



**An-Najah National University
Faculty of Graduate Studies**

**THE IMPACT OF AI ON STUDENTS'
ACHIEVEMENTS IN WRITING SKILLS AND
CREATIVE THINKING AS PERCEIVED BY
ARAB ENGLISH LANGUAGE TEACHERS IN
HAIFA DISTRICT**

**By
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**Supervisors
Dr. Fawaz Aqel
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**This Dissertation is Submitted in Partial Fulfillment of the Requirements for the
Degree of Ph.D. in Learning and Teaching, Faculty of Graduate Studies, An-Najah
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2025

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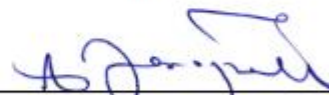
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Dedication

To my family, the foundation of my strength and the source of my inspiration.

To my husband, whose unwavering support and faith in my journey carried me forward.

To my sister, whose generous help and steady presence made this path lighter.

To my children, who fill my life with hope and meaning, may this dissertation be a spark that inspires your own achievements in the future.

This accomplishment is as much yours as it is mine.

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I am grateful to all learners and readers who will devote part of their time to exploring this dissertation. Knowing that my work may support or inspire someone along their academic path is one of the most meaningful rewards of this journey.

Declaration

I, the undersigned, declare that I submitted the dissertation entitled:

THE IMPACT OF AI ON STUDENTS' ACHIEVEMENTS IN WRITING SKILLS AND CREATIVE THINKING AS PERCEIVED BY ARAB ENGLISH LANGUAGE TEACHERS IN HAIFA DISTRICT

I declare that the work provided in this dissertation, unless otherwise referenced, is the researcher's own work, and has not been submitted elsewhere for any other degree or qualification.

Student's Name

Areen Khalid Mahmud Jabarin

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Date:

14/10/2025

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Abstract

This research aimed to investigate the impact of the Grammarly AI writing application on the writing skills of English language learners (ELLs) and to present the views of English teachers regarding the use of AI assistance in promoting creative thinking. The research employed a mixed-methods approach, involving a quasi-experimental pre-post-test design with a questionnaire and semi-structured interviews. The population was 60 high-achieving 10th and 11th-grade students and 92 secondary school English teachers in the Haifa District. The findings were statistically significant in terms of the students' writing skills after using Grammarly, with differences observed based on gender, grade level, and English proficiency level. Teachers generally acknowledged the benefits of AI in improving technical writing, particularly in the phases of brainstorming and idea generation, but offered mixed views regarding its impact on creativity. Some teachers perceived it as an alternative to originality, while others expressed concern about potential overdependence. The study recommends expanding access to AI in schools, offering teacher training, and incorporating AI-supported writing tasks into English curricula to enhance writing outcomes and promote learner autonomy. The study provides a foundation for future scholarly publications in applied linguistics and educational technology.

Keywords: Achievement; Artificial Intelligence (AI); Creative Thinking Skills; English Language Learners (ELLs); Haifa District; Teacher Perceptions; Writing Proficiency.

Chapter One

Introduction and Literature Review

1.1 Background of the Study

Artificial intelligence (AI) is a result of deliberate developments spread over many decades. It has now moved beyond purely theoretical experiments and is being widely used practically in most industries. The collaborative efforts of system design experts, data specialists, psychologists, linguists, and educators have made it possible for AI to become a reality. These technologies impact the way people use gadgets and change their mindset when dealing with problems.

In a similar fashion, AI-enabled gadgets such as ChatGPT, Grammarly, and Quillbot are used in learning environments to nurture the students' writing skills and to give them feedback on their output. AI can go through large amounts of data and provide personalized help to students without the need for conventional classroom practices (Neha, 2020). However, AI-supported learning is not without its drawbacks. Socially and ethically challenging issues, algorithmic bias, and increased responsibilities for teachers in AI-supported environments are some of the problems that have been identified (Schiff, 2021).

The integration of AI in language learning has undergone a significant transformation recently. One such application is Grammarly, which helps a writer by giving real-time corrections in grammar, sentence structure, and writing style. Therefore, it has been reported that students' English writing skills have improved (Kim & Kim, 2022). Besides, AI can provide a creative angle to language learning that is equally important. AI-powered technologies can take care of the technical side of work and thus give more room to the learners for developing new ideas and trying new ways of expression.

Wu et al. (2021) suggested that if AI technologies were used for the right purpose, they could substantially enhance creative thinking and enable learners to use the language in ways that are not always possible through traditional methods (Wu, et al., 2021). On the other hand, these advantages have certain limitations attached to them. Doubts have been raised as to whether AI can fully mimic the human teachers' ability to contextualize and provide insights, especially in the areas of creativity and critical thinking. Although AI

systems are still a force of change in education, their impact on creative thinking skills and the changing role of teachers need to be further explored.

Considering that teachers are the ones who implement AI in schools, it is on them that the decision-making power rests as to whether AI enhances or limits students' creativity. Their insights throw light on the complicated relationship between the integration of AI and the academic performance of students. Moreover, places like the culturally and linguistically diverse Haifa district provide an ideal setting for exploring these kinds of interactions. Its student community is made up of different ethnic groups with varying levels of English proficiency, which makes it a suitable place for investigating the influence of AI on writing skills and creative thinking.

Haifa District is well known for its use of technology in education that is mainly through English language teaching. Teachers in this area have adopted AI assistant tools like Grammarly, Padlet, and Magic School AI to help their students improve their writing skills. A number of teachers have also gone an extra mile themselves to facilitate the use of educational technologies. This kind of environment has a lot of potentials to explore the educational worth of AI-driven language skills development.

This research aims to fill these voids by looking at the use of AI as a tool to enhance students' writing skills and to foster their creative thinking. Besides, the study will examine the views of English language teachers on the use of AI in their teaching practices. The study intends to reveal a detailed picture of the benefits and difficulties of AI usage in education. Therefore, its results will be a significant input to the extensive research that explores the applicability of AI technologies to achieve better learning outcomes, while also considering the social, ethical, and practical implications of such technologies.

The distinctive feature of this research is that it has concurrently investigated the teachers' perspectives and students' performance concerning AI-based English language learning in the Arab EFL community in the Haifa District. While prior research has largely been based on students' feedback or general technology adoption, only a handful of studies have purposely combined quantitative and qualitative data to uncover how teachers evaluate AI's influence on their students' creative thinking and writing skills. This all-inclusive strategy helps to identify the gap that exists in current research and also gives a

culturally informed perspective that reflects the linguistic and educational context of Arab learners in Israeli secondary schools.

1.2 Problem statement

Even through Artificial Intelligence (AI) software is progressively becoming a part of the learning process, there is still not enough research on its widening influence on English Language Learners (ELLs), especially in the areas of their writing abilities and creative thinking skills. To illustrate, Grammarly, a tool mainly recognized for its grammar correction and style enhancement features, is used mostly for its technical functions; nevertheless, the deep impact of these tools on learners' creative thinking has not been sufficiently examined. Creative thinking is an indispensable part of language learning; however, only a handful of studies have considered the possibility that AI tools may foster, weaken, or have no significant effect on this skill, particularly teachers' perspective. Moreover, AI enables learners to perform tasks that are generated and completed by the machine, so the role of teachers in the integration of AI technology into classroom instruction becomes highly essential. Nonetheless, their views on the influence of AI technology on creativity and writing proficiency are still an enigma in the broader educational contexts. It is important to understand whether teachers see AI as a source of creative thinking that facilitates, hampers, or is indifferent so that these devices can be integrated smoothly into the teaching practice (Artika & Nurmaliah, 2023). The point is even more relevant in the Haifa District, where cultural and linguistic diversity not only determine the learning experiences but also the outcomes. The research fills these gaps by examining the net impact of AI devices such as Grammarly on pupil writing and creative thinking and the perception of English teachers on the AI influence on these skills. The adoption of a mixed-methods framework in the research serves as a platform for the target audience, which includes educators, policymakers, and curriculum developers, to learn about the best use of AI in English language instruction.

1.3 The intended aims and objectives

1. To examine the impact of the Grammarly AI writing tool on the writing proficiency of English Language Learners (ELLs) in the Haifa District and to identify differences in its effectiveness across various levels of language proficiency.

2. To explore English teachers' perceptions of the integration of AI tools in language education, particularly regarding their influence on students' creative and thinking skills, as well as on overall learning outcomes.
3. To identify the pedagogical benefits and challenges experienced by English teachers when integrating Grammarly and other AI-based tools into classroom practices, and to determine the implications of these findings for effective language teaching and learning.

1.4 Research Questions

Pre and post-test (experimental)

Are there any statistically significant differences in the impact of Grammarly on students' performance across different baseline English proficiency levels? Moreover, how is this difference mediated by grade, gender, and writing proficiency?

Questionnaire and interviews (Quantitative and qualitative)

Do English teachers perceive integrating AI as having a positive, negative, or neutral impact on students' creative thinking skills based on insights gathered through questionnaires and interviews?

What advantages and disadvantages do English teachers experience in integrating AI tools like Grammarly into their pedagogical practices to enhance language learning?

1.5 Significance of the Study

This research is a big deal for a variety of important reasons. One of them is that it measures the impact of AI tools as a consequence of recent research, thus filling a significant gap. It is the goal of this investigation to determine the extent to which the AI tool Grammarly influences writing skills and the creative thinking of students. In doing so, it goes farther than the technical aspect of giving language instruction.

Next, the study deeply analyses the perspectives of English teachers, thereby eliciting a query as to how those educators view the connection between AI incorporation and the enhancement of creative thinking. The research also analyses if teachers think that AI-enabled learning helps, hinders, or does not affect students' creative abilities. These

findings will enable the teachers' actual experiences to be understood, along with the advantages or challenges they face when implementing AI tools in their classes.

Thirdly, the results will serve as a guide to pedagogical strategies, contributing to the educational process of teachers, the policymakers, and the curriculum developers by providing them with scientifically validated suggestions on how to effectively use AI in language learning with little or no negative consequences on creativity and critical thinking. Besides this, the research, through its focus on the Haifa District, tries to explain how AI integration can be innovative in different educational contexts which, in turn, are influenced by specific cultural and linguistic factors.

1.6 Theoretical Framework

Artificial Intelligence: Artificial intelligence (AI) is a field that focuses on the development of "intelligent agents", i.e., devices that can understand their surroundings and perform actions that would increase the chances of achieving their goals. A machine is said to have "artificial intelligence" when it only mimics human cognitive processes usually associated with "learning" and "problem-solving". The impact AI has had on education is really massive. The one-of-a-kind abilities of AI make it possible to sift through huge datasets as well as offer personalized learning experiences. Also, it is changing the old ways of teaching and learning. AI-powered online tutors will adapt to a student's level of understanding, giving them prompt feedback and suggestions tailored to their needs (Simonite, 2021). So students get customized teaching and support that go hand-in-hand with their academic performance and eventually, they will be led to the realization of their own success. The same way AI grabs the bull by the horns in the digital world, yet it is taking over the work of teachers—it can do the grading and issuing of the feedback—thus, it is claimed that educators will have more time "to get involved with the students hand to hand". Excitingly, the use of AI is not only facilitating the learning process but also providing the best possible conditions for safety through various features, which have, by design, been thought for disabled learners. Besides, it is also willing to spot the learning gaps and fix them thus, at the same time, guaranteeing equality in receiving support. Still, AI continues to evolve and its very revolutionary effect to education is becoming more and more discernible. AI is helping education move forward in a very positive way (through individualized learning, efficiency, or access to education) whether people realize that or not (Alam, 2023). The current research is based on three

educational theories that serve as a robust conceptual framework for understanding the impact of AI tools on the writing skills and ideation of English language learners: Sociocultural Theory (Vygotsky, 1978), Cognitive Load Theory (Sweller, 1988), and Connectivism (Siemens, 2005). Together, these theories provide an understanding of how tech-supported feedback, cognitive scaffolding, and networked learning environments can make the EFL learning process more engaging and effective.

1.6.1 Sociocultural Theory

Sociocultural theory views learning as an inherently social and mediated activity, in which interaction with more experienced others and tools influences the development of higher cognitive functions. Vygotsky's (1978) concept of the Zone of Proximal Development (ZPD) describes the distance between what a learner can achieve independently and what they can accomplish with guidance. Accordingly, AI software such as Grammarly functions as a digital scaffold that provides immediate, one-to-one feedback to assist students in controlling their writing, teaching grammatical conventions, and slowly progressing towards independence. The automated, yet context-sensitive corrections simulate the role of a teacher, with the ZPD by supporting learners just beyond their current level of mastery (Luckin, Holmes, Griffiths, & Forcier, 2016).

1.6.2 Cognitive Load Theory

Cognitive Load Theory (CLT) describes that the success of learning is dependent on the ability to connect working memory limitations. Second language writing is a cognitively demanding activity that requires focused attention in spelling, grammar, vocabulary, and organization. Grammarly reduces cognitive load by leaving surface revision (e.g., verb tense, punctuation) to it and enabling students' minds to concentrate on higher-level writing activities, including building arguments, forming well-structured sentences, and articulating complex ideas (Chapelle, 2017; Sweller, 1988). There is, therefore, a balance between effort and automation, which produces both improvement in writing skills and creative thinking.

1.6.3 Connectivism and the Role of AI in Learning

Connectivism is a developing theory of learning that describes the way knowledge exists and is shared in an electronic world. Siemens (2005) contends that learning today occurs between networks, among individuals, on online platforms, and through various data

sources. AI-driven tools such as Grammarly are essentially conversational units that learners can use in their educational journey. They provide learners with continuous formative feedback and language help. These instruments help in the development of digital literacy as they improve technical writing skills, metacognitive skills, and learner independence. AI tools, which allow students to check, correct and polish their work at once, are a perfect example of the main ideas of connectivism learning - they are adaptable, can be used in a network, and the learner is able to direct himself/herself (Downes, 2012; Anderson & Dron, 2011).

1.6.4 AI in Education

An educational revolution powered by artificial intelligence with the potential to improve the quality of education AI educational is changing. In a nutshell, AI technologies are designed to support student initiatives in exploring new areas of study, acquiring skills, and using these skills flexibly in different disciplines. AI, through various types of technology, can create new opportunities for language and communication learning. Besides, teachers can understand the instructional content more easily and get deeper insights into the target language (Woo, 2022; Kim & Kim, 2022). Communication practice, learning through interactive games, and conversational activities are some of the ways in which AI platforms and tools are used today. AI not only fulfills the needs of learners but also educates them so that they can become more self-dependent. It improves students' participation in the classroom by offering incentives to students and exposing them to different language sources.

Furthermore, it has recently been uncovered in research that AI has come a long way in dealing with intricate issues by means of cutting-edge software tools and algorithms, which allow machines to behave in an intelligent manner. These functions language instructors to scaffold learners' cognitive skills through designing cognitive learning activities (Alqahtani, et al., 2023; Liu, Chen, & Yao, 2022).

The change in learners' abilities concerns not only cognition but creativity as well, which is in line with the educational paradigm shift brought about by AI innovations. One of the most obvious examples of such a shift is the development of hybrid learning models that can provide personalized education by adapting to each student's unique capabilities and interests.

Additionally, combined evaluative and assessment processes enable instructors to understand their students' learning styles and offer them individualized learning materials (Bhutoria, 2022). Second, the use of AI in education, particularly in resolving different languages and bilingual education, helps and supports students in learning both languages. Practically, a recommendation to make this happen is to use speech-to-text capabilities. These characteristics are particularly beneficial for students who might consider themselves "unwilling writers," as they enable them to write more easily and openly. Adapting such technology has demonstrated a tremendous capacity for enabling previously hesitant students to develop their expressive prowess (Liang, 2023).

1.6.5 Terms related to AI

Artificial intelligence refers to the development of machines that can perceive, reason, decide, learn, and adapt to their environment, tasks that would typically require human-like capabilities. Sharma et al. characterized artificial intelligence AI as computer code that is able to mimic human thought and cognition and emulate human reasoning processes (Spencer, 2022; Chen, Chen, & Lin, 2020).

An algorithm is a set of guidelines or thousands of codes that show mathematical instructions a machine or computer can follow to solve a specific problem or complete a task. It works like a cookbook or a sequence of instructions, outlining the computer's actions to accomplish a particular goal (Spencer, 2022; Holmes, Bialik, & Fadel, 2019).

Deep learning: Deep learning is an aspect of machine learning that makes predictions or takes actions by analyzing complex data using neural networks (similar to the structure and functions of biological neural networks) that can identify complex patterns, classify information, and make predictions with high accuracy (Spencer, 2022; Holmes, Bialik, & Fadel, 2019).

Generative AI is a type of AI that can generate creative and unique content, such as music, images, or text, with characteristics similar to those of human-made content.

Machine learning refers to how computers respond by acting without being given every step or instruction in advance. In general, algorithms can learn what to perform rather than having specific instructions coded, even though they require much programming. However, machine learning uses input data to predict novel outcomes rather than issuing

direct commands, producing outputs that are not directly specified. It works in three steps: analyze data, build a model, and undertake an action (Holmes, Bialik, & Fadel, 2019).

1.6.6 Operational definitions

For conceptual clarity and reliability in measurement, this study applies the following operational definitions. Each definition describes how key concepts were measured or applied in the context of English language instruction in high schools.

1.6.7 Writing Proficiency

Writing proficiency is the ability of students to compose written texts in English that are clear, well-structured, and grammatically correct. Writing proficiency in this study was defined by the official rubric for Module C of the Ministry of Education (2020) (English Curriculum, 2020), which evaluates students' performance across four categories: content, organization, language accuracy, and mechanics, with a maximum score of 30. The approach aligns with the views of writing-assessment scholars, who argue that linguistic accuracy and the logical flow of the idea are equally important (Weigle, 2002). Writing tasks were administered before and after the AI tool implementation to identify any changes in the students' performance due to the instructional intervention.

1.6.7 Creative Thinking

Creative thinking is described as the ability of learners to come up with original, adaptable, and detailed written ideas. This definition is derived from Lubart & Zenasni (2010) who characterize creativity as the capacity to produce ideas that are both novel and relevant to the given context. The study assessed creative thinking based on teachers' answers to the questionnaire items (questions 17–23), which gauged the students' readiness to try out ideas, view the situation from different angles, and express their own viewpoints. Moreover, the information was also gathered from the teacher interviews where the participants narrated the students' writing activities and judged the degree to which their work was creative and showed cognitive development.

1.6.8 AI Writing Tool (Grammarly)

The writing process was supported by the computer-assisted writing tool Grammarly. This online application is designed to provide instant feedback on grammar, vocabulary, and readability while writing tasks are in progress. Only the free version of the tool was

used, and it was introduced on a weekly basis for a 12-week period. The main function of Grammarly was to provide students with revision support on their own and to make them language use enhancement in real time. The user's position with the tool is based on the premise that a computer-based feedback system can raise learners' awareness of linguistic patterns and their continuous interaction can result in improvement of their accuracy and writing style (Knutson, Knutson, & Hsiang, 2020).

1.6.9 Teachers' Perceptions

Teachers' professional attitudes and perceptions about the role and influence of computer-assisted writing tools in the classroom were investigated. A semi-structured questionnaire with a five-point Likert scale was used to assess these, along with semi-structured interviews. Items in the questionnaire were centered on teachers' perceptions of students' engagement, creativity, and writing performance. This method is in line with Pajares (1992) who states that teachers' beliefs have a major impact on their instructional decisions and the overall atmosphere of the classroom. During the interviews, teachers got the opportunity to elaborate on their experiences and express their opinions more extensively, thus, giving a deeper insight into the teaching environment.

1.6.10 Student Achievement

Student achievement is the measurable educational improvement in the English writing skills of the learners that happened between the pre-test and post-test. The same Module C rubric was used on both occasions to ensure scoring consistency. The term achievement covered the improvement in grammatical correctness, clarity, coherence, and the capability to present the ideas that were logically structured. As a matter of fact (Zhang, 2020; Grabe & Zhang, 2013) have pointed out that the growth of writing skills can be best assessed by looking at both the linguistic side and the argumentative side of the tasks or drafts.

1.7 Literature review

1.7.1 Historical overview

The use of AI in education can be traced back to the research of psychologists Sidney Pressey and B.F. Skinner. Pressey, who was a professor at Ohio State University, was the first to utilize multiple-choice tests as a tool to not only evaluate but also improve student

learning. According to him, immediate feedback was the core of tests to efficiently promote learning, which was quite a challenge in the case of manual grading. To substantiate his arguments, Pressey referred to Edward Thorndike's law of effect (Holmes, Bialik, & Fadel, 2019).

The most complex machine Pressey ever created was based on a mechanical typewriter, and he attempted to market it unsuccessfully on multiple occasions. Like the punched cards used in self-playing pianos, the machine fed a card containing questions and punched holes into a spinning drum within the device to indicate the proper responses. The machine had a small window on the case, which displayed the current question number, and five typewriter keys were present on the case, one for each possible answer. Along with the window, the learner could use these keys to select their responses for each question as they progressed through a printed sheet containing questions and answers. The learner was only allowed to move on to the next question after confirming if their response was correct or not (Holmes, Bialik, & Fadel, 2019).

Skinner, in 1958, improved Pressey's method by suggesting that human learning could be expanded using operant conditioning methods he had created for rats and pigeons in "Skinner Boxes." Skinner built his teaching machine in 1958: a wooden box with a cover that had a window. There were two windows in the device; one showed the questions on paper disks, and the other allowed entry to a paper roll where the students might write down their responses (which would be graded by a teacher later).

During the 1950s, Norman Crowder developed a form of programmed instruction known as intrinsic or branching programmed instruction, which was a paper-based alternative to the earlier teaching machines. Crowder's primary focus was on communication rather than psychology. Crowder claimed to use a method where the user was given a brief information page and a multiple-choice question. Depending on their answer, they would be directed to a further page, which either provided additional information to broaden their knowledge or offered feedback to help them understand what they had done incorrectly. If the user answered correctly, they would progress to a new page with additional information. In contrast, an incorrect response would direct them to a page with personalized feedback on the error, based on their selection. In the 1950s, the British polymath Gordon Pask developed a teaching machine known as SAKI (the Self-Adaptive

Keyboard Instructor). His machine was unique because the task presented to a learner was adapted to the learner's performance. Later, in the 1960s and 1970s, many computer-aided instruction (CAI) programs and systems were developed, and they continued to evolve into the systems we have today (Holmes, Bialik, & Fadel, 2019).

1.7.2 Advantages of Artificial Intelligence in Education (AIED)

According to the study by Chen, Chen, & Lin (2020), AI has a great number of advantages when applied in educational settings. Besides that, AI is able to evaluate student works automatically and effectively through a real-time feedback system. In relation to personalization, It is reported that AI creates a abundance of new communicational means among the students and the teaching system and it guides the students to the different content path depending on their individual academic abilities and vocational qualifications. Likewise, AI proved to be very efficient in accelerating and simplifying the generation and execution of the new educational system for a short period of time (Neha, 2020). Students may also greatly benefit from application of simulated-based works that made the usage of VR, for example, as a 3D virtual-interactive workspace, an essential part of a better-experience-educational system (Chen, Chen, & Lin, 2020).

AI has a variety of features are developed for AI educational purpose. First of all, these features can be a great help for teachers, as they can palm off the administrative workload to AI, can engage the students with a personalized teaching road map, are supported by AI in making more precise decisions, and also are able to provide the students with the instant feedback. On the one hand, such an achievement paves the way for quicker performance of the tasks as, for instance, the requirements of the provision of the commentaries both on the carried-out works and in a form of the oral communication, and simultaneously the preparations for the following day lesson involving a very challenging and time-consuming working-process remain at a hand of the teachers.

On the other hand, AI is perfect assistants to educators in the creation of teaching methods tailored to the individualized needs of students as well as the identification of the students' learning preferences and styles. In addition to this, AI can facilitate data-driven decision-making approaches through providing the data analyses to the teachers making them more data-driven. Summing up, AI can be a means via which the students obtain their instant comments on their work, establish a culture of involvement and

development, as well as being powerful tools in teachers' hands by liberating them from monotonous and routine work, increasing personalization and deepening student-interaction (Chen, Chen, & Lin, 2020).

Second, there are several advantages of AI in teaching, including predicting student performance, delivering personalized content, integrating external learning into instruction, modifying instructional methods, and enhancing personalized instructional plans. Additionally, AI can predict the likelihood that a student will drop out and assess their performance on projects and exercises, allowing for early warning and intervention. AI is also capable of examining the course content and curriculum, providing individualized content that appeals to and is relevant to each student. AI also assists learning beyond the classroom, with collaboration giving way to higher-order learning. AI may also adapt teaching to individual student information, responding to their distinct needs and personal learning styles. Finally, AI assists educators in creating individualized lesson plans personalized to each student, fostering a more fruitful learning process. Learning is also an aspect of education that can be improved using AI. Moreover, AI enhances the identification of students' learning styles, enabling teachers to tailor their approach to meet diverse needs and thereby improve the overall learning experience. Furthermore, AI has the potential to transform education by addressing learning deficiencies at the initial stages, personalizing university course choices based on students' interests and objectives, anticipating future career paths from study data, and identifying students' learning states to offer intelligent adaptive interventions. Through AI-powered systems, educators can identify areas where students struggle and provide targeted support promptly (Chen, Chen, & Lin, 2020).

Another benefit is that AI-powered software can provide valuable feedback to both educators and students. It assists in creating customized courses based on their specific requirements and provides feedback on the overall course performance. Such AI systems enable students and educators to obtain the necessary support and identify areas where instructional enhancements can be made (Neha, 2020).

Additionally, AI-powered data can transform how schools identify, educate, and support students. Intelligent data collection, powered by innovative computing systems, changes how colleges interact with potential and current students. From recruiting to helping

students choose the most effective courses, intelligent computing systems are helping to align all areas of the faculty better to meet students' needs and goals (Neha, 2020).

1.7.3 Artificial Intelligence in Education (AIED) limitations

While applying AI to analyze student profiles appears to have advantages, such as identifying at-risk students who are at risk of dropping out, it is vital to appreciate that doing so can also risk compromising the privacy of students. In certain circumstances, where attendance is subject to government assistance programs such as Bolsa Família in Brazil, AI profiling has the potential to harm families in ways that amount to punishment. (Holmes, Persson, Chounta, Wasson, & Dimitrova, 2022).

AI-based tutoring systems promise to support students by teaching fundamental concepts and skills. However, they cannot currently assist with higher-order and creative thinking skills, which still require human instructors. It is worth noting that future advancements in AI may lead to the development of AI instructors capable of addressing these limitations effectively (Schiff, 2021).

With the use of effective capture, in which data are captured to influence learners' behavior, comes a psychological domination that threatens learner autonomy and privacy. Additionally, the use of biometric technology like facial recognition for e-proctoring or emotional sensing is questionable based on its destruction of natural human rights and stripping away of human dignity. The practices, therefore, require the use of care in achieving the ethical effects and potential harm that come from applying such technology in learning spaces (Holmes, Persson, Chounta, Wasson, & Dimitrova, 2022). One of the most debated issues on the ethics of AIED is the following: Who benefits from an A.I. system? The students, schools, education system, companies, politicians, and decision-makers? Thus, the focus shifts from the ethical considerations to the technology itself. Instead, it focuses on the ethical conduct of the individuals within the companies responsible for designing, implementing, and applying their systems, as well as the decision-makers involved. Thus, comprehending AI loyalty requires clearly defining its ownership and identifying potential conflicts of interest (Holmes, Persson, Chounta, Wasson, & Dimitrova, 2022).

1.7.4 Creative Thinking and Writing Skills

A study by Liang (2023) showed that the importance and enormous value of thoroughly studying and investigating creative thinking and writing skills in English Language Learners cannot be overstated. This is a crucial attempt that holds the potential to bring about transformative growth, empowerment, and profound enhancement in the linguistic skills and communicative abilities of language learners (Liang, 2023). English as a second language learners can reap a lot from producing creative works and learning to express their thought in a unique way in writing. Among the benefits mentioned by the authors Nel & Müller (2023) are the ones that relate to the development of creative thinking, the stimulation of imagination, the enhancement of problem-solving skills, the broadening of vocabulary, the improvement of grammar and syntax, and the obtaining of a real and accurate written voice. Besides that, coming up with creative ideas and writing them down help students to communicate their viewpoints, develop interesting stories, take part in persuasive talks, and use language to attract, motivate, and influence readers.

The acquisition of these skills not only deepens and extends the English learning journey of the learners but also gives them the transferable skills that are applicable in different areas such as academic, professional, and personal (Nel & Müller, 2023). In a world that is becoming more and more connected, the skill of being able to write in a clear and coherent manner is a very important tool that can open up new opportunities and also make the interaction between different cultures easy and successful.

Therefore, the act of spending time, committing energy, and investing money in coming up with new ideas and in writing is not only useful but also very valuable as it brings great and lasting effects to the overall development and ultimate success of ESL students (Cremin, 2022).

1.7.5 Creativity and Writing Skills Development

Over the past ten years, educators have been highly influenced by creative language learning methods, especially as the emphasis on developing creativity in writing has grown stronger. To illustrate, South Korea has made creative writing a mandatory subject in the curriculum, introduced at an early stage of education, and students are frequently engaged in competitions to showcase their creative use of language (Guo, Pataranutaporn, & Maes, 2024). On top of that, innovations in technology have paved the way for creative

writing instruction to be more engaging as teachers can now utilize various digital tools like word processors, spell checkers, digital visuals (for example, clip art, photographs, and sound effects), and electronic libraries to help students in their creative work. Not only do these tools extend what learners have access to, but they also make it easier for students to interact with their peers and experts for feedback and critique (Guo, Pataranutaporn, & Maes, 2024).

Nevertheless, in addition to these advantages, there are still issues. Isabelle & Prysycz argue that a technology that may be a source of motivation for students at the beginning to write may become a source of discouragement for those who are not sure of their writing skills. Among the tools are also mind-mapping, which is supposed to help one think divergently by coming up with ideas related to a central topic, has been used as well. Nevertheless, the availability of empirical research that supports the argument that these instruments effectively foster the creative writing process is quite scant (Buzan, 2024; Basri & Syamsia, 2020).

Taking all these aspects into consideration, the present research is aimed at exploring the extent to which cutting-edge technological means may assist English as a foreign language learners to develop creative thinking skills, reinforced by teachers' experience and insights.

1.7.6 AI and creative thinking

Newton & Newton (2020) delve into the complicated relationship between AI and creative thinking in the learning environment. They uncover two sides to this issue: firstly, AI tools being the main factors that could help creativity to grow and reach new levels. By means of such programs as ChatGPT and Jenni AI, students get rid of the writer's block and come up with new ideas, thus, they can subsequently express their innate creativity because it is already grounded. In contrast, the worry is that if youngsters are always using AI, the latter will take over their minds, and hence become the source for original concepts. Therefore this question immediately appears: how could teachers use AI in a way that creativity is further developed and not the other way around – the creative process is hampered? The paper emphasizes that it is necessary for students if they want to be able to distinguish credible from non-credible content, they have to be taught this skill. This is due to the fact that AI-generated content is not always accurate

and sometimes even biased, so learners should be equipped to confirm data, and then check it against trustworthy sources. By making this a habit, teachers can empower students in terms of the ethical use of AI while at the same time, they expose learners to various types of thinking that will lead to their creativity skill development.

Newton & Newton (2020) imply that integrating AI instruments in class sessions with deliberate planning is the best move. Teachers are given the green light to employ AI for the initiation of work-related tasks, whilst students are still holding the responsibility of the continuation and upgrading of their ideas on their own without any technological help. The authors compare this scenario with other ones involving inventions, for example, the use of computers and translation software, which accompanied by a set of issues initially. After some time, instructors underwent the change and turned the new devices into their allies in education. Nevertheless, they debate that the same tactics might not be sufficient for AI adaptation.

Even though AI tools can do incredible things in terms of the growth of creative thinking, the teacher's role remains to be the same – they escort students in their responsible usage. The main purpose is to let pupils enjoy AI's benefits while they also learn to be creative and think critically on their own without the need for help.

1.7.7 Theories of Writing Skills Development

Different theoretical frameworks provide fundamental insights into the evolution of writing skills, each of them highlighting the different facets of the complicated becoming a proficient writer process. The cognitive approach concentrates on the mental operations that are necessary for writing and it involves organizing one's ideas, brainstorming, and revising. The most important idea of this perspective is that cognitive functions like memory, attention, and problem-solving are of vital importance in writing development and different strategies could be used to activate these functions (Nystrand, 2023; Schunk & DiBenedetto, 2020).

Meanwhile, the sociocultural view sees writing as a product of the interaction of social and cultural contexts, and believes that a learner's writing abilities co-develop with education, family background, and cultural norms. Hence, educators are culturally competent guides when implementing these educational practices in their classrooms and at the same time, they carry out guiding roles in the supplementing of these practices.

Process theory underlines the writing act as one coming through the various stages—prewriting, drafting, and revising—thus, the role of feedback and more than one invention in the mastery of writing skills is made evident. Genre theory, on the other hand, makes it clearer that a narrative, a research paper, or any other kind of writing, is basically different, thus, it depends on the teacher to direct the students on the particular set of skills and methodology for each type (Bai, Wang, & Nie, 2021; Kardiansyah & Salam, 2021).

Besides that, individual differences theory is aware of the fact that each learner is differently gifted or lacks in the area of writing and it supports the idea that instruction should be customized to the needs of individual learners. Educators and researchers can implement comprehensive learning models through the synthesis of these different theoretical perspectives which leads to the empowerment of learners to excel in their written communication tasks (Bai, Wang, & Nie, 2021; Kardiansyah & Salam, 2021; DeMink-Carthew, Netcoh, & Farber, 2020).

1.7.8 Process Writing Approach and Genre-Based Approach

Process writing is more about coming up with and expanding ideas rather than just language accuracy, which students are allowed to make purposeful messages. This method raises both the cognitive and the creative side of the students' minds, thus making writing an adventurous and reflective process. Scholars reveal that process writing enhances language awareness and invites learners to engage in critical thinking as they follow different stages in their writing before they come up with the final version, hence content getting more focus than that of errors (Bean & Melzer, 2021).

Genre-based approach that complements process writing in helping learners produce well-structured texts in different genres was initially suggested by Martin (1987). This is a model focusing on how linguistic features in different genres are influenced by the conventions of that genre and at the same time learners are encouraged to change their viewpoints and most critically examine the voices, purposes, and the contexts in writing of the others. Genre-based instruction enables students to produce texts that are informed by the context and, thus, improving their adaptability to various communicative situations (Lee, 2023; Caplan & Johns, 2022).

To sum up, individual theories of writing development have different angles of the issue but none of them by itself is a comprehensive explanation of how students get writing

skills. Cognitive theory deals with memory and problem-solving in the right way but it might overlook the social influences on language use. Sociocultural theory points out cultural and contextual factors but at the same time it might understate individual strategic choices. Process and genre theories offer the possible ways of writing, though they could limit it as either a series of steps or strict genre conventions. The viewpoint of individual differences accounts for learner variability, however, it is not very helpful in practical aspects of the classroom. As a result, scholars recommend an integrated approach that characterizes writing as both a cognitive and socially embedded process (Nystrand, 2023; Bai, Wang, & Nie, 2021).

1.7.8 Adaptive Learning and Intelligent Tutoring Systems

Artificial Intelligence's Adaptive Learning Systems and Intelligent Tutoring Systems (ITS) are advancements in customized learning. These AI systems adapt feedback and learning materials to the needs and abilities of every learner, making learning efficient and engaging. For instance, ITS can build an independent learning space for learners on the basis of their own learning style by means of reliable feedback and indicators of actual performance in real-time. It adapts to learning and develops skill proficiency through responsive feedback, provided asynchronously (Sarker, 2022; Xu, et al., 2021).

Second, ITS is a highly effective pedagogical tool for delivering corrective feedback and instructing students on various subjects. ITS can imitate personalized instruction and is almost capable of handling numerous topics and adapting to individual strengths and weaknesses, despite its chat-like limitations (Sarker, 2022). It can also support the technical and creative writing processes in language learning, as the study aims to investigate whether AI can enhance creativity and writing ability.

1.7.9 Overview of AI Tools in Education

Since the invention of digital computers in the mid-twentieth century, computer scientists have started developing tools to model human intelligence. Their programs have revolutionized the computer industry and daily human activities. Today's technologies arrange artificial intelligence tools, and the trend is to integrate these technologies into various fields of human life, including education, especially language learning (Beaty, Zeitlen, Baker, & Kenett, 2021; Zong & Zhen, 2021).

The discovery of the importance of language skills and the effective learning of languages dates back many years, when cognitive scientists identified relationships between language and creative thinking. The importance of the education of creative thinking has already taken its place in school curricula. As AI technology advances, Computer-Aided Learning tools become more natural, fun, and effective. Teachers and students have both advantages and disadvantages when using such tools (Beaty, Zeitlen, Baker, & Kenett, 2021; Zong & Zhen, 2021).

Artificial intelligence AI English teaching supports provide a number of positive aspects to teachers and students. AI supports can provide personalized learning experiences to students, including language proficiency feedback and language understanding support. Teachers can benefit from AI support by gaining knowledge of student progress and resources available to prepare more effective and engaging English classes.

