated learners.

2.10 Components of self-regulation.

Different components have been hierarchically classified in different ways by different theorists. Spellman et al. (2016) dichotomized SR into cognitive (general comprehension), metacognitive (regulation of cognition), and resource (environment) management strategies components. Karlen (2016) divided SR into metacognition, intrinsic motivation, and a strategic component. Alexander (1997) cited several different categories of components usually found in discussions of SR, including interest, strategic processing, self-efficacy, personal agency, and goal setting.

According to Bai (2019), there are three components involved. These components are: Planning which means establishing an outline before writing an English essay or paragraph, self-monitoring which means making sure if the writing of an essay or a paragraph fulfills the teacher`s expectations, and acting on feedback which means combining the teacher`s helpful comments into the writing process.

Consequently, Self-regulated learning is a regular process, in which the learners plan for activities, control their achievement, and then reflect on the

outcome. The process then resumes as the learners use the feedback to make adjustments and arrangements for the next activity. Accordingly, the process should not be a standardized one; it should be customized for each learner and for particular learning activities.

Based on the previous literature, the current study adopted the following three components:
(a) Orientation, (b) Performance, and (c) Evaluation; and five subscales (i.e. internal orientation, external orientation, cognitive strategies, metacognitive strategies, and evaluation).

2.11 Writing fluency, self-regulation, and AI

Teachers' duty is to always support their students and provide the best circumstances to learn English. By knowing this, then, teachers are able to adjust the teaching technique with their students so that learning goals can be achieved completely. Having shifts from traditional teacher-centered instruction toward a learner-centered approach, since such a transition requires substantial changes in curriculum development, teacher education, and classroom applications, Using AI in learning contexts can provide more comprehensive practical implications to promote SRL integration as well as students` writing fluency.

One of the most significant and effective relationship between AI and writing fluency is to guarantee an encouraging writing environment with simultaneous writing feedback. Wang et al. (2023) asserted that AI can analyze students` habits and preferences to recommend encouraging materials suitable to their needs. In addition, it can provide accessibility tools, such as chatbots, virtual assistants, and personalized recommendations that would help in

removing learning barriers and offer a lot of exposure, practice, encouragement, and correction.

Using AI may be possible to revolutionize learning but it is also possible to automate ideas and replicate practices that have little to do with learning. In general, AI can be used in different ways that may have different implications for the development of human cognitive capabilities resulting from providing them with self-regulated learning which is regarded according to the current study as both a mean and an outcome of learning at the same time.

According to Manuel (2021), there are a lot of various activities that can help students in improving their writing fluency. Some of these activities include descripting pictures or videos, using the "think, pair, and share" method, interacting to discuss writing-based thoughts, and adopting diary writing. AI educational applications provide students with these activities in an encouraging environment.

2.12 Self-regulation as an outcome of AI and a stimulus for writing fluency.

Hatch, (2016) indicate that Self-regulation can be developed and learned like literacy, through providing learners with focused attention, encouragement, and practice opportunities in different contexts. Skills that are not developed earlier can be acquired later, with numerous opportunities for intervention. AI provides these required opportunities as stress that overwhelms children’s skills or support can create toxic effects that negatively impact their learning development.

According to Puranik et al., (2019) students may perceive that their learning (behavior) is negatively affected by a lack of school resources, and especially by teachers' lack of teaching knowledge (environmental factors). Simultaneously,

students suffer from poor learning. Regarding early writing skills, self-regulation supports composition quality as well as writing fluency in first grade. Puranik et al., (2019) confirm that early writing components are specifically linked to the development of self-regulation components like task dependency, focused attention, and being able to follow directions to complete a task.

One possible reason for needing self-regulation in learning, is teachers` needs to predict the amount of effort the students exert, how well they persevere in coping with challenges, and how effectively they regulate their thoughts, actions, and plans to produce given attainments. Consequently, the mechanism through which self-regulation exerts its effect on the students` achievement is through the suggested environment of using AI as a mediator by which we achieve self-regulated learning and benefit from this outcome to enhance their writing fluency as Students respond better to writing projects when they understand why the project is important and what they can learn through the process of completing it.

AI can support existing capabilities. When competencies are understood as combinations of domain-specific expertise and behavioral repertoires, AI can reduce the need for human knowledge, experience, and practicel, and emphasize the importance of behavioral repertoires. As a result, humans do not necessarily need to learn domain-specified that earlier was required for competent behaviour. In particular, as domain-specific knowledge becomes less important for competence, transversal and domain-independent generic competences may become relatively more important.

Moreover, AI can speed-up cognitive development and create cognitive capabilities that would not be possible without technology. The mechanization or human work has made possible things that would be impossible without

technology; similarly, the mechanization of cognitive work makes possible new activities that have not been possible before.

AI may reduce the importance of some human cognitive capabilities, or make them obsolete. For example, as AI can convert speech to text and vice versa, dyslexia may become socially less important than it has been in the past. However, although in cases such as dyslexia and dyscalculia AI may have clear benefits for individuals, the overall impact is not easy to predict. For example, computers may support people in adding and multiplying numbers; if they became reliant on computational machines, it may, however, become more difficult to develop more advanced mathematical skills that require mental arithmetic and number skills. From a pedagogic point of view, it may sometimes be more beneficial to use AI to help people to develop competences that allow them to overcome difficulties in writing and counting, instead of using AI to make redundant skills that underpin important cognitive capabilities.

In a related study by Seker (2015) highlights the significance of SRL in language teaching by exploring its impact on language achievement. It investigates learner reported use of SRL, focusing on its three main components – orientation, performance, and evaluation – and their power in predicting foreign language achievement. A total of 222 undergraduate foreign language learners at a state university participated in the study. Data was collected from two sources: a five-point Likert-type self-regulated language learning questionnaire, adapted from models and research instruments used in previous studies to investigate SRL and language learning strategies, and the university's English achievement exam. Quantitative analyses indicated that although participants reported moderate to low levels of SRL use, it is a significant predictor of foreign language achievement and had significant correlations with

language achievement. The results are meant to draw attention to the importance of SRL research within the foreign language teaching field as well as foster SRL implementation in language instruction.

Commentary

Throughout reviewing literature and previous studies in this chapter, the researcher could assert that AI does not only present more effective sort of education but it also can exchange the learning context with a socially suitable one. The researcher could also identify the dimensions, benefits, and challenges of using artificial intelligence in education and in learning English in particular. Moreover, the current study sheds the light on the inevitability of having awareness of students who are characterized with their strong correlation to various technology means.

Being aware also that the students` learning achievement (behavior) can result in lack of confidence in their learning ability (personal factor) which, in turn, may lead to worsening their learning performance (behavior). Thus making use of this passion and adherence to technology means represented in AI applications and including the learning process via educational AI applications will probably help with developing their language fluency.

The ultimate goal of several studies asserted that there is a fundamental need to help students become fluent in using the English language. Writing fluency helps them to communicate, formulate thoughts, and express ideas in written forms. Hence the researcher in this study found the need for improving the students` writing fluency since there are few studies that have examined the predictive validity of self- regulated learning resulted in AI educational applications in connection to students' writing fluency.

Fast development in natural language processing and AI-based human-machine combinations will increase modern learning opportunities, too. For instance, while dialogical robots and learning partners are getting more widely accessible, learning through instructional robots is getting more powerful. Emotional AI and sentimental programming will be essential components of these systems. Furthermore, genuine translation software increases language learning opportunities, and AI systems can be used to interpret students' written texts which assist them in writing texts that better communicate what they meant to convey.

The current study describes the impact of AI on education and presents a perspective on this topic. It also addresses how AI can help to decrypt students` difficulties and understand how to help them to improve the imagination of a collectivity and to design a new educational experience. After conducting the overview of existing solutions and possibilities, the main conclusion will be clear. The educational landscape is changing and reshaped by AI even though AI will not replace completely our traditional educational system. In fact, it is wrong trying fully replace social interaction with AI. It should be added to the traditional studying process as it was done with gamification and currently happening with VR and AR technologies.

The implementation of AI technology is giving many opportunities for the development of massive open online courses. Assessment of a large number of assignments, detection of learning and teaching gaps would not be problems anymore with the implementation of intelligent systems. Moreover, measuring learning progress is becoming more and more effective. At the same time these intelligent assessment systems can skip some correct but rare unique solutions since the system makes decision-based on massive statistics. However, it means

that assessment systems based on AI cannot be absolutely true in every possible situation without a human mentor.

Therefore, the previous studies which recommended different methods and strategies for improving the learners` self-regulation as well as their writing performance, revealed the inevitability of focusing on this target. Consequently, the literature supported the relation between the study`s dependent and independent variables and proved a rationale for integrating them. Nevertheless, rare studies exploited the importance of integrating AI applications in education to develop the learners` language fluency.

Moreover, researching the components and principles of writing fluency has benefited the researcher greatly in designing the needed program based on AI concept, self- regulated learning and the experimental design.

Chapter Three
Method

Chapter Three
Methods

This chapter illustrates the research methodology used in the study, the instruments, and the experimental procedures. It describes the study design, participants, the duration of the study, and description of the study program. It also describes treatment and statistics of the obtained results.

3.1. Study Design

The researcher used the quasi-experimental design with one – group pre-posttest design along with a mixed research that combined both quantitative and qualitative assessments in order to investigate the main components of writing fluency and self-regulation.

3.2. Participants

The participants of the study were 33 students (boys and girls) (N= 33), aged 15 in preparatory three at Hassan Abubakr governmental language school in Alqaliobia governorate and have been learning English for 11 years. Their linguistic level was intermediate. The researcher aimed to develop their WF as well as their self-regulation through using some relevant AI applications.

3.3. Instruments of the Study

The instruments of the current study included:

1- A pre-post writing fluency test. (see appendix C).

2- The writing fluency rubric. (see appendix D).

3- EFL students' Self-regulation Scale. (see appendix E).

These instruments were based on a list of components designed by the researcher.

3.3.1. Validity of the writing fluency rubric, checklist, and the self – regulation scale.

The writing fluency rubric, checklist as well as the self – regulation scale were submitted to the jury members who indicated their validity and suitability (appendix A).

3.3.2. The pre/post writing fluency test (appendix C)

The researcher conducted the pre/posttest to measure the students` entry writing level before and after implementing the suggested program so as to indicate whether the program was effective in developing their writing fluency level or not.

3.3.2.1 Description of the test: It consists of eight different writing topics. The total score of the test is 100. Table 1 points out the question‘s number, the item‘s number, the writing fluency component it assesses, and the score given to each item.

Table 1

Test specification

The assessed components	**Number of questions**	**The score for each question**
Mechanics,	*5*	*20*
Organization,	*2*	20
Detecting and producing interpretations,	*2*	20
Text smoothness	*2*	20
Reflection		20
		100

Content. The test was designed and organized considering the following:

- The final list of writing fluency components.

- Previous studies and literature related to writing fluency assessment.

- The suggestions and modifications of the jury members.

In the first question students were asked to read a passage quickly to get a general idea and fill in the blanks with suitable words from the words given to them. This measures the learners` ability to organize their thoughts and use suitable words to produce a meaningful text. The second question aimed at indicating the learners' ability for organization through arranging given sentences to form an organized paragraph. Then the next two topics handled measuring the learners` ability to think of a self-image and reflect their thinking by asking them to write responses in a paragraph form to introduce themselves and express their future dreams. The last question demanded their imagination to reflect on their thoughts if they were in a time machine.

The learners were also asked to write two more topics which are "Express and explain interpretations of what you would do to fight diseases and improve health conditions if you were the minister of health." In addition to these two questions measure the learners` ability to detect and give interpretations? Furthermore, the researcher introduced two more questions to measure the learners' ability to produce a smooth text.