Lastly, English learning through AI can also enhance the learning experience of both students and teachers (Rusmiyanto, et al., 2023). Rusmiyanto et al. (2023) found that several AI tools exist to develop English language proficiency. English language learners benefit from the use of such tools since they can build their language proficiency safely and productively. They read more, write more, listen more, and talk more in real life.. AI technologies offer convenience, such as interactive dashboards that enable students to track their progress over time. The AI-friendly approach encourages students to write by creating various tasks, allowing them to express their ideas freely, and correcting grammatical and vocabulary errors. Lowering affective filters is one of the distinctive features of these AI tools to help students develop assertiveness and fluency in speaking. In auditory comprehension, AI technology can be applied in parallel to the human system to provide interactive auditory experiences to many students in such areas (Rusmiyanto, et al., 2023).

1.7.10 Writing AI tools

Two significant studies by (Marzuki, Abdullah, & Hassan, 2023; Tseng & Warschauer, 2023) investigate the applications and benefits of AI writing tools, highlighting their importance in the instructional process through their varied functions and educational impact. These studies offer a comparative perspective on how various tools enhance different aspects of writing.

AI writing tools, like QuillBot, are great helpers for students as well as teachers. With the help of features of QuillBot, such as paraphrasing, students can stay away from plagiarism and teachers can reach their educational goals. Broad use of the tools by educators to maintain academic honesty is one of the research findings. Wordtune is referred to as a tool that helps with the tone and the style of the language, to a large extent, and at the same time it is a support for the students' self-evaluation process. Jenni AI is a good tool when it comes to gathering and arranging ideas, and it is a way of teaching that students hesitating in the areas of structure and creativity can benefit from. ChatGPT is an application for simulating conversations and, therefore, the students' conversational writing skills get enhanced and the educators get enabled to use the same for real-world communication practice. Copy.ai is a way to invite students to be creatively thinking of writing by showing the examples that motivate them to experiment with different styles which in turn push their creative frontier further. Paperpal is a service that concentrates on grammar and gives suggestions for corrections in real time, and Essay Writer is a tool that guides and helps students to write essays that are coherent and well-structured.

Tseng & Warschauer (2023) agree with the above statements and go beyond them by looking at the prolonged impact of AI writing tools in the learning environment. They mention that such instruments have the power to completely change the way writing is taught and at the same time raise less concern about dependence and ethics. Both articles emphasize that using AI writing tools frequently has a major effect on writing skills growth; yet, the main condition for their effectiveness is the teacher's role in guiding students to use them properly and thus enhance their autonomy, critical thinking, and creativity.

On the plus side of these tools, the studies disclose that using AI writing tools lead to better educational results through language improvements such as grammar, vocabulary, style, and varying text types. Besides that, these tools gain time for students and teachers and make writing tasks achievable for students of different proficiency levels (Marzuki, Abdullah, & Hassan, 2023; Tseng & Warschauer, 2023).

However, the teachers have to take care of the other side of the coin as well, such as that the students could become so dependent on the tools that they may fail to develop their writing skills of independence. In order to guarantee that the AI tools are used in the right

way and integration as helpers to traditional learning in class, it is crucial to promote the proper usage (Tseng & Warschauer, 2023).

1.7.11 Effect of AI on Writing Ability

AI conducts tasks akin to human intelligence, such as visual perception, voice detection, language translation, and decision-making, in areas like writing and creative work. AI has made writing easier and more efficient. AI is a successful writing tool since systems are trained on large corpora and can generalize the output, making estimates of the probabilities of various words or word groups in a particular context (Gayed, Carlon, Oriola, & Cross, 2022). English serves as a language of communication and is used as a language of instruction in most parts of the world. For those whose English is not their first language, learning it can be enjoyable and straightforward due to the integration of artificial intelligence technologies. Many language learners use modern computer devices to communicate with friends, family, and teachers via email, chat, and social media platforms like LinkedIn. Therefore, all this writing at the electronic communication level enhances learners' writing skills with the aid of artificial intelligence (Setiyadi, 2020).

However, using artificial intelligence to develop writing skills becomes more accessible through the control of writing abilities for academic and professional purposes via computer technologies (such as computers, tablets, and smartphones), software, and applications available to language learners. AI also uses tools that simplify writing practice and correct various texts through grammar, style, coherence, and synonymy checkers, among others. These tools aim to support the development of language learners' writing expression processes. Therefore, these computer systems put various resources with similar needs for an academic audience into operation, allowing the academic community to use them to enhance the quality of their texts (Gayed, Carlon, Oriola, & Cross, 2022; Kim & Kim, 2022).

1.7.12 Higher-order thinking skills (HOTS)

Facilitate a set of higher-order thinking processes needed to foster deep understanding, critical thinking, and innovative problem-solving among students. HOTS, beyond simple recall and memorization, allow students to apply, analyze, synthesize, and evaluate information to construct sophisticated views and well-informed decisions. Such skills

allow students to comprehend concepts, question, manipulate, and apply their knowledge to new contexts (Achilov, 2017).

HOTS enables learners to categorize, identify, and associate different elements in a problem, interpreting them as capable of managing complex tasks with an orderly mindset. Creative thinking promotes this by leading learners to think creatively, generating new ideas, and considering novel solutions. Such skills include fluency, the ability to come up with many ideas, flexibility, the ability to look at a problem from a new perspective, originality, and elaboration. On their own, they allow students to go beyond the usual methods, thereby increasing their creative abilities and also their capacity for innovative problem-solving (Achilov, 2017).

Higher-order thinking skills (HOTS) refer to the capabilities of figuring out the reliability of the given information, making logical conclusions, and being able to find the hidden assumptions. These skills open up the way for learners to become mature, judgment-based decision-makers and to be critically engaged with the content, which, in turn, leads to an active involvement in learning through analysis, interpretation, and questioning as opposed to a passive kind of learning.

The decision-making and problem-solving abilities, therefore, become a further argument for the existence of HOTS as they allow students to pinpoint issues, come up with different solutions, and decide on the most appropriate course of action supported by evidence. This method makes students ready to systematize data, create hypotheses, verify them, evaluate the results, and if necessary, adjust their strategies, thus arriving at solutions that are not only realistic but practical too (Artika & Nurmaliah, 2023).

1.7.13 Impact of AI on Creative Thinking

The technological revolution has changed international education profoundly, one of the effects being the change in the way foreign languages are taught and learned. The use of Artificial Intelligence (AI) in the learning process has brought a lot of innovations in educational contexts, such as making personalized learning more reachable, AI acting as a virtual tutor, and assessment and evaluation processes getting more efficient.

Writing is an extremely difficult task that requires the integration of one's creativity, problem-solving skills, and critical thinking skills. Besides, it invites the use of multiple

cognitive abilities that enable students to develop reflective thinking skills, come up with creative solutions, and demonstrate critical thinking skills, which, according to Artika & Nurmaliah (2023), are the most important skills for writing.

1.7.14 Student achievement

Marazano (2003) identified Student performance as students work toward learning goals, standards, and curriculum. He states that it includes tests of knowledge, skill, and cross-subject matter skill, and can be assessed through standard tests, class tests, or performance tasks. In this study, students receive a precise assessment of the gain in English language writing ability, as measured by their pre- and post-intervention performance on an AI-enabled tool, Grammarly. In addition to technical accuracy, improvements in coherence, organization, vocabulary use, and the capacity to convey ideas are also incorporated.

1.8 Previous studies

1.8.1 Compare AI-assisted learning with conventional methods

An example of the impact AI can have on learning mathematics was demonstrated in a study conducted by (Ramprakash, Nithyakala, Bhumika, & Avanthika, 2024). Researchers used the ChatGPT generative AI tool. The study focuses on the application of AI technology in assisting learners in the concept of differentiation and integration. The modern learning environment offers exposure to the innovative potential of AI; however, its real impact on learning products requires further research.

This research employs a mixed-methods design, which involved a survey that aimed to assess students' preferences and their perceptions for traditional and AI-supported problem-solving approaches. After this, a post-test was given to see how the use of ChatGPT influenced the students. The findings show that students liked using ChatGPT since it helped them to understand difficult concepts and they got the feedback immediately.

However, a few of them also said that they would like to get more personalized guidance and that their teachers would understand the context better. The integration of AI tools like ChatGPT in the traditional learning model is identified by the study as a way to provide students with a seamless and in-depth learning experience. Moreover, Ramprakash, Nithyakala, Bhumika, & Avanthika (2024) also agree with this view and

state that AI-supported collaborative e-learning can lead to higher learner engagement and motivation.

On the other hand, a closer examination of the results of each learning method can provide insights into the learning process. For example, in previous research on vocabulary learning, researchers compared learning via a paper-based dictionary, a web-based dictionary, a web-based intelligent tutoring system, and a portable web-based personalized vocabulary notebook. The results revealed that participants who used the intelligent tutoring system and the portable, web-based, personalized vocabulary notebook enhanced their vocabulary knowledge and facilitated their ability to use words creatively. Another study implemented four types of web-based learning (network instruction, CBI, AI-based knowledge construction [AIKC], and AI-based representation). We compared the learning effectiveness of learners at varying levels of English proficiency and conditions. The results showed that AI-assisted learning offered different learning benefits according to students' proficiency levels (Fang, Xu, He, & Han, 2022).

The impact of technology in classroom teaching and learning has commanded the attention of educators for decades. Such techno-centric emphases have generally been positive and growth-oriented. However, questions relevant to sustaining creativity in the English language classroom in the face of technological advancements remain largely unexplored in the English language education community. One reason could be the widespread perception that AI decreases creativity and discourages learners from developing their own creativity or originality. Such apprehensions have been balanced by those who argue that AI has the potential to make valuable contributions to understanding the creative process. One study conducted in Hong Kong Chinese secondary schools aimed to seek and address the gap by exploring and reporting investigations into the impact of artificial intelligence (AI) on the creative thinking and writing skills of English language learners (Ahn & Oh, 2024; Guo, Pataranutaporn, & Maes, 2024; Liu, Chen, & Yao, 2022).

The study examined the perceptions of teachers about AI and creativity in English language teaching and learning. The creativity aspect of the English curriculum is being emphasized by policy-makers, curriculum developers, and language education

specialists, which in turn positively influences teachers' instructional practices. According to the teachers, they have the ability to develop students' creative mastery.

The findings of research on teaching a second language (TSL) have significant implications, as they uncover how educators in Hong Kong schools perceive creativity. The analysis of the data provides the rationale behind the suggestions concerning Technology-Assisted Design (TAD) and pedagogical content knowledge (PCK) which can help teachers to facilitate students' creative thinking.

In order to accomplish this, more emphasis needs to be placed on the development of TAD, encouraging teacher innovation, and strengthening pedagogical strategies through regular professional development workshops. Besides, these sessions should also make teachers more conscious of creative teaching methods as they have been shown to have a great impact on teachers' capability to carry out innovative instructional approaches through the observation of activities and experiencing them directly (Ahn & Oh, 2024; Guo, Pataranutaporn, & Maes, 2024; Liu, Chen, & Yao, 2022).

The study employed a mixed-methods research design, applying surveys and interviews to achieve its objectives. The study begins with a survey to assess teachers' perceptions on the impact of AI on students' English language learning. The survey results served as a sampling reference for the interviews. Specifically, the survey questions aimed to investigate how English-language teachers perceive the role of both the writing process and the use of AI in students' creative, critical, and digital problem-solving skills. Supplemental questions asked teachers to reflect on whether they thought using AI for English learning was a positive move and what concerns the English as a Foreign Language (EFL) learning community might have regarding students using AI (Ahn & Oh, 2024; Guo, Pataranutaporn, & Maes, 2024; Liu, Chen, & Yao, 2022)

The General Information Questionnaire was distributed to gather basic demographic information, including teaching experience, educational attainment, classroom experience with digital technology, and students' age groups and language proficiency levels, see appendix (F). The questionnaire used in the survey studies was adapted from Samraj (1998) and Hwang and Shih (2017). Hwang and Shih (2017) conducted two rounds of content reviews. The first round of the reviews involved five English-language teachers and five information and communication technology teachers. This feedback

was integrated into modifying concepts and language used in the survey questionnaire. In the second round, three linguistics professors verified the survey questions. However, no feedback submissions were made from these experts. Based on feedback from this first round of review, the questionnaire was refined. Following refinement, the open-ended survey questionnaire was administered to 18 EFL teachers from five universities and national organizations. Findings indicated that the two data sources were valid, and the results suggested moderate to high internal consistency for the measurements within the instruments (Ahn & Oh, 2024; Guo, Pataranutaporn, & Maes, 2024; Liu, Chen, & Yao, 2022).

1.8.2 The use of AI in education according to gender and age differences

A study was conducted that highlights significant gender differences in the use of AI tools, particularly generative chatbots, with important implications for educational equity. In a large-scale Norwegian study of higher education students ($n = 2,692$) found that male students engaged more frequently and across a broader range of generative AI chatbot applications, expressing greater interest in their relevance to future career prospects. In contrast, female students primarily used the chatbots for text-based purposes, including understanding and translation, and expressed concerns about creative thinking, independent use, and authenticity. The data also emphasized the deep hunger for learning and the need for instruction focusing on the responsible use of AI tools. Even after controlling for exposure and training, these patterns were still visible, which implies that men usually adopt AI tools without much thought, while women use them more cautiously and critically. Furthermore, a cross-national study incorporating 143,000 participants from 18 different studies revealed that women are 10–40% less likely than men to use generative AI, and this difference is not eliminated by the provision of access. According to the research, gender awareness should be at the core of AI-led educational interventions, which will help promote digital literacy and critical thinking skills, especially among female learners. A research by Picton & Clark (2024) carried out by the National Literacy Trust in the UK, gives an in-depth view of how kids and youths use generative AI for literacy growth. The report based on the survey of a nationally representative sample of over 3,500 students aged 8 to 18, depicts both the extensive use and the cautious hope of AI technology in the school system. About 40 percent of the respondents said that they had used generative AI, for example, chatbots such as

ChatGPT, in doing writing assignments, coming up with story ideas, or expanding vocabulary. What is more, students from the lower-income families were found to be more likely to use AI tools for their writing needs which in turn spotlights the power of generative AI to bridge the digital and literacy gaps. Besides, the majority of the students showed a positive attitude towards the AI tools as they were curious and interested in them although the concern of accuracy, overreliance, and ethical issues were also raised. The research reveals that AI tools can not only improve writing skills but also increase the creative ability of learners especially those who are English language learners, and at the same time, it stresses the need to use these tools as part of a structured, educationally informed plan if the problems of over-dependence and negative resulting are to be solved (Picton & Clark, 2024).

1.8.3 Grammarly as a Case Study

Learners are increasingly using AI tools that are specifically designed to fix grammatical errors in English. As the use of these AI applications is becoming more and more common, this research seeks to find ways in which these technologies can help ESL learners to develop their grammar skills. To this end, Grammarly, a comprehensive artificial intelligence editing tool used to edit and correct written texts, was employed as a case study by (Alotaibi, 2023). Thirty undergraduate students studying General Academic English courses participated, and a questionnaire was used to assess their knowledge levels after each session. According to the reported levels of knowledge at session endings, undergraduate students reported the findings as positive, negative, and enjoyable. The qualitative research method, specifically content analysis, was employed to assess the validity of the information provided by students participating in the study (Alotaibi, 2023; Fitria, 2021). The fact that many students learning English encounter problems with the correct usage of English grammar has created a need to support foreign language education with information and communication technologies. As the number of foreign language learners has increased in recent years, the number of services provided by AI for foreign language education has also increased. It is also a trial-and-error process for foreign language teaching to apply different learning environments, tools, and various materials to deliver high-quality teaching content to users and make learning more engaging and efficient. Despite the need to master a foreign language, some conflicting

problems arise from students' grammatical errors, which are fundamental to the English language (Alotaibi, 2023).

1.8.4 Challenges and Considerations

As machine learning techniques improve and get more sophisticated, AI-based applications can produce authentic text or audio responses based on a written stimulus or prompt. In the AI community, this phenomenon is known as GPT-3, "Generative Pretrained Transformer 3" developed by OpenAI. Feeling creatively stimulated, ESL/EFL students and English language learners are starting to use these digital assistants as if they are participating in a language dialogue, asking for idioms and jokes, or posing exciting questions to be explored with a natural language processing (NLP) application, and simply framing the main topic as the prompt can produce various convergent points and opinions. Creative writing performance activities in language learning classes, theoretically speaking, attempt to shift students' way of thinking from "traditional-conventional" to "imagination," employing language as an active and dynamic tool for communicating personal emotions and thoughts (Alto, 2023).

However, the more powerful and valuable these GPT-3 applications are, the more complex and challenging they become regarding their control and usage. Though these apps could eventually become cool and creative means of teaching languages, a bunch of still-open ethical and practical issues might be so troublesome that they put these apps aside in the corner of the classroom, waiting for another day.

Technically, this research looked at a group of ESL students from a Japanese university where GPT-3 was employed as a tool to help the learners come up with similes and metaphors. The work concentrated on uncovering and resolving various teaching and moral problems such as language control, data protection, accessibility, and the appropriateness of the exercises (Alto, 2023).

1.8.5 Teacher Training and Support: Professional development and best practices for AI integration are essential

In process-based AI tutoring systems for creative writing, teachers assume the role of observing and providing feedback on the learner's process, rather than the outcome of the creative task. This requires a shift from evaluating the final creation to observing how the

learner thinks, collaborates with others, reflects on problems, and deals with complexity. Opening up for dialogues about taking chances and allowing failure as part of the learning process is vital, if possible. Barriers between AI and the teacher, as well as between the teacher and the learner, need to be addressed. Nonetheless, research indicates that teachers need to develop confidence in using AI tutoring systems in the classroom, despite students' doubts and resistance being a potential barrier (Tang, 2024).

High-quality AI tutoring systems often depend on collaboration between interdisciplinary teams. A teacher's theoretical understanding of AI tutoring and high technology literacy is always valuable. It might be inadequate to make them understand, apply, and communicate most of the important aspects of the tutoring system. To the extent that students can actually gain an advantage from these highly advanced and technical AI systems, the design theory of AI tutoring systems and the teacher's role in implementing these systems must shed much more light on this. The Education and AI community can benefit from enabling greater interdisciplinary interaction, led by teacher-tried best practices and pedagogical impact research (Tang, 2024).

1.8.6 Teachers' Attitudes, Perceptions, and Acceptance towards AI

The integration of AI into the classroom is sparking debates about the impact of AI on education and teaching. Considerably, researchers have concentrated their efforts on unveiling how teachers perceive AI, what kind of attitude they develop towards its integration, and to what extent they make use of it in their teaching practices.

These factors are essential to determining whether the implementation of AI in the classroom will be successful or refused. At the same time, AI-based programs for grammar correction in English are gaining popularity among language learners. A case study by Alotaibi (2023) aimed to investigate how English language learners can be assisted in acquiring improved English language grammatical knowledge through the expanded application of AI. Grammarly is one of the comprehensive artificial intelligences editing tools employed to edit and correct written texts.

Thirty undergraduate students studying General Academic English courses participated, and a questionnaire was used to assess their knowledge levels after each session. According to the reported levels of knowledge at session endings, undergraduate students reported the findings as positive, negative, and enjoyable. The qualitative research

method, specifically content analysis, was employed to assess the validity of the information provided by students participating in the study (Alotaibi, 2023; Fitria, 2021).

The attitude of teachers towards AI determines how they will apply it in the classroom. Yim & Wegerif (2024) argue that teachers who view AI as a supplement to their pedagogy are more likely to apply it. They are open when they view AI as a supplement, not an addition to the teaching process. Similarly, other teachers are also worried about debating the usability results of AI, how exposed it is to bias, and the lack of mandatory rules on use. Shi, Ding, & Choi (2024) add to this evidence by illustrating the impact of teachers' teaching styles on their attitudes. Teachers with a strong style in guiding students will use AI responsibly, viewing it as an additional tool for enhancing their instruction. By contrast, more adaptable pedagogues are willing to have AI participate in a co-teaching capacity with students, engaging with them and co-creating learning experiences. The degree to which teachers adopt AI is commonly researched through models like the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT). Yim & Wegerif (2024) observe that teachers will adopt AI if they find it easy to use and helpful to students. They emphasize institutional support, believing that the greater the administrative support and training teachers have, the more they will explore the possibilities of AI. Shi, Ding, & Choi (2024) emphasize the importance of classroom practice. Their research found that teachers familiar with AI-based tutoring systems are more likely to incorporate AI into their teaching and have confidence in its value. They find that teachers' philosophies toward teaching, whether they accept AI as an addition or a core of the learning process, have a significant impact on whether they are open to AI-based tools.

All the research studies consider teachers' attitudes towards AI, but use varying methods and motivations. Yim & Wegerif (2024) employ a survey research approach, gathering information from various educators with the aim of changing general negative perceptions about AI. Shi, Ding, & Choi (2024), however, conducted an in-depth case study of teachers who have deliberately incorporated AI into their classrooms. It represents two complementary views: one with a quantitative, statistical perspective on teacher attitude, and the other with qualitative, in-depth data on how AI performs in specific learning settings.

In addition, Yim & Wegerif (2024) state that training is a fundamental element toward maintaining the integration of AI by educators. Educators who have received expert-guided and professional training sessions are more likely to feel comfortable incorporating AI into the classroom. Shi, Ding, & Choi (2024) note that practical experience with the application of AI tools is more important than theoretical training, as it enables teachers to better understand the advantages and disadvantages of AI.

Emotional and cognitive challenges have been pointed out by Shi, Ding, & Choi (2024) as a result of AI integration in education. Some teachers, especially those who have not used AI much, find it difficult to understand the in-the-moment data about students' learning that AI generates. Correspondingly, Yim & Wegerif (2024) focus on difficulties faced by institutions and mention that among teachers the most common problems are those related to vague policies and lack of administrative support for AI implementation.

In moving education forward, AI has great potential, yet, the path towards a wide application of AI is still barricaded with some obstacles. Teachers are most of the time in a position to say that they don't have any guidelines, they haven't participated in any training, and they are not sure about the privacy of data, and these are the major points of their worries. According to Yim & Wegerif (2024), untrained teachers are hesitant how to utilize AI in their teaching. Besides that, Shi, Ding, & Choi (2024) affirm that there exists a group of educators who experience anxiety when they are expected to comprehend AI-generated reports with the rest of their work and at the same time use AI's functionalities. These findings indicate that the presence of support, availability of resources and assistance in the form of strategies which are specifically designed for teachers' needs is indispensable for the successful use of AI.

Most educators identify AI-driven writing aides and grammar correctors as helpful instruments that offer prompt feedback to students and thus develop their writing capabilities. In contrast, both papers agree that AI should not be considered as a substitute of the teacher, who is the one to guide the students' independence, reflection and deeper engagement with language. The key to success lies in finding a balance between the benefits of AI and keeping strong student-teacher interactions.

1.8.7 Limitations in Research on AI's Impact on Creativity

While the use of artificial intelligence (AI) tools in language teaching has been a popular topic, most of the research that has been done is focused on AI enhancing technical writing skills, e.g. grammar, rather than the creative thinking ability of the students. As an illustration, Grammarly is a tool which is very frequently utilized for giving on-the-fly feedback that makes writing more accurate and coherent. However, its role in creativity generation is barely touched by research (Alotaibi, 2023), since most of the research articles only talk about AI as a means that leads to better learning outcomes and gives personalized feedback. The impact of AI on creative expression and divergent thinking—one of the most important features of language proficiency—has been almost ignored (Fletcher & Benveniste, 2022).

This research work intends to bridge the gap by investigating the influence of AI on writing both from the technical side as well as the students' creative thinking, thus revealing a more complete view of the AI language learning assistant role. This kind of treatment will not only clarify the different ways AI can be used in teaching but also highlight how AI can be used to develop student's innovative and expressive skills which are necessary for their holistic language education.

1.9 Conclusion

Artificial intelligence (AI) tools are progressively integrated into the education system, however, the question of how they affect the writing skills of secondary school students, especially in EFL (English as a Foreign Language) contexts, is still a matter of debate. The handling of writing by the middle and high school students has been a side issue in most papers which have only concentrated on the university level and adult learners, consequently, the situation of the former as the Arab students coped with the multicultural milieu of the Haifa District remains nearly invisible.

Besides, in spite of the fact that Grammarly has been shown to be very effective in grammar correction and style improvement, the influence of such instruments on the writing proficiency of different groups of students is still speculative for further research. Realizing this void in current literature is the driving force behind the fair and efficient use of AI in school work.

Furthermore, there is a scant number of research works looking at the figuring-out of teachers using writing AI tools. The opinions of instructors about the introduction of AI in their teachings give an insight into the actuality of benefits, difficulties, and the day-to-day running of teaching in the classroom.

This research fills the void in the literature by investigating the impact of the Grammarly AI writing tool on the writing skills of Arab EFL secondary students with a focus on gender and age differences. It also surveys a sample of EFL teachers about the use of AI tools in writing instruction with a focus on students' creativity and motivation. By employing a mixed-methods design in a linguistically and culturally diverse environment, this research sheds light on the role of AI in EFL and offers valuable insights for the creation of new inclusive and effective pedagogical practices.

Chapter Two

Design and Methodology

2.1 Introduction

This chapter describes the methodological framework of the study, covering its design, context, participants, instruments, data collection procedures, and analysis techniques. The main objective was to find out the effect of using Grammarly, an AI-based writing tool, on students' writing proficiency. Besides that, it surveyed educators' opinions regarding the implementation of AI and the resulting impact on students' creative thinking and writing skills. Moreover, this chapter justifies the choice of the study's design, context, location, population, sample, scope, variables, and methods, thereby securing the research's validity, reliability, and ethical integrity.

2.2 Research context

In the current research, a mixed-methods quasi-experimental approach was employed, combining quantitative tools (pre- and post-tests, questionnaires) with qualitative methods (semi-structured interviews). The main aim of this study is to present a comprehensive overview of the influence Grammarly has on teachers perception concerning AI integration influence on students creative thinking ability in writing.

2.3 Quantitative Component

Quantitative part of the study to measure students' writing competence (60 students) before and after the use of Grammarly for both groups. Pre- and post-test essays were administered and analyzed using the Ministry of Education's Module C rubric, which provided accurate measurements of students' performance. Additionally, a structured questionnaire was administered to 92 English teachers to gather their views on the integration of AI in language learning.

2.4 Qualitative Component

This study included a qualitative part that involved 15 semi-structured interviews with English teachers in the Haifa District. These interviews helped to reveal the beliefs and experiences of the teachers about the use of Grammarly as an AI-based assessment tool for students. A thematic analysis was done by the researcher to understand the teachers'

views which were not disclosed in the questionnaires and these views included the topics of originality, creativity, and dependence on technology.

2.5 Rationale for Mixed-Methods Design

The main factor behind choosing a mixed-methods design was that the research questions could not be adequately answered by either quantitative or qualitative approaches alone. Quantitative data served as a precise metric of students' writing improvements, whereas qualitative data helped to understand the contextual and pedagogical aspects that contributed to these gains. The use of both methods enhanced the study's trustworthiness or internal validity through triangulation, which is a process where the results obtained from one method are confirmed, explained, or illustrated by the findings from the other method.

2.6 Geographical and Demographic Background

The investigation presented here took place in the Haifa District, which is located in the northern part of the country. Geographically, it comprises the city of Haifa and a number of cities, towns, and villages (such as Umm al-Fahm and Wadi Ara) in the Haifa area. Demographically, the population is a mixture of the four main Israeli ethnic and religious groups: Jews, Muslims, Christians, and Druze, and the area is considered a model of a multicultural and multilingual learning environment (Central Bureau of Statistics [CBS], 2023).

Within this Geographical and demographic setting two groups of participants inhabited the present study. On the instructor's side, the foreign language instructors teaching English in the Arab high schools located in the Haifa District were the study participants whose opinions were gained through structured questionnaires and semi-structured interviews. Their participation to the maximum extent possible in terms of the teaching challenges and the potentials of AI in the EFL classroom was a kind of their input.

The student side, on the other hand, the quasi-experimental component was in one Arab secondary school in the district, 10th- and 11th-grade students were involved in pre- and post-test writing tasks. This made it possible to them to evaluate the impact of Grammarly on their writing skills in a real and contextually appropriate learning environment.

2.7 Sample and Population

The population under study consisted of two categories: the high school pupils and Arab English language instructors in the Haifa District.

2.7.1 Student Sample

The student sample included a total of 60 high school students, equally divided between the 10th grade (15 males and 15 females) and the 11th grade (15 males and 15 females). All participants were taken from two classes in a local official Arab high school in the Haifa District. It was a targeted selection aimed at students who had both English academic competence and general level competence, to facilitate their meaningful contribution to AI-based writing tasks. This allowed them to assess how Grammarly impacted their own writing competence in a real and contextually situational learning setting.

2.7.2 Sample and Population

The people of the city were split into two groups. One group consisted of high school students and the other Arab teachers of the English language in the Haifa District. As per the Common European Framework of Reference for Languages (CEFR), their language proficiency was between A2 and B1 levels. At the A2 level, the students are able to use basic sentences and share simple information about daily activities. But, at the B1 level, they are capable of writing connected texts, giving their views, and narrating experiences as well as plans.

2.7.2 Inclusion Criteria

The students in the group were either from grade 10 or grade 11 and had a good command of the English language (A2–B1). They were under the researcher's instruction. The selection of such a group was a guarantee that the students would be able to carry out AI-supported writing activities on their own and comprehend a series of instructional practices.

2.7.3 Exclusion Criteria

Students with less than adequate English capability as per their past English achievements, or those from classes that were not directly taught by the researcher, were

not part of the study. The decision was made to keep teaching consistent and have control over the variables that might have an effect on the results and that were influenced indirectly. The research was carried out with top students of the 10th and 11th grades because such learners have enough English proficiency to be able to use AI-supported writing and creativity tasks effectively.

Their proficiency ensured that the changes in writing and creative thinking that were observed could be the result of the intervention alone and not of language comprehension difficulties. Nevertheless, this purposeful choice might restrict the applicability of the results to a wider population; hence, the next research should consider including a diverse group of students at different proficiency levels to confirm and expand the findings obtained.

2.7.4 Teacher Sample

The second sample included 92 Arab English language teachers working in secondary schools in the Haifa District. Teachers participated in both a structured questionnaire and semi-structured interviews. The demographics used in the controls in the analysis were gender, teaching experience in years, and training in AI. These were used because they are most likely to impact teachers' attitudes towards adopting technology in the classroom. For example, differences might arise between male and female teachers, between experienced and non-experienced teachers, or between those with and without AI-related professional development.

2.7.5 Sampling for Interviews

The teacher interviews employed purposive and voluntary sampling. Fifteen participants were selected based on three criteria: (1) they were currently teaching English in a high school within the Haifa District, (2) they expressed willingness to participate in an in-depth interview, and (3) they integrated at least one AI in their teaching practices. Teachers were placed in contact through professional development sessions and school visits. Although invitations were extended, only those who gave informed consent and were available at the suggested times attended the interviews. This facilitated naturalistic interaction with participants without disrupting school routines. While not statistically random, the time and the number of participants available introduced an uncertainty into the process that helped to make the sample representative.

2.8 Tools and instruments

2.8.1 Digital tools

Padlet

It is an interactive, web-based platform that allows users to collaboratively post, organize, and share multimedia content on a virtual board. It functions as a digital canvas, allowing students and teachers to contribute text, images, links, audio, and video files in real-time. Moreover, multimedia materials can be shared on a virtual board. It is an e-whiteboard where students and teachers can type in text, images, links, audio files, and video files in real-time. At the classroom level, Padlet facilitates engagement, feedback, and monitoring of thinking in both synchronous and asynchronous settings (Holland & Muilenburg, 2021). Padlet was used to gather students' pre- and post-test comments in this research, allowing for the proper organization, current relevance, and easy accessibility of both individual and collective inputs.

Grammarly

It is an artificial intelligence-powered digital writing assistant designed to promote the clarity, accuracy, and readability of the user's writing. It provides instant feedback on grammar, spelling, punctuation, sentence structure, and tone, and provides suggestions for improvement and language refinement. In schools, Grammarly is applied to enhance students' writing abilities by providing them with computer-based, personalized writing recommendations (Li & Zou, 2022).

2.8.2 Pre and post-test

Before the integration, a writing pre-test was given to both groups. The test included one task: writing a composition about a topic taken from Module C writing lists. The pre-test prompt was:

"Which profession(s) do you think should get the highest pay? Choose one or two professions and write a passage (70–90 words) explaining your choice."

After the integration of Grammarly, a post-test was also given to the two groups, similar to the pre-test. The post-test prompt was:

"In your opinion, do you think children should have cell phones under the age of 10 (5th grade)? Why or why not? Explain your opinion in 70–90 words."

Both tasks were completed within controlled classroom environments and graded according to the certified Ministry of Education Module C Writing Rubrics. The four broad areas that these rubrics assess are content, language, organization, and mechanics, and these are subject to a maximum combined score of 30.

Pre- and post-test procedures were not externally validated by specialists because the Local Ministry of Education had officially approved them. They are taken from the English curriculum and worked on intensively across the country in schools to assess writing ability. Their validity, in terms of alignment with the curriculum, confirms their reliability and appropriateness for the target student population.

2.8.3 Questionnaires

The researcher designed a formal questionnaire to investigate teachers' perceptions of integrating AI tools into English language education. The tool was constructed in six sections, all of which were appropriate for the study's goals and research inquiry. Section 1 (Items 1–6) collected demographics and teaching experience, including gender, age group, level of education, years of teaching experience, grade levels taught, and previous experience with AI-associated software. Such controls enabled subgroup analyses and allowed for the exploration of variability by teacher profiles. Section 2 (Items 7–9) probed teachers' familiarity with digital technology, i.e., AI tools such as Grammarly, ChatGPT, Gemini, and MagicSchool, to investigate their ease of classroom adoption. Section 3 (Items 10–16) targeted general teacher perceptions of employing AI in instruction, and the items included were those related to instructional support, workload reduction, and interference with conventional pedagogies. Section 4 (Items 17–23) were about students' creative thinking, i.e., how AI might have influenced their originality, independent idea generation, and organization. Section 5 (Items 24–30) looked at writing skills, i.e., how AI was perceived to help or hamper lexical richness, sentence organization, grammaticality, coherence, and content creation. Eventually, Section 6 (Items 31–33) was a survey of teachers' ideas and suggestions about using AI in the future for teaching, including curriculum aspects, training requirements, and ethical considerations. The questionnaire ended with an open-ended question, which gave respondents the opportunity to share more of their experience and provide more suggestions. The complete layout of the tool is shown in Table (1), see Appendix (B).

2.8.4 interviews

Semi-structured interviews served as the main qualitative research instrument. The interviews aimed to reach an understanding of teachers' perceptions, experiences, and reflections of the Arab EFL high school teachers on the use of AI technologies, especially the Grammarly platform, in English language teaching. Questions for the interviews were composed by the researcher and piloted by a group of academic jurors for clarity, appropriateness, and relevance to the research purpose, see Appendix (F).

Open-ended questions in the interviews were intended to draw out the views of the teachers about the role of AI in either facilitating or limiting students' creative thinking and writing skills. They also evaluated teachers' acceptance, concerns, and expectations about AI integration in their instruction. The instrument produced qualitative data that was used to supplement the quantitative findings of the questionnaire and pre- and post-writing tests, thus allowing for a more comprehensive interpretation of the research findings.

To enable the participants to thoroughly present their ideas and also to be able to identify the emotional side of their responses, the interviews were carried out in Arabic, which is the participants' native language. With consent being given by the participants, each interview was recorded, transcribed word for word, and then translated into English for thematic analysis.

Furthermore, the interviewer made some notes in order to capture the production of the talk and the non-verbal gestures that were used later to confirm the reliability of the data and to gain a deeper understanding of it. In total, fifteen interviews were held, with this number being decided upon based on the principle of theoretical saturation which means that data collection stopped when no new themes or information were found.

2.9 Data Collection Methods

2.9.1 Pre and post-test

Initial Writing Process

Prior to the research intervention, the students were engaged in writing classes that were a part of their normal English curriculum. These classes included traditional, handwritten compositions, and the classroom teacher assessed them manually by using a general

rubric that mainly focused on the structure, coherence, and basic grammar. This practice was the initial move to creating a groundwork in writing skills before the incorporation of tech-based tools.

Pre-Test Using Padlet

A test was given to students to assess their writing skills, which is the pre-test. The test was conducted through Padlet, see Appendix (M), an online collaborative platform that students could use for writing and posting their works. Students in the 10th and 11th grades were assigned a group writing task that assessed their expression of personal opinions and providing logical arguments corresponding to the requirements of Module C, see Appendix (O).

All pre-test responses were evaluated based on the official Module C writing rubric, which is local Ministry of Education mandated, and the local Ministry of Education wrote the rubric. The rubric had four parts: Content and Analysis (10 points), which measured the relevance, clarity, and the expansion of the ideas; Vocabulary (8 points), which looked at the range and the appropriateness of the vocabulary, including the use of language chunks and expressions; Language Use (8 points), which checked for grammatical accuracy, syntax, word order, and sentence structure; and Mechanics (4 points), which looked at punctuation, spelling, and capitalization, see Appendix (J). Such a scoring system contributed to the consistency and validity of students' initial work.

Intervention Using Grammarly

After the pre-test, a three-month intervention was held during which students were regularly introduced to and engaged with the Grammarly AI writing tool. In order to provide equal access, every student made an account with the free version of Grammarly, and no premium features were enabled. The intervention was held in the school computer lab, where students came for a 45-minute weekly English lesson focusing on writing.