The learners` ability to produce correct punctuation, accurate spelling and maintain using contextualized grammar rules were considered in marking the previous questions.

At the end of the program, the participants had the same writing fluency test again, measured and rated using the same rubric so as compare their results at the beginning and end of the treatment.

3.3.3.2 Piloting the test. The test was piloted on a group of preparatory three-stage learners in Hassan Abobakr governmental language school. Those students were out of the treatment. It was administered before applying WF program to a group of 10 students to:

- Ensure the test reliability.

- Indicate the appropriate time to answer the questions of the test.

- Establish the test validity.

- Check the appropriateness of the test questions to the participants.

3.3.3.3Reliability of the WF Test.

To calculate the reliability of the WF Test, the researcher used Cronbach's (1951). Reliability shows how far items are closely related as a group. Table 2 indicates the coefficient of the test reliability.

Table 2

Test Reliability Coefficient

Cronbach's Alpha	**N of Items**
0.75	8

Table 2 shows that the alpha coefficient for 10 items is 0.75, which is higher than zero, thus it indicates That the items have relatively high internal consistency and consequently the test has high stability and consistency.

3.3.3.4 Test Timing

The researcher recorded the time taken to answer the test during the pilot administration and used the following formula to calculate the average time of the test:

T1 + T2+ T3+T4…….

N(33)

Where:

T1= the time taken by the first learner to answer the test.

T2= the time taken by the second learner to answer the test.

N= the number of all learners.

Throughout applying the previous formula, the researcher found out that one hundred and twenty minutes (120 min.) was suitable time to answer the questions of the test.

3.3.3.5Test validity

Test validity means the ability of the test to measure what it was expected to measure. The test was verified by presenting it to a group of EFL jury members who are specialized in teaching English as a foreign language in order to determine its appropriateness for the participants of the study. Some of the jury members presented some comments and suggested some modifications upon which the researcher made some amendments to the items of the test.

3.3.3.6 Calculating internal consistency

To ascertain the internal consistency of the writing fluency components that were measured through the test, Pearson`s correlation coefficients between each component and the total score of the test were calculated after deleting the targeted writing fluency component from the total score. The following table shows Pearson`s correlation coefficients:

Table 3

Correlation coefficients between the degree of each component and the total test score

Writing fluency component	Correlation coefficient to the total score
Mechanics	0.69
Organization	0.68
Writing smoothness	0.70
Detecting information and interpretations,	0.66
Reflection	0.60

Table 3 indicates that all the components are statistically significant. This indicates the internal consistency of the test.

3.3.4. Writing fluency rubric (appendix D)

3.3.4.1 *Aim*.

The writing fluency rubric was designed to evaluate the participants` performance in the pre/posttest so as the researcher can deduce the learners` ability to use the written language fluently before and after applying the program.

3.3.4.2 Description.

The researcher found that measuring the writing fluency is not a simple process. According to Atasoy and Temizkan, (2016), in their research, quantity and quality are the main dimensions to be discussed. The dimension of quantity includes the average of words composed each moment whereas the dimension of quality includes the following sub-dimensions:

(1) Text accuracy, (2) word and sentence complexity, and (3) the organization of ideas.

The researcher in this study developed a rubric that consisted of five components for assessing the participants` writing fluency.

3.3.4.3. Rating the rubric

The five components chosen by the researcher are rated according to a rating scale ranging from the emerging level to the fluent level. Learners' scores range from '0 to 5' for the emerging level which indicates the lowest level till '16 to 20' for the fluent level which indicates the highest level.

3.3.4.4 Validity

The researcher verified the validity of the rubric through presenting it to some jury members and making use of their advice and their insightful comments and modifications to get the final form of the rubric.

3.4. Self-regulation scale (Appendix E)

Various studies have described many scales for measuring self-regulation; however, few scales have been developed specifically for online learning environments. Therefore, the researcher used an adapted rubric that was rather appropriate to the study purpose. That is to have an instrument that was specifically tailored for the current context. The scale aimed to measure the development level of learners` self-regulation before and after applying the suggested AI program. The scale utilized in the study was mainly based on Boekaerts'(1997) Self-Regulated Learning Model, Oxford's (1990) Strategy Inventory for Language Learning (SILL), and Seker, (2016) Self- Regulated Learning Model in which the researcher analyzed various learning strategy models.. In addition to these widely-used learning strategy models, other

models and formations of learning strategies were analyzed, and common themes were determined.

As a result of the analysis, the emerging themes were coded and grouped under three categories, namely, orientation/motivation, performance, and evaluation.

The final form of the scale consisted of two sections. The first section contained demographic questions for data such as age, gender, and different interests. The second section of the scale included 30 statements in a five-point Likert Scale format, marked by 'strongly agree' (1) and 'strongly disagree' (5). The statements were divided into three categories:
(a) Orientation, (b) Performance, and (c) Evaluation; and five subscales (i.e. internal orientation, external orientation, cognitive strategies, metacognitive strategies, and evaluation).

The first component included items (n = 14) to identify motivational orientations regarding both internal and external motives. Results of previous studies confirmed the explanatory power of motivational strategies in predicting foreign language achievement and a self-regulated learner is characterized as being motivated and capable of setting clear goals (Beishuizen & Steffens, 2011).

The second component addressed performance strategies (n = 21) and consisted of two sub-scales: cognitive (n = 8) and metacognitive strategies (n = 13). Cognitive strategy refers to any strategy used to work on the learning material at hand, such as analyzing, taking notes, rehearsing, getting the main idea, and memorizing. Cognitive strategies can be defined as providing an explanation, coordination, and rehearsal. Whereas elaboration represents the

strategies that connect the existing information with the recent one, organization strategies help learners to retrieve the knowledge required for learning. Rehearsal strategies, on the other hand, are used to keep the recently learned information in the working memory by memorizing or repeating it. Items related to metacognitive strategies made up the second sub-scale under the performance component. Metacognitive strategies represent a substantial category in some widely used self-regulated language learning scales and have frequently been found to highly correlate with general learning outcomes as well as with foreign language learning outcomes.

In order to effectively use metacognitive strategies, one must control and regulate their understanding of cognition so as to achieve their goals. Learners must acquire adequate metacognitive information, which includes an understanding of their own learning preferences and the demands of the learning tasks, in order to activate metacognitive strategies. which include an understanding of their own learning preferences and the demands of the learning tasks, in order to activate metacognitive methods. Learners can control and accommodate the strategies needed to plan their learning, create problem-solving strategies, make appropriate learning decisions based on the language tasks, explore new learning methods, complete the task, and entail this information independently in new learning contexts by utilizing their metacognitive knowledge. In language learning, metacognition aids language learners in achieving better results, understanding written texts faster, and having better retention abilities.

The last component consisted of eight items for evaluation strategies and involved reflecting on the learning outcomes, evaluating the results by referring to the targeted goals, and, in case of dissatisfaction, modifying or alternating the strategies implemented during learning. Having efficient evaluation strategies is

not only necessary to reflect on the learning outcomes but also crucial for the process of evaluating the strategies employed and modifying or alternating them if needed. Monitoring the outcomes and having the ability to alternate strategies will encourage and assist learners in defining and shaping strategies for further learning experiences, and aid them on the way to becoming fully self-regulated.

3.4.1. Internal consistency of the self-regulation scale

To ensure the internal consistency for the components of the self-regulation scale, the correlation coefficient between each component and the total degree of the scale was calculated after deleting the effect of the subscale from the total degree.

Table 4

Correlation values between the degree of each component and the total degree

Components	**Correlation**
Orientation	0.67
Performance	0.71
Evaluation	0.64

Significant 0.01 as n= 30, P≤ 0.45.

Table 4 shows statistically significant correlations between each item and the total sum of the scale which ensures the internal consistency of the scale.

3.4.2. Internal consistency for the items of the self-regulation scale

To ensure the internal consistency for the items of the self-regulation scale, the correlation coefficient between each component and the total degree of the scale was calculated after deleting the effect of the item from the total degree.

Table 5

Correlation values between the degree of each item and the total degree

Correlation values with total degree	Items No	Correlation values with total degree	Items No	Correlation values with total	Items No
0,68	21	0.56	11	0.69	1
0,64	22	0.65	12	0.60	2
0,57	23	0.64	13	0.61	3
0,68	24	0.66	14	0.61	4
0,65	25	0.66	15	0.60	5
0,60	26	0.66	16	0.60	6
0,60	27	0.61	17	0.63	7
0,66	28	0.61	18	0.63	8
0,69	29	0.55	19	0.62	9
0,63	30	0.67	20	0.68	10

Significant 0.01 as n= 30, P≤ 0.45 .

Table 5 shows statistically significant correlations between each item and the total sum of the scale which ensures the internal consistency of the scale.

3.4.3 Internal consistency of the whole scale

• **Alpha- Cronbach:** Cronbach's alpha coefficient was calculated for the scale and its value was 0.85, which is an acceptable value and generally indicates the accuracy and reliability of the test as a means of measurement, and therefore it is reliable.

3.5 The artificial intelligence program (appendix F)

Purpose of the program. The proposed program (Appendix F) was designed to contribute to developing the writing fluency components for preparatory three English learners; through adopting AI applications.

***Performance objectives of the program*.** By the end of the program, the learners were expected to:

- Express their thoughts in language in general and in writing fluency in particular, enhance their reflection ability and demonstrate a conscious and thoughtful understanding of visualized items.
- Provide a thoughtful and logical reflection of topics that indicates a significant depth of self-reflection.
- Demonstrate unity and coherence within written sentences, organization, and clear sequence of events.
- Create writing sequence, avoid unnecessary ideas repetitions and utilize supplementary ideas.
- Use various coherent sentences in writing naturally and smoothly in addition to having the ability to pinpoint significant ideas with natural rhythm and flow.
- Produce well-written explanations of pictures or videos, showing deep interpretations and producing reasoning links between ideas and topic.
- Make correct punctuation, accurate spelling, and maintain using correct grammar rules.

Performance objectives of the program regarding self-regulation. By the end of the program, the learners were expected to:

- Determine personal goals such as communication with others and using technology.
- Decide what to study, and use study materials efficiently.
- Understand the task, use relevant resources and manage the time needed for completing a task.
- Cope with obstacles and have persistence for success.
- Reflect on learning outcomes.

Description of the program. The program is based on adopting AI applications to enhance EFL students` language writing fluency and self-regulation. The program consists of 24 sessions, three sessions a week; including two

orientation sessions to illustrate the target of the program, its components and explain the expected positive effect of using AI applications in learning. The researcher aimed to develop the learners' WF as well as their self-regulation. The duration of the program was forty -eight hours. The session activities contain different AI applications which the instructor has chosen to support and enhance the learners` writing fluency components and self-regulation regarding the following characteristics:

- Flexible and attractive.
- Supportive and provoking learners` thinking.
- Expanding ideas through collaborative activities of sharing ideas.
- Identifying items of topics, videos, and text.
- Posing some questions such as: What is going on in the AI world they are dealing with? And how are you dealing with the situation you experience in the AI world?
- Helping learners give reasonable solutions for some problems, guided by the instructor.
- Provoking and supporting the learners` interpretation ability.
- Helping learners to increase their individual reflections using some AI in V+R world applications such as" *Non-Stop English VR application" – ''Mondly AI in VR world application''- Mondly AI in AR-* Chatbots and Duolingo- Andy – Semantris.
- Guiding learners to give relevant solutions for some problems, guided by the instructor. All solutions are directed toward achieving the intended learning outcomes (ILOs).
- Stimulating the learners` desire to learn English.
- Encouraging learners to decide, plan and understand what they study.
- Coping with obstacles, asking for and receiving support among the learners and each other.

The AI Program included the following:

Twenty-four sessions including two orientation sessions. The purpose of the orientation sessions is to illustrate the concept of AI to the participants, its recent applications in learning, raise their awareness of its importance and efficiency in learning, and motivate their desire for learning (their self-regulation).

Twenty-two sessions, one different topic for each, using some activities and applications. The topics were selected precisely to suit the participants' interests in addition to their relationship with their curriculum needs. During the application, the +researcher aroused a number of open-ended questions for the participants to urge them to make interpretations of the AI world to which they are applying its activities.

Each session started with presenting objectives, aids, and warm-up activities integrated with information about the topic then the sessions were divided into three stages lead-in, procedures, and consolidation.

Sources.

In order to prepare the program's activities, several sources were used such as the Microsoft store for Minecraft game modded by AI Grammarly program that would assist in holding discussions and posing questions created by the researcher. Moreover, the researcher used Google Play for AI learning applications.

Duration of the program

The program consisted of 24 sessions, three sessions a week; two hours each. The program continued for eight weeks so the total duration was 48 hours.

Activities and learning strategies. The researcher prepared and designed activities that aimed at enhancing the participants` WF and their self-regulation. These activities depended on using AI applications that reinforce collaboration

through peer work such as group discussions, class discussions, and peer editing. The researcher also posed some questions that develop the participants` interpretations abilities, their reflection, and organization of thoughts.

Some of the questions are:

1- Where are you in the VR- AI world?
2- What`s going on in this world?
3- How do you feel during engaging in this activity?
4- How can you describe in an organized paragraph form the topic of the incidents in the AI context?

The researcher also used more techniques to develop the participants` writing fluency and self-regulation. Such techniques included reinforcing domains of ideas, encouraging and scaffolding learners` discussion, observation, and interpretation. Moreover, these techniques motivate learners to express their opinions and support them with evidence, exchange ideas and information to construct meanings with each other which significantly contribute to improving their writing fluency level.

3.8Assessment

3.8.1 Writing fluency assessment for preparatory stage students

Molin et al., (2020) assure that traditional educational institutions hardly provide students with the desired or necessary formative assessment. Teachers` amount of time dedicated to providing learners with formative assessment is quite limited. This happens as a result of overloaded classes and amount of curriculum. Students should be Self-regulated, responsible, internally motivated, and actively engaged in profound and meaningful education.

To evaluate the participants` writing fluency, the researcher has to ensure their ability to write fluently. Throughout various discussions and diverging views, various related ones were linked to assist participants` developing abilities to share and construct meanings. Then, they were assisted in making

connections across content areas to extract deeper meanings and foster more understanding than is possible through adopting AI.

Learners–centered facilitation techniques; including strategies for writing and paraphrasing to create an engaging group discussion environment. In addition to, creating well carefully chosen AI activities that depend on engaging learners to solve complex problems while regarding, establishing evidence, contributions, and perspectives of their peers so students can be successfully assessed through AI activities which provide them with opportunities to practise the target language and receive feedback on their productions. One of the most significant contributions of AI is providing learners with immediate feedback.

Participants` progress was supported by facilitating discussions of the selected AI and AI- VR works and environment which worked as evaluation devices for constructing meanings, communicative abilities, reflection and organizing ideas in coherence.

Based on the previous procedures, the assessment of the participants` writing fluency considered the following forms:

- Learners during discussions had to assess each other`s ideas, opinions, and reflections and pick out the most relevant and effective one. In a related study, the impact of peer assessment training on writing performance among Arab EFL high school students was examined by Almahasneh and Abdul-Hamid (2019). Results showed that peer assessment permitted students to comment on the points of strengths for their peers` work using guided and useful criteria. Students were also able to refine their feedback in writing performance during peer assessment.

- AI applications` assessments allows students to find out information by themselves rather than receiving it directly from their teachers which allows them to develop their abilities of problem solving, reflective thinking, analyzing and producing responses so such skills can be transmitted to other learning experiences.

- The researcher had to check the learners` discussion regularly, analyze, and paraphrase their responses so as to enable him to assess their progress and embed the targeted phrases, expressions, and implicit grammar correction.

At the end of the program, the summative assessment had to be applied through the administration of the post-writing fluency test.

3.8.2 Self-regulation assessment

Within the academic context, self-regulation learning processes can be developed through training; therefore, there is a need for the assessment of the participants` self-regulation to support its development in the participants. Kara.et al., (2017) add that when assessing self-regulation achievement, the developmental process had also to be considered, especially with regards to environmental factors and care as well as social interactions to include teachers, peers, and the physical environment .

Based on the previous indications, the assessment of the participants` self - regulation considered the following

- Self-regulation supports learners to be able to manage and adjust their behaviors to environmental demands through the development of cognitive, socio-emotional, and physiological skills (Skibbe,et al.,2019). Thus, the

researcher made sure that each activity includeed learning for personal goals such as communications with others, desire to use English, and ability to understand the task.

- Well-developed self-regulation leads to positive adjustment and developmental outcomes (Coelho et al., 2019). Throughout the program, the researcher assessed the learners` ability to have time management for the needed tasks or activities they were required to do. In addition to, modifying the study skills according to their needs.

- Every activity assesses the learners' self-regulation through reflection on both learning outcomes and performance.

- At the end of the program, the summative assessment had to be applied through the administration of the self-regulation scale.

Chapter Four
Results and Discussion

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This chapter aims at illustrating, interpreting, and discussing the results of the study. It is divided into three parts. The first part presents thorough quantitative data analysis of the pre/post implementation results through statistical operations and the verification of the research hypotheses. Results are then explained and discussed. The second section presents a qualitative analysis of the results obtained from some of the participants` writings; supported by the related studies and literature. Then, the data gained by the participants' questionnaire is analyzed. Finally, the chapter presents general conclusions on both the quantitative and qualitative findings. In addition to some drawbacks and challenges that occurred during conducting the study.

4.1 Results of the Study

To obtain the results of the study, the researcher answers the main question presented in the first chapter:" **How can AI applications in education enhance EFL students` language writing fluency and self-regulation?''.** To answer the previous question, the researcher had to examine the first hypothesis.

4.1.1 Testing the validity of the first hypothesis

The first hypothesis states that there is no statistically significant difference between the mean scores of the study participants on the pre and post-writing fluency test applications as an overall degree in favor of the post-test.

To verify this hypothesis, a t-test for two paired samples was used to determine if there was a significant difference between the participants' “writing fluency" mean scores in the pre and post applications of the WF test. These results are explained in Table 3:

Table 6

t-test Results of Differences between the Participants' Mean Scores on the Pre and Post-WF regarding their Overall Writing Fluency. (n= 32),

Component	Mean		Std. Deviation		T- test Value	Sig.	Effect size (η^2)
	Pre	Post	Pre	Post			
Overall writing fluency	36.19	66.96	23.13	20.71	10.120	0.000	**0.768**

Table 6 shows that the average of the participants' mean scores in the post WF test as an overall degree are higher than their mean scores in the pretest which indicates that the participants' level in writing fluency components as an overall degree were improved after using the proposed AI program. Moreover, the standard deviation of the mean scores in the WF post-test as an overall degree is lower than the pre-test. This indicates the convergence of the participants' level in the overall WF components after using the proposed AI program.

In addition, the table shows that the probability value of t. calculated (0.000) is less than the significance level of 0.01 between the mean scores of the study participants on the pre and post writing fluency test as an overall degree. This indicates a statistically significant difference at the significant level of 0.01 in favor of the posttest scores so the zero hypothesis is not accepted whereas the alternative one is to be accepted. Therefore, it can be concluded that there is a statistically significant difference at the level of ($0.05 \geq \alpha$) between the mean scores of the study participants on the pre and post-WF test applications as an overall degree in favor of the post-test. Consequently, it could be concluded that the proposed program was effective in enhancing the learners' overall WF; so, the first hypothesis could be verified

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The effect size was calculated using Eta square (η 2). Abd El-Hameed (2016, pp. 273-284) mentioned that the effect size is calculated in case of using t-test for paired– samples or independent samples through the following mathematical formula:

Effect size (η2) = t2 ⁄ (t2 +df)

Where df = degrees of freedom , T = computed t value

And (η2) is interpreted as follows:

If (η 2) < 0.010, then the effect size is weak.

If 0.010 ≤ (η 2) < 0.059, then the effect size is small.

If 0.059 ≤ (η 2) < 0.138, then the effect size is medium.

If 0.138 ≤ (η 2) < 0.232, then the effect size is large.

If 0.232 ≤ (η 2), then the effect size is very large.

From the previous table, it is clear that the value of the effect size expressed in the Eta square for writing fluency components as an overall degree equals (0.768), which is higher than (0.232), and this means that the effect size is very high. This indicates that the proposed AI program has a significant impact and is very effective in developing WF as an overall degree for third-year preparatory school students.

4.1.2 Testing the validity of the second hypothesis:

The second hypothesis states that there is no statistically significant difference between the mean scores of the students of the research group in the pre and post-applications of the WF test as sub-components. To verify this hypothesis, a T-test for two paired samples was used to indicate if there was a significant difference between the participants' “writing fluency" mean scores in the pre and post applications of the WF test as sub-components. Results are clarified in Table 7 as follows:

Table 7

t-test Results for the Significance of Differences between the Participants` Mean Scores on the Pre and Post the writing fluency test as sub-components, where (n = 32

Components	*Mean*		*Std. Deviation*		*T- test Value*	*Sig.*	*Effect size (η^2)*
	Pre	**Post**	**Pre**	**Post**			
Mechanics	8.63	14.88	5.64	1.14	8.455	0.000	*0.698*
Organization	10.37	14.09	5.38	1.37	6.021	0.001	*0.539*
Text smoothness	4.87	12.31	4.61	1.94	8.334	0.000	*0.691*
Detecting and producing interpretations,	5.62	12.66	4.77	1.99	8.487	0.006	*0.699*
Reflection	6.68	13.03	5.06	1.65	6.753	0.003	*0.595*

From the previous table 7, it is clear that the participants` mean score in the pre and post-administration of the WF test as sub-components is higher than the pre- application, and this indicates that the level of participants in all components of WF increased after using AI applications. Moreover, the standard deviation of the participants` scores in the post- application of the writing fluency test as sub-components is less than the pre-application. This indicates that the level of the participants in all components of WF were improved after applying the proposed AI program.

The table also shows that the probability value of t. calculated regarding WF components, is less than the significance level of 0.01. This indicates that there is a statistically significant between the pre and post- WF test as sub linguistic components at the significance level of 0.01 in favor of the post-test. Consequently, the zero hypothesis is refused whereas the alternative one is accepted. Therefore, it can be concluded that there is a statistically significant

difference at the level of ($0.05 \geq \alpha$) between the mean scores of the participants on the pre and post - WF test applications as sub linguistic components in favor of the post-test.

From the previous table, it is clear that the value of the effect size expressed in the Eta square for WF is higher than (0.232), and this means that the effect size in developing the components of WF is very large, and this indicates that using AI applications has a significant impact and is very effective in improving WF as sub-components degree for third-year preparatory school students.