Throughout the twelve weeks, students engaged in writing tasks while Grammarly was offering them an immediate feedback on their grammar, punctuation, clarity, and vocabulary. Grammarly was not only a tool for automatic corrections, but also a platform that helped students become more interactive and encouraged them to actively revise their

work. Students were instructed to think over Grammarly's suggestions very carefully rather than simply accepting them. Teachers helped students to make editing decisions by asking them to discuss, compare, and contrast their drafts, thus getting a deeper understanding of writing conventions and stylistic choices. At this point, students' independence in editing their own work together with their command of grammar, coherence, and vocabulary was the target.

Post-Test in Padlet

Following the intervention, students were again tested on the same digital platform (Padlet) with the same design and cognitively demanding writing prompt as the pre-test, see Appendix (N). In fact, this consistency of task design made it possible to compare student performance before and after using the Grammarly tool in a reliable way. Students' essays were once more evaluated through the Module C rubric, which mainly targeted the language-related aspects of the texts, such as grammatical accuracy, sentence structure, vocabulary variety, and overall coherence.

The Objectives of the Experiment

The foremost goal of this classroom quasi-experimental study was to find out if ESL secondary school students could improve their writing skills by using AI-assisted writing tools like Grammarly. The intervention aimed to capture the influence of these tools on different writing areas to an extent that there would be no doubt left. Those areas were Content and Analysis (relevance, clarity, and idea development), Vocabulary (range, appropriateness, and use of language chunks and expressions), Language Use (grammatical accuracy, syntax, word order, and sentence structure), and Mechanics (punctuation, spelling, and capitalization).

Besides assessing the core components of writing, a research question was raised in the study whether grade level (10th or 11th) and gender (male or female) as independent variables could affect the improvement after an AI-based intervention. The comparative analysis of these factors was instrumental in ascertaining if the age or gender of students determined their sensitivity to AI tools, ability to use digital writing platforms, or overall writing progress.

In a thorough manner to evaluate the learners' progress, their essays were segmented into the opening part, the body, and the conclusion while following the local Ministry of Education's Module C instructions which had been taught beforehand. Each section of the essays from both pre- and post-tests was separately scored using the standardized Module C rubric to provide insight into the skills of idea introduction, argument development, and conclusion crafting.

Data collected from the research were looked at carefully with statistical methods to reveal the changes in performance for each structural component. Along with mean scores, standard errors of the mean (SEM) were also computed and shown on charts to indicate students' progress. Such a method allowed for a complete picture of students' writing development while their specific ways of getting Grammarly to help them have been brought to the fore, such as organizing, clarifying, and consistently expressing their ideas in a coherent and logical manner.

2.9.2 The Questionnaire: Design, Structure, and Purpose

As part of the study's mixed-methods design, a structured questionnaire was developed by the researcher and administered to a group of jurors to assess its appropriateness for the study's objectives. The study tries to examine the perception of Arab high school EFL teachers on incorporating AI tools, such as Grammarly, into writing classes and developing students' creative thinking, see Appendix (A). The questionnaire served as a part of the quantitative component to gather large-scale perceptual data, complementing the experimental classroom intervention.

The questionnaire was administered via Google Forms, see Appendix (G), a software that was used because it is easy to use, accessible, and can be used to collect structured data. The electronic questionnaire was sent via WhatsApp groups of Arab English language teachers in the Haifa District. WhatsApp was used as the central dissemination platform because it is prevalent among the target environment's educators, providing for maximum response and coverage.

The questionnaire was specifically designed in accordance with the study's research questions. Every section served a particular function, and conceptual consistency was present between the measure and the theoretical framework of the study. Themes of the study were deeply rooted in a mixture of recent strict scientific research on AI for

language education, teacher technology acceptance, and writing instruction. These resources were utilized to provide the wording of the items, the layout of the thematic sections, and the choice of the measurement scales.

Questionnaire Structure Section 1: Demographic and Professional Background (Items 1-6)

The first part collected general demographic and professional information of the participants. The information consisted of gender, age category, educational level, years of teaching experience, grade levels taught, and prior training on AI tools. These were instrumental in figuring out potential trends and differences in responses for various subgroups, e.g., gender or teaching experience. The layout of the questionnaire is shown in Table (1) see Appendix (B).

Section 2: Familiarity with AI Tools (Items 7–9)

Material from this section identified the teaching staff's knowledge of AI tools like Grammarly, ChatGPT, Gemini, and MagicSchool. Respondents were prompted to indicate their usage of these tools and the degree to which they had incorporated them into their teaching. Besides this, they measured their ease in employing AI technology in the classroom. The section was useful in establishing the degree of digital literacy of the respondents, thus helping them to make sense of their views in the later sections.

Section 3: Teachers' Perceptions of Integrating AI in Teaching (Items 10–16)

This part of the document looks at the overall perception of the use of AI tools by the teachers in their instructional practice. The questions were designed to find out if the participants believed that AI could make the teacher more effective, help in preparing the lesson, speed up the assessment, or be a supplementary tool for their daily work. The additional questions probed participants' views about the AI impact on the teaching profession. The statements in this part depicted the general mood of the teachers about the use of AI in their classroom practices.

The respondents believed that AI tools could be instrumental in teaching, make lesson planning easier, help in assessment, and lessen teachers' workload. In addition to that, the participants had different views on whether AI is a helpful tool that complements the traditional teaching methods or a disruptive one. Generally, this part of the document was

a “climate check” that helped to understand the general educational stance of teachers towards the use of AI in the classroom.

Section 4: Impact of AI on Students’ Creative Thinking (Items 17–23)

Teachers had to think about the effect of AI instrument usage on the followings of students: being original, independent thinking, and getting ideas grow. They also considered if AI helped or hindered students to creatively express themselves. Some questions were focused on the students' skills of organizing and elaborating ideas and their progress in these areas, while the rest of the questions gauged the level of concerns believers felt about the heavy usage of AI and the possible disappearance of the independent thought.

Section 5: The Impact of AI Tools on the Writing Skills of Students (Items 24–30)

This section looked at the teachers' views on the changes brought by AI technology in the writing of students, with particular emphasis on vocabulary range, sentence structure, organization, clarity, grammatical accuracy, and content creation.

The respondents were asked if the use of AI tools leads the students to write in a more coherent way or if they just take the suggestions without a thinking process. The questions also investigated the extent to which writing through AI continues to enhance writing skills in the future or merely results in the formation of dependency.

Section 6: Recommendations and Future Use (Items 31–33)

The final section of the survey got educators to express their views regarding the use of AI in education in the coming days. The first artificial intelligence-related question contemplated its integration into the teaching program, another queried whether teachers would need further training, and the third asked if there were any ethical considerations involved. The last open-ended question in this section was a call for ideas from the participants or to identify obstacles if they had the experience of teaching with AI support.

2.9.3 Structural Overview of the Questionnaire Sections and Items Prior to Validity and Reliability Assessment.

The following table outlines the main sections of the questionnaire and the distribution of items, prior to conducting validity and reliability procedures, to provide a clear structural overview of the research tool.

Table (1)

Outlines the main sections of the questionnaire and the distribution of items

Section No.	Section title	Number of items within the section	Total number of items within the section
1	Demographic and Professional Background	1, 2, 3, 4, 5, 6	6
2	Familiarity with AI Tools	7,8,9	3
3	Teachers' Perceptions of Integrating AI in Teaching	10, 11, 12, 13, 14, 15, 16	7
4	Impact of AI on Students' Creative Thinking	17, 18, 19, 20, 21, 22, 23	7
5	The Impact of AI Tools on the Writing Skills of Students	24, 25, 26, 27, 28, 29, 30	7
6	Recommendations and Future Use	31, 32, 33	3

3.9.4 Teacher Interviews

In this study, a series of semi-structured face-to-face interviews was conducted with a sample of Arab EFL high school teachers (15 teachers) working in the Haifa District. The purpose of these interviews was to explore, in depth, teachers' perceptions, experiences, and reflections regarding the integration of artificial intelligence AI tools, particularly the Grammarly platform, into English language instruction. The interview questions were prepared by the researcher and tested by a group of jurors, see Appendix (F).

Interview Procedure and Context

The research interviewer conducted the interviews, which facilitated the building of understanding between the interviewer and participant, a requirement for eliciting open thinking and genuine provision of information. The interviews were conducted in participants' native language, Arabic, which facilitated achieving fluency and affective richness in the responses.

After obtaining the participants' permission, interviews were recorded on audio using a cell phone application. They were transcribed and verbatim translated by the researcher to be made available for thematic examination. Field notes were also taken during the interviews to document the non-verbal reactions, contextual details, and emerging concepts, see Appendix (J, K). Using such a dual method of recording and note-taking ensured data quality and reliability of collected data. The researcher followed the qualitative research standards to determine that the sample size (n=15) was based on theoretical saturation, which says that no new ideas or themes were obtained from further data collection (Creswell, 2013; Guest, Bunce, & Johnson, 2006).

The interviews were conducted over several weeks and took place in two primary settings:

Setting 1: Professional Development Workshop

During an in-service education course for English teachers, the researcher had regular and convenient access to a consistent group of participants. Three interviews were conducted during each day of the workshop: one prior to the session, one during the scheduled coffee break, and one after the session had concluded. This regular frequency schedule created an environment that was both unstressed and concentrated, thus it made it possible for teachers to talk without any kind of tension or distraction. Furthermore, the professional development setting contributed to the raising of a reflective and pedagogically engaged mindset in the participants, and hence, the quality of their responses during the interviews was enriched.

Setting 2: School Visits

Apart from the interviews of students, on-site interviews were also conducted in nearby schools, as the researcher made visits to colleagues and peers in the workplace. Free periods also saw interviews being conducted in remote classrooms or school meeting rooms, in order to minimize disruption and ensure participant convenience.

Participant Reasoning and Sampling Selection

The sampling was voluntary and purposive. They were picked according to three general criteria:

1. They were presently teaching English in a high school environment within the target area.

2. They were willing to engage in a lengthy interview.
3. They were implementing AI tools during practice teaching.

Teachers were interviewed either during the professional development sessions or via school visits. While invitations were extended to the larger group, only those who provided informed consent and attended at the suggested times were considered for an interview. The final sample was a mix of genders, years of teaching experience, and experience with AI tools to gain a broader understanding of teachers' perceptions of using AI in the classroom.

While the locations of the interviews were not random in a statistical sense, the researchers used random methods in terms of the availability and timing of the interviews, as they were carried out on those people who happened to be free and willing at that moment. In this way, the researcher got the freedom to approach participants at any place they might be at that time without interfering with their school schedules.

Interview Guide Design and Structure

The interview guide included seven open-ended questions, which were carefully structured around six major thematic domains directly related to the study's research questions and objectives. The domains comprise: background of the previous experience in teaching and the usage of AI tools; overall views regarding AI in education, i.e., overall attitudes of teachers towards its adoption; effect of AI on creative thought, especially students' creativity and generation of ideas; effect of AI on writing skill, including developments in grammar, vocabulary, structure, and fluency; the challenges teachers face in AI integration, whether pedagogical, technological, or cultural; and, finally, recommendations and visions for the future use, focusing on the ethical and sustainable application of AI in education. The semi-structured format gave the researcher an opportunity to pose additional and explanatory questions whenever necessary, and usually get deep, thoughtful answers that differed from the original schema.

2.10 Methods of data analysis

Quantitative and qualitative data were analyzed using statistical and interpretative methods that were consistent with the mixed-methods study design.

2.10.1 Quantitative Data Analysis

All results and parameters of the statistical analyses are detailed in Data S1 for the various Figures. All statistical tests were performed using SPSS v26.0 (IBM) or GraphPad Prism (v10.1.2). A two-tailed paired t-test was used to compare different conditions for the same group, and a two-tailed independent t-test was used to compare a single variable between distinct groups. When the normal distribution assumption was violated, the non-parametric Wilcoxon test was used to compare different conditions within the same group, and the Mann-Whitney test was used to compare different conditions or stimuli between different groups. For comparison between multiple groups and parameters, a mixed model (MM) analysis of variance (ANOVA) was applied to the data. This model contained one random effect (ID), one within effect, one between effect, and the interaction between them. For comparison within a group using multiple variables, a two-way between-subjects ANOVA model was applied to the data. This model contained one random effect (ID), two between effects, and the interactions between them. All ANOVA tests were followed, if main effects or interaction were found, by a post-hoc Student's t-test with Holm-Sidak correction. When normality could not be assumed, the non-parametric Kruskal-Wallis test was performed. Significance was set at 0.05 and adjusted using the Holm-Sidak method when multiple comparisons were made.

2.10.2 Qualitative Data Analysis

The qualitative part of the research comprised semi-structured, faceto-face interviews with 15 Arab English language teachers from the high schools in the Haifa District. The purpose of the interviews was to explore the teachers' understanding of the use of AI technology in general and their experience of using Grammarly as a tool for teaching English, focusing on creative thinking and writing.

To interpret the qualitative data, the researcher used Thematic Analysis in line with the Braun & Clarke (2006) model. This method was selected because of its adaptability and appropriateness in terms of features, which help in locating, sorting, and explaining significant themes in the whole dataset, see Appendix (K).

All the stages of the analysis were done with the help of the qualitative data analysis software MAXQDA which provides efficient means for coding, visualizing, and handling large quantities of textual data.

Transcription and Preparation of Data

In order to maintain the comfort of the participants and ensure that the responses reflect the true thoughts of the interviewees, all interviews were held in Arabic, which is a common language for the researcher and the participants. Once the consent of the participants was obtained, every interview was audio-recorded via a secure mobile application. Subsequently, the recordings were transcribed and translated word for word. The transcripts were checked thoroughly for correctness, and only in those instances where the meaning was the same, minor changes were made. Parts of the original Arabic materials were later translated into English to present the report while keeping the participant's original response's tone and the slight variations.

Analytical Procedure

The thematic analysis was a structured six-phase process. Initially, the researcher immersed herself in the data by going through all the interview transcripts several times, jotting down notes, and recording her initial impressions. In the second phase, the initial ideas for coding were realized by means of the software MAXQDA. Transcripts were examined line by line and each segment answering the research questions was given a descriptive label.

In the third phase the themes were identified by sorting the similar codes into larger categories and looking for patterns across the participants. From these clusters of related codes, the most frequent themes that reflected the recurring ideas were developed. During the fourth phase, the themes were reviewed, refined, combined, or discarded depending on their coherence, relevance, and support by evidence within the dataset. Also, the consistency of coding throughout different transcripts was verified.

In the fifth stage, the main themes obtained were described and named to express their inherent meaning, and where appropriate, some subthemes were created. The final step entailed creating the thematic report through which the findings were presented in a logical order following the research objectives. For each theme, examples of participant quotations were chosen to demonstrate and provide evidence for the theme discussed.

The analysis focused on six main areas which were also the parts of the study's interviews: teachers' backgrounds and instructional experience; general perceptions of

AI in education; the impact of AI tools on students' creative thinking; the influence of AI on writing proficiency and idea generation; challenges associated with integrating AI into classroom practices; and teachers' recommendations for practical use and future implementation, see Appendix (J).

2.11 Validity and Reliability

To confirm the findings of the pre- and post-tests that served as the source of the quantitative data, the researcher used parametric tests (t-test, ANOVA) and non-parametric tests (Wilcoxon, Mann–Whitney, Chi-Square) as well. Cronbach's Alpha coefficients were used to assess the validity of the questionnaire, while its reliability was assured by an expert review, a pilot test, and factor analysis.

In the case of qualitative data, the reliability was enhanced through member checking and triangulation with the quantitative results. The validity and reliability of the study were improved by several measures. The entire audit trail was kept, which included all the coding decisions and changes in the themes. The researcher used visualization tools in MAXQDA to record theme development and continuity. The direct quotations were used to give the most accurate account of the participants' views. Besides this, the researcher kept reflexive journals to recognize potential biases, assumptions, and positionality during the analysis.

The researcher's deeper reflexivity resulting from her prior experience teaching English in the same educational context, helped to ensure that the interpretations were data-driven and the pre-existing assumptions were not unfairly influencing them.

2.11.1 Pilot Test of Research Instruments

All research instruments, i.e. pre-test/post-test writing tasks, teacher questionnaire, and semi-structured interview guide were pilot tested methodologically and contextually for the target population before the data collection phase. The questionnaire was given to the pilot sample of 30 Arab English language teachers in the Haifa District. These participants were selected based on their availability, and willingness to participate, and represented diverse teaching backgrounds within school environments similar to those in the main study.

After the pilot administration, statistical analyses were performed to evaluate the questionnaire's validity and reliability. Along with this, item clarity, response distribution were examined, and questions that might have been misinterpreted or ambiguous were identified. Internal consistency was checked by Cronbach's alpha coefficient, which showed a very high level of correlation between items within each thematic domain, thus, strong reliability was achieved. Construct validity was improved by analyzing correlations between items to confirm that each domain was really measuring its intended concept.

Besides that, content validity was correspondingly supported by an expert review, during which academic evaluators considered whether questionnaire items adequately covered the theoretical dimensions of AI integration, writing instruction, and the development of creative thinking. Such a rigorous piloting process played a significant role in confirming that research instruments were not only strong but also appropriate for a large-scale study.

The factor structure of the questionnaire was also considered to confirm the theoretical grouping of items among the six general categories. Once both statistical analysis and qualitative remarks were gathered, a few of these improvements were made. Replicated questions were deleted or combined, some items were reformulated for better understanding, and some of the items were reorganized for better flow and continuity. Respondents also rephrased some of the Likert-scale items to improve consistency and comprehension. Lastly, pilot questionnaire answers were excluded from the final sample so that the findings can be made valid (n=92).

2.11.2 Triangulation for Increased Validity

Employment of methodological triangulation, in which evidence from three different sources- experimental tests, quantitative surveys, and qualitative interviews- was applied, helped enhance internal validity of the research. Through cross-validation of results based on these different approaches, the research was able to enhance the reliability of confirmed patterns and conclusions. For example, writing improvement among students was compared with teachers' views elicited through a survey and an interview. A three-cornered comparison gave meaning and avoided the danger of bias in generating conclusions based on a single source of data.

2.11.3 Procedural Standardization for Data Collection

The research applied standardized procedures at each phase of data collection. For the experimental phase (pre- and post-tests), the same prompts, rubrics, and AI instrument directions were applied in pre- and post-tests. Under the survey, the same format and mode of presentation (Google Forms) were used across all participants, with the exact instructions and timing provided. For the interviews, the same semi-structured guide was used, and all interviews were conducted in Arabic by the researcher herself, under the same conditions (e.g., quiet locations, similar lengths).

2.11.4 Validations and Revisions of The Questionnaire

For linguistic accuracy and content validity, the questionnaire was reviewed by five juror experts in educational technology, see Appendix (C) who also monitored the English teaching methodology and AI education. They were in charge, respectively, of giving their opinion on the instrument structure, the clearness of the items, the correspondence of the items to research objectives, and the cultural appropriateness.

The feedback from the jury led to several substantive revisions:

Clarity

Item 16, for instance, was rewritten from "AI tools make students think of new ideas in writing" to "AI tools prompt students to think of new and original ideas in writing," to make it more specific rather than vague.

Redundancy

Items 17 and 18, both concerning the discouragement of creativity by AI, were rewritten to differentiate between losing independent thought and being overly reliant on AI.

Demographic Refinement

In Item 6, the initial open-ended question asking about training in AI was substituted with multiple-choice ranges (e.g., "None," "1–2," "3–5," "More than 5") to retain and facilitate easy and uniform answers.

Contextual Additions

Reviewers also suggested that a brief definition of AI tools at the top of the form be included so that participants, particularly those with less experience with AI, would have some level of understanding.

Wording Enhancements

These items, like "I use AI tools extensively in different areas of my teaching, like lesson delivery, assessment, and student interaction," were reworded as "I use AI tools extensively in different areas of my teaching, like lesson delivery, assessment, and student interaction." The final instrument from the previous suggestions had improved validity, reliability, and linguistic adequacy. The final instrument was regarded as being conceptually valid and suited for the target population in the study.

2.11.5 Empirical Quantification of Respondents' Answers

Since sections 1 (items 1-6) and 33 of section 6 contain questions with qualitative answers, these items were not included in the marking process of the questionnaire, nor were they included in the parametric analyses. All other sections (2-6, items 7-32) had questions with scaled answers from 1 to 5, where 1 indicated a negative attitude towards AI and 5 indicated a positive attitude towards AI. Scoring of these items (except for items 14, 18, 21, and 22) was done according to the number of the chosen option, where option one was given a score of 1, option two was given a score of 2, and so on. As for items 14, 18, 21, and 22, these items were purposely phrased in a contradictory manner compared to the other items in this questionnaire, where smaller responses (closer to 1) indicated a positive attitude towards AI, and higher responses (closer to 5) indicated a negative attitude towards AI. Therefore, items 14, 18, 21, and 22 were marked in a reversed order to the other quantitative items, where option one was given a score of 5, option two was given a score of 4, and so on. Given the applied scoring method, the higher the total score in the questionnaire, the more positive the respondent teacher's attitude towards AI integration in education.

2.12 Ethical Considerations

Ethical integrity was of utmost importance at all levels of the research process, primarily since the research was conducted on human beings, including students and teachers in high schools. All steps were adhered to strictly in accordance with ethical procedure so that the rights, dignity, and privacy of everyone at all levels of the research were protected. The ethical context of the study pertained to the standards of the institutional ethics review board and higher international standards of human subject research.

Ethical integrity was kept throughout the interview process. Each participant was given both verbally and in writing, clear information about the study's purpose, the voluntariness of their participation, their right to withdraw at any time, and the confidentiality of their responses.

There were no names or identifiers for the schools or sensitive information recorded in the transcriptions. Data from the participants were anonymized by assigning code names such as "T1", "T2", etc. The original audio files and transcriptions were kept in a secure location on a password-protected device and will only be retained for the research.

2.12.1 Informed Consent

Prior to any data collection, all study participants, students, and teachers provided informed consent. Further parental consent was sought from student participants under the age of 18 through formal letter invitations. Participants were entirely aware of the purpose of the study, the nature of participation, and the estimated duration of their participation. They were also informed in writing that their participation was completely voluntary and that they were free to withdraw from the study at any time without justification or penalty. This is an informed and autonomous participation by virtue of an informed and autonomous decision.

2.12.2 Confidentiality and Data Protection

In order not to compromise participants' anonymity, all the information collected remained totally confidential. Participants' names were replaced with codes (e.g., S1, T4) upon reporting, data analysis, and transcription. Data containing participants, such as names of schools, cities, or specialized occupations, were removed or rendered general to hide individual identity. All digital data, that is, the questionnaires, recordings, and

transcripts, were stored on password-encrypted devices available only to the researcher. Handwritten comments were scanned, encrypted, and kept secure. Also, the final report does not include details that could identify participants or institutions.

2.13 Scope of the Study

2.13.1 Time Frame

This research was conducted throughout the 2024–2025 academic year, starting in October 2024 and concluding in June 2025.

The pre-test and post-test phases took place from January to March 2025.

The teacher questionnaire was administered in February 2025 for the sample estimation, see Appendix (H).

The teacher interviews were conducted between February and the end of March 2025.

2.13.2 Location

The study was carried out in public high schools located in the Haifa District, specifically in Arabic-speaking communities. These schools teach English as a foreign language to 12th-grade students, and the research involved both students and English teachers working in this educational context.

2.14 Variables of the Study

This study analyzes a number of variables with both teacher and student participants to determine the factors that influence the success of Grammarly's use in the teaching of the English language.

2.14.1 Student Variables

- Gender: The variable here studies whether there is any disparity in improving writing skills between male and female students when they use the Grammarly tool. The study would like to understand if gender is a significant factor in how students react to feedback from AI.
- Grade Level (10th and 11th Grades): The students were taken from two different levels of secondary school. This factor takes into account whether educational

maturity level and age affect the capacity of the students to learn through AI-provided writing aid, since writing requirements and mind growth differ across these grades.

- English Proficiency Level: While not a grouping variable, students' baseline proficiency according to CEFR (A2 to B1) was used to measure change and growth after the intervention, adding a layer to the analysis of Grammarly's effectiveness.

2.14.2 Teacher demographic data

The participants in the study are Arab English teachers who teach in high schools within the Haifa District. This study aims to understand the impact of faculty members' and staff members' characteristics on their perception of the use of Artificial Intelligence as a tool in English language teaching.

- Gender: This dimension examines whether the male and female instructors are varied in terms of their experience or perspective on employing AI tools in schools.
- Years of Teaching Experience: Teachers' professional experience may influence their acceptance of adopting new technologies and their confidence in integrating AI into their teaching practices.
- Participation in AI-Related Training: This variable takes into account whether teachers are officially trained or taking courses on education with AI, viewing its purpose and effectiveness differently compared to those who have no such training.

2.15 Limitations of The Study

Although the research was well conducted to examine the effect of Grammarly on students' writing and teachers' views regarding AI integration, some limitations should be noted:

2.15.1 Generalizability of Findings

The sample of the population included two selected classes (one of 10th graders and the other of 11th graders) of the Haifa District. The results cannot thus be completely generalized elsewhere, to another place, school system, or age group. Cultural, linguistic, and socio-economic realities might affect the adoption and employment of AI tools elsewhere.

2.15.2 Time Limitations

The time spent implementing Grammarly in the classroom was 3 months (January to March 2025). While this time frame allowed for pre- and post-testing, it may not have been sufficient for observing deeper, long-term changes in writing habits or creative thinking development. A longer intervention might bring more significant or different results.

2.15.3 Self-Reporting and Social Desirability Bias

Both semi-structured interviews and structured questionnaire answers were employed to capture teachers' perceptions. As with any self-reporting, there is always the risk of social desirability bias; in this instance, the respondents have provided more optimistic ratings of AI on the basis of expectation or occupational norms as opposed to experience.

2.15.4 Technological familiarity and usage variability

All participants were not equally experienced with AI tools and ed-tech before taking part, something that differentiated the extent to which they applied Grammarly. Availability of hardware or computer skills can change learner results and teacher attitude. Factors related to Language and Curriculum:

Since the study was done in an EFL setting, findings can vary where English is spoken as a mother tongue. Additionally, variation in curriculum, formative and summative assessment, and instructional practices can influence the implementation and assessment of Grammarly.

2.16 Summary

This chapter has outlined the methodological design on which the study was predicated, including the justification for using a mixed-methods, quasi-experimental design and why it addressed the research goals. The socioeconomic and educational background of the Haifa District was presented to place the study within its sociolinguistic and institutional backdrop. Student and teacher sample profiles were outlined, together with inclusion and exclusion criteria that secured the participation of subjects most pertinent to the research goals.

The chapter additionally described the research instruments of the study, such as the pre- and post-test writing tasks, the teacher questionnaire, and the semi-structured interviews. It explained in detail the steps taken to confirm the validity and reliability of these tools through pilot testing, expert evaluation, and statistical analysis.

Each step of the data collection was also carefully planned—from the writing assessments being administered to the questionnaires being distributed and the interviews conducted—to ensure that the results were consistent, comparable, and of methodological integrity. Moreover, the chapter elaborated on the quantitative and qualitative data analysis methods, highlighting the harmonious relationship between the statistical testing and the thematic interpretation in answering the research questions.

The study was governed by ethical considerations at every stage, and the chapter ended with a discussion of the limitations of the research to provide transparency and to help position the results appropriately.

The study sets the foundation for investigating the effect of Grammarly on the writing skills of students and creative thinking, as well as investigating teachers' views on using AI to teach the English language.

Chapter Three

Results

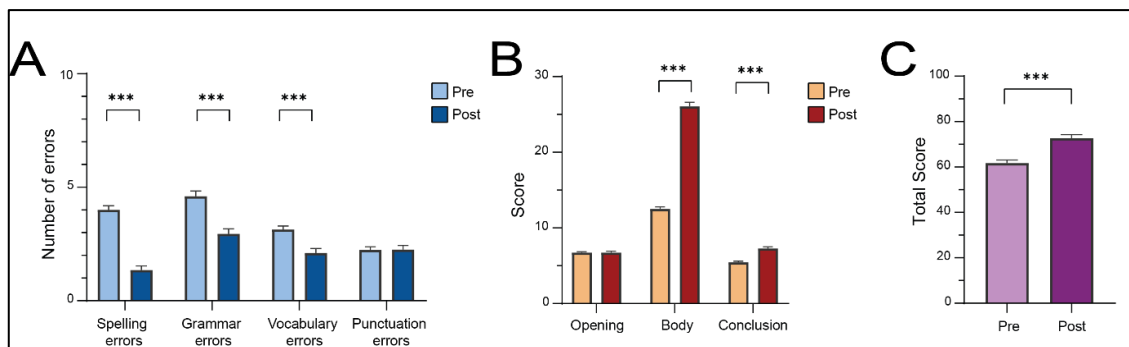
3.1 Before and After Grammarly AI Experiment Results

3.1.1 The general effect of Grammarly AI on the writing proficiency of all participants

To examine the general effect of AI on writing proficiency across all subjects from both grades and genders, paired t-tests were calculated. The results of the t-tests revealed a significant decrease in the number of Spelling [Fig. 2A; $t_{(58)}=15.9, p<0.001$], Grammar [Fig. 2A; $t_{(58)}=7.29, p<0.001$], Vocabulary [Fig. 2A; $t_{(58)}=5.6, p<0.001$] errors, but had no differences in the number of Punctuation errors [Fig. 2A; $t_{(58)}=0.00, p=1$]. Both Body [Fig. 2B; $t_{(58)}=-31.67, p<0.001$] and Conclusion [Fig. 2B; $t_{(58)}=-10.17, p<0.001$] scores also showed a significant improvement after using Grammarly AI, but no difference was found in the opening scores [Fig. 2B; $t_{(58)}=-0.231, p=0.818$]. Looking at the overall Total scores, a significant positive effect of Grammarly AI on the writing proficiency of all students was found [Fig. 2C; $t_{(58)}=-8.079, p<0.001$]. These results explicitly demonstrate a positive influence of using the Grammarly AI writing tool on the writing proficiency of English Language Learners (ELLs) in Haifa District, as suggested in the first research question of this study.

Figure (1)

The general effect of using Grammarly AI on the writing proficiency of all participating students



* $p<0.05$, ** $p<0.01$, *** $p<0.001$, paired samples t-test.

A. Mean (+SEM) number of errors in Spelling, Grammar, Vocabulary, and Punctuation among all participants ($n=59$).

B. Mean (+SEM) scores for Opening, Body, and Conclusion among all participants.

C. Mean (+SEM) total score for all participants.

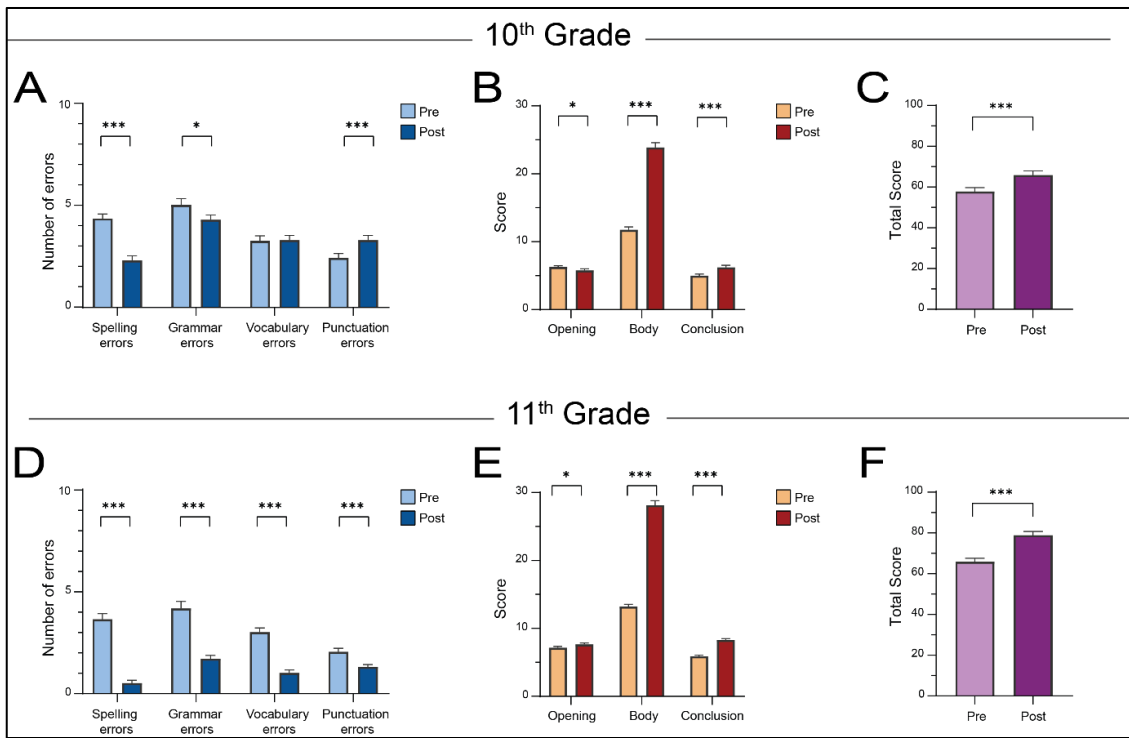
3.1.2 The effect of Grammarly AI on the writing proficiency of 10th and 11th grade students separately

To gain a deeper insight into the effects of Grammarly AI on students' writing proficiency, changes in variables were calculated for students of each grade separately. 10th-grade students showed a significant decrease in the number of Spelling [Fig. 3A; $t_{(28)}=12.15$, $p<0.001$] and Grammar [Fig. 3A; $t_{(28)}=3.42$, $p<0.05$] errors, while exhibiting an increase in the number of Punctuation errors after using Grammarly AI [Fig. 3A; $t_{(28)}=-4.68$, $p<0.001$], and no change in the number of Vocabulary errors [Fig. 3A; $t_{(28)}=0.55$, $p=0.586$]. In addition, a significant increase was also found in the Body [Fig. 3B; $t_{(28)}=-22.84$, $p<0.001$] and Conclusion [Fig. 3B; $t_{(28)}=-5.378$, $p<0.001$] scores after using Grammarly AI, but not in the Opening scores where there was a significant decrease rather than increase [Fig. 3B; $t_{(28)}=2.55$, $p<0.05$]. However, in the total score, 10th-grade students showed a significant increase after using Grammarly AI [Fig. 3C; $t_{(28)}=-5.32$, $p<0.001$].

The 11th-grade students exhibited a somewhat different pattern of results- they showed a significant drop in the number of errors in Spelling [Fig. 3D; $t_{(29)}=12.19$, $p<0.001$], Grammar [Fig. 3D; $t_{(29)}=7.6$, $p<0.001$], Vocabulary [Fig. 3D; $t_{(29)}=9.1$, $p<0.001$], and Punctuation [Fig. 3D; $t_{(29)}=3.96$, $p<0.001$]. In addition, 11th-grade students showed significant improvements in their Opening [Fig. 3E; $t_{(29)}=-2.457$, $p<0.05$], Body [Fig. 3E; $t_{(29)}=-25.78$, $p<0.001$], and Conclusion [Fig. 3E; $t_{(29)}=-10.1$, $p<0.001$] scores. Finally, and as expected, there was a significant increase in their total scores after using Grammarly AI [Fig. 3F; $t_{(29)}=-6.15$, $p<0.001$].

Figure (2)

The difference in the effect of using Grammarly AI on the writing proficiency of 10th grade and 11th grade students



*p<0.05, **p<0.01, ***p<0.001, paired samples t-test.

A. Mean (+SEM) number of errors in Spelling, Grammar, Vocabulary, and Punctuation among 10th-grade participants (n=30).

B. Mean (+SEM) scores for Opening, Body, and Conclusion among 10th-grade participants (n=30).

C. Mean (+SEM) total score for 10th-grade participants.

D-F. As in A-C, respectively, for 11th-grade participants.

To determine the effect of using Grammarly AI on writing proficiency between 10th and 11th-grade students relative to each student's baseline writing proficiency, for each subject, a “Change Score” was calculated in which the pre-values in each variable were subtracted from the post-values.

Chan Score score – Pre score.

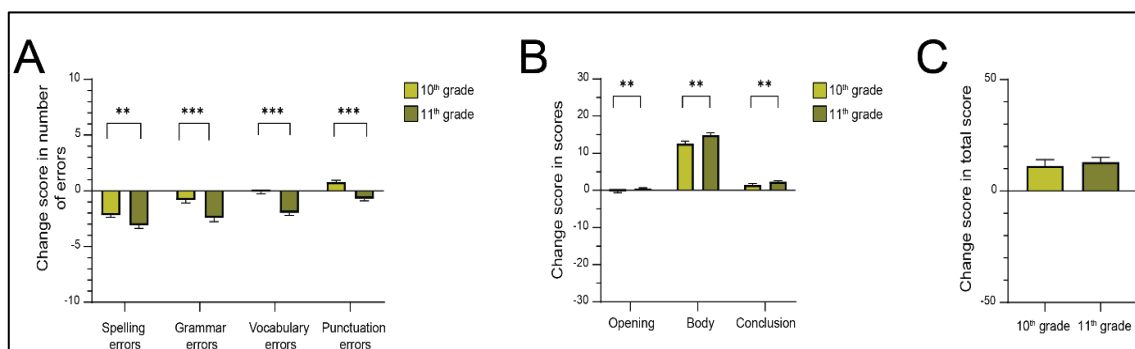
This score is meant to quantify both the direction and size of the effect of using Grammarly AI for each student in each variable, where positive values indicate a positive (increase) effect and negative values indicate a negative (decrease) effect.