4.1.3 Testing the validity of the third hypothesis:

The third hypothesis states that there is no statistically significant difference between the mean scores of the research group students in the two applications, the pre and post applications of the self-regulation scale as a total score. To verify this hypothesis, a T-test for two paired samples was used to determine if there was a significant difference between the participants' self-regulation mean scores in the pre and post application of the self–regulation scale as a total score. Results are clarified in Table (8) as follows:

Table 8

t-test Results for the Significance of Differences between the Participants" Mean Scores on the on the Pre and Post application of the self-regulation scale as a total score, where (n = 32), (degrees of freedom = 31)

Performance	***Mean***		***Std. Deviation***		***T-test Value***	***Sig.***	***Effect size (η^2)***
	pre	**post**	**Pre**	**Post**			
Self–regulation as a total score	38.87	72.28	5.89	7.11	23.453	0.000	*0.947*

Table 8 shows that the average of the participants' mean scores in the post applications of the self-regulation scale regarding the total degree are higher than their mean scores in the pretest application. This indicates that the participants' level in self-regulation were improved after using the proposed AI program. Moreover, the standard deviation of the mean scores in the post-self-regulation scale is less than the pre - self-regulation scale which indicates the convergence of the participants' mean level in self-regulation after using AI applications.

In addition, the table shows that the probability value of t. calculated (0.000) is less than the significance level of 0.01, which indicates a statistically significant difference at the significance level of 0.01 in favor of the post scale so the zero hypothesis is rejected whereas the alternative one is accepted. Therefore, it can be concluded that there is a statistically significant difference at the level of ($0.05 \geq \alpha$) between the mean scores of the research group on the pre and post-self-regulation scale for as a total degree in favor of the post-test."

From the previous table also, it is clear that the value of the effect size expressed in the Eta square for self-regulation equals (0.947), which is higher than (0,232). This means that the effect size in self–regulation is very high, and this indicates that the use of artificial intelligence has a significant impact and is very effective in developing self-regulation as a total degree for third-year preparatory school students.

4.1.4 Testing the validity of Fourth hypothesis:

The fourth hypothesis states that there is no statistically significant difference between the mean scores of the students of the research group in the pre and post-applications of the self-regulation scale as sub-components. To verify this hypothesis, a T-test for two paired samples was used to determine if

there is a significant difference between the participants' self-regulation mean scores in the pre and post administrations of the self–regulation scale as sub-components. Results are clarified in Table (9) as follows:

Table 9

t-test to results to indicate the differences between the mean scores of the participants of the research group in the pre and post-administration of the self-regulation scale as sub-components, where (n = 32), (degrees of freedom=31).

Components	***Mean***		***Std. Deviation***		***T- test Value***	***Sig.***	***Effect size (η^2)***
	pre	**Post**	**Pre**	**post**			
Orientation	12.00	21.81	2.06	3.12	14.889	0.003	*0.877*
Performance	23.06	42.75	5.52	5.83	16.639	0.001	*0.899*
Evaluation	3.81	7.65	0.96	1.03	15.107	0.005	*0.88*

Table 9 shows that the average of the participants' mean scores in the post application of the self-regulation scale regarding the sub-components are higher than their mean scores in the pretest application. This indicates that the participants' level of self-regulation were improved after using the proposed AI program. In addition, the standard deviation of the mean scores in the post-self-regulation scale is less than the pre-test which indicates the convergence of the participants' mean level in self-regulation after using AI in learning.

Moreover, the probability value of t. calculated (0.000) is less than the significance level of 0.01, which indicates a statistically significant difference at the significance level of 0.01 in favor of the post questionnaire so the zero hypothesis is rejected whereas the alternative one is accepted. Therefore, it can be concluded that there is a statistically significant difference at the level of

($0.05 \geq \alpha$) between the mean scores of the research group on the pre and post-self-regulation scale for the sub-components in favor of the posttest.

From the previous table, it is clear that the value of the effect size expressed in the Eta square for self-regulation components is greater than (0.232), and this means that the effect size in self–regulation is very large. This indicates that the use of artificial intelligence has a significant impact and is very effective in developing self-regulation as sub-components for third-year preparatory school students.

4.1.5 Measuring the effectiveness of the proposed program in enhancing language fluency and self-regulation:

Although the effect size is very large in the previous table which indicates the effectiveness of using artificial intelligence in improving writing fluency and self-regulation for preparatory school students , the corrected gain percentage was calculated for Ezzat (Ezzat Abdel Hamid, 2013 , 28) is given by the formula:

$$CEG_{ratio} = \frac{M_2 - M_1}{P - M_1} + \frac{M_2 - M_1}{P} + \frac{M_2 - M_1}{M_2}$$

CEGratio = Corrected Gain Ratio

M1 = Mean of pre –Measurement.

M2 = Mean of post-measurement

P = the maximum score for the test

This is interpreted as follows:

- If the corrected gain ratio is less than 1.5, the program is ineffective.
- If the corrected gain ratio is between1.5 to 1.8, then the program is of average effectiveness.
-If the corrected gain ratio is greater than or equal to 1.8, the program`s effectiveness is acceptable or it is considered as effective.

The following table shows the corrected gain ratio values:

Table 10

The averages of the scores of the research group in pre and post-application, of writing fluency and self-regulation, and the corrected gain percentage for Ezzat.

Performance	*Full Mark*	***Mean scores***		***Ezat correct Ratio***	***Gain significance***
		Pre M_1	**Post M_2**		
Writing fluency	100	36.19	66.96	1.72	*Average effectiveness.*
Self – regulation	90	38.87	72.28	2.91	*Effective*

It is clear from the previous table 10 that Ezzat`s corrected gain percentage regarding enhancing writing fluency for third-year preparatory school students equals (1.72), which ranges between (1.5 and 1.8). This indicates the use of AI is average in its effectiveness in enhancing writing fluency among third-year preparatory school students "the research group", Ezzat`s corrected gain ratio regarding enhancing self-regulation equals (2.91), which is higher than (1.8), and this indicates that the use of artificial intelligence is effective in enhancing self-regulation among third preparatory grade students "the research group''. Consequently, the fourth study question of the research is answered, which states: What is the effectiveness of using AI applications in enhancing the students` self-regulation and language writing fluency for preparatory three students at governmental language schools?

4.2 Discussion of results

Throughout the previous statistical analysis, it was clear that the participants` writing fluency and self – regulation were enhanced after applying the proposed AI program. Results also clarified the significant difference between the mean scores of the study participants on the pre and post-WF test as a whole and its components. In addition to achieving a significant difference

between the mean scores of the study participants on the pre and post-self – regulation scale and the effect size which varied from high to medium. This indicated that the participants` writing fluency and self-regulation were enhanced after being taught using AI applications. Consequently, this revealed that the proposed AI applications used in the study, had a positive effect on enhancing the 3rd year preparatory stage students` WF in addition to enhancing their self-regulation.

The previous results showed significant statistical differences between the participants' mean scores in the pre and post applications of the WF components test compared with the t-table which proved a great enhancement in the participants' levels of WF components in the dependent variable and in enhancing the WF components.

The researcher believes that the enhancement of participants` WF could be due to the following reasons:

1- AI applications provided participants with opportunities to have rich and practical environments to establish connections between the classroom language and their real life language. This occurred through engaging in realistic activities that allowed them to use grammar implicitly to visualize, analyze, construct meaning, reflect, and express opinions and ideas. This agreed with the results of the study of Sumakul et al., (2022) who concluded that using AI in learning increased the learners` motivation to use the language and assisted them to overcome obstacles that affected their communicative competence.

2- AI applications represented a well- structured and an effective learning environment that would enhance autonomy in terms of error correction and providing feedback.

3- All the program`s topics were selected according to the participants` current interests which increased their motivation to engage in the activities and tasks using the language to fulfill the required tasks.

4- AI applications enabled Participants to create meaningful, organized topics and discuss them with their partners. These findings were consistent with the study of Labidi (2022) who concluded that the linguistic richness of AI activities resulted in better opportunities for learners to use the language meaningfully.

5- Throughout the sessions, participants' responses, comments, and questions were regularly assessed. The researcher's notes and personal observations, Grammraly app which provided immediate correction as well as the participants' collaborative assessment based on peer feedback, all contributed to enhancing the participants` language performance as well as their written language production. This finding was consistent with Losada et al. (2017) and Kleanthous & Cardoso (2016) that pointed out the importance of ongoing observation, teacher`s notes, continuous assessment and feedback. In addition, the studies also emphasized using peer feedback to provide collaborative assessment, contributed to producing more accurate grammarly written texts and consequently enhancing the learners` written language.

6- All the selected AI applications that were *Minecraft game in Grammarly AI mode, Semantris vocabulary AI game, Mondly VR in AI mode and some selected chatbots* were linguistically rich. In addition, choosing interesting and culturally rich topics, increased the participants` curiosity to use the target language to answer questions, write about places, travel, and work. This increased their active participation in the writing activities independently in terms of vocabulary, grammar and reflection. This also enabled participants to establish meaningful and logical sequence of ideas and discuss them with their partners.

7- The researcher`s explanation to the aims of the program to the participants, and providing them with clear instructions on their roles as well as the researcher's role during the treatment, had a positive effect on the participants' learning. Eventually, they improved their WF to express meanings rather than to just concentrate on language form. This enabled them to focus on the purpose of each activity and behave according to that purpose. Moreover, having a comfortable learning environment where they could respond freely to the activities and encouraged them to express their opinions, also contributed to achieving the aims of the program.

8- Using Pair, group, and collaborative work was an essential factor that had a positive effect on the participants' written language production. Participants were encouraged to use pair and group work to use the language which allowed them to assist each other and reflect on each other`s work on performing the required tasks. Moreover, they exchanged information and performance during their work which in turn helped them to construct and improve their own work. This result was consistent with the findings of Ortiz and Cuéllar's (2018) study, which came to the conclusion that the students' cooperative work during the tasks to support one another, helped the study to achieve its goals. In further research, González-Lloret (2020) concluded that group work and collaborative learning enhanced students' writing and oral communication abilities as well as their self-confidence, and self-regulated learning.

Results of the WF components varied as explained in the t-test and calculating the effect size of t calculated value of reflection (0.595) and organization (0.539) which are regarded as the least affected components. This could be because the participants were not trained well to develop these components before or because most English teachers used to provide their

learners with vocabulary, asking them to memorize new words and learn grammar rules explicitly away from training them on using them correctly. So the researcher believes that these components need more attention and modification of curriculums and using further AI teaching strategies to train learners on:

- Using grammar rules that enable them to form correct structured sentences.
- Reflecting the newly learned vocabulary in authentic targeted paragraphs.
- Reflecting their opinions, ideas, and have alternative ways to deal with controversial issues.
- Organizing their thoughts and have a logical arrangement of these written thoughts.
- Working in collaborative and group working environment.

Concerning, results indicated in the previous tables regarding the total degree of self–regulation scale using t-test and calculating the effect size of t-calculated value showed a significant statistical difference between the participants' mean scores in the pre and post administrations of self–regulation scale in favor of the post application of the program. Moreover, the effect size score was high which proved high effectiveness in the dependent variable and in enhancing the overall self-regulation. Therefore, the researcher could assume that the program was helpful in enhancing the learners' self-regulation. Consequently, the second research hypothesis has been verified.

Results indicated in the previous tables regarding the components of self-regulation using the t-test and calculating the effect size of t calculated value of the sub-components of self-regulation asserted a significant

statistical difference between the participants' mean scores in the pre and post administration of the self-regulation components questionnaire compared with the t-table which showed high development in the learners' level of self-regulation components on the dependent variable and on enhancing the self-regulation components.

The development of the participants` self-regulation as a whole is due to using AI applications in learning as they:

- Allow participants to regulate and control their own learning processes in learner-paced open and distance learning environments.
- Help participants to use a variety of cognitive strategies that aid them in processing, interpreting and retaining knowledge.
- Foster learning for individual objectives including social interaction and technology use, feeling successful, using English for doing missions, etc (Internal orientation).
- Urge participants ` desire for future jobs, satisfy parents and teachers (External orientation)
- Contribute to guiding participants to know how to organize, monitor, and regulate their intellectual processes in order to achieve their personal objectives (*metacognition*).
- Enable participants to participate in the choice, control, have persistence, coping with obstacles, and monitoring of parts connected with academic tasks.
- Improve participants' abilities in reflecting on learning outcomes.

4.3 Qualitative Analysis and Discussion

In this part, the researcher analyses the qualitative data collected from participants' writings with regard to writing fluency components and how they were enhanced after applying the program`s tasks and activities. Then she identifies the qualitative results and provide further explanations for the findings. Then, there is a discussion of the self-regulation questionnaire

presented to the participants before and after the application of the proposed AI program.

4.3.1Analysis of the learners' writing with regard to the targeted WF components.

The study program was clearly effective in enhancing the participants` WF through the program`s AI applications. The researcher in the current study guided the participants to tackle some components of WF, i e, mechanics, organization, text smoothness, detecting and producing interpretations and reflection that were targeted by AI applications. The following analysis discusses the participants' performance with regard to each component and how it was enhanced.

4.3.1.1 Mechanics

The term "Mechanics" generally refers to the technical rules that form syntax and grammar. It is the norm regulating writing's techniques, such as capitalization, punctuation, and abbreviations.

In the WF pre- test, throughout the samples of the participants` writing of different topics included in the writing fluency, it was clear that participants did not pay due attention to the importance of doing well mechanics written work. Most of them neglected using capitalization, punctuation marks and keeping the unity of tenses in writing the required topics. Following are some examples:

- **Participant Hussien** answered the question "*Covid 19 is a legend and has no effect on man`s life"*as followed:

covid 19 isnt a legend because much people are injured they went to hospitals and some people died i also know doctors warn people of it some people stayed in homes and didn`t go out for long time.

- **Participant Mariam :**

Covid 19 isnt legend because a lot of people were sick they went to hospitals and some people died and some people stayed at homes and didn`t. no one can visit them

It is clear that the participants did not pay attention to the inevitability of starting each sentence with a capital letter. They also neglected using the apostrophe mark for abbreviation. Moreover there was no fixed tense in their writing as one of the participants started writing using the present simple tense then shifted to the past simple tense without any logical reason for using different tenses whereas the second participant tended to use the past simple then shifted to the present simple tense without any logical reason too.

During the program, the researcher clarified the importance of producing correct mechanics written sentences and that neglecting capitalization and punctuation marks will cause uncompleted work. After that, The researcher asked the participants to watch a video about the robot Sophia during her first visit in Sweden, write notes during watching and then using Minecraft world integrated with Grammarly app. They were required to have chats in groups to each other about the ideas they got through watching, paying attention to Grammarly mechanics, vocabulary and grammar correction and being aware that neglecting this correction would lead to losing grades in their group competition.

Participants were able to provide related vocabularies, write correct punctuation marks and correct grammar after practicing the words and expressions they watched in the video. This is because they were trained to apply the language mechanics more appropriately. In spite of doing some lexical and grammatical mistakes in writing, there was a remarkable progress in their answers compared to their previous ones before watching the video and doing the AI activity.

These are examples of some participants' performance after applying the program that shows the enhancement of their mechanics in writing:

- **The student Hussien answered the the same fourth question as followed:**

Covid 19 isn't a legend because many people are injured. They went to hospitals and some people died. I also know doctors warn people of it some people stayed in homes and didn`t go out for long time.

Source. A screenshot of the participants Chabot on Minecraft game

- **Participant Mariam :**

Covid 19 isn't legend because a lot of people were sick. Many of them were locked at homes. Others went to hospitals to have continuous care. Some people died and no one could help them. There are also a lot of research that confirm that the virus is not a fake or unreal thing but it is existent and spread all over the world.

As noticed from the previous participants' samples, there was a remarkable improvement in their carefulness to use correct grammar forms suitable to the topic they were writing in addition to paying attention to using correct punctuation marks that regulate writing techniques.

4.3.1.2 Organization

The ability of participants to organize their thoughts and ideas was remarkably enhanced throughout the program. The instructor drew the learners` attention to the importance of not only having enough number of ideas and reflection on these ideas but also to the inevitability of organizing these thoughts and ideas in coherent sentences and arranging them in a logical sequence. During the activities participants produced logical sequence of organized, related ideas to communicate and report information.

The researcher chose two questions that are appropriate to the participants` level. These questions aimed to measure their organization ability in writing before and after applying the program.

In the WF pre- test, when participants were asked to fill in blanks with suitable given words to produce an organized sequence of ideas to form a paragraph, most of the participants could not choose the appropriate words to fill the gaps though the meanings of words were familiar to them, they were not aware of the importance of producing an organized sequence of ideas. Following are some examples of the participants` responses to the questions related to organization component:

The participant Adam wrote:

We learn a lot of ***subjects*** *at school. Everything we study has some* ***helps*** *in our life. We learn Arabic to be able to tell others what we want and understand each other. We learn* ***communicate with*** *languages to* ***foreign*** *people from overseas and to know how they* ***think*** *and talk..*

plants *are also very important. They can do sums*

*quickly and **store** information. History tells us **about** our country and people from all over the world. Geography tells us about **Computers** animals and people and where they live. Exercise **uses** us to be fit.*

In the second question, participants were asked to re–arrange sentences to form an organized paragraph. Some of the participants` answers before applying the program were as follows:

The participant Adham wrote:

Someone I'm proud of

Of all the members of my family, my mother is the person I am proud of. She is a very good cook. Moreover, she works hard. She is a useful person in society. She often spends her free time cooking delicious dishes for us, which makes everyone in my family happy She is 40 years old. I consider my mother the best model for me. She looks much younger than her age with short hair and a beautiful face. At work, she is respected by all of her friends. I really admire her for her wonderful dishes. At the end, I always love her and I will always be proud of her.

The participant Mahamed wrote:

Of all the members of my family, my mother is the person I am proud of. Moreover, she works hard. She is a useful person in society. She is a very good cook. She is 40 years old. I consider my mother the best model for me. She often spends her free time cooking delicious dishes for us, which makes everyone in my family happy. She looks much younger than her age with short hair and a beautiful face. At work, she is respected by all of her friends. At the end, I always love her and I will always be proud of her. I really admire her for her wonderful dishes.

In the pre-test, it is noticed in the answers of the participants in the two questions that measure their organization ability, that they could not pay enough attention to the importance of producing a logical sequence and arrangement of the sentences to form coherent sentences or paragraphs whereas, in the post-test, the participants seemed to be more aware of producing organized paragraphs with logical arrangement and reflection of ideas which denotes enhancement in the organization component after the application of AI program.

Some of the participants` answers after applying the program

The participant Adham wrote

Of all the members of my family, my mother is the person I am proud of. She is a very good cook. She is 40 years old. She looks much younger than her age with short hair and a beautiful face. At work, she is respected by all of her friends. Moreover, she works hard. She is a useful person in society. She often spends her free time cooking delicious dishes for us, which makes everyone in my family happy, I really admire her for her wonderful dishes. In the end, I consider my mother the best model for me. I always love her and I will always be proud of her.

The participant Mahamed wrote:

Of all the members of my family, my mother is the person I am proud of. She is a very good cook. She is 40 years old. She looks much younger than her age with short hair and a beautiful face. At work, she is respected by all of her friends. Moreover, she works hard. She is a useful person in society. She often spends her free time cooking delicious dishes for us, which makes everyone in my family happy, I really admire her for her wonderful dishes. In the end, I consider my mother the best model for me. I always love her and I will always be proud of her.

After applying the program, it is noticed that participants were able to formulate organized, coherent sentences and paragraphs. There was a remarkable enhancement in the learners' organization of ideas, texture, good selection of word patterns, and content. The participants consistently used a variety of related sentences written in natural and smoothly technique with correct sentence structure effective, coherent and related ideas.

4.3.1.3 Detecting and producing interpretations

The participants' ability of detecting and producing interpretations was apparently enhanced throughout the program. During the activities, participants could identify, visualize and recognize ideas or topics displayed via pictures, photos, movies, or any other media means and infer the implicit topics or messages out of these means. They could interpret the displayed topics, showing deep interpretations and produce reasoning links between the ideas and the topic. This was evident in writing thoughtful and conscious explanation of visualized topics that indicated their deep understanding and vivid reflection of the displayed items.

In the pre writing fluency test (questions 5 & 6), when asked to watch an online picture about “viruses and diseases” with interpreting photographs and visualize what they would do if they were ministers of health. Most of the participants could not produce well explanation or think deeply of the given photo. They did not have the ability to deepen thinking and visualize themselves as a part of the scene. Moreover, they involved a limited and inconvenient written description of their poor image.

Following are some examples of the participants` writing in the writing fluency pre- test to the following topics:

“Look at the following picture. Express and explain interpretations, of what you would do to fight diseases and improve health conditions if you were the minister of health”.

The participants (Mariam, Esraa, Esraa, and Adham in Group (A) explained and visualized the following ideas:

“*Health problems very important topic be careful. There is diseases such as the flu and viruses. We must take medicine and go to the doctor help. If I were the minister of health, I will make new hospitals and doctors and nurses work hard to solve problems and give good medicine to ill people to help them.*

The participants Mahmoud, Anas, and Ali in Group(B)tackled the following ideas:

“*Doctors care about patients in hospitals and nurses help them too. The minister of health must give them rewards and good salary for their work. They can have many diseases because the viruses and diseases they deal with. If I were the minister of health, I would care about them and offer them good salaries. I will also contribute to making them have a good life.*

The participants Basmala, Tasneem, and Esraa in group (C) visualized the following ideas:

"*It is very important to fight health problems such as diseases that cause a lot of health problems and suffering to many people and make them stop working and unable to care about their families. If I were the minister of health, I will build new hospitals and try to find good medicines for patients. I will also encourage scientific research to produce new medicines."*

In the second topic ; participants were asked to look at a picture, imagine having Artificial Super Intelligent Robot, write answers to questions related to the picture that required testing their ability to detect and give the interpretation such as their opinions of AI and how it could help people in life, work and homes.

Before the application of the program, Group (B) included the following ideas:

"Artificial intelligence became very important. If I have an artificial super-intelligent robot, I will be very happy because it will help me do everything I want. I think it is very good. I don`t think it can replace the human world. It would help me to do the homework for me and clean my home and makes me happy."

In the pretest, it is noticed that the participants' responses on the topic revealed that most of them could not write enough details on tackling that topic, as shown in the previous sample. It is also noticed that the preceded written text lacks natural flow and rhythm. Moreover, the writing of the participant`s sample lacked the selection of appropriate word patterns, vocabulary, and content.

Before applying the program, the participants' responses to the topic indicated how they were not able to show a good explanation of the topic or think deeply about the displayed picture. They could not involve their feelings in the topic, deepen their thinking to express the whole idea or produce reasoning links between their ideas and the topic. It is also noticed that the participants did not expand their ideas during their written responses to the topic and produced very limited illustrations of the procedures they would do to fight diseases if they were ministers of health. They could not depict, construct and develop their ideas as a result, they wrote a lot of unclear ideas without organization or support for these ideas.

At the beginning of the application the program, the participants encountered the same problem. The development of their visualization and interpretation skills was integrated in a sequence of language focused activities.

Throughout the pre-task activity, most of the participants could not detect and find relevant words to visualize and interpret ideas that describe ways of fighting diseases and procedures that could be done in case of having the position of the minister of health. They presented inadequate and limited description of the given topic; indicating unconscious understanding of the items depicted. This could be as a result of the fact that they did not learn before how to visualize, develop their thoughts, or infer meaning from the presented pictures.