As shown in Figure (4), 11th-grade students showed a bigger decrease, indicating a greater improvement, in the number of errors in Spelling compared to 10th-grade students [Fig. 4A; Independent samples t-test, $t_{(57)}=2.927$, $p<0.01$], Grammar [Fig. 4A; $t_{(57)}=3.891$, $p<0.001$], Vocabulary [Fig. 4A; $t_{(57)}=6.54$, $p<0.001$], and Punctuation [Fig. 4A; $t_{(57)}=6.05$, $p<0.001$] compared to the 10th grade students. 11th-grade students also showed higher positive change in Opening [Fig. 4B; $t_{(57)}=-3.529$, $p<0.01$], Body [Fig. 4B; $t_{(57)}=-3.406$, $p<0.01$], and Conclusion [Fig. 4B; $t_{(57)}=-3.201$, $p<0.01$] scores. Despite those differences, no difference between the students from both grades was found in how much their total scores improved after using Grammarly AI [Fig. 4C; $t_{(57)}=-1.319$, $p=0.192$].

Taken together, these results demonstrate that the effect of the Grammarly AI tool on the writing proficiency among English learners is grade-mediated, where 11th-grade students show higher improvements in various writing proficiency variables compared to 10th-grade students.

Figure (3)

The difference in Change Scores between 10th and 11th-grade participants



* $p<0.05$, ** $p<0.01$, *** $p<0.001$, Independent samples t-test.

A. Mean (+SEM) change scores for the number of errors in Spelling, Grammar, Vocabulary, and Punctuation among 10th-grade participants (light green, $n=30$) and 11th-grade participants (dark green, $n=30$).

B. Mean (+SEM) change scores for the Opening, Body, and Conclusion scores for 10th-grade and 11th-grade participants.

C. Mean (+SEM) change scores for the total score for 10th-grade and 11th-grade participants.

3.1.3 The effect of Grammarly AI on the writing proficiency of male and female students of 10th and 11th grades

Given that the total sample contains data from both male and female students, it was of interest and importance to examine gender-related differences in the effect of using Grammarly AI on writing proficiency. For that purpose, the pre-AI vs post-AI differences were examined for male and female students from the 10th and 11th grades separately.

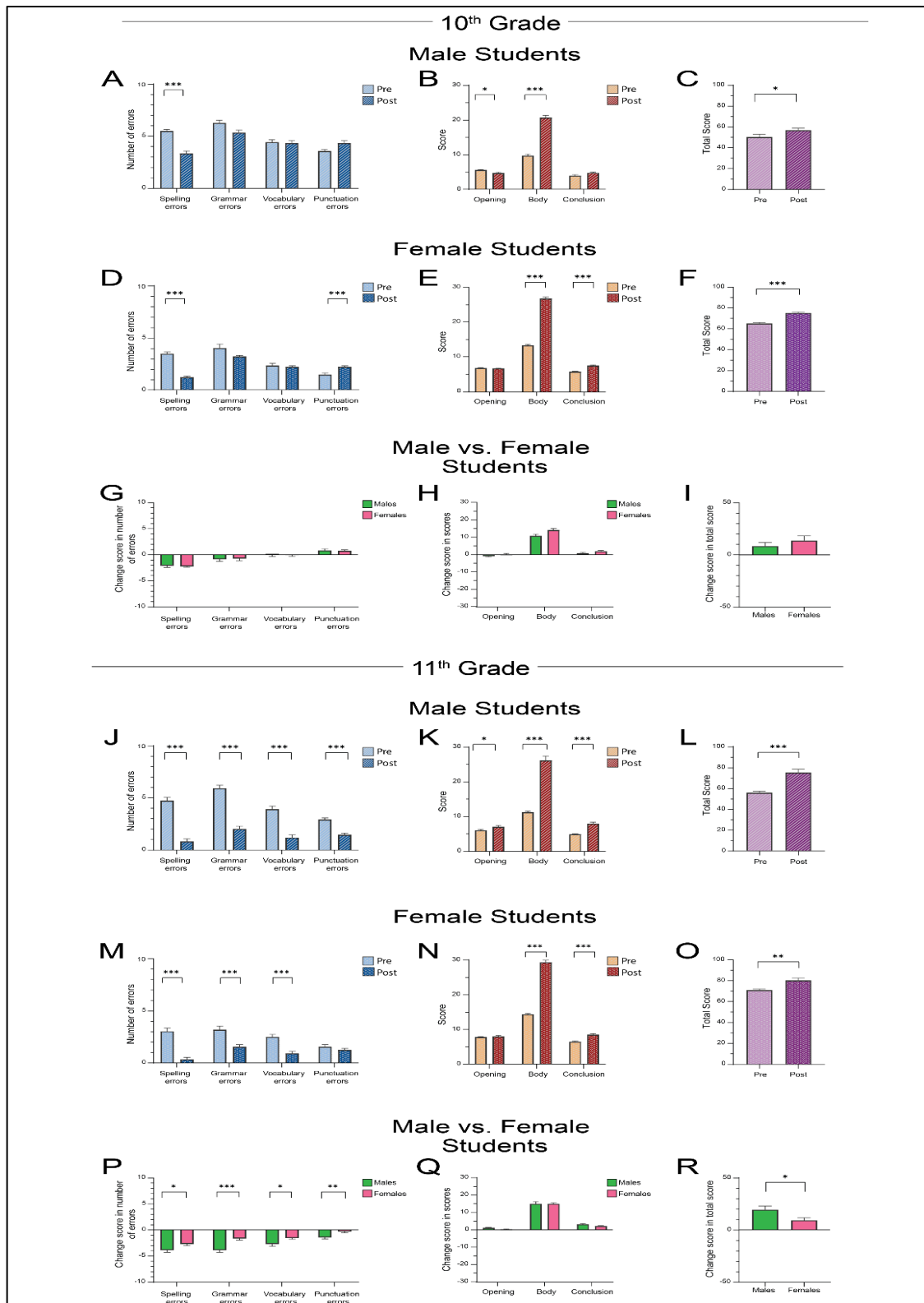
10th grade male students showed a significant decrease in the number of spelling errors [Fig. 5A; Two way Mixed-Model ANOVA, Time: $F_{(1,27)}=142$, $p<0.001$, Gender: $F_{(1,27)}=180$, $p<0.001$, TimexGender: $F_{(1,27)}=0.112$, $p=0.74$; *post hoc* paired samples t-test- $t_{(13)}=6.2$, $p<0.001$], while showing no change in the number of errors in Grammar [Fig. 5A; Time: $F_{(1,27)}=11.4$, $p<0.01$, Gender: $F_{(1,27)}=67$, $p<0.001$, TimexGender: $F_{(1,27)}=0.063$, $p=0.804$; *post hoc* paired samples t-test- $t_{(13)}=2.5$, $p=0.062$], Vocabulary [Fig. 5A; Time: $F_{(1,27)}=0.286$, $p=0.59$, Gender: $F_{(1,27)}=110.2$, $p<0.001$, TimexGender: $F_{(1,27)}=0.026$, $p=0.873$; *post hoc* paired samples t-test- $t_{(13)}=0.211$, $p=0.836$], and Punctuation [Fig. 5A; Time: $F_{(1,27)}=21.2$, $p<0.001$, Gender: $F_{(1,27)}=175$, $p<0.001$, TimexGender: $F_{(1,27)}=0.025$, $p=0.875$; *post hoc* paired samples t-test- $t_{(13)}=-2.62$, $p=0.062$]. Female students, on the other hand, showed similar effects to males in the number of errors in Spelling [Fig. 5D; *post hoc* paired samples t-test- $t_{(14)}=14.8$, $p<0.001$], Grammar [Fig. 5D; $t_{(14)}=2.26$, $p=0.08$], Vocabulary [Fig. 5D; $t_{(14)}=0.69$, $p=0.499$]. However, unlike male students, female students showed a significant increase in the number of Punctuation errors post using Grammarly AI [Fig. 5D; $t_{(14)}=-4.78$, $p<0.001$]. When comparing the Change Score between male and female students directly, no significant differences in the Change Score were found for any of the errors [Fig. 5G; Independent samples t-test- Spelling: $t_{(27)}=0.335$, $p=0.74$; Grammar: $t_{(27)}=-0.251$, $p=0.804$; Vocabulary: $t_{(20.68)}=0.159$, $p=0.875$; Punctuation: $t_{(19.45)}=0.159$, $p=0.878$].

Male students also showed a significant decrease in their opening scores after using Grammarly AI [Fig. 5B; Time: $F_{(1,27)}=8.08$, $p<0.01$, Gender: $F_{(1,27)}=180$, $p<0.001$, TimexGender: $F_{(1,27)}=5.917$, $p<0.05$; *post hoc* paired samples t-test- $t_{(13)}=2.747$, $p<0.05$], while showing a significant increase in their Body scores [Fig. 5B; Time: $F_{(1,27)}=623$, $p<0.001$, Gender: $F_{(1,27)}=166$, $p<0.001$, TimexGender: $F_{(1,27)}=6.75$, $p<0.05$; *post hoc* paired samples t-test- $t_{(13)}=-12.3$, $p<0.001$], and no change in their Conclusion scores [Fig. 5B; Time: $F_{(1,27)}=30.76$, $p<0.001$, Gender: $F_{(1,27)}=166$, $p<0.001$, TimexGender:

$F_{(1,27)}=3.52$, $p=0.071$; *post hoc* paired samples t-test- $t_{(13)}=-1.935$, $p=0.075$]. Female students, however, showed a different pattern of results, exhibiting a significant increase in their Bodies [Fig. 5E; $t_{(14)}=-29.5$, $p<0.001$] and Conclusion scores [Fig. 5E; $t_{(14)}=-9.54$, $p<0.001$] while exhibiting no change in their Opening scores [Fig. 5E; $t_{(14)}=0.564$, $p=0.582$]. This indicates that the significant drop in the Opening scores observed earlier for the entire sample of 10th-grade learners (Fig. 2 B) stems solely from the male students. When comparing the Change Score between male and female students directly, no significant differences in the Change Score were found for the Opening [Fig. 5H; Independent samples t-test- $t_{(16.68)}=-2.369$; $p=0.059$], Body [Fig. 5H; $t_{(19.53)}=-2.546$; $p=0.056$], and Conclusion [Fig. 5H; $t_{(17.29)}=-1.83$; $p=0.085$] scores. Lastly, both male and female students showed significant improvement in their total score post using Grammarly AI [Fig. 5C, 5F; Time: $F_{(1,27)}=27$, $p<0.001$, Gender: $F_{(1,27)}=156$, $p<0.001$, TimexGender: $F_{(1,27)}=0.2$, $p=0.658$; *post hoc* paired samples t-test- *Males*: $t_{(13)}=-2.461$, $p<0.05$, *Females*: $t_{(13)}=-8.31$, $p<0.001$], with no significant difference in the extent of this improvement [Fig. 5I; $t_{(16.19)}=-0.435$; $p=0.669$].

Figure (4)

Gender dependent differences in the effect of using Grammarly AI on the writing proficiency of 10th and 11th-grade participants



A-F, J-O: * $p < 0.05$, ** $p < 0.001$, post-hoc paired samples t-test following significant main effects in 2-way Mixed-Model ANOVA;

G-I, P-R: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, Independent samples t-test.

- A. Mean (+SEM) number of errors in Spelling, Grammar, Vocabulary, and Punctuation among 10th-grade male participants (n=15).
- B. Mean (+SEM) scores for Opening, Body, and Conclusion among 10th-grade male participants.
- C. Mean (+SEM) total score for 10th-grade male participants.
- D-F. As in A-C, respectively, for 10th-grade female participants (n=15).
- G. Mean (+SEM) change scores for the number of errors in Spelling, Grammar, Vocabulary, and Punctuation among 10th-grade male participants (green, n=15) and 10th-grade female participants (pink, n=15).
- H. Mean (+SEM) change scores for the Opening, Body, and Conclusion scores for 10th-grade male and female participants.
- I. Mean (+SEM) change scores for the total score for 10th-grade male and female participants.
- J-L. As in A-C, respectively, for 11th-grade male participants (n=11).
- M-O. As in A-C, respectively, for 11th-grade female participants (n=19).
- P-R. As in G-I, respectively, for 11th-grade male and female participants.

As for gender differences in the effect of Grammarly AI on writing proficiency among 11th-grade male and female students, both male and female students showed significant drops in the number of errors in Spelling [Fig. 5J, 5M; 2way Mixed-Model ANOVA, Time: $F_{(1,28)}=180$, $p<0.001$, Gender: $F_{(1,28)}=12$, $p<0.01$, TimexGender: $F_{(1,28)}=6.225$, $p<0.05$; *post hoc* paired samples t-test- *Males*: $t_{(10)}=9.97$, $p<0.001$, *Females*: $t_{(18)}=9.05$, $p<0.001$], Grammar [Fig. 5J, 5M; Time: $F_{(1,28)}=108$, $p<0.001$, Gender: $F_{(1,28)}=26.86$, $p<0.001$, TimexGender: $F_{(1,28)}=18.29$, $p<0.001$; *post hoc* paired samples t-test- *Males*: $t_{(10)}=9.43$, $p<0.001$, *Females*: $t_{(18)}=5$, $p<0.001$], and Vocabulary [Fig. 5J, 5M; Time: $F_{(1,28)}=110$, $p<0.001$, Gender: $F_{(1,28)}=10.85$, $p<0.01$, TimexGender: $F_{(1,28)}=7.84$, $p<0.01$; *post hoc* paired samples t-test- *Males*: $t_{(10)}=6.367$, $p<0.001$, *Females*: $t_{(18)}=8.216$, $p<0.001$]. As for Punctuation errors, male students showed a significant decrease in the number of Punctuation errors [Fig. 5J; Time: $F_{(1,28)}=29.35$, $p<0.001$, Gender: $F_{(1,28)}=17.07$, $p<0.001$, TimexGender: $F_{(1,28)}=12.14$, $p<0.01$; *post hoc* paired samples t-test- *Males*: $t_{(10)}=9.97$, $p<0.001$], while female students did not [Fig. 5M; $t_{(18)}=1.55$,

$p=0.137$]. When comparing the Change Score between male and female students directly, male students showed a greater decrease in the number of errors in Spelling [Fig. 5P; Independent samples t-test- $t_{(28)}=-2.5$, $p<0.05$], Grammar [Fig. 5P; $t_{(28)}=-4.276$, $p<0.001$], Vocabulary [Fig. 5P; $t_{(28)}=-2.8$, $p<0.05$], and Punctuation [Fig. 5P; $t_{(28)}=-3.485$, $p<0.01$]. These results indicate that in terms of writing error quantity, 11th-grade male students benefit more from using Grammarly AI than their female classmates.

In addition, both male and female 11th-grade students showed a significant increase in the Body [Fig. 5K, 5N; Time: $F_{(1,28)}=595$, $p<0.001$, Gender: $F_{(1,28)}=20.75$, $p<0.001$, TimexGender: $F_{(1,28)}=0.001$, $p=0.975$; *post hoc* paired samples t-test- *Males*: $t_{(10)}=-11.89$, $p<0.001$, *Females*: $t_{(18)}=-25.34$, $p<0.001$] and Conclusion [5K, 5N; Time: $F_{(1,28)}=123.58$, $p<0.001$, Gender: $F_{(1,28)}=13.5$, $p<0.001$, TimexGender: $F_{(1,28)}=5.675$, $p<0.5$; *post hoc* paired samples t-test- *Males*: $t_{(10)}=-7.45$, $p<0.001$, *Females*: $t_{(18)}=-7.886$, $p<0.001$] scores. Male students also displayed a significant increase in their Opening scores [Fig. 5K; Time: $F_{(1,28)}=9.174$, $p<0.01$, Gender: $F_{(1,28)}=30.99$, $p<0.001$, TimexGender: $F_{(1,28)}=3.9$, $p=0.58$; *post hoc* paired samples t-test- *Males*: $t_{(10)}=-2.62$, $p<0.05$], but female students did not [Fig. 5N; $t_{(18)}=-1$, $p=0.331$]. When comparing the Change Score between male and female students directly, no differences were found in either Opening [Fig. 5Q; Independent samples t-test- $t_{(28)}=1.975$, $p=0.113$], Body [Fig. 5Q; $t_{(28)}=-0.031$, $p=0.975$], nor Conclusion [Fig. 5Q; $t_{(28)}=2.382$, $p=0.07$] scores.

Lastly, both male and female students showed significant improvement in their total score post using Grammarly AI [Fig. 5L, 5O; 2way Mixed-Model ANOVA, Time: $F_{(1,28)}=50.71$, $p<0.001$, Gender: $F_{(1,28)}=22.78$, $p<0.001$, TimexGender: $F_{(1,28)}=6.3$, $p<0.5$; *post hoc* paired samples t-test- *Males*: $t_{(10)}=-5.47$, $p<0.001$, *Females*: $t_{(18)}=-4.068$, $p<0.01$], with male showing a greater improvement in the total score than their female class-mates [Fig. 5R; Independent samples t-test- $t_{(28)}=2.511$, $p<0.05$].

Taken together, the data reflect gender- and grade-dependent differences in the effect of using Grammarly AI on writing proficiency. More specifically, 10th-grade male and female students showed similar improvements after using Grammarly AI, while 11th-grade male students showed greater improvement in their writing proficiency than female students.

3.1.4 The Impact of Grammarly AI on Students' Proficiency levels and its Moderation by Baseline Proficiency levels

To address the second research question of this study, I compared the pre- vs. post-proficiency levels of the participating students. For that purpose, I divided all students from both classes of both genders into three groups according to their pre- and post-total scores- the first group included students below the 25th percentiles with a total score below 55, the second group included students within the 25-75 percentiles with a total score ranging between 55 and 70. The third group included students above the 75th percentile with total scores above 70.

Both 10th and 11th-grade students exhibited a significant increase in their proficiency levels after using Grammarly AI [Fig.6A; Wilcoxon Test- 10th grade: $z=-4.379$, $p<0.001$, 11th grade: $z=-3.38$, $p<0.01$]. To examine any gender-related differences in proficiency level improvements, I compared the pre- vs. post-proficiency levels for male and female participants separately. Both male and female participants showed a similar significant increase in their proficiency levels after using Grammarly AI [Fig.6B; Wilcoxon Test- Males: $z=-3.704$, $p<0.001$, Females: $z=-3.922$, $p<0.001$].

However, when looking at gender-related differences within each grade separately, both males and females showed significant improvement in their proficiency levels after using Grammarly AI in the 10th-grade sample [Fig.6D; Wilcoxon Test- Males: $z=-2.45$, $p<0.05$, Females: $z=-3.64$, $p<0.001$], while only males showed significant improvement in their proficiency levels after using Grammarly AI in the 11th-grade sample [Fig.6E; Wilcoxon Test- Males: $z=-2.9$, $p<0.01$, Females: $z=-1.67$, $p=0.096$]. Those differences repeat the gender-related differences in the change scores exhibited in Fig.5P-R. Despite those differences, both grade samples showed similar improvements in the change score for their proficiency level [Fig.6C; Mann-Whitney test- $U=404$, $p=0.59$], indicating that on the general level, both 10th and 11th-grade students seem to benefit similarly in improving their proficiency levels after using Grammarly AI.

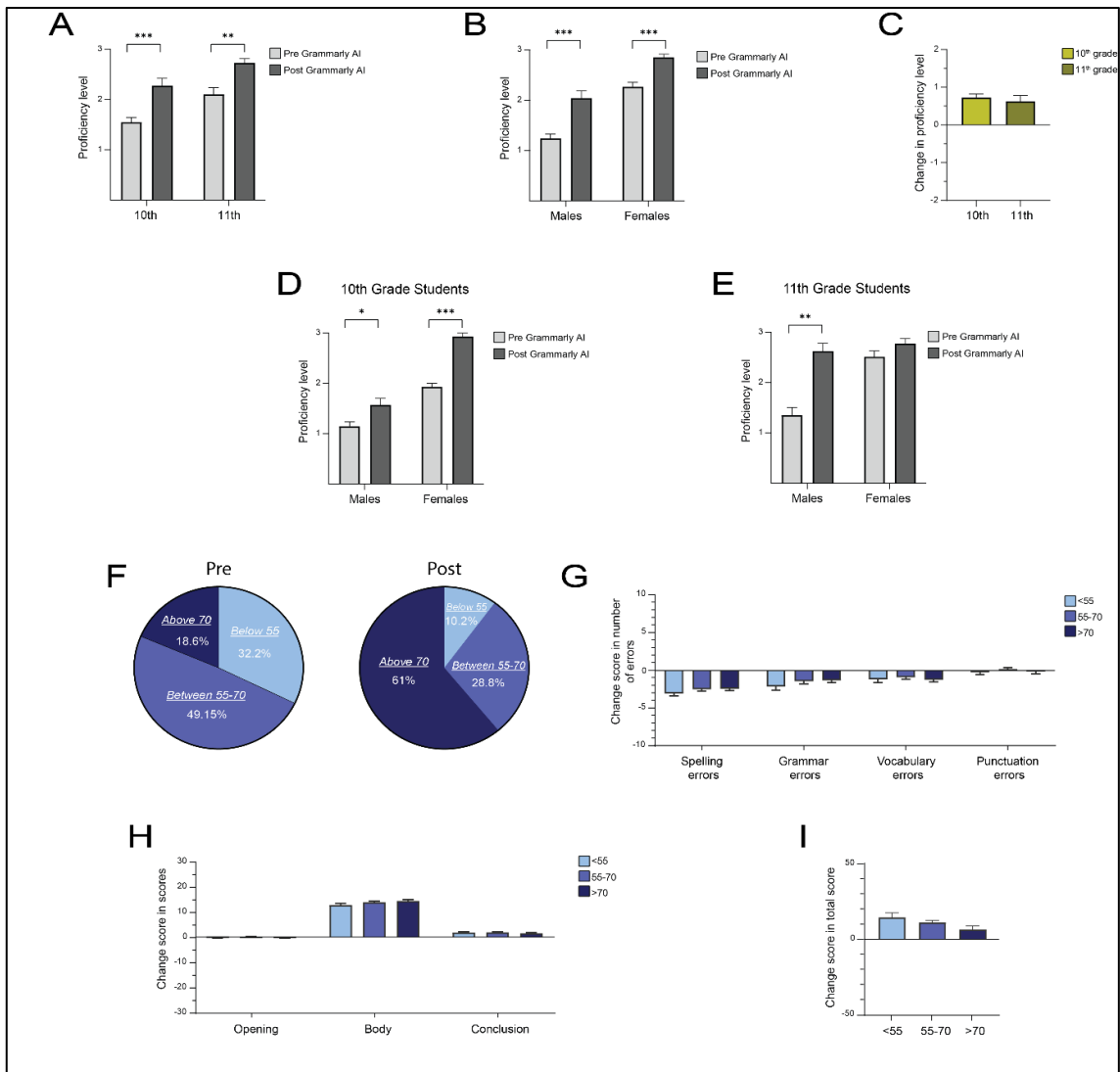
One other variable that can have an impact on how using Grammarly AI might affect writing proficiency is the pre-existing (baseline) level of the student's writing proficiency, as assumed in research question number 3 of this study. To that end, I first examined the change in the distribution for the number of students within each group pre (Fig 6F, left

pie chart) and post using Grammarly AI (Fig 6F, right pie chart), and found a significant difference between the two variables- Time (pre\post), and the count of students within each proficiency group [Chi-Square Test- $\chi^2_{(2)}=23.96$, $p<0.001$; Phi(ϕ)=0.449, $p<0.000$]. However, examining the Change Scores across the three proficiency groups produced no significant changes in the number of spelling errors [Fig. 6G; Independent-Samples Kruskal-Wallis Test- $H_{(2)}=1.487$, $p=0.475$], Grammar [Fig. 6G; $H_{(2)}=2.65$, $p=0.265$], Vocabulary [Fig. 6G; $H_{(2)}=1.731$, $p=0.421$], and Punctuation [Fig. 6G; $H_{(2)}=2.584$, $p=0.275$]. Similar results were found between the three proficiency groups in the Change Scores for the Opening [Fig. 6H; $H_{(2)}=0.37$, $p=0.831$], Body [Fig. 6H; $H_{(2)}=2.53$, $p=0.282$], and Conclusion [Fig. 6H; $H_{(2)}=0.574$, $p=0.0.751$] scores. Lastly, and as expected, no significant changes between the three proficiency groups were found in the total score [Fig. 6I; $H_{(2)}=4.44$, $p=0.109$].

Taken together, it seems that using Grammarly AI clearly changes the proficiency levels of the students significantly for the better. The extent of this improvement, however, is not affected by the students' pre-existing proficiency level, as students from all three proficiency levels seemed to improve equally after using Grammarly AI.

Figure (5)

The effect of using Grammarly AI on the writing proficiency of participating students and how differences in baseline proficiency levels mediate it.



A-B, D-E: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, Wilcoxon Signed Ranks Test.

A. Mean (+SEM) change in proficiency level (Post-Pre) for 10th grade (n=29) and 11th grade (n=30) students.

B. As in A, for male (n=25) and female (n=34) students from both grades.

C. Mean (+SEM) change score for proficiency level between 10th-grade and 11th-grade students.

D. Mean (+SEM) change in proficiency level (Post-Pre) for 10th grade (n=29) and 11th grade (n=30) students.

E. As in D, for 11th grade male (n=14) and female (n=15) students.

- F. Pie chart depicting the percentage for the number of students in the three proficiency groups (below 55, light blue; between 55-70, light purple; and above 70, dark blue) based on their Pre-Grammarly AI total scores (left), and based on their Post-Grammarly AI total scores (right).
- G. Mean (+SEM) change scores for the number of errors in Spelling, Grammar, Vocabulary, and Punctuation among the three proficiency groups ($n_{<55}=11$, $n_{55-70}=20$, $n_{>70}=11$).
- H. Mean (+SEM) change scores for the Opening, Body, and Conclusion scores among the three proficiency groups.
- I. Mean (+SEM) change scores for the total score for the three proficiency groups.

The data presented in Figure (6) illustrates significant improvements in students' writing proficiency following the use of Grammarly AI, with variation observed across grade levels, gender, and initial proficiency groups.

Both 10th- and 11th-grade students' performances have meaningfully upgraded (Panels A and C) with the 11th graders showing on average a slightly higher progression, possibly, because they have been longer exposed to English and have a higher cognitive maturity level. The gender-wise analysis of data (Panels B and E) indicates that girls have overall advanced more than boys, especially in the 11th grade, which could be a reflection of differences in participation, learning strategies, or engagement in writing tasks.

After the intervention with Grammarly, the proficiency levels in Panel F clearly illustrate the shift of students from the bottom levels of performing categories to the middle and high levels of proficiency. In line with this, Panels G, H, and I present a great decrease in spelling, grammar, vocabulary, and punctuation errors for all groups besides the Opening, Body, and Conclusion sections, which show a rise in organization and idea development. The improvement of the total writing scores (Panel I) for all the groups is in line with the use of Grammarly as a means of writing development. The research results signal that AI-generated feedback by Grammarly is an efficient facilitative tool, which, as a result, particularly benefits students having intermediate language proficiency. The differentials' statistical significance (p-values in Panels A–B and D–E) strengthens the argument that the changes happened a lot.

This chapter also described the instruments utilized for the collection of research data such as the teacher questionnaire, semi-structured interviews, and the pre- and post-test writing tasks. It went on to describe the measures taken to ascertain the instruments' validity and reliability through pilot testing, expert review, and statistical analysis.

By and large, the stages of data collection were not only detailed but also the actual events were the meticulous execution of the plans—from administering the writing assessments to distributing the questionnaires and conducting the interviews—were described as the chief means to achieve consistency, comparability, and methodological integrity. Furthermore, the chapter delineated the quantitative and qualitative analysis methods and put a premium on the harmonious relationship between statistical testing and thematic interpretation in answering the research questions.

The research was entirely based on ethical principles, and the chapter ended with the limitations of the study being acknowledged which, therefore, facilitated transparency and enabled the findings to be located within their proper context.

3.2 Questionnaire Results

3.2.1 Internal consistency measured by Pearson's correlations

To examine internal consistency, two correlation-based analyses were performed-

1. **Pearson's correlation between the sum score for each section and the total score of the questionnaire.** Results are summarized in Table (2).

Table (2)

Correlation coefficient values between the score of each section and the total score of the AI in the Teaching Questionnaire

Section	2	3	4	5	6
Pearson's correlation with the total score	0.411***	0.889***	0.849***	0.869***	0.52***

*** Correlation is significant at the 0.001 level (2-tailed).

According to the data in Table (2), the values of Pearson's correlation coefficients between sections 2-6 and the total score ranged between 0.411 and 0.889. The correlation coefficients for all sections (2-6) were found to be statistically significant at a significance

level of 0.001, indicating high internal consistency of these sections with the total score of the AI in the Teaching Questionnaire.

2. Pearson's correlation between the score of each item and the sum score for the section it belongs to. Results are summarized in Table (3).

Table (3)

Correlation coefficient values between the score of each item and the total score of its section in the AI in Teaching Questionnaire

Section	Item	Correlation coefficient
2	7	0.838***
	8	0.845***
3	10	0.735***
	11	0.712***
	12	0.671***
	13	0.681***
	14	0.081
	15	0.805***
	16	0.792***
4	17	0.548***
	18	0.444***
	19	0.741***
	20	0.708***
	21	0.445**
	22	0.167
	23	0.535***
5	24	0.75***
	25	0.706***
	26	0.746***
	27	0.764***
	28	0.671***
	29	0.755***
	30	0.671***
6	31	0.81***
	32	0.863***

***, **, * Correlation is significant at the 0.001, 0.01, and 0.05 levels, respectively (2-tailed).

To determine the internal consistency within each section, Pearson's correlation was calculated between the score of each item and the total score of the section to which it belongs. In Section 2, the correlation coefficients are 0.829 and 0.862 for items 7 and 8, respectively, and both are statistically significant, indicating high internal consistency for this section. In section 3, correlation coefficients range between 0.081 and 0.805. All items' coefficients were found to be statistically significant except for item 14 (with a coefficient of 0.081), indicating that the internal consistency of the section is mostly strong, apart from one item. In section 4, correlation coefficients range between 0.167 to

0.741, all of which were found to be statistically significant except for item 22 (with a coefficient of 0.167), indicating that the internal consistency of the section is mostly strong, apart from one item. Similar results were found for section 5, with coefficients ranging from 0.671 to 0.764, all being statistically significant, indicating high internal consistency. As for section 6, correlation coefficients are 0.81 and 0.863 for items 31 and 32, respectively, with both being statistically significant.

3.2.2 Internal consistency measured by Cronbach's alpha and Spearman-Brown Coefficient

To estimate the stability of the AI in the Teaching Questionnaire, Cronbach's alpha for internal consistency was calculated, as well as the Split-Half correlation and Spearman-Brown Coefficient.

The value of the stability coefficient for the questionnaire as a whole was 0.886, while the stability coefficients for sections 2-6 were 0.587, 0.744, 0.543, 0.847, and 0.57, respectively. In addition, Spearman-Brown coefficient values for sections 2-6 were 0.587 (moderate), 0.718 (strong), 0.501 (moderate), 0.756 (strong), and 0.574 (moderate), respectively.

These values indicate that the internal consistency for axes 2, 3, 4, and 6, which fall within the range $0.5 < \alpha < 0.8$, has moderate (acceptable) reliability. As for axis 5, a Cronbach's alpha > 0.8 indicates high (good) reliability.

To examine what items (if they existed) within each section are lowering the value of Cronbach's alpha, Cronbach's alpha for the section if item X within the section is deleted was calculated (items with increased alpha upon deletion are highlighted in yellow in Table (6)). In axis 3, eliminating item 14 (the same item with a non-significant correlation between its score and the score of section 3, see Table (5) raised the alpha value from 0.744 to 0.853. In section 4, deleting items 21 and 22 yielded bigger alpha values, although not by much (an increase of 0.03 to 0.06). As for section 5, no item increased the value of Cronbach's alpha upon deletion.

Table (4)

Values of Cronbach's alpha for each section of the AI in Teaching Questionnaire, Cronbach's alpha if items within sections were deleted, correlation between the two halves of the section, and Spearman-Brown Coefficient

Item	Section	Cronbach's alpha for the whole section	Cronbach's alpha if Item Deleted	Correlation between the two halves of the section	Spearman-Brown Coefficient
7	2	0.587		0.416	0.587
8					
10	3	0.744	0.681	1	0.718
11			0.688		
12			0.699		
13			0.697		
14			0.853		
15			0.656		
16			0.661		
17	4	0.543	0.503	0.331	0.501
18			0.521		
19			0.374		
20			0.401		
21			0.58		
22			0.604		
23			0.486		
24	5	0.847	0.821	0.604	0.756
25			0.828		
26			0.822		
27			0.818		
28			0.836		
29			0.820		
30			0.839		
31	6	0.57		0.403	0.574
32					

4.2.3 Construct validity using factorial analysis

For checking Factorial validity, an exploratory factor analysis was conducted for the questionnaire in the following procedure:

First, the suitability of the data for factor analysis was examined using the Kaiser-Meyer-Olkin-Bartlett test (KMO & Bartlett's test), where the value of KMO was 0.825. The value of the chi-square in Bartlett's test was 1148.162. This value was statistically significant at the significance level of >0.001 . With 300 degrees of freedom, the significance of the chi-square value means that the data is suitable for factor analysis.

Accordingly, the factor analysis coefficient was found using the Principal Component Analysis method, and the factors were rotated orthogonally to maximize the variance attributed to Kaiser; the rotation method used was Direct Oblimin with Delta set at 0.

The following criteria were adopted to determine the number of components: the Kaiser criterion, which is considered one of the most common criteria, and depends on the value of the latent root being equal to one or more. It was also taken into account that the saturation of the item on the component should not be less than 0.35, which is considered a moderate threshold. The component is not adopted unless three or more items are saturated on it. Figure (1) shows the graph for the predicted number of components.

Figure (6)

The number of expected components from the factor analysis of the AI in the Teaching Questionnaire

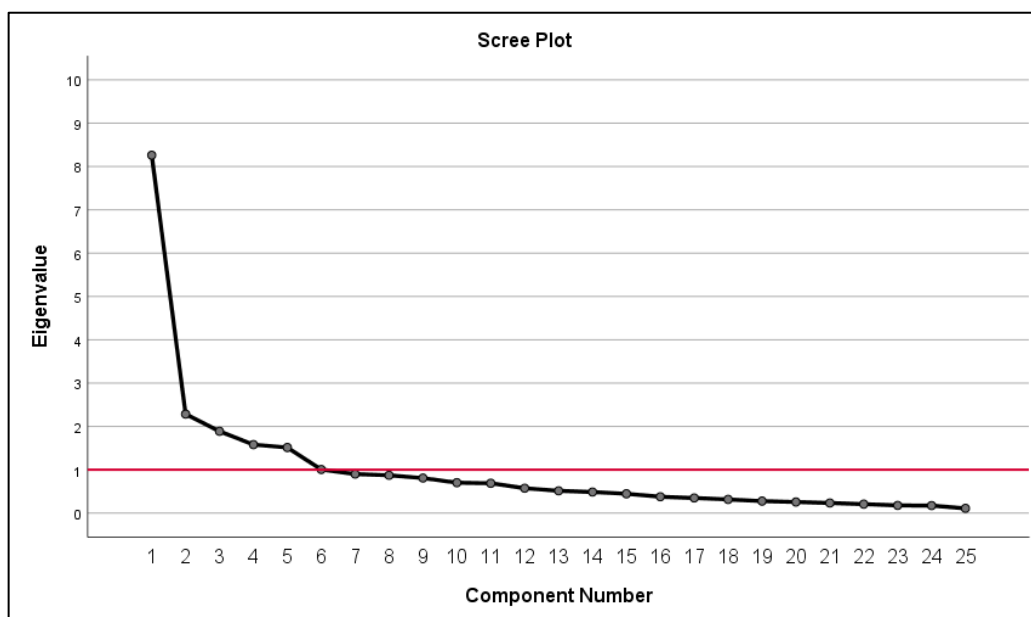


Figure (1) shows the presence of six components with a latent root of more than one, which collectively explain 66.135% of the total variance. The explained variance by the different components is summarized in Table (5).

Table (5)

Percentages of explained variance by the components yielded from PCA analysis and their level of saturation

Component	% of Variance	Cumulative %	Total number of items with high loading (>0.35)
1	33.044	33.044	12
2	9.141	42.185	4
3	7.55	49.73	3
4	6.32	56.05	3
5	6.055	62.11	6
6	4.026	66.135	6

To determine which items to keep and which items to consider removing, the following criteria were applied: items with high loading (>0.35) on only one component are kept. In contrast, items with high loading on multiple components are considered for removal or editing for the final version of the questionnaire. The loading value of each item of the questionnaire in each component is summarized in Table (6).

Table (6)

The rotated component matrix is sorted by loading values of magnitude within each component (only loading values >0.35 are shown)

Section	Item	Component					
		1	2	3	4	5	6
3	11	0.79					
3	15	0.736					
3	12	0.733					
4	19	0.725					
4	20	0.678					
3	16	0.67					
3	10	0.616		-0.498			
3	13	0.534					
5	26	0.499					0.378
4	23	0.385					0.352
4	18		0.799				
3	14		0.727				
2	7			-0.816			
2	8			-0.702			
4	21				0.836		
4	17		0.36		-0.546	-0.42	
6	32					-0.792	
5	28					-0.73	
5	29					-0.664	
5	30	0.426				-0.556	
6	31					-0.405	
5	27						0.799
4	22		0.373		0.35		-0.614
5	25						0.488
5	24						0.434

According to the data in Table (6), item 10 from Section 3, items 17, 22, and 23 from Section 4, and items 26 and 30 from Section 5 have high loading values in more than one component, items highlighted in red in Table (8). Therefore, those items are removed from the analysis. Upon deletion, components 2, 3, 4, and 5 become poorly saturated with 3 items or fewer in each; therefore, those components are excluded from the results, yielding a final total of two components, 1 and 4.

3.2.4 Construct validity using stepwise regression

To calculate construct validity, collinearity between the variables was first checked, and all yielded Condition Indexes below 50, indicating that there is no collinearity between any of the variables. Then, the total score was first calculated (for all items in sections 2-5). Stepwise regression models were performed, in which the total score of each section was entered as an independent variable, and the total score of the questionnaire was entered as the dependent variable for a stepwise regression equation. First, collinearity between the variables was checked, and all yielded Condition Indexes below 50, indicating that there is no collinearity between any of the variables. Results are summarized in Table (7).

Table (7)

R-square and R-square change were obtained by step-wise regression models using scores from the questionnaire sections as predictors

Model	Sections in the model	R square	R square Change	Model's Significance
1	3	0.791	0.791	***
2	3 and 5	0.933	0.142	***
3	3, 4, and 5	0.966	0.033	***
4	3, 4, 5, and 2	0.981	0.021	***
5	2,3,4,5, and 6	1	0.013	***

According to the data in the Table (7), regression model number 1 with only the scores of section 3 as a predictor explains 79.1% of the total questionnaire's score variance. Regression model number 2, with both sections 3 and 5 as predictors, explains 93.3% of the total score's variance, which is 14.2% more compared to model 1. Adding the total scores of section 4 as a predictor to model 2 (model number 3) and adding the total scores of section 2 as a predictor to model 3 (model number 4) yielded a 3.3% and a 2.1% increase in the explained variance for the total score of the questionnaire, respectively.

3.2.5 Demographic and Professional Background

Table (8) presents the demographic and professional characteristics of the 92 participating English teachers. The majority of participants were female (60.7%), with males constituting 39.3%. In terms of age, the largest group fell within the 31-40 years range (36.1%), followed by 20-30 years (28.7%) and 41-50 years (26.2%), with a smaller proportion aged 51+ years (9%), see Appendix (D).

With regard to the educational attainment, most of the participants were holders of a Master's degree (69.6%), whereas 20.7% were holders of a Bachelor's degree and 9.8% of a Doctoral degree. Also, the participants' teaching experience was diverse with the greatest number of participants having more than 10 years of experience (46.7%), followed by 6–10 years (37%), 3–5 years (7.6%), and less than 3 years (8.7%).

Majority of the educators taught multiple grades (10th, 11th, and 12th) (58.7%), and only 19.6% were teaching 10th grade, 17.4% 11th grade, and 4.3% 12th grade exclusively. As for the respondents' knowledge of the use of AI instruments Table (3), the teachers generally yielded positive views: 33.7% of them picked option 4, and 28.3% chose option 5. The average score for item 8 was 3.03 (SD = 1.074), with 38% opting for choice 3 and 23.9% for choice 4, indicating a moderate level of familiarity.

Information from the training sector disclosed that almost half of the participants (46.7%) have done 1–2 courses, while 28.3% have completed 3–5 courses. Only 10.9% of ground personnel has taken more than 5 courses and 14.1% of the participants have never been trained in AI. Almost all of the respondents were able to name ChatGPT as the AI writing tool that they are most familiar with and thus use frequently (85.87%). Other AI writing tools such as Grammarly (44.6%), MagicSchool (40.2%), and QuillBot (10.87%) were mentioned as well. The remaining small percentage (4.35%) of individuals claim to be users of some other AI tools.

Table (8)*Descriptive statistics and answers' frequencies in percentages for sections 2-6, items 7-32*

Section	Item	Answer frequency (%)					Mean	Std. Deviation
		1	2	3	4	5		
2	7	3.3	7.6	27.2	33.7	28.3	3.76	1.052
	8	8.7	20.7	38	23.9	8.7	3.03	1.074
3	10	4.3	9.8	34.8	37.0	14.1	3.47	0.999
	11	3.3	7.6	34.8	35.9	18.5	3.59	0.985
	12	2.2	4.3	19.6	41.3	32.6	3.98	0.949
	13	3.3	13.0	34.8	38.0	10.9	3.40	0.961
	14	19.6	32.6	27.2	12.0	8.7	2.58	1.188
	15	5.4	12.0	26.1	33.7	22.8	3.57	1.132
	16	7.6	6.5	28.3	33.7	23.9	3.60	1.149
4	17	10.9	27.2	30.4	18.5	13	2.96	1.194
	18	42.4	33.7	17.4	6.5	0.0	1.88	0.924
	19	10.9	15.2	31.5	25.0	17.4	3.23	1.223
	20	4.3	6.5	33.7	42.4	13.0	3.53	0.954
	21	22.8	19.6	26.1	20.7	10.9	2.77	1.310
	22	14.1	48.9	27.2	8.7	1.1	2.34	0.868
	23	2.2	15.2	35.9	35.9	10.9	3.38	0.947
5	24	5.4	8.7	25.0	44.6	16.3	3.58	1.040
	25	3.3	9.8	21.7	43.5	21.7	3.71	1.022
	26	4.3	17.4	18.5	42.4	17.4	3.51	1.104
	27	6.5	16.3	30.4	35.9	10.9	3.28	1.072
	28	9.8	21.7	34.8	27.2	6.5	2.99	1.074
	29	5.4	15.2	21.7	44.6	13.0	3.45	1.073
	30	7.6	17.4	27.2	33.7	14.1	3.29	1.144
6	31	8.7	5.4	68.5	5.4	12.0	3.07	0.970
	32	6.5	17.4	29.3	31.5	15.2	3.32	1.128

Table (8) presents the descriptive statistics and percentage distributions of teachers' responses to questionnaire items 7–32, covering Sections 2 through 6. These sections include teachers' familiarity with AI tools, their perceptions of AI integration in teaching,

its perceived influence on students' creative thinking and writing skills, and their views on recommendations and future use. The table includes the mean and standard deviation for each item, offering insight into central tendencies and variability in teacher perceptions across the sample.

3.3 Interview Findings

As one of the qualitative aspects of this mixed-methods research, fifteen semi-structured face-to-face interviews were conducted with Arab EFL high school teachers in the Haifa District. The main objective of the interviews was to produce the knowledge, experience, and perceptions of the teachers on the incorporation of AI tools, i.e., Grammarly, in English language teaching, and perceived effects on students' creative thinking capacity and writing progression. All interviews were carried out in Arabic to allow maximum comfort and richness of response from participants. The recordings were then literally transcribed and analyzed thematically with the qualitative data analysis software MAXQDA. Following Braun & Clarke's (2006) six-phase thematic analysis approach, the researcher systematically coded the transcripts, put codes into categories, and derived leading themes that show the main ideas from the data, see Appendix (K).

This section introduces thematic findings in relation to six main themes that address the study's research questions and show participants' shared experiences, concerns, and aims in using AI technologies for facilitating creative thinking, authentic voice, and students' writing capability.

Thematic findings offer an organized summary through which Arab EFL instructors' experience of AI implementation in their teaching can be explored. For the rest of this chapter, each theme is explored, along with illustrative interview quotes of participants. They also indicate how teachers view the connection between AI tools and the way in which they support students' creative thinking skill development, writing ability, and overall expression in EFL education.

3.3.1 Theme 1: Teachers' General Perceptions of AI Tools

The teacher-participants showed varied reactions to questions that inquired about their general attitudes towards AI technology in education. While they were broadly optimistic about the promise of AI-assisted writing tools like Grammarly, their optimism was

commonly qualified by caution and doubt. One consistent thread throughout the interviews was the feeling that AI tools might be helpful to pedagogical additions, but not substitutes for usual pedagogical practice. Teachers commonly included Grammarly's capacity to help students fix grammar, enhance vocabulary, and rearrange sentences.

The tools were seen primarily as means to liberate teachers from time-consuming tasks so that they could engage in more advanced pedagogical activities such as facilitating students' logical and creative thinking. As an instance, Teacher T7 remarked:

"Grammarly serves as another helper in the classroom. More time and energy from me can go to idea development while the tool deals with small grammar issues which would have been a waste of the valuable lesson time."

Similarly, Teacher T4 shared:

"Students feel more empowered when they receive immediate feedback from Grammarly.

Students no longer have to wait for the teacher to point out every small mistake, thus the learning process becomes quicker and less frustrating."

Among those advantages, a doubting thread deeply intertwined with the teachers was their doubt. Quite a few of them were concerned that AI feedback without any regulation would lead dependency and learning that cannot be verified. They referred to a situation wherein students would only pay attention to grammatical correctness thus neglecting the development of creative thinking and authentic expression. Teacher T12 giving a warning said:

"AI tools correct the 'how,' but they do not teach the 'why.' I fear that some students will stop asking questions and blindly accept corrections."

Moreover, the difference in AI suggestions is another issue raised by the teachers. A few teachers have pointed out that the feedback given by Grammarly sometimes is not enough as it ignores the stylistic and contextual aspects of the writing which is especially true for EFL students who have to strike a balance between grammatical correctness and meaningful communication.

Teacher T9 illustrated this tension:

"Sometimes Grammarly flags sentences that are correct but a bit unconventional. One of my students gets so confused that they think they are wrong when in fact they are using language in a creative way."

Interestingly, a small minority of teachers (approximately 20%) expressed concern that the integration of AI might unintentionally result in teachers losing their skills. They speculated that as AI takes over, there might be less support from institutions for teacher professional development in writing instruction.

Teacher T15 conveyed this concern:

"We should not let ourselves become overly dependent. If we depend too much on AI to 'correct' student writing', we may lose our skills in teaching writing in a systematic way."

In spite of these doubts, most of the participants were of the opinion that AI tools could, if properly supported and critically used, create a richer learning environment. They added that human teachers should be the ones leading the interpretation, discussion, and critical reflection.

Teacher T2 summarized this balanced view:

"Artificial intelligence is a fantastic instrument if it is utilized in a smart manner. This technology may be a great help to teaching, but it is still not capable of substituting it. Learners require the intervention of a teacher, especially in the areas of idea generation, creativity, and insightful thinking."

In general, teachers shared a midpoint opinion. They saw such AI-powered tools as Grammarly very helpful for learning, but at the same time they pointed out that human monitoring should be maintained and students should be made to think critically when using the technology.

3.3.2 Theme 2: Impact of AI Tools on Students' Creative Thinking

Teachers' reactions to the question were diverse. The responses from teachers showed a puzzling situation of contradiction where on the one hand AI was considered as a means to foster creativity and on the other hand it was viewed as something that might hamper

students' inventiveness and the real nature of their expression. These views were also exemplified by a student who stated that Grammarly helped her/his creativity and open-mindedness since she/he didn't have to worry about grammar and language accuracy any more. As a result, students' mental involvement was mainly focused on coming up with new ideas, strengthening their arguments, and language exploration, and at the same time, they were devoid of the anxiety of making small mistakes.

Teacher T3 shared a real example:

"Before Grammarly, my students were really timid. Their sentences were extremely short and simple, and they were afraid of making mistakes. Today, they are using metaphors, rhetorical questions, and even humor in their writing because they are aware that someone will help them with the writing mechanics."

In the same vein, teacher T8 also observed that as the students became more proficient in the technical aspects of writing, they began to experiment with new words, longer sentences, and creative techniques which they had initially avoided out of fear. One of the participants (T7) pointed out:

"Creativity cannot happen without confidence. Grammarly was that safety net, and I saw students taking creative risks which they probably would not have done before."

This view is in line with the notion that easing the cognitive load of surface-level issues (e.g. spelling or punctuation) allows the brain to be more engaged with higher-level thinking such as creativity and the generation of new ideas.

Nevertheless, nearly half of the teachers have raised a voice of concern about the possible negative impact of AI feedback on the creativity of students. They noticed that some students started to censor their ideas, and at the same time, they simplified their writing style in an attempt to "please the AI" rather than to convey their sincere thoughts.

The teacher T5 tried to explain this disagreement by saying:

"Students began doubting their own abilities. They would refrain from writing anything that was even slightly different because they thought that Grammarly would flag it as incorrect."

Teacher T2 similarly noted:

"One of the things that slowly faded from the children's compositions were the bright and distinctive elements of their writing, references to their culture, jokes, and imaginative turns. Their essays turned into grammatically flawless ones but lacked emotional depth."

The teacher was also concerned about another risk that Grammarly is inclined to promote a standardized, formal version of English. Consequently, students coming from different linguistic and cultural backgrounds may experience that they have to adjust to a limited way of defining 'correct' language, thus losing their inherent voice and stylistic creativity."

Teacher T1 reflected:

Our Arab students are frequently able to infuse their writing with vivid metaphors and the narrative techniques of their oral traditions. At times Grammarly considers these as 'awkward' since they are not in line with native English patterns. We are in danger of discarding this richness if students use automated feedback too heavily." Paraphrasing, while some teachers perceived Grammarly as a means leading to more creative self-confidence, others cautioned that it restricts students' genuine expression. The main solutions advocated by the respondents were, in their collective view, teacher instruction: learners have to be taught explicitly the manner in which they should use AI tools wisely, picking the suggestions that improve clarity to the extent that voice and creativity are not interrupted. Teacher T11, expressing this balanced opinion, brought it to the point in a nutshell:

Grammarly should be a tool, not a boss. Students must learn to trust their voice first, and then use AI advice to polish, not erase, their creativity."

Based on the experience of teachers, it is apparent that AI tools like Grammarly can both limit and extend creative thinking depending heavily on the way they are supported and used in the learning process.

Suggestions made by participants included a variety of methods to ensure that AI expands or limits creative thinking:

- Teaching students to approach AI feedback as uncertain suggestions and not as confident corrections.

- Encouraging the students to maintain a genuine voice and culture in their writing.
- Structuring assignments in which creative risk-taking is actively rewarded over grammatical accuracy.
- Leading class discussions on how and why to reject or accept AI recommendations.

The dilemma presented to creative thinking by AI is one of uncertainty. Technology support can free students to be creative, but can accidentally institutionalize the saying and close off authenticity. Pedagogical planning and critical AI literacy, therefore, are necessary fundamentals to making AI tools a blessing and not a curse for student creativity.

3.3.3 Theme 3: Influence of Grammarly on Students' Writing Skills

This was the main point that was almost all of the interview transcripts teachers clearly and repeatedly referred to. Faculty members were unanimous in their views that Grammarly was the main factor that brought about the change in the quality of students' writing, especially in grammar accuracy and the use of vocabulary. As a matter of fact, they emphasized the limitations of the device and the issues of instruction that needed to be addressed before understanding the full impact of this AI tool.

Among the teachers who were interviewed, Grammarly was found to be the main factor that brought about the change in students' command of grammatical structures, spelling, and punctuation. It was mentioned by many that students became more conscious of their usual mistakes and took the initiative to correct them before handing in their work.

Teacher T2 remarked:

"One of the biggest benefits was seeing students independently identify subject-verb agreement errors or punctuation mistakes, issues they previously ignored completely."

Another instructor T14, gave an example of how Grammarly helped students develop metalinguistic awareness:

"Students now ask why a correction was suggested. They are beginning to figure out the language rule behind the suggestion, which didn't happen when I just handed them back their marked essays."

Grammarly also seems to have led to the student confidence growth, especially among those students who were previously struggling with writing mechanics. T11 shared:

"I had one student who always felt ashamed of her grammar. However, once she started using Grammarly, she told me, 'Miss, it helps me feel like I'm not stupid.' That comment stayed with me."

Several teachers also questioned the depth of writing changes that resulted from the tool intervention despite its great strength. They pointed out that although grammar and spelling errors were lessened, content development, idea organization, and argumentation had not improved as much.

Teacher T6 commented:

"Grammarly can definitely find a comma that is missing. But it will not be useful to a student who has no idea how to create a proper argument or write a convincing paragraph."

Other participants expressed their concern that Grammarly might make students overly dependent on quick fixes at the surface level without really understanding the changes made to their texts, thus not choosing to involve themselves in the more cognitively demanding work of drafting and revising.

T9 highlighted this point:

"I observed students clicking on all the suggested changes and not really understanding them. From their side, it seems as if they were handing over their thinking process to someone else."

Moreover, teachers were skeptical about the ability of Grammarly to give feedback regarding tone, creativity, or coherence, especially in the case of narrative or reflective writing. T7 shared that:

"The tool is fine for academic essays. But when I request students to write a personal narrative, the feedback is off-target, and sometimes even baffling."

The interviews uncovered one educational insight very clearly: Grammarly yields the best results when it is utilized as a helper rather than a substitute. Educators, who integrated

Grammarly in a thoroughly designed writing process that involved stages such as idea generation, writing a draft, peer-reviewing, and teacher conferencing, observed a more significant student writing growth in their classes. Hence, the classroom and the educational model play a leading role in deciding if AI tools lead to only slight changes at the surface level or genuine deep learning.

T3 reflected:

"When we showed them how to use Grammarly as one part of the process, not the whole process, students improved both in fluency and in the structure of their writing. But when they used it independently, progress was very little."

Teachers proposed a number of tightly linked instructional strategies and educational practices to top up the working power of Grammarly to the utmost. It was their intention to stop Grammarly being seen just as a device for machine-like checking and, on the contrary, to locate it as a method of raising students' deeper cognitive engagement in their writing activities. They underlined the necessity of being able to help the utilization of the tool through writing workshops and teacher-led lessons during which students not only get to know the tool but also learn how to understand and apply teachers' suggestions in a proper way.

Moreover, teachers advised students to scrutinize Grammarly's suggestions carefully and decide deliberately whether to accept them or not instead of doing so automatically.

Secondly, the integration of AI-generated comments with peer review and teachers' feedback was recognized as a significant step toward the comprehension of writing. Third, they supported the idea of using writing tasks that extend beyond grammar correction, writing tasks that involve the creative expression, the development of the argument, and critical thinking.

On the whole, Grammarly is a nice extra to the student's writing skill development, especially in terms of mechanical accuracy and confidence-building, but the teacher's role is still very important in facilitating the interaction between the student, the tool, and the task, thus writing instruction not only focusing on form but also on meaning, coherence, and creativity.

3.3.4 Theme 4: Teachers' Reflections on the Limitations and Challenges of AI Integration

One of the major issues raised by quite a few participants was the disparity of school regulations, specially in impoverished Arab communities. A few educators pointed out that the minimal access to technology, for instance, the shortage of computers, weakness of the internet connection, or old hardware, was in most cases the reason why the introduction of Grammarly into their lessons was postponed.

T3 explained:

“The concept is fantastic, but it is just not feasible with 30 students and only 10 computers that work. Making this a regular part of a lesson is out of the question. Before teaching, we need to have the materials.”

This sentiment was echoed by another participant who talked about the difference between schools:

"There are some schools that are well-equipped, and their students get early exposure to AI gadgets, while the rest are left at a standstill. This creates a digital divide," he said.

In addition to these barriers, teachers brought up pedagogical concerns related to students' employment of AI tools. One of the complaints that were frequently mentioned was that the students overly relied on the automatic correction function. Educators reported a situation when students mindlessly take the correction that Grammarly has done for them without doubting it and without understanding the correction. Participant T5 remarked:

"Ultimately, it is a habit, they just press ‘accept’ not only without reading but also without thinking. They are not taught how to write better; they are only repairing the obvious mistakes."

It, first of all, signifies a worry of very superficial learning where the goal of writing skills development is replaced by that of getting error-free texts. Teachers thought that this might result in the weakening of the students' metacognitive awareness and their ability to monitor and evaluate their language usage.

There is another concern that was expressed by several participants who pointed out that Grammarly does not invariably give contextually appropriate suggestions. For instance, it could misunderstand syntactic patterns that are influenced by Arabic or it may identify stylistically untypical yet syntactically correct sentences for non-native speakers as errors. Teacher 1 elaborated:

"Grammarly sometimes considers certain things as wrong when, in reality, it is perfectly alright in our context. The students are puzzled. They cannot decide whether it is a language problem or a cultural one."

It illustrates the demand for localizing AI that not only can identify linguistic interference from Arabic but also welcoming various learner profiles. Without this awareness, the students may feel irritated with or stop trusting the tool especially when it contradicts what their real teacher has taught them.

The majority of the people who took part in the discussion considered lack of professional development or rather the absence of it as another big issue that has been debated most vocally. Only a handful of them were provided with formal training regarding the employment of AI instruments such as Grammarly in the teaching process. Most of the teachers reported that they learn by themselves often by watching some tutorials on YouTube or by getting some advice from teacher WhatsApp groups. T11 shared his thoughts:

"We are pushed to use technology, but nobody is showing us the way how to make it work for our students. We manage on our own, learning through trial and error."

Such a void in institutional backing and training usually puts teachers in a position of being ill-equipped or in doubt about how to leverage the pedagogical potential of AI on condition they also ensure student agency and engagement. Some of them believed that a system-wide training program, including in-service workshops, would give them the confidence and efficiency to employ these tools in the classroom.

Finally, ethical and assessment-related concerns were addressed by a minority of participants who doubted the fairness of using AI-assisted texts for grading or assessment. They feared that the students who highly depend on AI tools would present work that does not represent their language skills. Teacher 3 asked:

“If Grammarly is doing half the work, are we evaluating the student or the software?”

To put it briefly, such AI tools as Grammarly may be considered as perfect helpers in a foreign language teaching, but the way they are used effectively is still very much dependent on local factors. Teachers pointed out that the students’ skills in using digital technologies, the proper guidance to learning provided by teachers, the ease of understanding and availability of school rules, and continuous professional development are some of the indispensable conditions for the successful use of AI tools in classrooms. Such results give very tangible advice to the people involved in making and implementing language teaching policies, e.g. curriculum designers and school administrators, who intend to facilitate the informed and pedagogically sound use of technology in multilingual classrooms.

3.3.5 Theme 5: Teachers’ Suggestions and Recommendations for Effective AI Integration

Across the interviews, participants provided generous, experience-near suggestions as to how AI tools such as Grammarly might be used better in EFL classrooms. These were hopeful about the possibilities of AI but practical about under what conditions it might be attached responsibly and pedagogically.

Among the key recommendations made by almost all the teachers was that there should be scaffolding of AI tool usage within pedagogically designed guidelines. As opposed to depending only on Grammarly as a tool for corrections, teachers advised using it as part of more holistic writing instruction involving guided modeling, reflective practice, and peer work. T 4 stated:

Grammarly is powerful, but it should not replace teaching. I use it after students’ brainstorm, write, and revise. It becomes one step in a longer process.”

For that purpose, some instructors reported effective practice involving the use of Grammarly in a writing workshop, in which students initially write a draft and subsequently examine Grammarly’s comment together with that of the teacher and peers. Such a process encourages creative thinking and metacognition, enabling students to internalize rhetorical strategies and grammatical forms rather than only fix surface errors.

The second most commonly cited suggestion was to teach explicitly how to use AI critically. Students did not have digital literacy skills, such as knowing how to weigh which of the recommendations from AI to take or reject, as students relayed. In response to this, participants identified offering mini-lessons or digital literacy modules that instruct students on reading and criticizing AI suggestions. One teacher described:

“We tell students to read books critically, so why not AI? They need to ask: Does this suggestion make sense in my context?”

Teachers also highlighted that AI tools should be used in a way that supports the curriculum objectives, especially writing standards, for example, those mentioned in the rubrics of Module C and G. Instead of letting Grammarly decide what "good writing" is, teachers suggested using AI as a tool within well-established learning goals, thus ensuring that students' writing is not only correct but also creative, well-structured, and with their own unique voice. In terms of real-life application, the majority of teachers were in favor of integration supported by the institution, e.g., as paid accounts, specified time in computer labs, and training sessions for both students and teachers. A couple of teachers pointed out that although the free version of Grammarly is quite useful, it cannot do much in terms of vocabulary suggestions and stylistic guidance. T12 proposed:

“If schools are serious about digital learning, they should invest in full access. Right now, students only get part of the picture.”

There was also widespread agreement that ongoing professional learning about AI in education is crucial. Educators stated that they want workshops, webinars, and teachers' communities of practice on ethically, effectively, and inclusively using AI tools. T6 said: “Create a platform where we can share lesson plans that use Grammarly, compare strategies, and even discuss mistakes. We’re learning together.”

Surprisingly, some of the teachers also mentioned the morality of the situation and came up with ways to ensure that students have the right to make decisions for themselves. Among these were such measures as restricting the use of Grammarly to only creative tasks in order to avoid stylistic standardization and asking students to think about how AI had influenced their revision. A number of teachers have thus far been putting reflective writing journals into practice in which students write down the ways they utilized Grammarly, what they learned, and what they were in disagreement with. T9 could not

help but say: "I request my pupils: What did Grammarly recommend? Did you agree? Why or why not? This creates ownership." To sum up, teachers recognized that the efficient use of AI by the students is not only an easy access matter. It requires a comprehensive pedagogy that sees the AI feedback as a part of human facilitation, which, in turn, develops digital and critical literacy and helps students become reflective, self-regulated writers. These ideas form a concept of AI in teaching that is technologically advanced, pedagogically focused, ethically sensitive, and students' rights-respecting.

3.3.6 Theme 6: Teachers' Views on the Future Role of AI in Education

Initially, through the interviews, educators were asked to consider the broad impact of AI on the future of the educational system.

While the research participants expressed different opinions on this issue, they all seemed to agree that the use of AI tools would become indispensable in language teaching, particularly in English as a Foreign Language (EFL), but these tools should not be used as a replacement of human teachers.

A considerable number of instructors were against the idea that Artificial Intelligence might replace human educators, and they gave one of their reasons as the fact that no machine can simulate the emotional, ethical, and pedagogical aspects of the teaching process. As T6 exemplified:

“Yes, AI can do a quick fix to a grammatically wrong sentence, but it is not able to ‘feel’ the story, understand why a student is bored, or explain the reasons why the student is disengaged. Teaching is relating; it is more than just grammar.”

The study participants agreed that the AI-based technologies such as Grammarly and other similar tools have become very powerful and advanced. They still, however, stress that those kinds of innovations should only be allowed to facilitate human teacher-student interaction rather than fully replacing it. Several interviewees commented on the unique human abilities of educators to encourage learners, respond with empathy, and adjust teaching to meet individual needs. As T11 exemplified:

“AI is great for the technical parts of the language. But what about the one who comforts or encourages a student when he is lost and insecure? This is definitely the teacher’s job.”

On the other hand, some of the interviewees expressed their worries that the school system may become very dependent on AI in areas such as grading, giving feedback, and content delivery. Those teachers warned that if such a dependence was established, it would result in shallow learning, and at the same time, it would threaten the quality of classroom talking and of students' reflective thinking. T5 has noted:

“In a case where the implementation of AI for marking tasks becomes a norm, the possibility for students to get rich and deep feedback from teachers will be reduced. Besides, feedback should be considered as communication, not a decision.”

Every respondent was on the same page that AI might be the leading force of pedagogy, in particular language pedagogy, when writing, editing, and revising works are involved. Most of the teachers envisaged AI in the future as being completely integrated with the EFL teaching methodology AI would not only be used for correction but also as a means of facilitating inquiry, creativity, and learner independence.

Others proposed incorporating AI literacy courses in the English course so that students can more effectively critically evaluate and responsibly use AI-recommended advice. Others proposed creating AI features that are individually personalized for EFL learners, as well as linguistically natural and culturally contextualized tools. In addition, teachers promoted student independence, facilitating their application of AI and promoting reflection and critical thinking rather than passive application of suggestions. As one instructor described (T14):

“The future is not about replacing us with machines. It is about helping students work with technology wisely, critically, creatively, and ethically.”

In short, the members stressed that its success would rest on how much, and with what sense of responsibility, it was done. They demanded professional education, revised curricula, and continuous discussion of the pedagogical and ethical aspects of AI introduction so that technology complements and does not replace the role of humans in education.

3.3.7 Summary of Teacher Perceptions

The following table, see Appendix (L) presents teachers' dual perceptions on AI-aided writing. Teachers reported improvements in grammar, punctuation, confidence, and metalinguistic awareness as advantages. Teachers feared untrustworthy participation, student dependency, and the limited efficacy of AI tools in addressing more essential issues of writing, namely, creating content and creativity, as disadvantages.

3.3.8 Conclusion of the interviews

The qualitative data collected from interviews with teachers provide rich and in-depth perceptions on how Arab EFL high school teachers in the Haifa District perceive and feel about incorporating AI tools, specifically Grammarly, into their English language teaching. These perceptions extend the quantitative findings by recording not just the advantages of AI tools for enhancing grammar and writing skills but also the ethical, pedagogical, and educational issues of their usage.

Teachers, quite frequently, termed artificial intelligence as an excellent tool for students to develop their writing skills just on the surface level and get a very quick feedback which makes the students more independent and motivated. Nonetheless, they expressed their worries about the possibility of students' overdependence, unfortunate reduction of their creativity, and the necessity of human guidance for the development of students' deeper thinking skills. Also, among many other things discussed in the interviews, the participants talked about the AI being a facilitator and not a replacer of the human pedagogy. In addition, conforming to their statements, different teachers shared diverse opinions regarding students' AI adaptability where attributes such as digital literacy, motivation, and age were the most significant. The quantitative data exhibit a mostly positive attitude of teachers towards AI writing proficiency and creative thinking though the level of excitement changes depending on the teacher's situation. Qualitative interviews also reflect these tendencies as educators often state that students who possess certain digital skills and are self-motivated find AI-supported learning environments easier. Nevertheless, they are at the same time concerned with the issue of overdependence on technology and integration that is pedagogically grounded. The interviewed teachers explained this worrying aspect further by indicating that AI usage should facilitate language learning, critical thinking, and creative skills rather than

completing cognitive tasks for the students. Therefore, the qualitative data not only agree with but also go beyond the quantitative findings to show that positive attitudes toward AI can bring the best results if they are accompanied by reflective, context-sensitive implementation.

3.3.9 Themes Summary Table

The following table provides a thematic overview of teachers' perceptions towards AI integration into language teaching, in particular, for creativity, writing development, and teaching practice.

Table (9)

Themes Summary Table

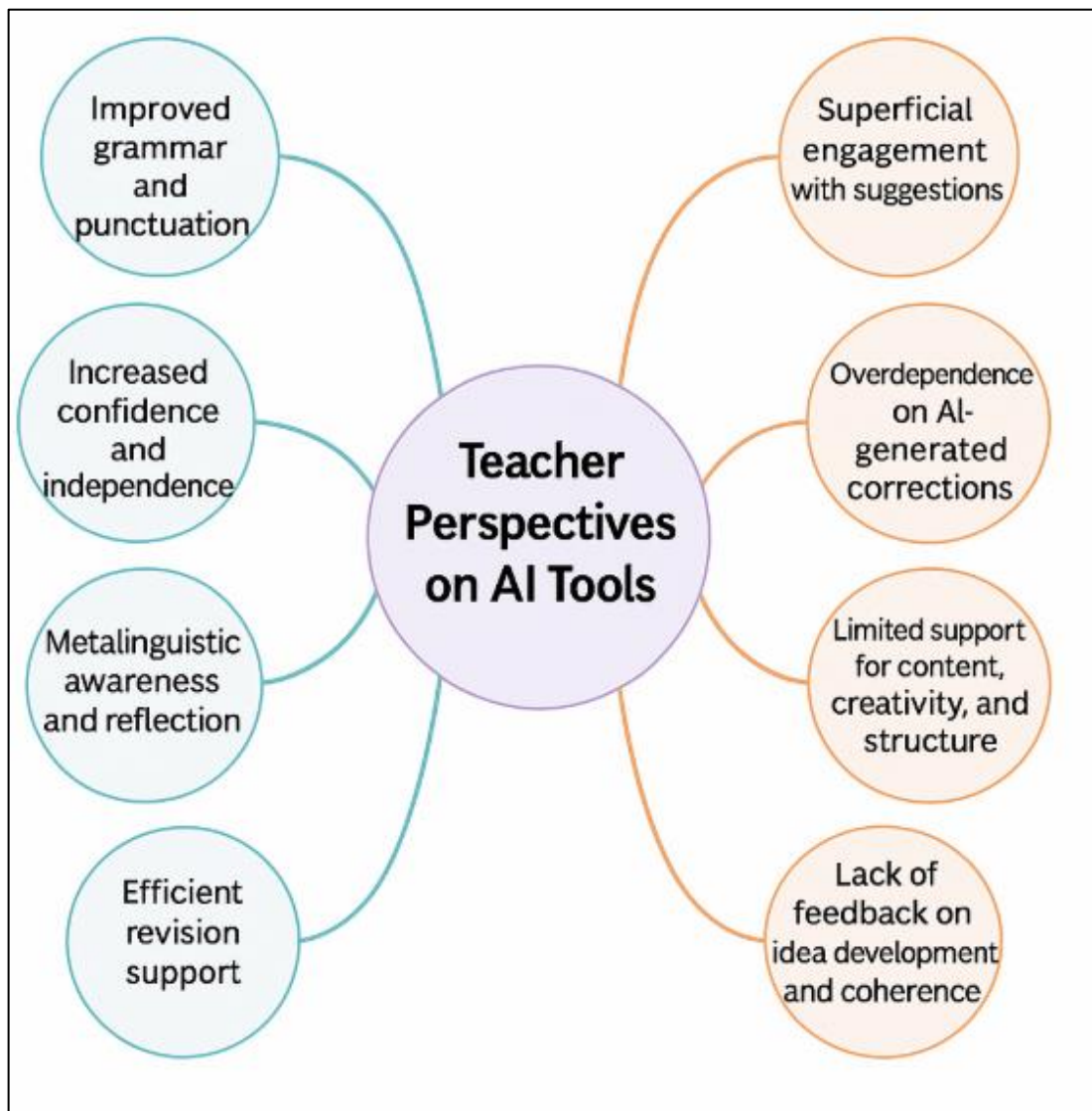
Theme	Description	Key Insights from Teachers
1. Perceptions of AI in Education	Explored teachers' general attitudes toward AI and its role in classrooms.	Teachers viewed AI as applicable for grammar correction and efficiency, but cautioned against its overuse and lack of emotional intelligence.
2. AI and Creative Thinking	Investigated whether AI supports or limits students' originality and idea generation.	Responses were mixed: Some saw AI as enhancing idea fluency; others feared it encouraged imitation rather than innovation.
3. AI and Writing Skills Development	Examined perceived changes in students' grammar, coherence, vocabulary, and structure.	Teachers reported improvements in grammar and mechanics but noted limited impact on deeper writing skills like voice and critical analysis.
4. Pedagogical and Technological Challenges	Identified barriers to effective AI integration.	Challenges included inconsistent digital structure, different school policies, lack of training, and unequal student access to devices and the internet.
5. Teacher–AI Collaboration	Explored teachers' views on AI as a co-teaching partner.	Teachers supported the idea of AI assisting with feedback and routine tasks, but insisted on maintaining teacher-led instruction for cognitive and emotional development.
6. Recommendations and Future Directions	Captured teachers' suggestions for improving AI use in schools.	Emphasized the need for AI literacy in the curriculum, ethical guidelines, teacher training, and tools adapted for EFL learners.

3.3.10 A Mind Map of Teacher Perceptions on AI Tool Integration in EFL Writing Instruction

The following mind map illustrates the dominant views of teachers toward the use of AI tools in EFL writing instruction. It provides a sense of the major themes that came out of the interviews.

Figure (7)

A Mind Map of Teacher Perceptions on AI Tool Integration in EFL Writing Instruction



The mind map represents the different and opposite views of teachers on the use of AI tools for teaching EFL writing. While some pointed out the use of AI for improving grammar and organization, others doubted its effect on students' creativity and independence. Besides, issues such as the use of AI balanced by teacher leadership, the

limitation of the school building, and the moral aspects around the place of technology in schools have been raised. These views are not intersecting but rather revealing the ongoing conflict between teacher decision-making, educational technology, and real learning contexts.

Chapter Four

Discussion, Conclusion and Recommendations

This chapter recounts the evidence brought about by the experimental intervention, questionnaire, and semi-structured interviews. This chapter will talk about the impact of the work in connection with the research questions, objectives, and the literature discussed in Chapter One.

The outcomes of this research provide feasible/realistic suggestions for teachers who want to integrate AI writing instruction in a way that makes sense. Out of the various instruments analyzed, Grammarly stood out to be the most effective as a supportive tool during the process of paragraph development. It found its utmost usage when the students were writing the body of the paragraph, a task where they are obliged to present their own ideas, support them with logical reasoning, and explain them with relevant clarifications.

At this point, the feedback given by Grammarly to the students in real time can best serve the students in that they can go on refining their expression, sentence cohesion can be improved and the linking between ideas can be clarified. Immediate suggestions made by the tool with respect to the structure, vocabulary, and tone keep a learner-text interaction going whereby the student is enabled to identify his/her error and make logical changes.