The pre-test revealed that the participants were unable to develop their thoughts in an adequate way. They watched a video and had a quick look at pictures without being able to comprehend or interpret pictures. They lacked visualization concepts that would have assisted them in forming, presenting, and constructing their ideas. This was clear in writing irrelevant sentences with unrelated words and meaningless ideas.

The researcher then began to clarify what is meant by depicting and producing interpretations, describing it as the ability to visualize images, films, pictures, or any visual media that are wordless and deduce the implicit ideas out of these visual means. After that, the researcher discussed some topics to motivate and foster the participants' ability to detect, visualize and produce interpretations. She guided them to utilize their senses and apply their thinking to imagine themselves as a part of the topic. During one of the activities the researcher carried out, she asked the participants to examine the following picture and try to visualize, interpret and predict a story to be written in a local magazine entitled "*Real –life robots for a better future*"

Here are examples of some participants' answers:

Group (A) concluded the following ideas:

I think in the future every person will have a robot to help him and carry out everything they need. I can predict a story that will happen in the future in which robots will solve a lot of problems and make life much easier and safer. The photos talk about a young woman whose parents are always worried about her but when they could buy a guard robot, it could follow her everywhere and protect her from any danger she may have. The robots also will serve them at home, cook their food and look after all the family.

Group (B) concluded the following ideas:

These photos predict a lot of matters that can happen in the future because of having robots. Robots will be able to guard people and protect them from danger. They can do dangerous experiments that may harm humans if they did them by themselves. Robots will also work as TV and radio presenters. They will replace doctors and examine patients and give them the right medicine. Everything will be done by robots but people must be careful if theses robots can think and work together, they may destroy people and get rid of them.

Group (C) concluded the following ideas:

We predict that in the future people will depend on using robots. Every person will have single robot to protect themselves from any danger. The scooters will be in place of the cars and buses to protect us from weather. Every person will be alone and we will be lazy to walk.

It is noticed throughout all the participants' samples that their ability to expand their ideas on reflecting their responses towards the displayed pictures was slightly improved. Nevertheless, they did not any have the ability to visualize or interpret texts or pictures clearly. This was evident in producing meaningless sentences containing unrelated words and unclear ideas. Their written sentences were short, unclear and incomprehensible. They lacked the ability to detect and interpret information to convey the meaning.

The researcher then began to illustrate the meaning of detecting and producing interpretations, indicating that they refer to interpreting or reading beyond the wordless images, films, or visual media and drawing conclusions about the implicit meanings included in those visual aspects. Then the researcher chose some VR topics that could attract and stimulate the participants` detecting and producing interpretations ability. She guided them to use their senses and employ their thinking and cognitive abilities to be parts of the displayed scenes.

After applying the program:

The participants' ability of detecting and producing interpretations was remarkably enhanced. Following is a sample of the participants` answers:

Group (A) concluded the following ideas:

"Today the world is facing a lot of health problems because of the existence of many diseases which spread recently. This spread of diseases could be due to pollution, unhealthy food, and WF internet connection. . If I were the minister of health and want to fight diseases, there are many steps I should do. Firstly, I will ask social media means to increase people`s awareness of the importance of eating healthy and fresh food and avoiding eating fast food. Secondly, I will oppose fines

and punishment on factories or any place that throws waste into seas or rivers and cause pollution to the environment. Thirdly, I will build more hospitals and train many doctors and nurses to use the latest forms of technology in their work to help patients to get better quickly. Moreover, I will guarantee safe and satisfied life conditions for the doctors and nurses to encourage them in their mission and not allow any kind of disappointment to stop them. In the end, it is very important for everyone in society to take part in fighting diseases to have a better country with healthy people.

After applying the program, the same group wrote:

"*Artificial intelligence has become one of the most important fields of technology. It is used to do the difficult and dangerous work which humans can`t do. If I have an artificial super-intelligent robot, I will be very happy for a lot of reasons. Firstly, it will help me discover everything I want to know. Secondly, it will change all of my life as it will help me do a lot of work at the same time without feeling bored or tired. Thirdly, I will be able to do amazing and distinguished works which no one can do by themselves but I think it will not replace the human world because nothing can replace the human mind as it invented artificial intelligence and can invent more intelligent and important means of technology. In the end, I think artificial intelligence is very useful and can change the whole world but we must be careful to use it in the good and useful fields and avoid using it in bad and harmful fields."*

After the application of AI activities, it is noticed that the participants could think deeply, interpret the scenes they have watched and expand their ideas. It is also noticed that a lot of the learners could illustrate health problems in an organized way and produce a logical sequence of details that handle ideas and clear vision of presenting effective solutions and suggestions to improve health problems in a case

being in the position of the minister of health. Moreover, the participants showed reasoning links between their ideas and the written topic in addition to expanding the vocabulary used in their writings.

Moreover, in the posttest, after the application of the AI program, the enhancement that happened to the participants' flow, texture, good selection of word patterns, and content could be noticed. The participants consistently used a variety of sentences; writing is natural and flows smoothly, sentences begin with a variety of words, sentence structure is correct and creative, rhythm, coherence, and flow, and sentence type and length are varied and effective.

- **4.3.1.4 Text smoothness**

Text smoothness refers to the learner's ability to use various coherent sentences in writing naturally and smoothly. Throughout the program, the participants' ability to produce relating ideas with natural rhythm and flow was remarkably enhanced. This was evident when they were able to construct flow of ideas from a text, utilize supplementary ideas which are not digressed from the topic, providing a rationale for their choices and avoiding unnecessary repetitions. They could also use variety of vocabulary and sentences to produce reasonable responses in their written production.

The instructor posed two topics, to measure "Text smoothness ". The first was ***Write the first impression that comes up to your mind when you read the coming phrase:***

"Covid 19 is a legend and has no effect on man`s life"

Following are examples of some groups' responses before applying the program.

1st group: *It`s wrong because there are a lot of people dead because the virus is killing them. The news on TV and radio told the people daily about the bad effect of this virus and how it caused many deaths among a lot of people all over the world.*

2nd t group: *"Covid 19 is not a legend and it has much effects on man`s life. We saw many people became ill and got the virus. A lot of doctors warned us from the danger of Covid 19. I think this disease is made to kill people around the world and scientists talk about China as the source of this virus.*

3rd group

Covid 19 can`t be a legend. This dangerous virus killed many people. Many people now are afraid from this virus and people no longer can work or travel as before because they feel scared. It is a dangerous and killing.

The learners responded to the second topic that measures text smoothness which required them to think about what would happen if robots such as Sophia had spread among our lives and if they thought they can destroy humans and replace them, giving reasons for their opinions.

Before applying the program

3rd Group wrote:

" if robots such as Sophia had spread among our lives, I think they will be very dangerous and can destroy our life. They can do all the work and make people jobless and they even can kill people and destroy life on Earth so I think it`s not a good idea."

At the very beginning of the program, most of the participants experienced the same problem, as it was clearly indicated in the previous samples that all the participants had generally one general focused central idea with few relevant details and illustrations. They tended to use just few simple, short sentences. They used a lot

of unnecessary gaps and pauses. Their writing lacked the natural flow of language and the ability of synthesizing new ideas and notions. Some participants attempted to use more ideas to support the topic but still lacked coherence and smoothness in writing. Moreover, some participants tended to repeat the same words and ideas throughout their writing which revealed poor and limited writing fluency.

The researcher then started to explain the meaning of text smoothness, clarifying it as the process of gathering and producing information and ideas with relevant details. In addition, this process of producing and analyzing ideas smoothly includes logical answers to the questions based on them, rational justification and transition for the responses.

The researcher then raised some topics, during the treatment that provided practical opportunities for the participants to motivate them to practise producing smooth texts. The presented topics tend to trigger and stimulate the participants' need to think and generate ideas smoothly. They then were engaged gradually to discover answers and related ideas for discussion. In addition, writing smoothly through those topics involved participants to observe logical sequence of discussion to develop their reflection and elaboration of thoughts.

After applying the program

1st group:

Many people have different opinions about Covid 19. Some believe that it is just a legend and there is nothing called Covid19 and has no effect on man`s life and others believe that it is a true disease that kills many people. The first impression that comes up to my mind when I read the phrase that it is a legend and has no effect on man's life is that it is impossible to be true because a lot of people are having this virus daily and also doctors and scientists could prove that it is already existent and affects man`s life. There are also a lot of science experiments and vaccines that help

to stop the spread of this killer virus. In the end, I think that Covid 19 is a real virus that can kill many people so everyone should be careful and wear face masks to be safe from this disease.

2nd tgroup

The spread of Covid 19 virus is a very serious topic for all the world nowadays. Some people think that it is not a real disease or virus. They think it is just a legend and it does not have any effect on people`s health or life. On the other hand, a lot of people believe that it is a real disease which threatens the life of many people around the world. When I read this phrase, I got the impression that comes to my mind is that it is impossible to be so. This is for many reasons: Firstly, millions of people died all over the world. Secondly, we saw around us and in everywhere that a lot of people were injured and got the virus.So I think that we must not ignore the fact of having such dangerous disease and do our best to fight it. Finally I suggest doing all the required precautions to avoid this dangerous virus to be safe and healthy.

After applying the program, the same group wrote:

‘’ if robots such as Sophia had spread among our lives, I think that will be a double-edged weapon. On the good side, they can do a lot of important and hard work which humans cannot do easily and thus saving effort, time and money. Moreover, they can be a strong defense for countries against enemies. On the other hand, the spread of robots can be very dangerous and can be a threat to people`s lives if they have the willingness and the ability to create more robots and replace themselves with humans. They will also cause a lot of unemployment for many people because they will do most work instead of them. So I think the spread of robots such as Sophia can be dangerous and may destroy life on Earth.

As noticed from the participants' samples after the post-test, the participants produced clear focused central ideas in their written texts. In addition to demonstrating effective use of high-quality, relevant thoughts written in coherence and smoothly way. They clearly addressed the topic justifying their opinions and providing expressive relevant thoughts, powerful functional information and creative instances to demonstrate their ideas for writing. Moreover, their language use and performance was obviously developed. Participants could express and explain their thoughts by using different words. They made a good choice of strong precise words and expressions that were closely related to the topic and directly to the point. They could also produce more coherent sentences with more advanced and correct structures.

Most of them wrote smoothly and confidently while expressing their own opinions about the robot Sophia. They demonstrated their own ideas freely and smoothly to present coherent and convincing form of topics. They also produced connected meaningful sentences. In addition, most participants showed effective and creative use of language. Exchanging chat answers among the participants on *Minecraft* world chatbots integrated with *Grammarly AI* application, provided them with more opportunities to express themselves more freely without worrying about any grammar or linguistic mistakes. This in turn enabled them to edit any errors and correct their writing simultaneously.

Reflection

Reflection is one of the most significant writing components. The researcher is convinced that reflective writing is an evidence of reflective thinking. Throughout the program, the participants' ability of reflection was much improved. This was clear throughout the activities when they could express themselves and formulate significant ideas that reflect a deep comprehension of what they read. They could construct meaning, illustrate ideas, and connect

them with their prior knowledge. In addition, their ability to reflect on their answers, provide support and evidence to their choices was highly developed throughout the program treatment. This reflection was evident in their written topics. The engagement in authentic language in visual situations through AI applications enabled them to formulate ideas and relate them to their prior knowledge to produce the intended meaning. Different AI activities contributed to enhancing their ability to construct meaning and have a deep reflection in their writings. The researcher chose some topics to stimulate the learners` ability to think reflectively such as introducing themselves, expressing their future dream and another question that required writing about their imagination in case of being in a time machine and have to reflect their thoughts.