With the help of a teacher, Grammarly gradually becomes not only a tool for corrections but also a reflective learning partner that students become aware of their writing choices. Using Grammarly in the classroom thus not only contributes to the accuracy of the language but also to the creative independence of students, which allows them to express their ideas in English in a logical and coherent way. The research relied on three main instruments, each focusing on the impact of AI-assisted tools like Grammarly on the students' English language acquisition and creative thinking abilities. The results of the experiment were evaluated to find the extent to which the intervention has influenced students' writing proficiency based on their grade, proficiency level, and gender. Later, the responses to the questionnaire were also reviewed in order to reflect the views of English teachers about the usage of AI in classes. These opinions included the role of AI in enhancing writing skills and in developing creativity. Lastly, the interview qualitative data were transcribed and analyzed to give a full description of the teachers' practices, the

practical, and the pedagogical implications of AI use in classrooms. The mixed-methods design utilized in this research offers a detailed and interconnected view of the study results. It makes it possible to see the differences and similarities between teacher perceptions and student performance, between quantitative and qualitative data, and between theoretical expectations and classroom realities.

4.1 Comparative Analysis of the Current Study’s Findings and Relevant Literature Studies

This chapter is a comparative analysis of the primary results of the research based on three sources: the experimental outcome, teachers' questionnaires, and qualitative interviews. Each table presents the level of support or comparison between the current findings and the findings provided in previous studies on AI integration in language learning, particularly writing development skills and creative thinking among English language learners.

4.1.1 Experimental Findings

Table (10)

Experimental Findings

#	Experimental Finding	Supporting Studies	Contrasting Views	Comment and APA Citation
1	Significant improvements in grammar, vocabulary, and structure after using Grammarly	(Kim & Kim, 2022)Alotaibi (2023)	Tseng & Warschauer (2023) warn against over-reliance	These findings reinforce earlier evidence about Grammarly’s potential to enhance main writing skills in EFL learners. However, this shows that tool effectiveness depends on pedagogical scaffolding (Kim & Kim, 2022); Tseng & Warschauer, 2023).
2	Greater improvement among 11th graders compared to 10th graders	Chang et al. (2024)	–	The observed age-based variation supports Chang et al.’s (2024) findings, suggesting older students may be influenced by AI feedback more effectively.
3	Higher gains among B1-level students than A2-level students	(Fang, Xu, He, & Han, 2022)	–	These results suggest that students with stronger baseline proficiency benefit more from AI feedback, confirming previous research (Fang, Xu, He, & Han, 2022).

The findings summarized in Table (10) indicate improvements in grammar, vocabulary, and writing structure following the implementation of the Grammarly tool. These results are related to previous research on the effectiveness of AI-based feedback in developing basic writing skills among EFL learners (Kim & Kim, 2022; Wu, et al., 2021). Greater developments were observed among 11th-grade students compared to 10th graders, and among learners at the B1 level relative to their A2 classmates. This suggests that basic language ability and developmental maturity also have a moderating effect on the effect of AI tools. Findings also emphasize pedagogical scaffolding, in that tool effectiveness is seen to be dependent on rational integration in lesson settings. Grammarly's ideal educational role is realized when implemented under teacher facilitation, as opposed to being used as an independent technological intervention.

4.1.2 Questionnaire Findings

Table (11) see Appendix (P) gives the outcome of the questionnaire regarding the perceptions of English teachers towards the application of AI, in this case, Grammarly, and the extent to which it affects the writing and creativity of students. While some of the teachers welcomed the fact that the tool helped enhance language and vocabulary accuracy, their comments described divergent perceptions on its impact on creativity. Some of the participants were concerned that over-reliance on Grammarly would ultimately decrease students' ability to generate original ideas and limit creative thinking. This is supported by literature warning that AI tools, when uncritically applied, may encourage over-reliance and reduce independent thinking (Newton & Newton, 2020) (Tseng & Warschauer, 2023). However, a few responses indicated that Grammarly might indirectly foster creativity through enabling students to get a command of the language and thereby changing their focus from the language to the development of ideas. Those mixed responses also suggest that the influence of the tool on creative thinking depends not only on its features but also on the pedagogical setting in which it is introduced. The results highlight the significance of guided integration, wherein the tool acts as a complement to, rather than a replacement for, the creative cognitive processes.

Table (12) Appendix (P) summarizes the major themes from qualitative teacher interviews. One of the most significant points raised by the teachers was the noticeable enhancement of students' confidence and their readiness to take writing risks when AI feedback was provided. This discovery is in line with the research that has been done

previously and which has been cited by teachers in their interviews and which has been done by Shi, Ding, & Choi in 2024 and Wu, et al., in 2021. Those studies emphasize the energizing and motivational effects of AI in students who are in a low-risk learning environment and are feedback rich. However, the participant teachers in this study were unanimous in their opinion that teachers' involvement is indispensable for interpreting AI-generated suggestions, thus emphasizing the role of human mediation that cannot be taken over by AI. Participant teachers held opposing views on the effect of Grammarly on students' creativity: one group of teachers believed that it limited the students, while another group saw the instrument as a supporter that provided a framework for the original expression. This tension forms the academic controversy and the need for in-depth research in this field. It is mentioned in the interview evidence that the secret to the successful integration of AI is not the tool itself but the way it is used in an adaptive and mindful pedagogical environment.

The three tables' findings present a reflective optimistic view of the use of AI tools in the language learning process. The results derived from both quantitative and qualitative data sources depict that Grammarly may be instrumental in the enhancement of writing skills and, in some instances, it could be a facilitator of innovative interaction.

However, the research also illuminates important mediating factors, including student age, level of proficiency, and teacher interpretation, which build the educational effects of AI applications. These findings form the basis for the need to approach AI-facilitated learning as an activity of pedagogy and not a static or essential strategy demanding little change or thoughtful consideration. The evidence in this work offers empirical confirmation of a professionally oriented, human-centered model of AI integration in English instruction.

4.2 Discussion of the pre- and post

In general, the results demonstrate a positive effect of Grammarly AI on students' writing proficiency. Students in both grade levels showed significant improvements in grammar, vocabulary, and structure following the intervention. A main grade-level effect was observed, as 11th-grade students showed greater improvements than 10th-grade students. This difference may be attributed to the developmental gap between the two groups, as

older students may possess higher metalinguistic awareness and thus respond more effectively to automated feedback mechanisms.

The data, quite interestingly, disclose gender-dependent differences. In the case of 10th-grade students, both male and female participants showed similar levels of improvement. Nevertheless, the situation is such that in the 11th-grade group, male students gained more than their female counterparts. The difference, therefore, might not necessarily indicate that Grammarly AI is less effective for females, but it could be that 11th-grade females had higher writing proficiency even before the intervention. It is quite possible that a "ceiling effect" has taken place where male students simply showed more measurable gains because they had more room for improvement.

Concerning initial proficiency levels, the analysis conducted showed that Grammarly AI writing proficiency improvements were similar for students with low, medium, and high baseline performance. This result implies that the instrument is a good fit for students with different language proficiency levels, and it is also a good support for teachers to use it in mixed-ability classroom settings. Moreover, the lack of interaction effects between baseline proficiency and writing gains is further evidence that the positive effects of AI-enhanced feedback are available to most students and not only to a certain subgroup.

4.3 Discussion of the questionnaire

The data gathered from the survey highlight that the opinion of Arab EFL teachers is positive in principle regarding the use of AI tools for teaching English. Still, they are related to demographic and professional variables differences, mainly gender, teaching experience, and prior exposure to an AI-related training program.

The gender-related patterns showed that the differences were indirect but essential. Generally, both male and female teachers were supportive of AI integration, but female participants (58.7% of the sample) seemed to be more reserved in their statements, particularly when they were asked about the effect of AI on the creative thinking of students. The caution women showed in their answers was most evident in their disagreement with the statements in Items 17 ('AI limits the learner's ability to produce original ideas') and 23 ('AI tools reduce students' opportunity to express their voice'), respectively, where disagreement dominated. Even if there were no gender-based

statistical differences, the overall pattern indicates that female teachers may have more concerns regarding the standardization of student expression and the possibility of voice and authenticity being affected. This aspect can be explained by gendered pedagogical approaches or higher sensitivity to affective and cognitive development, as cited in research about educational technology adoption (Teo, 2011).

On top of that, the variable of teaching experience also had a say in the formation of the attitudes. Teachers with more than ten years of work experience (44.5% of the sample) were more inclined to voice their skepticism concerning the extension of AI tools use in the curriculum. On the other hand, those with fewer years of experience, especially in the 3–10-years range, were more likely to say that Grammarly had a positive impact on the writing skill development. This may be an indication of generational differences in the use of digital tools or different professional priorities: the more experienced educators might advocate for pedagogical depth and be wary of overusing the technology, whereas the less experienced teachers might consider AI as a classroom assistant that lightens their workload and supports the struggling students.

The effect of previously trained AI was eventually the main factor that influenced the outcome. Educators who had acquired three or more AI-related courses (39.1% of the sample) were more at ease in questioning AI's influence, whether it was a positive or a negative one. Such individuals were highly probable to firmly agree that AI technology contributes to improving one's grammatical accuracy, vocabulary, and overall writing quality (Items 24–30), especially Item 25 (“AI tools help students' grammatical accuracy”) which had a relatively high average ($M = 3.71$). Meanwhile, teachers who had never been trained in AI (13%) mostly had uncertain or neutral opinions. This difference between the two groups clearly sheds light on how crucial PD is in developing well-informed perceptions.

Moreover, teachers who regularly utilize apps like ChatGPT and Grammarly are most likely to perceive AI as a valuable and time-saving resource in the teaching process. Contrarily, the significantly higher percentage of users for ChatGPT (84.7%) over Grammarly (41.3%) may indicate that there are some factors relating to the preference of tools that affect the teaching direction. While a generative tool like ChatGPT is seen as a means to support students' exploratory thinking, Grammarly being a tool focused on

correctness and mechanics, thereby, intensifies the contradiction found in teachers' attitudes toward writing versus creativity.

The responses of the participants to the questions 17-23 in the survey reveal the perception of Arabic-speaking EFL teachers regarding the use of AI tools in the creative development of students. Their answers show a mixture of anxiety, partial agreement, and uncertainty, which indicates that the participants had a generally cautious attitude towards the impact of AI on creativity.

The statement 18 ("AI tools weaken students' ability to create unique expressions") got the lowest average ($M = 1.88$), as 64% of the respondents who marked either "disagree" or "strongly disagree" counted that AI tools usage might not lead to students generating creative thinking in the future. Educators appeared to be particularly worried about the scenario where such tools not only make things fairer but also reduce originality, especially when students are using them passively or overly depending on them.

In the same vein, Items 21 ("AI-generated suggestions limit imagination") and 22 ("AI tools suppress independent idea generation") had relatively low mean scores ($M = 2.77$ and 2.34 , respectively), which are consistent with a large number of teachers who think that AI tools are not a source for new ideas or being an independent expression. These insights unveil the distinctions between the internal creativity domain, and the next analysis might determine which aspects of creativity teachers see as the most vulnerable.

The trend, nevertheless, was not wholly unfavorable. Item 20 ("AI tools help students organize their thoughts") had a fairly good average ($M = 3.53$), so a few teachers might be recognizing the organizational aspect of AI tools, particularly in the students' field of developing or clarifying their ideas. Thirty-eight percent of the respondents selected "agree," indicating that even if creativity as a more profound concept could be affected, certain aspects of idea management and expression might still be somewhat positively impacted by AI assistance.

In general, the findings of this section disclose that AI-based writing assistants like Grammarly may be beneficial in helping students with the structure and flow of their writing. However, these tools are not typically regarded as ones that organically invite or stimulate creative thinking or expression. The teachers' words suggest that the

phenomenon of creativity is outside the reach of machines and its growth still depends largely on proper human guidance, authentic engagement, and reflective learning. Future research should take into account not only the perceptions but also performance-based indicators to determine if students using AI have different creative profiles than those who use conventional tools.

The final section of the questionnaire (queries 31 and 32) revolved around educators' propositions regarding the prospective employment of AI instruments in English teaching. The findings of this part convey that the respondents, while considering AI integration in teaching, exhibited caution as well as restraint. The idea of giving up completely on the further use of AI was nowhere to be seen, yet, similarly, there was no enthusiasm for its role to be advanced in the English curriculum.

Item 31 ("I recommend integrating AI tools formally into the curriculum") was the lowest scorer with just a 3.07 mean. Most noteworthy is the fact that 62.0% of the respondents selected the neutral midpoint (option 3). This, in turn, proposes that the biggest number of teachers are still not quite sure or even a little bit hesitant to give their approval to the use of AI tools at the curricular level. Likewise, the statement in item 32 ("AI should play a larger role in English instruction") was rated 3.32 on average with most of the answers being either moderate agreement or neutrality (29.3% chose option 3; 27.1% chose option 4). These results uncover a concealed conflict behind the façade: numerous teachers admit the usefulness of AI in the process of writing skill enhancement, which is clear from the previous parts of the questionnaire, while at the same time, they hesitate to support the formal or systemic implementation of AI.

The doubt whether the teachers can handle the instructional and institutional aspects of such tools might be reflected in their hesitation to use them. They might be thinking about how AI can be integrated into the existing curricula, what kind of professional development would be needed, or how to ensure that all students have equal access. The fact that most answers are neutral suggests that even though AI is being used informally and on an experimental basis in the classroom, its future as a regular part of English education is still uncertain for the majority of teachers.

To sum up, teachers are rather cautious than confident when they express their views about the use of AI tools in the future. This calls for a continuous interaction with teachers

through training sessions, conversations, and joint policy-making in order to help them understand ways in which AI can be integrated in a meaningful and ethical manner into English language teaching. Additionally, subsequent research could involve in-depth qualitative investigation of reasons for neutrality and how certain measures (e.g., hands-on workshops or pilot programs) could change these views.

4.4 Discussion of interviews

The qualitative data from the semi-structured interviews of Arab EFL high school teachers in Haifa District have given an in-depth and detailed picture of how educationalists perceive and feel the application of AI-based tools, especially the use of Grammarly, in the classroom. These revelations serve as a follow-up to the questionnaire findings by explaining more explicitly the trends that have been observed quantitatively and making significant contributions to both the research questions and the objectives of the study.

In most cases, teachers seemed to hold a favorable view of AI tools and mainly through the lens of the facilities these tools provide for the giving of an immediate feedback, thus student confidence gets to be raised and motivation particularly in the areas of grammar and vocabulary is further enhanced. A number of teachers even went to the extent of characterizing Grammarly as a "support system" that enabled revision by the students themselves and thus it was a means of fostering more writing ownership among them. This therefore is in line with the first two Rout research objectives and cohabit with the theory that AI can be of considerable assistance in bringing about surface-level writing improvements.

The limitation points that were added by the interviews pointed toward the deficiency of teachers in deep areas of writing development such as idea generation, coherence, and elaborative skills of the argumentative type while they were using Grammarly. The fact stated by the teachers was that while Grammarly may be correcting 'how' changes, it hardly ever 'why.' Upon further explanation, one of the teachers said, "It is Grammarly that rectifies the sentence, but the teaching comes in by the student learning how to put together an argument." An implication was drawn from that statement pointing out that AI applications might only be able to autonomously develop extensive writing skills to the level that they have to rely on teacher facilitation."

Creativity turned out to be a complicated matter. Educators had mixed beliefs about AI; some suggested that the tool eased the mental burden and in that way, the student got the freedom to be daring in linguistic usage. Whereas the others cautioned that it was limiting the development of student voice and thus uniqueness was being restricted and that the most common phrase was that students were "writing to conciliate the AI," which is strongly correlated with Research Questions 4 and 5. Besides the pedagogical issues raised, the respondents revealed structural and institutional concerns as a result of their participation in the interviews. Among the barriers to teachers' adoption of technology were reported by them as unequal access to technology, lack of sufficient training, and technical problems (e.g., the web's unreliability or lack of available computer labs).

Some reported that older teachers were more resistant to AI use out of fear of loss of control or job displacement. These are repeated in Research Questions 6, 9, and 10 and suggest that successful AI integration cannot rely on the presence of technology but also requires systemic investment, teacher support, and thoughtful curriculum planning.

In spite of these fears, teachers preferred to stress that AI must be viewed as a supporting mechanism, not replacing the teacher. The most powerful message from interviews was one of balance: implement AI to support mechanics but leave room for human critique, debate, and creativity. Teachers suggested precise ethical AI usage standards, school-level infrastructure investments, and teacher training serving and equipping teachers and students to use AI well and critically.

4.5 Conclusions

The combined findings from the experimental intervention, teacher questionnaire, and semi-structured interviews provide a coherent and convergent understanding of the effect of AI-facilitated tools, specifically Grammarly, on English language teaching in Arab secondary schools. Although the components used different methods to explore the phenomenon, it was still possible to identify clear convergent patterns from them. These patterns not only confirm the study's mixed-methods design but also enhance the overall interpretive framework.

Experimental data have shown that the use of Grammarly has significantly improved the students' writing skills in terms of grammar, vocabulary, and structural organization. The improvements have been demonstrated at different proficiency levels, however, the

greatest effect has been seen in 11th-grade male students. Besides that, teacher interviews provided qualitative insights which supported these quantitative results as all the participants acknowledged that the use of Grammarly helped them to achieve surface-level accuracy in writing and also gave the power to the learners, especially those who were less-achieved students. In sum, the findings lead to the first and second research objectives, thus proving that the use of Grammarly as an instrument in teaching writing skills is very effective and hence a positive answer to Research Questions 1–3 has been given.

Results from the teacher questionnaire depicted that, in general, teachers had positive views about the role of AI in writing as a process and saw it as a supporting tool especially in grammar and vocabulary. Nevertheless, the data from the questionnaire and the interviews showed that there were still persistent worries regarding the AI's negative impact on creativity. According to the teachers, the AI-supported tools lack the capacity to generate the user's originality and authentic expression. In particular, the concerns of AI effect on creativity were most commonly expressed by experienced teachers and those who were already familiar with AI tools, thus the contact for these teachers intensifies their knowledge not only about the advantages but also the disadvantages of technology. These findings speak directly to Research Questions 4, 5, and 7, and contribute to Objectives 4 and 5 by revealing educators' views of AI as a thinking facilitator that can also limit creativity.

Besides that, interviews have revealed various educational and institutional challenges, such as unequal access to technology, over-dependence on automated suggestions, and resistance by teachers who are not confident with technology. These problems are linked to Research Questions 6, 9, and 10 and Objectives 6, 7, and 8 in that they indicate the structural and human factors that limit the use of AI and emphasize the need for professional development and systemic support.

In brief, the triangulation of data sources provides support for the conclusions drawn in the study and attest to the effective addressing of the research questions by the study. This research has fulfilled its objective: to probe the influence of AI tools on students' writing skills, creative thinking, and teachers' perceptions of their pedagogical implications. The results are an extensive and solid contribution to the field of AI in education supported

by both empirical evidence and interpretive depth. They are indicative that AI technologies can bring about a revolutionary change in language learning; however, the conditions for their successful use are the presence of well-thought-out pedagogical guidance, equal access, and critical oversight.

Follow-up research should extend this work by using validated instruments to directly assess creative outcomes as well as by studying the long-term cognitive and curricular effects of AI use among diverse student groups.

4.6 Recommendations

This study's results are a strong confirmation of the successful use of AI tools such as Grammarly for students' writing improvement; besides, they raise a large pedagogical discussion about the necessity of AI changing the teaching-learning process drastically. A compelling argument is that AI, as one of its subfields, when used in the right way, does not eliminate the need for the teacher, rather it changes the role of the teacher, the curriculum, and the student in an educational interaction which is more dynamic, flexible, and focused on human factors.

4.6.1 To Curriculum Designers

Curriculum designers are advised to:

1. Include AI literacy as part of the English curricula. Students must be provided with the information and moral understanding that they are able to use AI tools in a correct and helpful way in writing, creativity, and communication.
2. Develop adaptable curricula that mix conventional and AI-assisted teaching methods. Curriculum should be shifting towards the adaptable models which are able to accept technological innovations and at the same time stimulate creativity, collaboration, and problem-solving skills.

4.6.2 To Teachers and Teacher Educators

Teachers are advised to:

1. Reconceptualize their instructional roles in the age of AI. As a smart assistant, Artificial Intelligence is to be seen by teachers. AI can be the most supportive tool in the areas of instructional design, feedback, and differentiation. Purposefully, by integrating AI tools, they can move out of the mechanical correction and administrative routines into higher-order teaching tasks such as facilitating critical thinking, creativity, and reflection. Besides, teachers are invited to use Grammarly as a handy tool in the writing process, especially the second stage, body paragraph, which is the students' expression of opinion, giving reasons, and including examples. At this moment, using Grammarly helps students not only in structure, coherence, and language accuracy but also in giving them the freedom of their ideas.
2. Engage in continuous professional development centered on pedagogical transformation. It is best for teachers to enroll in training, which focuses on the usage of AI tools and the impact of AI on teaching philosophy, lesson design, and assessment practices.

4.6.3 To Policymakers and Educational Leaders

Policymakers and Educational Leaders are advised to:

1. Reposition AI as a system-changing concept rather than a simple application: Policy makers should realize that giving education to children is not only about teaching them the skills that will be needed in the future which is already known, but it is rather about enabling them to develop and even make new futures which are still unknown. The incorporation of Artificial Intelligence should not be considered just as one more "add-on" but rather as a revolutionary instrument that impels the whole educational system to be more adaptable, to facilitate the individualization of learning and to ensure that the system is fair to all students.
2. Provide for fair access to and the ethical use of AI in education: Equity should be turned into both a moral and pedagogical priority. It entails supplying the right infrastructure, continuous training, and well-defined ethical principles that ensure that all students, irrespective of their socioeconomic background, have the possibility to make use of AI tools in a creative and responsible way. Educational leaders should

reimagine schools as hubs of innovation, empathy, and multilingual creativity, where technology is a tool that facilitates inclusion, rather than a cause of division.

4.7 Future Studies

1. Expand the research scope and methodology to include diverse contexts and variables:

Future studies can compare the views of teachers and the performance of students in public and private schools in order to find out how AI tools use is affected by the socio-economic conditions, the availability of institutional resources and the flexibility of the curriculum. Experimental designs with pre- and post-tests and control groups can give more exact measures of the influence of AI-assisted instruction on writing proficiency and creative thinking. Besides that, different proficiency levels (low, average, and high achievers) and grade levels, e.g., 12th graders, can be included, to have more detailed comparative analyses concerning cognitive maturity and familiarity with academic standards.

2. Broaden the tools, measures, and duration of AI-based interventions:

Future research might use worldwide creative thinking measurements, like the Torrance Tests of Creative Thinking (TTCT) or the Evaluation of Potential Creativity (EPoC), to delve deeper into the connection between AI tools, creativity, and academic writing performance. By simply lengthening the intervention periods, the researchers would be able to see the students' development of metacognitive habits and their growing writing autonomy much more profoundly.

Moreover, experiments could be designed to analyze the impact of various generative AI tools such as ChatGPT and Magic School if used separately, together, or in comparison with Grammarly, thereby identifying the technological features that most effectively lead to the creative process.

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Appendices

Appendix (A)

Teacher Questionnaire

Integration of AI in Teaching

Dear Teacher,

Thank you for taking the time to participate in this critical study. This questionnaire explores your perceptions of using artificial intelligence (AI) tools to enhance students' creative thinking and writing skills. Your insights are critical for advancing research in this field and will contribute significantly to understanding how AI impacts education.

Your responses will remain confidential, and all data will be used for academic purposes. This questionnaire should take a few minutes to complete.

Your input will provide invaluable information for this study, and I greatly appreciate your honesty and cooperation.

Sincerely,

Areen Jabarin- PhD student

Advisors: Dr. Fawaz Aqel, Dr. Alam Musa

Section1 : Demographic and Professional Background

1. Gender:

Male

female

2. Age:

20-30

31-40

41-50

+51

3. Educational level

Bachelor's degree

Master's degree

Doctoral degree

4. Years of teaching experience

Less than 3 years

3-5 years

6-10 years

More than 10 years

5- The classes I teach

10th

11th

12th

All of the above

6- Number of AI training courses I have attended

None

1-2 courses

3-5 courses

More than five courses

Section 2: Familiarity with AI tools

Rate your agreement with the following statements.

Note that: 1- Strongly disagree 2- disagree 3- Neutral 4- Agree 5- Strongly agree.

7- I am familiar with AI tools in education (e.g., Grammarly, Gemini, ChatGPT, Magic School)

1. Strongly Disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

8- I regularly incorporate AI tools into my teaching practices (e.g., lesson planning, grading, or student support)

1. Strongly Disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

9- What types of AI writing tools do you commonly use to support students in improving their writing quality, particularly in content and organization?

1. Quillpot
2. ChatGPT
3. Grammarly
4. Magicschool

Section 3: Teachers' Perceptions of Integrating AI in Teaching

Rate your agreement with the following statements.

Note that: 1- Strongly disagree 2- disagree 3- Neutral 4- Agree 5- Strongly agree.

10- AI tools significantly enhance the quality and effectiveness of teaching practices.

1. Strongly Disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

11- AI tools improve students' overall learning outcomes.

1. Strongly Disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

12- AI tools simplify complex tasks for students, such as providing ideas for writing.

1. Strongly Disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

13. AI tools encourage students to generate innovative and original ideas in their writing.

1. Strongly Disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

14. The use of AI tools limits students' ability to experiment with unique language and creative storytelling techniques.

1. Strongly Disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

15. AI tools enable students to explore topics in greater depth.

1. Strongly Disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

16- AI tools positively affect students' ability to explore alternative perspectives.

1. Strongly Disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

Section 4: Impact of AI on Students' Creative Thinking

Rate your agreement with the following statements.

Note that: 1- Strongly disagree 2- disagree 3- Neutral 4- Agree 5- Strongly agree.

17-AI tools significantly improve aspects of creative thinking in general?

1. Strongly Disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

18. Students rely too much on AI tools instead of developing creative thinking skills.

1. Strongly Disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

19. I always encourage my students to use AI tools for creative tasks.

1. Strongly Disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

20. AI tools improve students' ability to refine and organize creative ideas.

1. Strongly Disagree
2. Disagree

3. Neutral
4. Agree
5. Strongly agree

21. The use of AI tools reduces students' opportunities to think independently and creatively.

1. Strongly Disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

22. AI tools influence how effectively students brainstorm and generate new ideas.

1. Strongly Disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

23. AI tools positively affect students' ability to organize creative ideas logically.

1. Strongly Disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

Section 5: The Impact of AI Tools on the Writing Skills of Students

Rate your agreement with the following statements.

Note that: 1- Strongly disagree 2- disagree 3- Neutral 4- Agree 5- Strongly agree.

24. AI tools significantly improve the content quality of students' writing

1. Strongly Disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

25. AI tools are effective in enhancing the organization of students' written work.

1. Strongly Disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

26. AI tools assist students in generating ideas and encourage creativity in their writing

1. Strongly Disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

27. The use of AI tools positively impacts students' ability to generate coherent and well-structured arguments in their writing.

1. Strongly Disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

28. AI tools positively affect students' originality and uniqueness of writing.

1. Strongly Disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

29. AI tools increase students' motivation and engagement in the writing process.

1. Strongly Disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

30. Long-term use of AI writing tools enhances students' ability to produce high-quality written work independently.

1. Strongly Disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

Section 6: Recommendations and Future Use

31. AI tools should be integrated into the curriculum to the extent of

High

Moderate

Low

32. The role of AI tools in the future of education will be central to teaching and learning

1. Strongly Disagree

2. Disagree

3. Neutral

4. Agree

5. Strongly agree

33. As a teacher, my concerns regarding the ethical implications of AI in education are ...

Link for the questionnaire:

<https://docs.google.com/forms/d/e/1FAIpQLSfHv8qu6hk4yIHRQl6bpSxWIMTzwHvhxmLDwZzc7yJevhF7Vg/viewform?usp=header>

Appendix (B)

Questionnaire Item Mapping Table

Questionnaire Item	Construct	Mapped to Research Objective(s)	Mapped to Research Question(s)
Q7	Familiarity with AI	Objective 4	RQ4, RQ6
Q8	AI Use in Practice	Objective 4, 6	RQ4, RQ6, RQ10
Q9	Types of AI Used	Objective 4	RQ4
Q10–Q12	Perception of AI in Teaching	Objective 4	RQ4, RQ6
Q13–Q16	AI & Creativity	Objective 5	RQ5, RQ7
Q17–Q23	Impact of AI on Creative Thinking	Objective 5	RQ5, RQ7
Q24–Q30	AI and Writing Proficiency	Objective 1, 2, 3	RQ1, RQ2, RQ3
Q31–Q33	Future Use and Ethics	Objective 6, 7	RQ6, RQ9, RQ10

Appendix C

Questionnaire Jurors

The following experts participated in reviewing and validating the questionnaire used in this study. Their academic and professional expertise contributed to ensuring the instrument's clarity, relevance, and alignment with the study's objectives.

Name	Academic Rank
Dr. Khaled Abduljaleel Dweikat	PhD
Dr. Waleed Salameh	PhD
Dr. Nidal Jayousi	PhD
Dr. Majdi Hanawi	PhD
Dr. Abdulkarem Ighbariya	PhD

Appendix D

Statistical Tables from Questionnaire, Pre and Post-test Analysis

Construct validity analysis – Stepwise regression

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	Change Statistics			Sig. F Change
						F Change	df1	df2	
1	.889 ^a	.791	.789	6.34861	.791	340.438	1	90	.000
2	.966 ^b	.933	.931	3.61460	.142	188.638	1	89	.000
3	.983 ^c	.966	.965	2.58896	.033	85.485	1	88	.000
4	.994 ^d	.987	.987	1.60241	.021	142.714	1	87	.000
5	1.000 ^e	1.000	1.000	.00000	.013	1994870403835680.500	1	86	.000

- a. Predictors: (Constant), s3_Sum
- b. Predictors: (Constant), s3_Sum, s5_Sum
- c. Predictors: (Constant), s3_Sum, s5_Sum, s4_Sum
- d. Predictors: (Constant), s3_Sum, s5_Sum, s4_Sum, s2_Sum
- e. Predictors: (Constant), s3_Sum, s5_Sum, s4_Sum, s2_Sum, s6_Sum

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	13721.305	1	13721.305	340.438	.000 ^b
	Residual	3627.434	90	40.305		
	Total	17348.739	91			
2	Regression	16185.923	2	8092.962	619.422	.000 ^c
	Residual	1162.816	89	13.065		
	Total	17348.739	91			
3	Regression	16758.902	3	5586.301	833.440	.000 ^d
	Residual	589.838	88	6.703		
	Total	17348.739	91			
4	Regression	17125.349	4	4281.337	1667.379	.000 ^e
	Residual	223.390	87	2.568		
	Total	17348.739	91			
5	Regression	17348.739	5	3469.748	.	. ^f
	Residual	.000	86	.000		
	Total	17348.739	91			

- a. Dependent Variable: Total_Sum
- b. Predictors: (Constant), s3_Sum
- c. Predictors: (Constant), s3_Sum, s5_Sum
- d. Predictors: (Constant), s3_Sum, s5_Sum, s4_Sum
- e. Predictors: (Constant), s3_Sum, s5_Sum, s4_Sum, s2_Sum
- f. Predictors: (Constant), s3_Sum, s5_Sum, s4_Sum, s2_Sum, s6_Sum

		Coefficients ^a					Collinearity Statistics	
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Tolerance	VIF
		B	Std. Error	Beta				
1	Constant)	17.330	3.526		4.914	.000		
	:3_Sum	2.644	.143	.889	18.451	.000	1.000	1.000
2	Constant)	10.766	2.064		5.216	.000		
	:3_Sum	1.666	.108	.560	15.380	.000	.567	1.762
	:5_Sum	1.269	.092	.500	13.735	.000	.567	1.762
3	Constant)	6.430	1.551		4.146	.000		
	:3_Sum	1.243	.090	.418	13.815	.000	.421	2.373
	:5_Sum	1.042	.071	.411	14.767	.000	.499	2.004
	:4_Sum	.993	.107	.279	9.246	.000	.424	2.358
4	Constant)	1.752	1.037		1.690	.095		
	:3_Sum	.977	.060	.329	16.287	.000	.363	2.752
	:5_Sum	1.085	.044	.428	24.757	.000	.496	2.018
	:4_Sum	1.079	.067	.303	16.137	.000	.419	2.386
	:2_Sum	1.231	.103	.160	11.946	.000	.830	1.204
5	Constant)	7.994E-15	.000		.000	1.000		
	:3_Sum	1.000	.000	.336	83911577.847	.000	.363	2.757
	:5_Sum	1.000	.000	.394	112535868.195	.000	.475	2.105
	:4_Sum	1.000	.000	.281	74791477.672	.000	.413	2.424
	:2_Sum	1.000	.000	.130	47526205.528	.000	.785	1.274
	:6_Sum	1.000	.000	.127	46998436.594	.000	.793	1.261

a. Dependent Variable: Total_Sum

Between pre-post for each variable, separate for grade - T-Test

		Paired Samples Statistics				
Grade			Mean	N	Std. Deviation	Std. Error Mean
10th	Pair 1	Pre_Spelling	4.4483	29	1.21262	.22518
		Post_Spelling	2.2414	29	1.27210	.23622
	Pair 2	Pre_Grammar	5.1034	29	1.69758	.31523
		Post_Grammar	4.2414	29	1.27210	.23622
	Pair 3	Pre_Vocab	3.3448	29	1.34366	.24951
		Post_Vocab	3.2414	29	1.27210	.23622
	Pair 4	Pre_Punct	2.4828	29	1.21363	.22537
		Post_Punct	3.2414	29	1.27210	.23622
	Pair 5	Pre_Opening	6.2414	29	.83045	.15421
		Post_Opening	5.7931	29	1.20651	.22404
	Pair 6	Pre_Body	11.6552	29	2.31880	.43059
		Post_Body	23.8966	29	3.73540	.69365
	Pair 7	Pre_Conc	4.9310	29	1.25160	.23242
		Post_Conc	6.2414	29	1.64002	.30454
	Pair 8	Pre_TotalScore	57.1552	29	10.62183	1.97242
		Post_TotalScore	66.5172	29	11.09254	2.05983
11th	Pair 1	Pre_Spelling	3.6333	30	1.51960	.27744
		Post_Spelling	.5000	30	.82001	.14971
	Pair 2	Pre_Grammar	4.1667	30	1.87696	.34268
		Post_Grammar	1.7000	30	.87691	.16010
	Pair 3	Pre_Vocab	3.0000	30	1.17444	.21442
		Post_Vocab	1.0000	30	.78784	.14384
	Pair 4	Pre_Punct	2.0333	30	.99943	.18247
		Post_Punct	1.3000	30	.59596	.10881
	Pair 5	Pre_Opening	7.1667	30	1.01992	.18621
		Post_Opening	7.6667	30	1.06134	.19377
	Pair 6	Pre_Body	13.2333	30	1.77499	.32407
		Post_Body	28.1667	30	3.58236	.65405
	Pair 7	Pre_Conc	5.9000	30	.99481	.18163
		Post_Conc	8.3000	30	1.17884	.21523
	Pair 8	Pre_TotalScore	65.6667	30	9.18989	1.67784
		Post_TotalScore	78.6667	30	10.25648	1.87257

Appendix (E)

Demographic and professional characteristics of the participants (N=30)

Participants characteristics	N	%
Gender		
Male	31	33.7%
Female	61	66.3%
Age		
20-30 years	25	27.2%
31-40 years	29	31.5%
41-50 years	28	30.4%
51+ years	10	10.9%
Education Level		
Bachelor's degree (BA)	19	20.7%
Master's degree (MA)	64	69.6%
Doctoral degree (PhD)	9	9.8%
Years of teaching experience		
<3 years	8	8.7%
3-5 years	7	7.6%
6-10 years	34	37%
>10 years	43	46.7%
Taught grades		
10 th grade	18	19.6%
11 th grade	16	17.4%
12 th grade	4	4.3%
All of the above	54	58.7%
Number of AI training courses		
None	13	14.1%
1-2 courses	43	46.7%
3-5 courses	26	28.3%
>5 courses	10	10.9%
Types of AI writing tools used to improve students' writing		
Quillbot	10	10.87%
ChatGPT	79	85.87%
Grammarly	41	44.6%
MagicSchool	37	40.2%
Other	4	4.35%

Appendix (F)

Interview Questions

Background Information:

1- Can you describe your teaching background and any experience you have with integrating AI tools into your educational practices?

Perceptions of AI Tools in Education:

2- What are your general perceptions of the role of AI tools in education? How do you feel they have influenced teaching and learning in your context?

Impact of AI on Creative Thinking:

3- How do you perceive the impact of AI tools on students' creative thinking skills, particularly in terms of enhancing originality and innovative expression?

Impact of AI on Students' Writing Skills:

4- In your opinion, how do AI tools affect students' academic outcomes, particularly in areas like writing skills, critical thinking, and idea generation? Could you share examples from your teaching experience?

Challenges in AI Integration:

5- What challenges do teachers face when incorporating AI tools into their teaching, both in terms of pedagogy and student learning outcomes?

Recommendations and Future Use:

6- In your opinion, do you think AI has the potential to replace human teachers in the future, or will it continue to serve as a complementary tool in education?

7- Based on your experience, what recommendations would you make for integrating AI tools more effectively into teaching practices? What changes or improvements would you like to see in the future?

Appendix (G)

Google Form – Questionnaire

Questions Responses **92** Settings



Integration of AI in Teaching

B *I* U ↻ ✕

Dear Teacher,

Thank you for taking the time to participate in this critical study. This questionnaire explores your perceptions of using artificial intelligence (AI) tools to enhance students' creative thinking and writing skills. Your insights are critical for advancing research in this field and will contribute significantly to understanding how AI impacts education.

Your responses will remain confidential, and all data will be used for academic purposes. This questionnaire should take a few minutes to complete.

Your input will provide invaluable information for this study, and I greatly appreciate your honesty and cooperation.

Sincerely,
Areen Jabarin- PhD student

Advisors: Dr. Fawaz Aqel , Dr. Alam Musa

Section 4: Impact of AI on Students' Creative Thinking

Rate your agreement for the following statements

Note that: 1- Strongly disagree 2- disagree 3- Neutral 4- Agree 5- Strongly agree

17. AI tools significantly improve aspects of creative thinking in general? *

	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly agree

18. Students rely too much on AI tools instead of developing creative thinking skills. *

	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly agree

19. I always encourage my students to use AI tools for creative tasks? *

	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly agree

20. AI tools improve students' ability to refine and organize creative ideas. *

	1	2	3	4	5	
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Appendix (H)

Sample Size Estimation – Questionnaire

Sample Size Estimation

According to the Ministry of Education, there are 19,000 English teachers (as of the 26th of November, 2024; 2024 ,תרט). The estimated distribution of teachers in the country is the following: Elementary: ~40%, Middle school: ~30%, High school: ~30%. Under this assumed distribution, the number of High school English teachers is roughly ~5700 teachers. Given that Arabs represent 21% of the entire population, and under the assumption that the same proportion is proper for Arab high school English teachers, their estimated number would be around 1200 teachers.

The total population is roughly 9.8 million, 1.13 million reside within the Haifa district, making up 11.6% of the entire population. 25% of Haifa district residents are Arab, as 282500 Arabs are living in the Haifa district. 282500 of 2.1 million make up 13.45% of all Arabs in the country. If the same proportion applies for the percentage of Arab high school English teachers, the entire population of Arab English high school teachers within the Haifa district, there would be ~165 teachers in estimation.

For estimating the minimal sample size needed for an adequate representation of the entire population of Arab English high school teachers within the Haifa district, we applied Gaiger's (1984) equation:

$$n = \frac{N \times Z^2 \times p(1-p)}{e^2 \times (N-1) + Z^2 \times p(1-p)}$$

For calculating the sample size (n), I entered the following values:

N (total population) = 165

p (estimated proportion of the population) = 0.5

e (Margin of error) = 0.05

Z (Z-score) = 1.96 for 95% confidence interval.

$n = \frac{165 \times 1.96^2 \times 0.5(1-0.5)}{0.05^2 \times (165-1) + 1.96^2 \times 0.5(1-0.5)} = 116$ respondents needed for a population of 165 with 95% confidence and $\pm 5\%$ margin of error.

Appendix (I)

Sample Interview Transcript (Arabic)

كود المعلم T1 :

الجنس: ذكر

اللغة الأصلية للمقابلة: العربية

مكان العمل: مدرسة ثانوية في منطقة حيفا

عدد سنوات الخبرة: 14 سنة

مدة المقابلة: 30 دقيقة

تاريخ المقابلة: 14 مارس 2025

طريقة إجراء المقابلة: مقابلة وجاهية

حالة الموافقة: تمت الموافقة الشفوية والمكتوبة على التسجيل والاستخدام لأغراض البحث الأكاديمي

1. الخلفية التعليمية والتجربة في دمج أدوات الذكاء الاصطناعي

عندما التقيت بالأستاذ محمد (اسم مستعار)، كان يجلس في غرفة الاستراحة بهدوء وذلك خلال احد الاستكمالات التي اشتركنا فيها، يحتسي كوباً من القهوة، وبين يديه دفتر ملاحظات مليء بالتعليقات والهوامش المكتوبة بخط يده.. بدا عليه التركيز والانشغال، لكن ما إن بدأت المقابلة حتى اعتدل في جلسته، ووضع الدفتر جانباً، ونظر إليّ بابتسامة ترحيبية وقال: "أهلاً وسهلاً، تفضلي، كيف أقدر أساعدك؟".

بدأنا بالسؤال الأول حول خلفيته التعليمية وتجربته في دمج أدوات الذكاء الاصطناعي في التعليم. ارتسمت على وجهه ابتسامة بسيطة، وبدأ يروي قصته بشغف واضح: "أنا صار لي تقريباً 14 سنة بدرس لغة إنجليزية للمرحلة الثانوية في منطقة حيفا، اشتغلت مع طلاب من كل الأنواع: المتفوقين اللي ما شاء الله عنهم، وطلاب بحاجة لدعم في المهارات الأساسية. بصراحة، طريقتي بالتدريس اتغيرت كثير على مدار السنين. بالبداية، كنت أمشي على النمط التقليدي؛ كتب، واجبات، شرح مباشر... بس مع الوقت، ومع التطور اللي صار بالتكنولوجيا، حسيت إنه لازم أواكب

هالتطور عشان أقدر أوصل للطلاب بطريقة أقرب لفهمهم". توقف قليلاً، وكأنه يسترجع ذكريات المحاولات الأولى، ثم تابع قائلاً

"قبل أربع سنوات، بدت أجرب أدمج التكنولوجيا بشكل أوسع في الحصص، وخاصة بمهارة الكتابة، لأن الطلاب كانوا يعانون كثير من الأخطاء المتكررة. بصراحة، أول أداة جربتها كانت Grammarly. كنت متردد بالبداية، خايف إنه الطلاب يعتمدوا عليها بشكل كامل وما يتعلموا من أخطائهم، بس قررت إنني أجربها على صف الحادي عشر كتجربة". توقف قليلاً، شرب رشفة من القهوة، ثم أكمل بابتسامة فخر: " المفاجأة كانت إنه الطلاب، حتى اللي كانوا ضعاف بالكتابة، صار عندهم جرأة يجربوا يكتبوا جمل أطول، ويجربوا مفردات جديدة Grammarly. كان يعطيهم ملاحظات فورية على الأخطاء، وأنا كنت أتابع معاهم، وأسألهم ليش غيروا الكلمة أو التركيب. حتى الطلاب اللي كانوا دائماً يكتبوا نفس الجمل، صاروا يجربوا أساليب مختلفة. في طلاب كانوا يجوا عندي يقولوا: أستاذ، اليوم ما عملت ولا خطأ بقواعد اللغة، Grammarly ما طلع لي شي بالأحمر!"

كان يتحدث بحماس ملحوظ، يرفع يديه أحياناً للتعبير عن النقاط، ويهز رأسه تأكيداً على أهمية التجربة. شعرت فعلاً أنه مقتنع تماماً بفعالية الأداة، ليس فقط لتحسين الكتابة، ولكن لبناء ثقة الطلاب بأنفسهم.

ثم أضاف، مع تعبير جاد على وجهه: "بصراحة، Grammarly كان مثل المعلم المساعد. أنا لحالي مع 30 طالب، صعب ألاحق كل جملة وكل كلمة، لكن الأداة كانت تعطي ملاحظات فورية وتفصيلية، وهذا ساعدني أركز على أشياء أعمق مع الطلاب، مثل تنمية الأفكار وربط الجمل مع بعض بشكل منطقي".

لم يتوقف عند Grammarly فقط، بل تابع حديثه عن أدوات أخرى جربها مع الطلاب: "غير Grammarly، جربت معهم QuillBot عشان نتدرب على إعادة الصياغة، وكان مفيد جداً، خصوصاً للطلاب اللي بيحاولوا يكتبوا مقالات طويلة وما بدهم يكرروا نفس الجمل. وكمان استخدمنا Read&Write لطلاب عندهم صعوبات تعلم، وكان فيه نتائج حلوة. لاحظت إنه الطلاب صار عندهم ثقة أكبر، وصاروا يطلبنوا يستخدموا الأدوات حتى بعد ما تخلص الحصّة".

رفع حاجبيه قليلاً كأنه يود التأكيد على النقطة الأخيرة، ثم قال: "بس الأهم من هيك، أنا ما بشوف هاي الأدوات بديلة عن المعلم، أبداً. أنا بشوفها امتداد لدوري. يعني الأداة بتساعد الطالب يصلح، لكن أنا دوري أتابع، وأفهمه ليش هذا

غلط، وكيف ممكن يصلح للأفضل. بصراحة، التجربة كانت إيجابية جدًا، وخالتي أقتنع إنه لو استخدمنا الذكاء الاصطناعي بطريقة صحيحة، ممكن نعمل تغيير كبير بمستوى الطلاب".

2. تصورات المعلم حول أدوات الذكاء الاصطناعي في التعليم

بدأت بطرح السؤال الثاني عليه:

"ما هي تصوراتك العامة عن دور أدوات الذكاء الاصطناعي في التعليم؟ وكيف تشعر أنها أثرت على التعليم والتعلم في سياقك التدريسي؟"

تراجع في مقعده قليلاً، ووضع يده على ذقنه وكأنه يسترجع التجارب التي مر بها في صفوفه. ابتسم بخفة وقال: "بصراحة، أنا عندي تفاؤل حذر تجاه أدوات الذكاء الاصطناعي في التعليم. شفت التكنولوجيا تتغير كثير على مدار السنين، من السبورات الذكية إلى التعليم الإلكتروني، لكن الذكاء الاصطناعي مختلف. ليش؟ لأنه بيعطي تغذية راجعة فورية، وهذا بحد ذاته شيء ثوري، خاصة بمجال الكتابة".

ثم انحنى للأمام، مشيراً بيديه وكأنه يريد أن يؤكد على فكرته "يعني مثلاً، في صفوفي بحيفا، كثير من الطلاب العرب بيعانوا من ضعف باللغة الإنجليزية، سواء بالقواعد أو تركيب الجمل Grammarly. مثلاً، بيوفر ملاحظات فورية، الطالب يكتب الجملة، والأداة بتوضح له وين الخطأ، وبتعطيه اقتراحات بديلة. هاد الشيء كان بمثابة تغيير في ديناميكية التعلم. الطالب ما بضل يستنى يومين أو ثلاثة عشان يعرف إذا إجابته صحيحة أو لا، المعلومة صارت لحظية".

توقف قليلاً، ثم تابع وهو يبتسم: "الأهم من هيك، الطلاب صاروا واعيين أكثر لأخطائهم. يعني، صار في عندهم نوع من الوعي الذاتي، كل مرة بيكتبوا جملة غلط وبيشوفوا التصحيح، بيتعلموا منها. في طلاب كانوا يعملوا نفس الأخطاء بكل مرة، وبعد شهر من استخدام Grammarly صاروا يعرفوا ليش لازم يستخدموا 'have' بدل 'has'، وصاروا يصححوا لحالهم بدون تدخل مني".

كانت تعابير وجهه تشير إلى الفخر، وكأنه يرى نتيجة جهوده تنعكس على طلابه. وأضاف بحماس واضح: "والموضوع مش بس بالأخطاء النحوية، حتى بالتركيب اللغوية. طلابي صاروا يجربوا جمل أطول، ويستخدموا مفردات

كانوا يخافوا يكتبوها بالسابق. لأنه صار عندهم أداة بتساعدهم، حتى لو غلطوا، في حدا رح يصلح، وما رح ينقص من علامتهم".

أثناء حديثه، لاحظت كيف كان يستخدم يديه للتعبير، وكانت نبرة صوته ترتفع عندما يتحدث عن طلابه بشغف. بدا واضحاً أن تجربته مع أدوات الذكاء الاصطناعي لم تكن مجرد تجربة عابرة، بل كانت بمثابة تغيير جذري في طريقة تفكيره حول تعليم اللغة. تابع حديثه بنبرة أكثر جدية "بس بنفس الوقت، عندي بعض التحفظات. الأدوات هاي خطيرة إذا ما انعملها دمج صحيح. يعني بعض الطلاب صاروا يعتمدوا عليها بشكل كبير، مجرد ما يشوفوا خط أحمر، بيضغطوا 'Accept' بدون ما يفهموا شو الخطأ أصلاً. أنا صرت أطلب منهم يكتبوا لي السبب وراء كل تغيير عملوه عشان أتأكد إنهم فاهمين، مش بس بيصلحوا بدون إدراك".

كانت ملامحه أكثر جدية وهو يتحدث عن هذه النقطة، وأردف قائلاً:

"إضافة لهيك، في عنا مشكلة ثانية، وهي الفجوة الرقمية. مش كل الطلاب عندهم إنترنت سريع أو أجهزة لايتوب في البيت، فهالشئ بيخلي التجربة مش متكافئة بينهم. في طلاب بيقدروا يستخدموا الأدوات بكل راحة، وفي طلاب بصلوا يستنوا للحصة الجاي حتى يقدروا يستخدموها".

3. أثر أدوات الذكاء الاصطناعي على التفكير الإبداعي لدى الطلاب

سألته:

"كيف ترى تأثير أدوات الذكاء الاصطناعي على مهارات التفكير الإبداعي لدى الطلاب، خصوصاً فيما يتعلق بتعزيز الأصالة والتعبير المبتكر؟"

ابتسم ابتسامة عميقة، وكان السؤال أثار في ذهنه تجارب عديدة مرّ بها مع طلابه. قام بتعديل جلسته للأمام، وبدأ يشرح بنبرة واثقة

"بدي أقولك بصراحة، كان عندي تخوف بالبداية إنه الطلاب يعتمدوا على الأدوات هاي بشكل تلقائي، يعني بصيروا ينسخوا ويعدلوا بدون تفكير. لكن اللي صار كان عكس هيك تماماً Grammarly. مثلاً، ما بيصحح الجملة ويس، بيعرض على الطالب خيارات مختلفة، وهون بديت ألاحظ إشي جديد؛ الطلاب صاروا يجربوا، يغيروا، يعدلوا، وبدون ما يحسّوا صار عندهم جرأة أكبر إنهم يكتبوا جمل معقدة، ويستخدموا تعابير جديدة".

توقف قليلاً، ثم تابع وهو يلوح بيديه بتعبير يظهر مدى انغماسه في الحديث:

"بتتذكرى السنة الماضية؟ كان عندي طالب اسمه أحمد، هذا الطالب كان دائماً يكتب نفس التراكيب، جمل بسيطة وما فيها أي تعبير مختلف. بس بعد ما بدأ يستخدم Grammarly، شفت تغيير كبير. كتب مرة موضوع تعبير عن السفر، وأنا متعود عليه يكتب جمل مثل 'I like traveling.'، 'I go to many places.'، لكن هاي المرة كتب: *Traveling opens doors to new experiences and shapes one's understanding of the world.* بصراحة، انبهرت! سألته كيف طلعت معك هاي الجملة؟ قلي Grammarly: ساعدني أختار الكلمات الصح وخالاني أجرب أشياء جديدة".

كان وجهه يعبر عن الفخر وهو يحكي لي هذه القصة، وكأن هذا الإنجاز هو إنجاز شخصي له أيضاً. واصل كلامه وهو ينظر إلى السقف قليلاً، وكأنه يسترجع لحظات أخرى مشابهة:

"مش بس أحمد، في طالبات كمان كانوا كتير مترددين إنهم يكتبوا أفكار جديدة، دائماً بخافوا من الأخطاء. بس مع الوقت، ومع استخدام الأدوات، صاروا يضيفوا أمثلة، ويكتبوا جمل معقدة. حتى صار عندي واحدة من الطالبات، اسمها ريماء، كتبت مقالة عن تأثير التكنولوجيا على المجتمع، وبلشت المقالة بمقولة هي كتبتها بنفسها *Technology: is not just a tool; it's the bridge to a new world.* ولما قرأتها حسيت إنني بقرأ مقالة أكاديمية، مو مجرد واجب مدرسي".

ثم نظر إليّ مباشرة وقال

"أنا ما بدي أقول إنه الذكاء الاصطناعي لحاله بعمل كل شيء، بس هو بمثابة محفز. يعني، الطالب لما يشوف إنه فيه دعم فوري وبدون انتظار، ببداً يتجرأ يكتب. حتى لو كان عنده أخطاء، يعرف إنه رح يتعلم منها مباشرة. وهذا الحكي ما كان موجود قبل، كنا نستنى أسبوع لحد ما نرجع للطالب مع الملاحظات، أما هسا، صار التصحيح لحظي، وصاروا يعرفوا وين الأخطاء بسرعة".

لم أتمالك نفسي من الابتسام، وسألته:

"هل تعتقد إن هالتغييرات أثرت على التفكير الإبداعي عند الطلاب؟"

هز رأسه موافقًا، وأجاب بنبرة مليئة بالثقة:

"أكيد! شفت عندهم جرأة أكبر في الكتابة، صاروا يجربوا أنواع جديدة من التعبير، يستخدموا استعارات وتشبيهات. صار عندهم فضول إنهم يجربوا تركيب جمل معقدة، أو حتى يعبروا عن مشاعرهم بطريقة أعمق Grammarly. ما أعطاهم الإبداع، لكنه شال الحواجز اللي كانت تمنعهم يجربوا، وهون الفرق الكبير".

كانت ملامحه تشير إلى اقتناع عميق بفكرة أن الذكاء الاصطناعي ليس بديلاً للإبداع، ولكنه أداة تفتح الأبواب أمام الطلاب ليكتشفوا إمكانياتهم اللغوية؟

4. أثر أدوات الذكاء الاصطناعي على مهارات الكتابة لدى الطلاب

سألته:

"في رأيك، كيف تؤثر أدوات الذكاء الاصطناعي على الأداء الأكاديمي للطلاب، وخصوصًا في مجالات مثل مهارات الكتابة، والتفكير النقدي، وتوليد الأفكار؟ هل يمكنك مشاركة أمثلة من تجربتك التدريسية؟"

ابتسم بشكل يوحي بأنه استرجع في ذاكرته العديد من الحصص الدراسية، وقام بتعديل نظارته وهو يقول: "بدي أحكيك إنه في البداية، كان عندي شكوك حول الموضوع. كنت متوقع إنه الطلاب رح يعتمدوا على الأدوات هاي كحل سريع، يعني يكتبوا النص، ويخلوا الذكاء الاصطناعي يعدل لهم، بدون ما يتعلموا من الأخطاء. لكن اللي صار فاجأني".

توقف للحظة، ثم تابع حديثه بنبرة أكثر جدية وهو يشبك يديه:

"لما استخدمنا Grammarly في الصف، لاحظت إنه الطلاب صار عندهم اهتمام أكبر بكتاباتهم. قبل، لما كنت أرجعهم الواجبات مع التصحيحات، كانوا يأخذوا الورقة، يطلعوا على العلامة، ويس. قليل اللي كان يرجع يقرأ الملاحظات، أو يحاول يفهم شو الغلط. لكن مع Grammarly، صاروا يشوفوا التصحيح لحظيًا، وهاي شغلة كبيرة".

ابتسم ابتسامة عريضة وكأنه يتذكر موقف معين، ثم قال وهو يحرك يديه للتوضيح:

"بدي أعطيك مثال: كان عندي طالب اسمه محمد، كان دايماً يكتب جمل طويلة ومربكة، وما فيها علامات ترقيم واضحة. لما استخدم Grammarly، صرت أشوف تحسن تدريجي. مرة إجا عندي بعد الحصّة وحكالي: أستاذ،

اليوم Grammarly أعطاني ملاحظة على الفاصلة (comma) بين الجمل، وما كنت أعرف إنه مكانها غلط. من يومها، صرت ألاقية بهتم أكثر بترتيب الجمل، ويحاول يستخدم الفواصل بطريقة صحيحة".

بدأت ألاحظ أنه عندما يتحدث عن طلابه، تظهر على وجهه ملامح الفخر، وكأنه يتحدث عن أبنائه. تابع حديثه بلهجة مليئة بالحماس:

"مش بس محمد، كمان في طالبات كتير استفادوا من الأداة، خصوصًا في موضوع المفردات. قبل، كانوا يكتبوا بنفس الكلمات المتكررة، بس مع الاقتراحات اللي بتيجي من Grammarly، صاروا يجربوا كلمات جديدة. حتى بديت أشوفهم يسألوا بعض: شو يعني هاي الكلمة؟ كيف بنستعملها؟ وهذا كان إشي مميز".

توقف قليلاً، ونظر إلى السقف وكأنه يسترجع تفاصيل الحصة، ثم قال:

"في مرة عملت نشاط كتابة جماعي، قسمنا الصف لمجموعات، وكل مجموعة كان معها جهاز فيه Grammarly. بدى أقولك إنه مستوى النقاش بينهم كان مختلف، صاروا يتناقشوا في التصحيحات، ويحاولوا يقنعوا بعض ليش هاي الجملة صح أو غلط. كان فيه تفاعل حقيقي، وكانهم عم يتعلموا من بعض. حتى اللي كانوا ضعاف بالكتابة، صار عندهم ثقة أكبر إنهم يكتبوا، لأنه في حدا عم يساعدهم مباشرة".

ثم أضاف وهو يشير بيديه للتأكيد:

"الأداة ساعدتهم يشوفوا أخطاءهم بعيونهم، مش مجرد ملاحظات مكتوبة على ورقة. يعني مثلاً، كانوا دايمًا يغلطوا في الـ verb tense، لكن مع التصحيحات الفورية، صاروا يعرفوا مباشرة وين المشكلة، وهي بالنسبة إلي كانت نقلة نوعية في التعليم".

شعرت برغبة في معرفة المزيد، فسألته:

"وهل تعتقد أن هذه الأدوات عززت التفكير النقدي عند الطلاب؟"

ضحك وقال:

"سؤال مهم! بدي أحكيك، مش كل الطلاب. في طلاب بيمشوا مع التصحيحات بدون ما يفكروا، لكن أنا بحاول دايمًا أشجعهم يسألوا حالهم: ليش Grammarly صحح لي هاي الجملة؟ شو الغلط اللي كنت أعمله؟ كنت أطلب منهم يكتبوا ملاحظات صغيرة على كل تصحيح مهم، يعني مثلاً: ليش غيرت الكلمة؟ أو ليش حذفنا الفاصلة؟ وبصراحة، اللي التزموا بهاي الطريقة، لاحظت عندهم تحسن مش بس في الكتابة، كمان في فهم القواعد نفسها".

كانت تعابير وجهه تدل على إيمان عميق بقدرة الطلاب على التعلم والتطور، وأن الأدوات التقنية مثل Grammarly كانت بالنسبة له ليست مجرد وسيلة لتصحيح الأخطاء، وإنما منصة لتطوير التفكير النقدي وتعزيز الثقة في الكتابة.

5. التحديات في دمج أدوات الذكاء الاصطناعي في التعليم

سألته:

"ما هي التحديات التي تواجه المعلمين عند دمج أدوات الذكاء الاصطناعي في التدريس، سواء من الناحية التربوية أو فيما يخص نتائج تعلم الطلاب؟"

تهدد بعمق وأعاد ترتيب الأوراق أمامه، ثم قال وهو ينظر لي بشكل مباشر:

"الصراحة، الموضوع مو سهل زي ما الناس بتفكر. لما بنحكي عن دمج أدوات زي Grammarly في الصف، بنواجه مشاكل كثير، بعضها تقني وبعضها تربوي".

توقف لثوانٍ وكأنه يسترجع بعض المواقف، ثم تابع بنبرة أكثر جدية:

"أول إشي، مو كل الطلاب عندهم نفس المستوى في التعامل مع التكنولوجيا. يعني في عندك طلاب بيمسكوا الجهاز ويفتحو Grammarly بدون أي مشكلة، وفي طلاب بتلاقيهم بيضيعوا بين القوائم ويسألوا كل شوي: أستاذ، كيف بعمل هيك؟ كيف بحفظ؟ كيف برجع للتصحيح؟، وهاي الفجوة بتخلق تفاوت في الاستفادة. في مرة كنت بدرس مجموعة من طلاب العاشر، وعملت لهم نشاط باستخدام Grammarly، اكتشفت إنه أربعة من الطلاب ما قدروا يدخلوا أصلاً، وكان السبب إنه ما عندهم حسابات منظمة أو حتى إيميلات فعالة".

توقف للحظة، ثم أكمل وهو يشبك يديه على الطاولة:

"وفي كمان مشكلة ثانية: الطلاب أنفسهم أحياناً يميلوا يعتمدوا على الأداة بشكل كامل، بدون ما يفكروا بالتعديلات. يعني مثلاً، في طالب كان يكتب جملة طويلة ومعقدة، و Grammarly صحح له الجملة، وهو مباشرة قبل التعديل بدون ما يسأل نفسه: طيب ليش صححتها؟ شو كان الخطأ أصلاً؟، وهون بصير عندك خلل، لأن الأداة بتصير كأنها حل سريع بدون ما الطالب يتعلم من أخطائه".

بدأت ملامحه تتغير وكأنه يود التأكيد على نقطة مهمة، فأكمل:

"أنا صرت أطلب من الطلاب بعد كل تصحيح، يكتبوا بجانب النص: شو كان الخطأ؟ وشو استفدت من التصحيح؟ حتى أتأكد إنهم مش بس بيضغطوا Accept وخلص. بدي إياهم يتعلموا، مش بس يخلوا الآلة تصلح لهم".

ابتسم قليلاً وهو يتذكر موقف مضحك، وقال:

"في مرة، طالب كتب لي فقرة كاملة، وكلها أخطاء، لما شاف Grammarly حطه خطوط حمرة بكل مكان، صار يضحك وقال لي: أستاذ، شكله لازم أغير كل شي!، ضحكت معه وقلت له: مش لازم تغير، لازم تتعلم. !ومن يومها، صرت أركز على إنه التصحيح مش هدف، الهدف هو التعلم من التصحيح".

ثم أكمل حديثه بنبرة أكثر جدية:

"فيه كمان جانب تقني لازم أحكي عنه. بعض المدارس مش مجهزة أصلاً بالحواسيب اللازمة، أو الإنترنت ضعيف. في حصص كثيرة ضاعت بسبب تقطع الإنترنت أو مشاكل في دخول الطلاب على حساباتهم. كان عندي صف مرة، كل الطلاب كانوا مستعدين للكتابة على Padlet و Grammarly، لكن الإنترنت وقع، وما قدرنا نعمل إشي غير نرجع للطريقة التقليدية".

هز رأسه بأسف وتابع:

"أنا بعرف إنه التكنولوجيا ممكن تساعدنا كثير، لكن إذا ما كانت البنية التحتية موجودة، رح نضل نحكي عن أفكار مش واقعية. لازم يكون في دعم من المدرسة ومن الوزارة، خصوصاً في مناطق مثل قريتنا، اللي أحياناً فيها مشاكل بسيطة بتوقف كل شي".

حاولت أن أتعلم أكثر فسألته:

"هل تعتقد أن هناك مقاومة من بعض المعلمين لاستخدام هذه الأدوات؟"

أخذ نفساً عميقاً، ثم قال:

"أكيد! في معلمين، خاصة القدامى، يشوفوا إنه الأدوات هاي ممكن تستبدل دورهم، أو يقلل من قيمتهم في الصف. وأنا ببحترم رأيهم، لكن بشوف الموضوع بشكل مختلف. أنا بشوف إنه الأداة هاي بتيجي تساعد، مش تستبدل. حتى أنا، لما بدأت أستخدم Grammarly، كنت متردد، فكرت: طيب، إذا الطالب صار يعتمد عليه، كيف رح يتعلم؟، لكن مع الوقت اكتشفت إنه إذا استخدمناها بطريقة صحيحة، ممكن فعلاً تطور من مهاراتهم".

أنهى حديثه بابتسامة صغيرة، وقال:

"بالنهاية، الأدوات هاي مثل السكين، ممكن تستخدمها بكفاءة وتقطع فيها الخبز، وممكن تجرح حالك فيها. المعلم هو اللي بحدد كيف يستخدمها، وهون بتيجي مسؤوليتنا كمعلمين نعلم الطلاب كيف يفكروا، مش بس كيف يكتبوا".

6. الذكاء الاصطناعي مقابل المعلم البشري

سألته:

"في رأيك، هل تعتقد أن الذكاء الاصطناعي يمكن أن يحل محل المعلمين في المستقبل، أم سيبقى كأداة مساعدة في التعليم؟"

ابتسم بابتسامة خفيفة، وكأنه توقع السؤال، ثم قال:

"والله سؤال مهم... ويتوقع إنه كثير من الناس بيفكروا فيه. بصراحة، أنا شايف إنه الذكاء الاصطناعي ممكن يساعد كثير، بس مستحيل يقدر يستبدل المعلم البشري. يعني، خلىنا نكون واقعيين، AI زي Grammarly أو أدوات تصحيح النصوص، بتساعد الطالب يكتب صح، بتساعده يشوف أخطأه بشكل فوري، وبتعطيه ملاحظات عن القواعد والكلمات. بس هل بتقدر الأداة هاي تحس بمشاعر الطالب؟ هل بتقدر تعرف إنه اليوم كان متضايق عشان صار معه موقف بالبيت؟ مستحيل!"

توقف للحظة، ورفع يده وكأنه يوضح نقطة مهمة:

"أنا بتكرر مرة كان عندي طالب، عادةً بيكتب بشكل ممتاز، فجأة بدبت الأخطأ إنه مو مركز، كتاباته صارت ضعيفة، وفيها أخطاء كان يتجنبها من قبل. لو كان Grammarly هو اللي يقيمه، كان راح يحط له علامة ضعيفة، بدون ما يفهم السبب. لكن لما كلمته على جنب، اكتشفت إنه عم بمر بفترة صعبة في البيت، ومش قادر يركز. جلست معه، حكيت معاه، وشجعتة، وبعد فترة بسيطة رجع لمستواه".

ثم أكمل وهو يهز رأسه بتأكيد:

"هاي الأشياء، هاي التفاصيل، التكنولوجيا ما بتقدر تشوفها. المعلم هو اللي بيحس بطلبته، بيعرف متى يضغط عليهم ومتى يخفف، متى يشجعهم ومتى يوجههم. حتى الطريقة اللي الطالب بيحكي فيها، لغة الجسد، النظرات، كل هاي أمور بتعطي المعلم إشارات مهمة. هل الذكاء الاصطناعي بيقدر يفهم لغة الجسد؟ هل بيقدر يعرف إنه الطالب مش فاهم بس مستحي يحكي؟ طبعًا لا".

حاولت استقرازه قليلاً وقلت:

"لكن في بعض الدول، صار في توجه لاستخدام الذكاء الاصطناعي في التدريس والتصحيح، وفي طلاب عم بيحبوا علامات عالية بناءً على هيك أدوات..."

ضحك وقال:

"صحيح، وما بنكر إنه في أدوات بتساعد فعلاً. أنا ما عندي مشكلة إنه الطالب يستخدم Grammarly أو ChatGPT حتى بطور كتاباته أو يتعلم مفردات جديدة. بس كدعم، مش كبديل. أنا في حصصي، بخليهم يستخدموا Grammarly، بس بعد ما يخلصوا من الكتابة، عشان يشوفوا أخطأهم ويتعلموا منها. وبس يطلع التصحيح، بنقعد مع بعض ونفهم ليش هاي الكلمة غلط، وليش هاي الجملة مش واضحة. الطالب مش آلة، والآلة مش إنسان، كل واحد له دوره".

ثم استند إلى الكرسي ومد يديه بتعبير يؤكد على فكرته، وقال:

"أنا بشوف إن الذكاء الاصطناعي مثل المعلم المساعد، بيمسك يد الطالب وبيمشي معاه بخطواته الأولى، بس اللي بيمسكه إذا وقع، واللي بيشجعه إذا تعب، واللي بيحتفل معه إذا نجح... هذا دورنا إحنا، مش الآلة".

ثم سكت لثوانٍ وأكمل بنبرة هادئة:

"يمكن بعد 50 سنة أو 100 سنة، الأمور تتغير، يمكن الذكاء الاصطناعي يتطور لدرجة يصير عنده إحساس أو قدرة على التفاعل الإنساني... بس حالياً، وحتى بالسنوات الجاية، أنا شايف إنه المعلم هو الأساس، والتكنولوجيا مجرد وسيلة".

7. التوصيات والمستقبل المتوقع لاستخدام الذكاء الاصطناعي في التعليم

سألته:

"بناءً على تجربتك، ما هي التوصيات التي يمكن أن تقدمها لتحسين دمج أدوات الذكاء الاصطناعي في التعليم؟ وما هي التغييرات أو التحسينات التي ترغب في رؤيتها في المستقبل؟"

تهده بعمق، وكأنه كان ينتظر هذا السؤال ليفرغ ما في جعبته من أفكار، ثم قال بابتسامة خفيفة: "والله عندي كثير أفكار، لأنه أنا شايف إنه الذكاء الاصطناعي فعلاً ممكن يحدث نقلة نوعية في التعليم، بس لازم نكون عارفين كيف نستخدمه بطريقة صحيحة، مش عشوائية".

ثم بدأ يشرح بتفصيل، محرّكاً يديه كأنه يرسم أفكاره في الهواء:

"أول إشي، أنا برأبي لازم يكون في دورات تدريبية للمعلمين. كثير من الزملاء عندي بالمدرسة، لما نحكي عن Grammarly أو أدوات زي ChatGPT، بيحكوا لي: طيب، كيف بنستخدمها؟ شو لازم أعمل عشان الطلاب يستفيدوا منها؟ يعني في نقص واضح في التدريب. لازم يكون في دورات متخصصة مش بس لكيفية استخدام الأدوات، كمان لكيفية دمجها بالمناهج، كيف نصح من خلالها، وكيف نتابع الطلاب بشكل فردي".

توقف قليلاً، ثم تابع بجديّة أكبر:

"وثاني إشي، لازم يكون في بنية تحتية قوية. أنا بحكي بصراحة، الإنترنت عندنا بالمدارس أوقات كثيرة بطيء، والطلاب بيعدوا ينتظروا ليفتح الموقع أو تحمل الصفحة، وهذا شيء محبط. لازم يكون في تطوير لشبكة الإنترنت، وتوفير أجهزة كافية لكل الطلاب، عشان الكل يستفيد. في مرات كنت أحجز غرفة الحاسوب عشان الطلاب يكتبوا على Grammarly، وأفاجأ إنه في نصف الأجهزة ما بتشتغل، أو الإنترنت بطيء لدرجة إنه الطلاب زهقوا".

أومأت برأسي موافقة، وسألته:

"هل تعتقد أن هناك حاجة لسياسات رسمية لتنظيم هذا الدمج؟"

هز رأسه بإيجاب، وقال بنبرة تأكيد:

"أكيد! لازم يكون في سياسات واضحة من الوزارة، يعني يكون في خطة متكاملة لكيفية دمج الذكاء الاصطناعي بالتعليم. مش بس نجيب الأدوات ونحطها بيد الطلاب ونقولهم يلا اشتغلوا. لازم يكون في متابعة، تدريب، تقييم مستمر، وحتى رقابة على استخدام الأدوات بشكل أخلاقي. يعني مثلاً، لما الطلاب يستخدموا ChatGPT عشان يكتبوا مقالات، هل هم فعلاً بيكتبوا؟ ولا عم يعتمدوا كلياً على الآلة؟ كيف نضمن إنه فيه تعلم حقيقي مش مجرد نسخ ولصق؟"

ثم مال بجسده قليلاً إلى الأمام، وكأنه يريد أن يوضح نقطة مهمة، وقال:

"أنا برأسي كمان، لازم يتم دمج المفاهيم هاي بالمناهج نفسها. يعني مش بس نعطي الطلاب الأداة ونتركهم، لازم نعلمهم كيف يقيموا التصحيحات، كيف يعرفوا الفرق بين الصح والغلط، وكيف يستخدموا الاقتراحات عشان يطوروا كتابتهم، مش بس يعدلوا الجملة وخلص. بدي الطالب يسأل نفسه: ليش صحح لي هيك؟ شو كان الغلط بالأصل؟، هاي الأسئلة هي اللي بتخلق عقلية ناقدة ومفكرة".

كانت تعابير وجهه مليئة بالحماس، وكأنه كان يتمنى لو أن هذه الأفكار تتحقق في يوم من الأيام. ثم أضاف بابتسامة خفيفة:

"وبالنسبة للمستقبل، أنا بتخيل لو يكون في أدوات ذكاء اصطناعي مصممة خصيصاً للطلاب العرب، بتفهم السياق

اللغوي، وتصحيح الأخطاء الشائعة التي بتصوير عنا. كمان لو يكون في برامج تعليمية تعتمد على الذكاء الاصطناعي لتطوير مهارات التفكير الإبداعي، مش بس الكتابة، يعني تخيل يكون في أداة تساعد الطالب يطور أفكاره، يقوي حججه، يعمق تحليله، مش بس يصحح له الأخطاء اللغوية".

توقف لثوانٍ وكأنه يستجمع أفكاره، ثم قال بنبرة مليئة بالأمل:

"أنا بشوف إنه الذكاء الاصطناعي لو استخدم صح، رح يساعدنا نبني جيل أقوى، جيل عنده ثقة بكتاباته، وعنده قدرة على التفكير النقدي والإبداع. لكن هذا كله مرهون بطريقة دمج الأدوات هاي في التعليم، إذا كانت مدروسة وموجهة، رح نشوف نتائج ممتازة. وإذا كانت عشوائية، رح تكون مجرد أداة تصحيح لا أكثر".