Here are some samples of the participants` writings before applying the program when asked to introduce themselves and express their future dreams :

"*I am Adham. I am in preparatory 3. I am Egyptian. I want be an engineer. My favourite subject is English. I buy a company in the future*."

Another learner responded to the same topic as follows:

"my name is maryam. I`m in preparatory 3 at Hassan Abo bakr school. I live in Egypt and I want to be a doctor in the future".

A third example of the participants' responses before applying the program:

"*My name is Abdallah. I am 15 years old. I am from Alqnater. I live with my family. I see myself in the future in space because I want to be an engineer and work in a good company.''*

In the second topic, participants were required to imagine being in a time machine and reflect in groups their thoughts. These are examples of some participants' performance in response to the instructions below:

1st group: *Time machine is a wonderful invention. I can imagine myself in this fantastic machine doing a lot of things I dream about. It was invented many years ago. It can travel through time and make you go to different places and go back in time. I can see people I want. It will change everything.*

2nd group: *riding a time machine is very enjoyable thing. It is a great invention. It helps anyone to do anything. It can make me travel through time and achieve all my dreams. I like it very much. At the end, I hope to have a time machine.*

Throughout the previous examples of the participants' writings before applying the program, it is noticed that most of their` responses, indicated poor reflection abilities. They used very brief and few or narrow set of words. Participants also produced very few responses and their writing showed a remarkable gap between their prior knowledge, experiences and the newly learned ones. This demonstrated little or no comprehension of the topic. Reflection was poorly written, lacked support of the main idea although they were given supporting hints to add more reflective details to their review. Most of them could not construct meaning to produce reflective writings. Their

responses in the pre-test lacked a lot of details and elaboration However, they were able to reflect on ideas precisely, clearly and thoughtfully demonstrating deep processing of knowledge after being exposed to the program and dealing with the various visualization AI activities during the treatment.

The researcher then started to explain the meaning of reflection indicating that it is an indicator of participants' reflective thinking which has a sequence of procedures. First, they remember a particular topic or an idea. Second, they analyze the topic or idea thinking in depth and from different perspectives to add more explanation to the topic. Third, they need to realize that reflection entails analysis and explanation of incidents rather than merely describing them. Moreover, linking these incidents to their prior knowledge to produce good reflection on the required topic. The researcher then raised some topics to trigger and stimulate the participants to think reflectively in some presented topics during the treatment.

During one of the AI activities, the researcher asked the participants in chat in groups through *Minecraft AI* world to reflect on one of the current events which people all over the world are worrying about which is the spread of Covid 19 virus, its implications and impact on people`s lives. In order to integrate their knowledge and analyze information, the researcher urged the participants to reflect on the given topic. Participants began to show some conscious and careful comprehension in writing the required topic. These are examples of some participants' performance in response to the instructions below:

- In groups, write a magazine article reflecting your thoughts about Covid 19 and how it affects our health and safety. Reflect your opinion about having a travel ban til the virus disappears.

1st group: *Covid 19 is extremely dangerous virus that killed many people The whole world is in danger. It is so deadly. Many countries forced travel ban to reduce infection. Before this scary virus people loved going on holidays and meet family and friends. We used to go on trips. Life during Covid-19 is very bad. It prevented us from visiting our friends or family because of this killing virus. we can`t go out without wearing masks to prevent infection. We hope to get vaccine or cure very soon to come back to our usual life to be able to go to restaurants, malls, and visit our family. We will see our friends and feel very cheerful and enjoy everything again.*

2nd group*: life was very different before this terrible virus covid-19, We could go with our parents to shops without masks and gloves. Also we* could travel to different countries without any problems We were enjoying our life without fear. We could go to schools and different places without fear of getting sick. Now, after declaring Covid 19 virus, all countries and health organizations advised people to care about personal cleanliness, and stay at homes to avoid getting the virus. So life now became different. We no longer go to schools and learn at home online. We can't visit our friends or even travel from place to place. People can`t go to the shops or cinemas so they feel bored and annoyed. Finally, I think doctors and scientists will find a good treatment soon for this virus and people will return to their usual life.

As noticed from the previous participants' samples, most of their reflections were to quite thoughtful and demonstrated appropriate depth of self-reflection on the topic using sometimes connections to prior knowledge. Some participants provided real life examples and sometimes reflected on their responses seeking reasons and evidence.

- After applying the program, participants` reflections were well-written and meaningful. Here are some examples of the participants` writing after the application regarding the first topic:

- *“I`m Adham. I am 15 years old. I am from Egypt and I am a student in a preparatory school. My school is called Hassan Abo Bakr distinguished Governmental language school. It is in Alqanater city. I have a good family. My father is a trader and my mother is a housewife. I have two brothers. I have many dreams for the future. In the future I want to join the faculty of engineering to be an engineer because I like building bridges and making important projects. I also hope to have a company and nice car. Moreover, I hope to make my family proud of me and be able to help my country.”*

- *"My name is Maryam. Iam 15 years old. I live in Egypt. I live with my mother in a nice flat. I am in preparatory 3 at Hassan Abo Bakr School. I don`t have any brothers or sisters but I have two friends. They are my best friends and my true sisters. In the future I see myself a big doctor .I will be famous and help many sick people to become good and healthy. I will help the poor people and I look forward to have a big hospital. At the end, I have a lot of dreams and I always pray to God to achieve my dreams”.*

- *"My name is Abdallah. I am a student at Hassan Abobakr language school. I am in preparatory 3. I live with my father, mother, two brothers, and one sister in our home in Alqanater city. Alqanater is an interesting and quiet city. My father is an engineer and my mother is a housewife. My brother Abdalrahman is older than me. He is in secondary 2 but my brother Adam is younger. He is in primary 6 and my sister Roqaya is a baby. She is only one year old. I love my family very much. In the future, I want to be an engineer like my father. I hope to work in a big company and become a famous engineer all over the world.”*

After the application of the program, it was clearly noticed that the participants tended to write their answers with more details, support, and evidence. This indicated the development they had on their reflection abilities in writing. They reflected their ideas clearly and linked their thoughts and dreams in a coherent way. They demonstrated significant depth of self-reflection on the topic using connections to prior knowledge. Most of them also could support their reflection in an organized and developmental way. The most outstanding noticed point is mates` helpful assistance to each other in case some of them could not deliver the intended meaning apparently. This occurred due to the inevitability of the group work in AI activities to present correct and acceptable text writings.

The previous samples show the participants' deep ambitions and enthusiasm to learn through applying new strategies such as AI. It is also noticed that they had a great interest in acquiring fluency; in all of the English language abilities such as speaking, listening, reading, and writing, or in other words learning the language as one entity, through the application of new strategies. Collaborative work affected the participants` involvement in thinking deeply and visually. Supporting the competitive learning environment, contributed greatly to developing the participants' acquired skills and knowledge.

Analysis of the Participants' Satisfaction scale

This part shows a qualitative analysis of the participants' responses in the satisfaction scale that allowed them to express their opinions freely about the WF program and the effect of using AI applications on their learning and whether they found it fruitful and beneficial or not and to what extent. Then,

theses opinions were analyzed. All the participants confirmed that AI activities provided them with meaningful context to practise English, consequently, developing their WF in particular, and their English language in general. Below are some samples of the participants' responses to the scale:

The first question was about the participants` opinions if the program`s activities and applications were useful or not and to what extent they had this feeling. Some of their writings in this respect were as follows:

- *I think the program was useful and I learned a lot of information that helped me to understand English and write correct and organized sentences.*
- *This program gave me a good training period to practise writing with correct punctuation marks, correct grammar, and oraganized thoughts.*
- *The program was very useful and enjoyable for me because I liked receiving automatic correction during writing through Grammarly app which made me free to practise English.*
- *I found the program very useful as it helped me to improve my writing, organize my ideas in a good form, and solve my problems in writing which I used to have.*
- *The program was very helpful for me as it helped me a lot in learning English, especially with writing*.

As it is noticed through the previous opinions, participants seemed to be more aware of the importance of producing correct writing structure. They also realized the necessity of organizing their thoughts, reflecting on different topics and benefit from co- operative work and receiving feedback on their work. This indicates that the program could help them to recognize and overcome their learning problems and consequently, develop their metacognitive awareness which is essential in the learning process.

Moreover, according to the participants` responses to the first question, it seemed that the program encouraged them to practise writing freely without worrying or stress. This emphasizes the significance of providing a supportive, anxiety-free learning environment, a key component of language learning, and an important requirement for improving language fluency. Participants also expressed their appreciation and satisfaction for receiving automatic correction and feedback, enabling them to have self-confidence and improve their performance which is helpful in their learning. This was evident in one of the participants` notes "it helped me to improve my writing, organize my ideas in a good form, and solve my problems in writing which I used to have". It shows he could self- assess his performance and overcome the problems he encountered.

The second question was about the activities they liked most and helped them to improve their language fluency. Some of their writings in this respect were as follows:

- *I liked Minecraft game because it allowed me to feel free in creating and building different worlds and at the same time, it enabled me to write English freely without worrying of making mistakes because of the Grammarly app. Which gave automatic correction.*

- *I liked the virtual reality game in an AI mode because it allowed me to experience different worlds and use language freely without being afraid of failure or making mistakes. This is because it offered me learning about the topics before writing or speaking.*

- *I liked Semantris game very much as it was such a funny and amusing game and at the same time, it enabled me to acquire a lot of vocabularies related to different topics which helped me in writing about these topics*.

The participants` responses confirmed that they had the desire to learn authentic tasks allowing them to reflect on their real life to develop their language learning. Their opinions also showed their deep ambition and desire to learn English for interaction through new learning strategies and educational programs that satisfy their needs and stimulate their passions. One of the participants wrote:

" *I enjoyed this way of learning English through AI applications that helped us to practise English freely in an interesting and engaging activities. I hope all teachers use AI in learning because they will make sure that everyone will understand and benefit well."*

What most of the participants did not like was the restriction they had in Minecraft world as they aspired to create their own world from their choice not from the curriculum. Six of them reported *"I wanted to create my own world in Minecraft game without being forced to create specific topics."*

The third question was about the participants' opinions of the group work. Most of their responses showed that they preferred group activities and stated that group work helped them to divide their missions which saved time in addition to allowing them to correct each other's mistakes. Some of their answers were as follows:

- `` *In my opinion, group work is very useful as it helped me to exchange new information with my mates".*
- `` *I liked group work because it allowed us to divide our missions which saved a lot of time and effort``.*
- `` *Group work is better for me as it made me not feel worried when I don`t know any information, I can ask my mates``.*

Participants satisfaction and preference to group work was a significant point since it motivates participants to interact in different ways whether orally or written and acquire information from one another.

However, some participants showed their preference to individual work and wished to alone. Some of their responses were as follows:

- `` *I don`t prefer group work, it doe not allow me to be free in my decisions* ``.
- `` *I think group work is not good and it is better to work alone so as if I do any mistakes, I won`t feel shy*``.

It is clear from the previous opinions that some students could be introvert and feel shy or stressed when they work in groups. Some of them may feel distracted or uncomfortable during group work due to lack of self – confidence to do the required activities. Therefore, it is the teacher`s role to be able to deal with different types of learners, provide them with an encouraging environment that varies between individual and group activities to motivate and support all types of learners.

The fourth question was about the difficulties participants face on using AI applications

4.4 Participants' self-regulation Scale

The participants were asked to select one among three choices for the components of self-regulation either “agree, somehow, or disagree" to determine their self-regulation development before and after applying the program. It was noticed that the changes among the learners` responses denote their changing attitudes from being relatively unaware of the importance of self-regulation to their positive awareness and attitudes towards it.

The studies' overall results show that self-regulation is a powerful indicator of language proficiency and may suggest special awareness to self - regulation

and its importance in language learning. Different research has assured the positive and effective performance of Language learners in reading comprehension, vocabulary acquisition, and writing skills due to combining cognitive and metacognitive strategies as they represent significant determinants of language learning and achievement. (Andrade & Evans, 2013; Wang, et al, 2009).

Furthermore, the results supported previous studies' findings of the descriptive ability of motivational strategies in determining success in the context of foreign language learning (Oxford et al. 2014).

This chapter included the study's quantitative and qualitative findings as well as an analysis of those findings. It also revealed that the implementation of AI applications in the learning process had successfully achieved significant development in learners` writing fluency level as well as their self-regulation. This was verified through the statistical analyses of the quantitative and qualitative outcomes. The following chapter will introduce the study's summary and recommendations for additional research.

Chapter Five
Summary, conclusions, and recommendations

Chapter Five
Summary, conclusions, and recommendations

This chapter presents a summary of the current study with a brief description of its problem, aim, research questions, instruments, participants, main procedures, and results. It also illustrates the general conclusion and difficulties encountered by the researcher. Moreover, it provides recommendations, and suggestions for further research.

5.1 Summary

Colossal changes have occurred in all fields of life and education is not isolated from these rapid changes. That is why Instructors need to find alternative techniques and strategies to replace the old – traditional ones and to suit learners` needs and requirements. The problem of this study is that EFL learners suffer apparent weakness in their ability to express themselves in various ways specifically in written situations. Their writings show a lack of meaningful relevant idea production, organization, and efficiency to write fluently with interpretations, they also lack the self-regulation and objectives for learning the English language as they are not engaged in the process of their own learning due to the exam traditional methods followed in Egypt which made them passive participants in the learning process.

The study aimed at designing a program that could assist the learners to write fluently with an ability to organize, expand their ideas, show reflection on different topics, produce relevant interpretations and write smoothly. Moreover, the program aimed at developing the learners` self-regulation by engaging them in activities that direct their cognition, motivation, and behaviors, toward the attainment of their academic goals. These activities also depended on creating a

productive learning environment that uses numerous and effective resources and implements positive beliefs about one's abilities and the value of learning. The researcher suggested using some relevant AI applications for the program that was conducted on 33 students (boys and girls), in preparatory three at Hassan Abubakr governmental language school. The program included twenty-four sessions and the duration of the program was about thirty-nine hours. The instruments of the study included a pre/post-WF test, the WF rubric, and the participants' self-regulation scale.

5.2 Pedagogical Implications

Several reasons illustrated the reasons why this program was effective in developing EFL learners` writing fluency and self-regulation. These reasons included the profound effect that was observed on the participants` level in their

writings as well as the noticed concern and attention they paid to the significance of mastering the language through the development they had in their self-regulation. This was evident in their willingness and motivation to participate in the study program and practise English actively in meaningful processing with the content delivered. In addition to the relevant difference of their results before and after the application of the AI program. Furthermore, learning in an enjoyable, comfortable, and no- judgmental environment encouraged the learners to interact and do their best to use English language to express their ideas and work actively without fear of making mistakes which consequently helped in having a clear vision and purpose of their learning.

The researcher`s appreciation, stimulation, respect, and acceptance through using AI applications motivated the participants to express their thoughts freely and highly estimate each other`s interactions and writings.

This agrees with the findings of a number of researchers, including Fernandez et al., (2019), Mynbayeva et al., (2017), Paradise (2021), and Groff, (2013), who aimed at investigating the general form of education after applying AI. Their ideas were summed up as the need for the adoption of effective and increasingly appropriate policies. They came to the conclusion that the capabilities of AI contribute to developing dialogues, enhancing communication, and establishing relationships that are balanced and reinforced in accordance with the demands of the most important institutions of society (like universities), which calls for a radical reform of the existing educational regulations to make them consistent with the use of AI in education. They also came to the conclusion that AI applications prompt encouragement, as well as personal and professional development.

5.3 Study Questions

The researcher attempted to answer the following main question: "*How can AI applications in education enhance EFL students` language writing fluency and self-regulation?"*

This main question elicited the answer to the following sub-questions:

1- **Research question one**: "What are the appropriate writing fluency components for the preparatory three students at governmental language schools?"

This question was answered through the researcher`s working experience and continuous discussions with preparatory three students as well as a pilot study on the same sample of English learners. It was also answered by reviewing the literature and previous studies on WF. A list of WF components was designed to identify the main components required for students in this stage. See appendix (B). A pre-WF test for the study group was also used to assess their level in WF. See appendix (C).

2- **Research question two:** "What are the components of self-regulation needed for preparatory three students at governmental language schools?"

Throughout the review of the literature and the previous studies on self-regulation, the pilot study, and the pre-scale results, the researcher prepared a list of self-regulation components that are needed to be enhanced. See appendix(D).

3- **Research question three:"** What is the suggested program based on using AI applications to enhance the students` self-regulation and language writing fluency?" In the light of the review of literature, previous studies, the pilot study, and pre-test results, the researcher designed specific activities that contribute to developing the writing fluency components as well as the self–regulation ones. The first two sessions were orientation ones that aim at presenting and explaining the strategy to the learners to be ready for working collaboratively and recognize the benefit of organizing, sharing ideas, making reflection, and producing interpretations in addition to realizing the importance of enhancing their self-regulation components; orientation, performance, and evaluation.

4- **Research questions four**: "What is the effectiveness of using AI applications in enhancing the students` self-regulation and language writing fluency?" The researcher conducted a post-WF test to measure the learners` WF development and analyze the statistical data, through the rubric, to determine their progress. In addition to a post self–regulation questionnaire to elicit the learners` development in their self–regulation. The researcher also explained qualitative data of the learners' performance and self-regulation. Both quantitative and qualitative results and findings are presented in Chapter Four.

5.4 Limitations

Throughout the experimentation, the researcher faced some obstacles but she tried to find solutions for them, here are some of these obstacles:

- At the beginning of the program, the learners` parents were amazed at the researcher`s request of bringing VR glasses to school and the researcher had to spend some time sending voice messages to the parents via the what's app group to inform them about the target of the program and ways of its application.
- Some learners tried ignoring the instructions of the *Grammarly writing correction* program which caused producing a lot of mistakes in their writings about the missions they did during Minecraft world as they felt it was not important to make the required correction. To overcome this problem, the researcher set a rule, from the beginning that their group mission will not be valid unless they correct their chat writings according to the *Grammarly program.*
- *Some participants did not attend some online sessions due to not having an internet connection. The researcher had to arrange meetings at the school computer laboratory where internet connection is available for all the participants.*

5.5 Results of the Study

Based on reviewing literature and theories relating to the inevitability of developing the learners` writing fluency and their self-regulation as well as the various impacts mentioned in several studies about using AI in education and how far applying it in the learning process could assist learners to develop and

enrich their writing abilities through motivating them to become more conscious of authentic target language input, detect their obstacles, revise their syntactic and lexical errors, and finally, to achieve more comprehensible output.

Quantitative and qualitative analyses for the current study were used to elicit its results. The quantitative analysis included statistical comparisons of the participants' mean scores in the pre-test and their mean scores in the post-test. The qualitative part included an analysis of the participants' writing samples and their responses to the self–regulation questionnaire. This analysis showed the following results:

- There is a statistically significant difference at the level of ($0.05 \geq \alpha$) between the mean scores of the experimental group on the pre and post-writing fluency test applications for the total degree in favor of the post-test.
- There is a statistically significant difference at the level of ($0.05 \geq \alpha$) between the mean scores of the experimental group on the pre and post-writing fluency test applications for the sub-linguistic components` degree in favor of the post-test.

- There is a statistically significant difference at the level of ($0.05 \geq \alpha$) between the mean scores of the experimental group on the pre and post-self-regulation questionnaire for the total degree in favor of the post-test.

- There is a statistically significant difference at the level of ($0.05 \geq \alpha$) between the mean scores of the experimental group on the pre and post-self-regulation questionnaire for the sub-components degree in favor of the posttest.

The development in learners` writing fluency as a whole was due to using AI applications in learning could be because of the following reasons:

- AI applications were not only useful in developing the learners` WF, but it was also effective in developing their language fluency as a whole.
- AI applications encouraged learners` discussions and solving problems.
- AI applications facilitated fruitful engagement in natural verbal language abilities and writing assignments that evaluated the ability to transfer from oral to written fluency.
- AI applications in VR contexts develop observation and intellectual abilities as they stimulate their desire to solve problems, connect ideas, and link previous background knowledge to the new one.
- AI applications in VR contexts enhance learners` ability of interpretations and reflections via broadening their minds and enhancing their thinking strategies.
- AI applications motivated learners to give evidence to their shared information, interpretive comments, and ideas to construct meanings.
- AI applications enabled learners to exchange mutual ideas and relate them with their prior knowledge which also encouraged them to collaborate positively.
- AI applications promoted learners to self-evaluate themselves, and to reflect on their WF to recognize their points of strengths and weaknesses.

Conclusions

The current study aimed at investigating the impact of using artificial Intelligence on Enhancing EFL Language Fluency in general, writing fluency in particular, and enhancing self-regulation for Preparatory Stage students. Based on the study results, it can be concluded that:

- Using AI was obviously effective in enhancing English fluency in general and each component of writing fluency in particular.
- The AI program proved its effectiveness in enhancing the learning process via enhancing the learners` self-regulation; engaging them in an enjoyable active

learning environment where they feel the importance of learning English in their life.

- AI program was also effective in enhancing the learners` self-regulation components (orientation, performance, and evaluation) as shown in the difference in questionnaire responses of the learners before and after applying the program in favor of the post-application.
- AI will not replace teachers or their social interaction with their students via traditional teaching but it should be a part of the learning process as gamifications, VR and AR technologies.

5.7 Recommendations

According to the previous results and conclusion, the study recommends the following:

- Instructors should provide their learners with more opportunities and encouragement to improve their writing fluency and their self-regulation.
- Using a supportive learning environment has a significant impact on the learning process as it affords an enjoyable and preferable atmosphere where learners can learn in a relaxing and successful way.
- There is obvious evidence that using AI in learning can positively affect learners` language fluency in general, and writing fluency in particular in addition to enhancing learners` self–regulation.
- AI enhances rapport among learners and more effort and ideas should be afforded to enhance rapport in the whole learning environment.
- Instructors need to explore up-to-date AI applications that contribute to the reinforcement of the learning process.

- Instructors should continuously give their learners self–confidence, and provide them with opportunities to reflect on their impressions and ideas about the educational process so as to assist their development of the self – regulation`s components.
- AI learning applications should be used to develop all aspects of language fluency.
- Allowing learners to have responsibilities for their learning process and have the desire that stimulates them to work autonomously, be self-directed, and self–regulated.

5.8 Suggestions for further research

Researchers may further put into consideration the following suggestions to explore the efficiency of AI applications in enhancing learners` writing fluency and self-regulation:

- Language fluency in general in different stages needs focused attention.
- Tending to use AI educational applications in the EFL learning process is very significant and should be put into consideration for creating a motivating learning environment.
- Instructors should be aware of selecting suitable and efficient types of AI applications and chatbots that fulfill the needs of their learners and their pedagogical goals.
- Writing fluency could be successfully integrated with oral activities through AI applications.
- AI applications achieve great results in developing different aspects especially speaking and listening fluency so they are highly recommended to be used in further research for developing these language components.

- AI allows students with difficulties such as dyslexia or other health problems to study more effectively so it will be beneficial to implement AI tools in learning content, teaching methods and assessment.

- Chat GPT can provide a personalized and engaging learning experience for EFL learners, helping them improve their writing fluency and overall language proficiency so it is highly recommended to be used in further research.

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