ثم ابتسم وقال:

"أنا بحلم أشوف طلابنا بيكتبوا مقالات قوية، حجج متينة، وأفكار إبداعية، مش لأن الآلة صلحت لهم، لكن لأنهم تعلموا منها وفهموا كيف يطوروا أنفسهم".

ملاحظة الباحثة:

قدمت هذه المقابلة صورة متكاملة لتجربة تعليمية حقيقية من معلم متمرس في بيئة عربية، انعكست فيها الفوائد والتحديات المرتبطة باستخدام أدوات الذكاء الاصطناعي. تُظهر إجابات المعلم T1 وعياً تربوياً عميقاً، وموازنة دقيقة بين الإمكانيات التقنية والدور الإنساني للمعلم. هذه الشهادة سُتستخدم ضمن التحليل النوعي لدعم نتائج البحث المتعلقة بالتصورات التربوية تجاه الذكاء الاصطناعي في تعليم اللغة الإنجليزية.

Appendix (J)

Sample Interview Transcript (English)

Interview Details

Teacher Code: T1

Gender: Male

Original Interview Language: Arabic

Workplace: a high school in the Haifa Region

Years of Experience: 14 years

Interview Duration: 30 minutes

Interview Date: March 14, 2025

Interview Format: In-person interview

Consent Status: Both verbal and written consent were obtained for recording and use for academic research purposes.

Question 1

1. Background Information

Can you describe your teaching background and any experience you have with integrating AI tools into your educational practices?

I have been teaching English as a foreign language at the high school level in the Haifa District for the past 14 years. During this time, I've worked with diverse student populations, including both high-achieving learners and those who struggle with basic language skills. My pedagogical approach has changed significantly over the years, from traditional textbook-based instruction to a more dynamic, student-centered model that incorporates digital tools and personalized learning strategies.

In the past four years, I have become increasingly interested in the role of technology in supporting language learning, particularly in writing instruction. One of the most transformative tools I have integrated into my practice is Grammarly, which I initially introduced as a trial in one of my 11th-grade classes. I aimed to explore whether real-time AI-powered feedback could help improve students' grammar, coherence, and overall writing fluency.

What I observed was that Grammarly provided students with an immediate and personalized form of guidance that I, as one teacher managing 30 students, could not offer on a one-to-one basis. Weak students who typically relied heavily on memorization started experimenting with sentence structure and vocabulary choices. Advanced learners used the feedback to polish their drafts before submission. Over time, students also became more aware of their recurring mistakes, which contributed to long-term maintenance and skill development.

Beyond Grammarly, I've used other AI-based tools, such as QuillBot for paraphrasing exercises and Read&Write for students with learning differences. These tools helped students develop confidence and independence in their writing. I've also encouraged my students to use voice-to-text applications, especially for brainstorming, and AI-powered dictionaries that offer contextual examples.

Importantly, I do not view AI tools as a replacement for pedagogical insight but rather as an **extension** of my teaching. These tools help me personalize instruction and provide differentiated support, especially in writing tasks where detailed feedback is crucial. My experience has shown that with proper guidance, AI tools can significantly contribute to students' academic outcomes, motivation, and creative expression.

2. Perceptions of AI Tools in Education

What are your general perceptions of the role of AI tools in education? How do you feel they have influenced teaching and learning in your context?

My overall perception of AI tools in education is cautiously optimistic. As an educator who has witnessed multiple waves of technological innovation in the classroom, from interactive whiteboards to online learning platforms, AI tools stand out for their ability to provide real-time, adaptive feedback, especially in the domain of writing instruction. In

the context of English language teaching, particularly for Arab students in the Haifa District, these tools offer new pathways for differentiated learning, enhanced student engagement, and increased writing proficiency.

In my classroom, the most significant influence of AI tools has been their capacity to personalize instruction. Unlike traditional correction methods, which are often time-consuming and generic, AI tools like Grammarly deliver instant, student-specific suggestions. This not only empowers learners to identify and correct their own mistakes but also promotes metacognitive awareness. Students begin to notice patterns in their errors, such as verb agreement or misuse of prepositions, and become more mindful writers over time. This process of self-correction fosters a sense of ownership and agency, particularly among students who traditionally rely heavily on teacher feedback.

Another notable impact lies in the shift in teacher-student dynamics. The role of the teacher shifted from being the sole evaluator to a facilitator and mentor. In my experience, I now devote less time to correcting superficial language errors and more to discussing content, coherence, and rhetorical strategies with my students. This has created more meaningful, higher-order conversations around writing and language use.

At the same time, I remain aware of the pedagogical limitations and risks associated with AI integration. A significant concern is overreliance: some students may accept suggestions without fully understanding the underlying rules or may adopt language that is grammatically correct but contextually inappropriate or stylistically inconsistent. This is particularly problematic when students are not equipped with the critical thinking skills needed to evaluate AI-generated feedback. In response, I have implemented classroom routines that require students to explain their revisions and reflect on the choices they make using AI assistance. This ensures that the tool serves as a means for learning rather than a shortcut to completion.

The context of Arab EFL learners adds another point to the discussion. Almost all of my students come from homes where English is not spoken, and exposure to authentic language input is minimal. For them, AI tools function not only as writing aids but also as exposure to standard usage, idiomatic expressions, and genre-specific conventions. It is not uncommon for a student to discover new vocabulary or syntactic structures simply by engaging with AI-generated suggestions.

Nevertheless, challenges remain. Not all students have equal access to devices or internet connectivity at home, which creates a digital equity gap. Furthermore, some parents express concerns about privacy or the role of machines in shaping their children's learning experiences. These concerns are valid and underscore the need for transparent policies and teacher training to ensure responsible and ethical AI integration.

In conclusion, AI tools, when integrated thoughtfully and supported by pedagogical guidance, can significantly enrich the teaching and learning process. They are especially effective in promoting writing proficiency, student autonomy, and engagement, but they must be used critically, ethically, and in balance with human interaction. The success of AI in education depends not on the tool itself but on how we, as educators, choose to embed it within a holistic, student-centered framework.

3. Impact of AI on Creative Thinking

How do you perceive the impact of AI tools on students' creative thinking skills, particularly in terms of enhancing originality and innovative expression?

The question of how AI tools influence students' creative thinking is, in my opinion, one of the most fascinating aspects of integrating technology into education. In my experience as an Arab EFL teacher in the Haifa District, the impact of AI tools, particularly those focused on language and writing, is context-dependent.

On one hand, AI tools like Grammarly can act as powerful tools for creative thinking. They free students from the paralyzing fear of making mechanical errors, such as grammar or punctuation mistakes, which often inhibits their willingness to take risks with language. Once students feel that the basic technical elements of their writing are being supported, they often become more confident in experimenting with new vocabulary, trying out varied sentence structures, or developing more arguments. This shift in focus, from correctness to expression, creates room for more creative exploration. In that sense, AI can serve as a scaffold, allowing students to engage more deeply with the content and structure of their writing.

In one of my 11th-grade writing projects, for instance, students were asked to write a persuasive letter about a social issue. Prior to using Grammarly, the majority of the students focused narrowly on grammatical correctness and avoided expressing

controversial or original ideas, perhaps because they feared being misunderstood. However, after a few weeks of writing practice with Grammarly's support, students began producing content that was more comprehensive, more personal, and, in many cases, more daring. I remember one student, usually quiet and reserved, who wrote a thoughtful letter about gender equity in her community. She told me afterward that Grammarly helped her feel "safe" enough to express herself because she knew her ideas wouldn't be dismissed for minor language errors.

That said, I must also acknowledge the limitations and potential risks. While AI tools can support creativity by removing barriers to expression, they can also unintentionally create originality when used passively or uncritically. For example, AI-generated suggestions are often based on patterns from large language databases and may promote overly conventional phrasing or stylistically weak expressions. If students rely too heavily on AI to make decisions for them, they may begin to lose their voice or avoid more creative but unconventional language choices. I've seen this happen when students use paraphrasing tools like QuillBot and end up producing accurate, generic sentences that lack emotional or rhetorical impact.

This is why I view my role as a teacher as not just a facilitator of AI integration but as a critical mediator. I consistently teach my students to question the suggestions made by AI, to compare them to their original intentions, and to make informed choices about whether or not to accept the changes. This process itself becomes a metacognitive activity, one that stimulates reflective thinking, linguistic decision-making, and ultimately, creativity.

Moreover, creative thinking in EFL writing involves more than producing imaginative content; it also includes the ability to frame arguments, explore multiple perspectives, and express complex emotions or cultural differences. AI tools can support this by offering alternatives and expanding lexical resources, but they cannot replace the human capacity for insight, empathy, and cultural relevance. Therefore, while AI tools can enhance creative thinking, they do so most effectively when embedded within human-centered pedagogical strategies that emphasize voice, purpose, and audience awareness.

An essential consideration in the Arab EFL context is the linguistic and cultural background of the learners. Many students come from environments where English is not

spoken at home and where creative expression in a foreign language is a significant challenge. For these students, AI tools serve as a bridge, not just between ideas and language, but also between cultures. For instance, by analyzing the vocabulary and tone of AI-generated suggestions, students begin to understand how different audiences might interpret their work, which in turn encourages a more sophisticated understanding of communication and creativity in global contexts.

In conclusion, AI tools have a positive but conditional impact on students' creative thinking. They enhance students' ability to express themselves confidently and coherently, thus creating the conditions for creativity to flourish. However, the proper development of creativity depends on how these tools are used, whether they are treated as shortcuts or as opportunities for deeper thinking and self-expression. As educators, we must guide students in using AI not just to correct their work, but to question, revise, and refine their ideas in ways that foster both linguistic competence and creative identity.

4. Impact of AI on Students' Writing Skills

In your opinion, how do AI tools affect students' academic outcomes, particularly in areas like writing skills, critical thinking, and idea generation? Could you share examples from your teaching experience?

From my experience as an Arab EFL teacher in the Haifa District, AI tools, particularly Grammarly, have had a profound and measurable impact on students' writing skills. These tools are reshaping not only how students write, but also how they think about writing. Before introducing Grammarly into my classes, writing assignments were often viewed by students as a final product, something to complete and submit. Now, many students have started to perceive writing as a process, one that involves planning, revising, and reflecting.

One of the most significant improvements I've observed lies in grammatical accuracy and sentence fluency. Grammarly provides real-time corrections and suggestions, allowing students to identify errors independently. This immediate feedback is particularly effective for EFL learners, as it eliminates the delay between writing and revision that often undermines learning. For example, in a recent persuasive essay unit with my 11th-grade class, students who used Grammarly over the course of two weeks demonstrated

clear improvement in verb tenses, article usage, and sentence cohesion. Even more importantly, they began asking more targeted questions about grammar rules, an indication that they were developing grammar awareness rather than just accepting corrections passively.

In terms of organization and coherence, the tool's clarity suggestions helped students re-evaluate sentence structure, transitions, and paragraph flow. Several students who previously submitted fragmented texts began to produce more logically organized work with smoother progression of ideas. This wasn't just a mechanical improvement; it reflected a deeper engagement with how writing communicates meaning. They started to reflect more on reader comprehension, adjusting their tone, word choice, and structure based on the feedback provided.

AI tools have also had a strong influence on critical thinking and idea development. While Grammarly is not a thinking tool, its indirect influence on student reasoning is significant. When students are freed from worrying excessively about grammar and spelling, they devote more energy to developing their arguments, supporting claims, and analyzing topics from multiple angles. I recall one student in particular who, after using Grammarly consistently, began to include counterarguments and contradictions in her opinion writing, something she had never done before. This growth in complexity suggested that the tool helped clear space for higher-order thinking.

Another example comes from a group writing project on environmental issues. Before the integration of Grammarly, many students focused on surface-level facts. However, after several rounds of AI-supported drafts, they began incorporating rhetorical questions, emotional appeals, and comparative analysis. They were thinking more deeply, not just about the *what* of their writing, but also the *how* and *why*. This shift indicated not only an increase in writing proficiency but also a development of persuasive and analytical thinking.

However, as with any tool, there are challenges. Some students became overly reliant on Grammarly, accepting its suggestions without understanding their rationale. This was especially true among lower-proficiency learners. To address this, I began implementing reflection sheets where students had to explain three corrections they accepted from

Grammarly and one they rejected, with reasons. This exercise developed their metacognitive skills and encouraged critical engagement with the tool.

It's also worth mentioning that the tool helps level the playing field for students of varying proficiency. Stronger students used it to upgrade their style, while weaker students relied on it for foundational support. The result was an overall narrowing of the performance gap in writing across my classes. Importantly, students began to see writing not as a test of correctness but as a mode of self-expression and intellectual engagement.

In conclusion, AI tools like Grammarly contribute to significant improvements in writing outcomes, grammatical accuracy, structural coherence, and argument development. More slightly but equally significantly, they promote reflective thinking, student autonomy, and confidence. When integrated thoughtfully, AI tools foster a classroom culture where writing is not just corrected but achieved, where students are shifted from passive recipients of feedback into active, critical participants in the learning process.

5. Challenges in AI Integration

What challenges do teachers face when incorporating AI tools into their teaching, both in terms of pedagogy and student learning outcomes?

While the potential of AI tools in language learning is promising, the process of integrating them into actual classroom practices presents a number of pedagogical, practical, and ethical challenges. As someone who has attempted to embed Grammarly and other AI-supported writing tools into my EFL instruction, I have come to understand that the success of these tools is not simply a matter of introducing new technology; it requires careful planning, ongoing support, and critical reflection from both teachers and students.

One of the significant challenges I have encountered is the unequal digital literacy among students. In my classrooms in the Haifa District, the range of students' familiarity with digital platforms varies significantly. Some students have mastered and navigate AI tools with ease, while others, particularly those from lower socio-economic backgrounds, struggle with basic digital operations. This gap can lead to frustration, reduced participation, or superficial engagement with the tool. For AI integration to be reasonable,

schools must invest not only in licenses and access but also in basic digital training and support structures for both learners and teachers.

Another pedagogical challenge is the tendency for students to misuse AI tools. For example, I have seen students accept Grammarly's suggestions without reading them carefully, simply clicking "accept" until the red lines disappear. This behavior often stems from a lack of understanding of the linguistic issues being corrected. As a result, students may submit texts that are grammatically sound but conceptually weak or impersonal. In such cases, the AI tool becomes a support rather than a learning aid. To moderate this, I've introduced class discussions and assignments where students must justify their revisions, reflect on errors, or compare different word choices. However, implementing these practices requires additional time and effort, which not all teachers can afford within the limitations of the curriculum.

Furthermore, teachers themselves may feel unprepared or unsupported in using AI tools effectively. Despite my enthusiasm for exploring educational technology, I have had to rely heavily on self-directed learning, watching tutorials, experimenting with features, and learning through trial and error. Formal training sessions are either rare or too general, often lacking the depth needed to apply these tools in language-specific contexts like EFL writing. Without institutional backing, many teachers may hesitate to adopt AI tools, fearing they may disrupt the flow of instruction or generate unexpected complications.

There are also ethical and pedagogical tensions. Some educators worry that AI tools diminish students' critical thinking by encouraging shortcut behavior. Others express concerns about data privacy, especially when students create accounts on third-party platforms. In my case, I had to carefully review the privacy policies of tools like Grammarly and consult with school administrators before making it a standard part of my instruction. These procedural steps, while necessary, often delay or complicate the integration process.

Another indirect but essential challenge lies in shifting the classroom culture. In traditional settings, students expect the teacher to be the ultimate source of authority and correction. Introducing AI tools repositions the source of feedback, and this can initially lead to confusion or resistance. Some students feel less motivated to write for a "machine," while others are skeptical of its ability to understand their voice or intention.

It takes time and guided discussion for students to understand that AI is not replacing their teacher but is instead extending the teacher's reach and enabling a more dynamic, self-directed writing process.

Lastly, there is the matter of assessment alignment. In national exams and formal assessments, students are expected to produce writing without AI assistance. This raises questions about the role of AI in preparing students for such evaluations. As a result, I had to adapt my assessment strategies, sometimes requiring students to submit both AI-supported drafts and handwritten versions, to ensure they develop skills independently as well.

In conclusion, while AI tools like Grammarly offer many advantages, their integration is far from complete. Teachers face technical, pedagogical, ethical, and institutional challenges, all of which must be addressed thoughtfully. For AI to become a sustainable and practical part of EFL instruction, it must be accompanied by teacher training, clear pedagogical frameworks, ongoing student guidance, and institutional support. The tool itself is only as effective as the context in which it is used, and it is our responsibility as educators to shape that context with care.

6. AI vs Human Teachers

In your opinion, do you think AI has the potential to replace human teachers in the future, or will it continue to serve as a complementary tool in education?

As an experienced EFL teacher, I firmly believe that AI will not, and should not, replace human teachers. While AI tools offer meaningful support, especially in the domains of grammar correction, writing feedback, and task personalization, they lack the human tone, emotional intelligence, and pedagogical intuition that define effective teaching. AI can best be described as a *complementary force*, one that, when used ethically and wisely, can enhance teaching, but not replace the irreplaceable role of the teacher.

There is a growing narrative in educational technology circles that suggests machines may one day outperform human educators in delivering content or assessing student work. While there is some truth to the efficiency and speed AI tools can provide, particularly with low-level language processing tasks like editing or spelling, this mechanical proficiency does not equate to holistic teaching. Teaching is not just about

delivering information; it is about building trust, motivating students, adapting instruction to emotions and contexts, and promoting growth over time. These are deeply human tasks that no algorithm can fully replicate.

For example, I once had a student who was producing unusually short, disengaged writing. Grammarly rated her work as “fluent” and “correct,” but it took a personal conversation for me to discover that she was dealing with a loss in her family. The tool had no way of detecting her emotional state, and it would have continued rating her writing as “excellent” based solely on surface-level indicators. That moment reminded me that teaching is inherently relational, and technology, no matter how advanced, cannot replace a teacher's empathy or ability to offer personalized emotional and academic support.

Additionally, AI lacks the cultural sensitivity and contextual awareness required in linguistically diverse classrooms such as mine. Many AI tools are designed based on Western English norms, and they sometimes misunderstand or flag expressions that are culturally or regionally appropriate for Arab learners. It is up to the teacher to mediate between such automated feedback and the student's authentic voice, ensuring that students do not feel isolated or invalidated by automated suggestions.

That said, I do see a decisive role for AI in assisting teachers, particularly in reducing workload and supporting differentiated instruction. For instance, AI tools help me provide immediate feedback to students, freeing up time that I can then invest in creative lesson planning, conferencing with students, or supporting learners with specific needs. AI has also helped bridge learning gaps during times of crisis, such as during COVID-related school closures, where its ability to provide round-the-clock feedback was invaluable.

To ensure that AI remains a supportive tool rather than a replacement for human interaction, we must focus on critical digital pedagogy. This means equipping both teachers and students with the skills to evaluate and use AI tools critically, ethically, and purposefully. I always make it clear to my students that Grammarly is not a teacher; it is a resource. I teach them how to question their feedback, how to defend their writing choices, and how to treat AI suggestions as prompts for reflection rather than automatic corrections.

In conclusion, AI should be understood as a valuable partner in education, one that enhances our ability to teach, but cannot replicate our role as educators. It can support instruction, update tasks, and empower learners, but the soul of teaching, the connection, inspiration, and personal guidance, resides in the teacher. Our goal should not be to replace teachers with AI, but to empower teachers through AI, allowing us to focus more deeply on the aspects of education that matter most.

7. Recommendations and Future Use

Based on your experience, what recommendations would you make for integrating AI tools more effectively into teaching practices? What changes or improvements would you like to see in the future?

Reflecting on my experiences with AI integration, particularly with Grammarly and other language support tools, I have several recommendations that could significantly improve the effectiveness and sustainability of AI use in educational contexts, especially in EFL classrooms like mine in the Haifa District.

First, there is a critical need for structured teacher training. Many of us are expected to integrate technology without formal preparation, which often leads to superficial or inconsistent use. Training should not only cover the technical aspects of using AI tools but also explore pedagogical strategies, how to embed these tools within writing units, how to monitor student use critically, and how to balance AI feedback with human guidance. For instance, I would appreciate workshops that show how to align AI-supported writing tasks with the national curriculum and assessment standards, particularly since tools like Grammarly often use feedback criteria that differ from local rubrics.

Second, AI integration must be supported by institutional policy and infrastructure. This includes ensuring that all students have access to devices and internet connectivity, something that cannot be taken for granted in all schools, and that data privacy policies are clearly communicated. Without reliable infrastructure, AI tools remain accessible only to a privileged part of the student population, impairing rather than reducing educational inequality.

Another important recommendation is to promote pedagogical balance. AI tools should not dominate the writing process or replace student-teacher interaction. Instead, they should be positioned as *preparatory tools*, resources that help students draft and revise before receiving human feedback. In my practice, I use AI feedback in the early stages of writing and follow it with peer reviews or teacher conferences. This creates a scaffolded approach, where students develop both independence and collaborative skills.

I also recommend incorporating student reflection and metacognitive activities. Simply using AI tools does not guarantee learning. Students must be encouraged to reflect on the feedback they receive, decide which suggestions to accept or reject, and explain their reasoning. These reflections can be integrated into writing portfolios or revision logs, making the writing process more transparent and cognitively engaging.

In terms of improvements, AI tools themselves need to change to support creative and critical thinking more explicitly. Currently, much of the feedback provided is mechanical, focused on grammar, clarity, or tone. I would like to see AI systems that can offer feedback on idea development, argument strength, use of rhetorical strategies, or even cultural relevance in EFL contexts. This would shift the tool from simply being a corrector to becoming a *thinking partner*, encouraging students to engage more deeply with their content.

From a curriculum perspective, it would be helpful to see official guidelines or models for how AI can be integrated into high school EFL teaching. This could include suggested lesson structures, ethical use policies, and assessment frameworks that acknowledge AI-supported work without diminishing students' contributions.

Finally, I believe in promoting a culture of inquiry around AI in education. Teachers and students alike should be invited to discuss the ethical implications of AI, its role in shaping language norms, and its limitations. These conversations not only explain the technology but also equip students to become critical users of digital tools in their academic and personal lives.

In conclusion, the future of AI in education holds great promise, but its success depends on thoughtful, informed, and human-centered implementation. My vision is not one where AI transforms education on its own, but one where teachers lead the

transformation, using AI as a powerful ally in developing thoughtful, creative, and confident learners.

Researcher's Note:

This interview provides a comprehensive insight into the authentic teaching experience of a seasoned educator in an Arab educational context. The teacher's responses reflect both the benefits and challenges of integrating artificial intelligence tools in the classroom. The reflections of Participant T1 demonstrate a deep pedagogical awareness and a thoughtful balance between technological capabilities and the human role of the teacher. This evidence will be used as part of the qualitative analysis to support the research findings regarding teachers' perceptions of artificial intelligence in English language education.

Appendix (K)

Coding Framework from Interview Analysis

This appendix presents the complete coding framework developed during the qualitative analysis of semi-structured interviews with Arab EFL high school teachers in Haifa District. The codes were identified through inductive and deductive thematic analysis, guided by the study's research objectives and questions. The coding tree outlines the hierarchical structure of main themes (parent codes) and subthemes (child codes), along with definitions and illustrative quotes.

Coding Tree -Thematic Structure

1. Grammarly as a Writing Assistant

- |— Grammar and Spelling Support
- |— Sentence Structure Improvement
- |— Vocabulary Enhancement
- |— Increased Student Confidence

2. AI and Creative Thinking

- |— Risk-Taking in Writing
- |— Creative Suppression / Over-reliance
- |— Standardization vs. Authenticity
- |— Cultural Expression and Identity

3. Role of the Teacher

- |— Human Feedback vs. AI Correction
- |— Teacher as Facilitator of AI Literacy
- |— Emotional and Motivational Support

4. Integration Challenges

- |— Digital Divide / Access Issues
- |— Lack of Teacher Training
- |— Misuse or Misunderstanding of AI Tools
- |— Institutional and Infrastructure Barriers

5. Visions and Recommendations

- |— Balanced Pedagogy
- |— Curriculum Integration of AI Literacy
- |— Professional Development
- |— Responsible Use and Critical Engagement

Codebook with Definitions and Sample Quotes

Code	Definition	Illustrative Quote
Grammar and Spelling Support	Teachers noted Grammarly’s effectiveness in improving grammar, punctuation, and mechanics.	“Grammarly takes care of the small grammar issues that eat up precious lesson time.” (T7)
Vocabulary Enhancement	Reference to Grammarly helping students use more advanced or accurate vocabulary.	“They started trying new words because the suggestions gave them courage.” (T8)
Increased Student Confidence	Grammarly encouraged hesitant students to write more.	“Before Grammarly, my students kept sentences short and simple. Now, they try metaphors and even humor.” (T3)
Risk-Taking in Writing	AI helped students experiment with ideas and rhetorical forms.	“Grammarly provided that safety net—I saw students take intellectual risks.” (T7)
Creative Suppression / Over-Reliance	Concern about AI leading to uniform writing or passive learning.	“They would avoid writing anything unconventional, afraid Grammarly would flag it.” (T5)
Standardization vs. Authenticity	AI pushes students toward ‘native’ norms, risking cultural flattening.	“The essays became grammatically perfect but emotionally flat.” (T2)

Cultural Expression and Identity	Impact of Grammarly on students' cultural voice in writing.	“Our Arab students bring rich metaphors... Grammarly sometimes marks them awkward.” (T1)
Teacher as Facilitator of AI Literacy	Teachers must teach students how to use AI critically.	“Students must learn to trust their voice first, and then use AI to polish it.” (T5)
Digital Divide / Access Issues	Inequity in device availability or internet access.	“Some students only use phones—they cannot benefit like others.”
Lack of Teacher Training	Teachers feel underprepared to guide AI use.	“We need proper training—not just technical, but pedagogical.”
Balanced Pedagogy	Advocating a mixed approach combining AI support with human instruction.	“Grammarly is a tool, not a boss.” (T8)

Code Frequency Table (Selected Codes)

Theme / Code	Number of Mentions
Grammar and Spelling Support	12
Increased Student Confidence	10
Risk-Taking in Writing	8
Creative Suppression / Over-Reliance	9
Standardization vs. Authenticity	7
Digital Divide / Access Issues	5
Teacher as Facilitator of AI Literacy	11
Balanced Pedagogy	14

Note: Frequency is based on thematic saturation across 15 interviews. Overlapping or co-occurring codes were counted in both categories when relevant.

Appendix (L)

Summary of Teachers' Perceptions

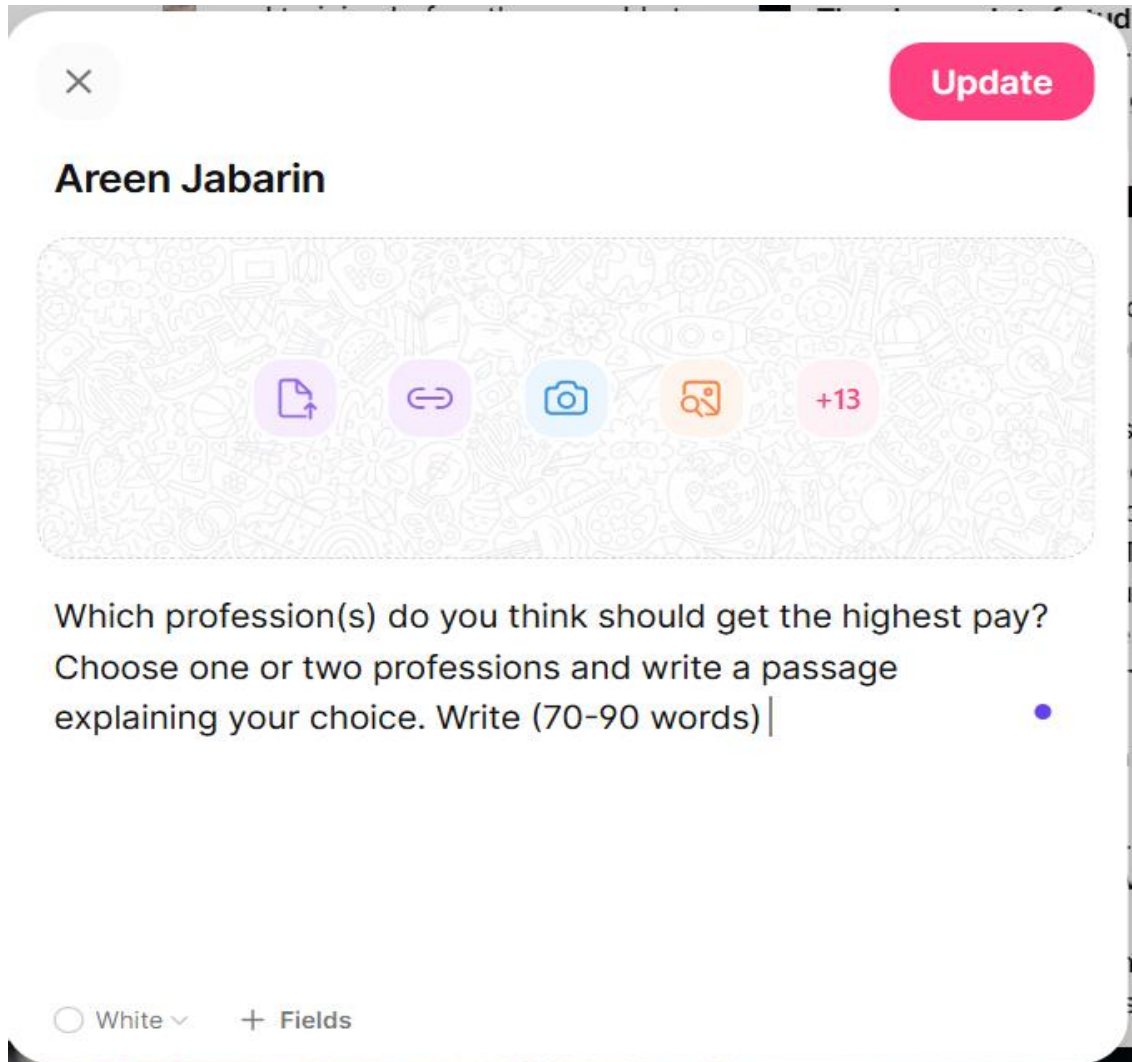
The following table summarizes both the perceived benefits and the main concerns related to the use of AI tools in EFL writing instruction.

Positive Impacts	Concerns & Limitations
Improved grammar and punctuation	Superficial engagement with suggestions
Increased confidence and independence	Overdependence on AI-generated corrections
Metalinguistic awareness and reflection	Limited support for content, creativity, and structure
Efficient revision support	Lack of feedback on idea development and coherence

Appendix (M)

Pre and post-tests on the Padlet platform

Pre-test (presented by the teacher)



The image shows a screenshot of a Padlet board. At the top left is a close button (X) and at the top right is an 'Update' button. The board title is 'Areen Jabarin'. Below the title is a toolbar with icons for adding content: a document, a link, a camera, a video, and a '+13' icon. The main content area contains a text prompt: 'Which profession(s) do you think should get the highest pay? Choose one or two professions and write a passage explaining your choice. Write (70-90 words) |'. At the bottom left, there is a color selection dropdown set to 'White' and a '+ Fields' button.

Post-test (presented by the teacher)

The screenshot shows a digital poll interface. At the top right is a pink 'Update' button. The title 'Children and Cell-phones' is centered. Below the title is a decorative banner with icons for document, link, camera, and a '+13' indicator. The main text asks: 'In your opinion, do you think children should have cell phones under the age of 10 (5th grade), why or why not? Explain your opinion'. At the bottom, there are options for 'Purple' and '+ Fields'.

Pre-test (10th grade) – students' responses

The screenshot shows a pre-test survey titled 'Pre-test 10th grade' with several student responses. The responses are as follows:

- Response 1:** The profession of doctor is the one that deserves to be the highest paid because this profession saves people's lives and it is a very difficult profession and only those who work hard in their specializations such as biology and chemistry and these important subjects are accepted into this profession and I think that this profession is the one that deserves to be the highest paid for these reasons that I mentioned and if it weren't for this profession most of the world would now be sick and need someone to treat them so I thank all the nurses in the world.
- Response 2:** A surgeon because he saves people's lives and it is the most important thing in life. I hope to become a surgeon when I grow up, but the problem is that the years of education are very long, and this is what makes me back down from the subject. But I do not know if God has written that I will become a surgeon, and it is supposed that the surgeon is the most paid.
- Response 3:** I think that Doctors should get highest pay ,because they work hard and help people survive and They learn for many years to master their work , Doctors often work long hours including hight an weekends which can lead to higher pay. They don't just provide healthcare, but deal with people's lives on a daily basis, which requires high skills, extensive knowledge, and continuous effort. Additionally, many doctors spend years in education and training before they are able to offer specialized care. Therefore, they should be compensated in a way that reflects their significant responsibilities and the sacrifices they make."
- Response 4:** I think doctor should get highest pay for the following reasons:
1 life saving:
The doctors are the most expensive people in the world because they have to work hard to keep the people life safe to get rid of diseases
2 difficult situations:
The doctors have to be careful and calm before they make any decisions on Operating room because one mistake can killed a person
3 alot of studying:
They have a lot of study and review for years to finish their university studies and be able to get a degree to start working .
- Response 5:** I believe that doctors and teachers should get the highest pay , for the following reason :
First, doctors save lives and help people stay healthy. Their work is important because everyone needs good health.
In addition, teachers educate students, guide them, and prepare them for the future. Without teachers, no one can become a doctor, engineer, or any other professional. Both jobs require many years of study and hard work.
In the end, doctors and teachers make a big difference in society, so they should earn the highest pay.
- Response 6:** I think that Medicine should get highest pay for the following reasons: Medicine is a diverse and vital field that focuses on maintaining, improving, and restoring human health. It combines science,
- Response 7:** I belive that Doctors should get the highest pay , for the following reasons :
First, doctors spend many yearstudying and training So many
- Response 8:** All professions bring money, but there are professions bring a lot of money.
High-tech: High-tech is one of the
- Response 9:** Which profession(s) do you think should get the highest pay? Choose

Pre-test (11th grade) – students' responses

Padlet
Areen Jabarin • 30 • 5mo
Pre-test 11th grade
Made with fortitude

MOHAMAD JBAREEN 5 months ago
Doctors and teachers are two professions that deserve the highest pay. Doctors save lives and help people stay healthy, which is one of the most important jobs in society. They work long hours and face a lot of stress to make sure people get the best medical care. Teachers also play a crucial role because they educate and guide the next generation. Without teachers, there would be no doctors, engineers, or scientists. They work hard to help students succeed, so they should be paid well for their efforts. Both professions are essential and should receive high salaries.

Hashem 5 months ago
Teachers and doctors deserve the highest pay because they play vital roles in society. Teachers shape the future by educating and guiding students, helping them become successful in life. Without good teachers, no other profession can thrive. Doctors, on the other hand, save lives and keep people healthy. They work hard, often under stressful conditions, to care for patients and fight diseases. Both professions require great skill and dedication. Paying teachers and doctors well shows respect for their hard work and helps attract talented people to these important jobs. A strong education system and good healthcare are the keys to a better future for everyone.

Secretive Flamingo 5 months ago
I think that teachers and doctors should receive the highest pay because of the following:
First, teachers are very important because they teach students and help them succeed in their lives to build a successful future.
Second, doctors work hard to keep people healthy and free from sickness.
Finally, I hope that doctors and teachers stay healthy to continue creating a good future that will benefit us and others.

Sleepy Quokka 5 months ago
In my opinion, professions that save lives, such as doctors, surgeons, and medical researchers, deserve the highest pay. These individuals undergo years of rigorous education and training to acquire the skills needed to help others in critical situations. Their work directly impacts the health and well-being of society, often requiring long hours, immense responsibility, and the ability to make life-or-death decisions. Additionally, they constantly face emotional and physical challenges while striving to find solutions to complex medical issues. For these reasons, I believe their contributions to humanity are invaluable and should be rewarded with high salaries that reflect their importance.

Dania sabahat 5 months ago
many of jobs like:
The job that deserves the highest salary is one that has a significant impact on people's lives and contributes to the well-being of society. For example, doctors and surgeons play a vital role in saving lives and ensuring the health of individuals. They work long hours, study for many years, and deal with stressful situations to provide the best care for their patients. Without them, many people would not have access to proper medical treatment, and their dedication deserves to be highly rewarded.
Another example is teachers, who are the foundation of education and the future. Teachers shape young minds, guide students toward success, and prepare them to face the challenges of life. Without teachers, no other profession would exist, as they are the ones who train and inspire future doctors, engineers, scientists, and many more.

Jana Jbareen 5 months ago
Medical Surgery
In my opinion, the profession that deserves the highest salary in the world is medical surgery. Surgeons save lives and treat people by performing operations. Their work is very hard and requires many years of study and practice. They also work under pressure and make critical decisions that affect the lives of others. Finally, I believe that surgeons deserve high pay for their skills and the great responsibility they carry in their work.

Abed 5 months ago
The Profession That Deserves the Highest Salary
In every society, there are professions that play an essential role in the development, well-being, and progress of humanity. While many jobs contribute to the functioning of the world, one could argue that healthcare professionals, particularly doctors and surgeons, deserve the highest salaries. Doctors save lives, alleviate pain, and improve the quality of life for millions of people. Their work requires years of rigorous education, continuous training, and unwavering dedication. They often deal with high-pressure situations, making life-and-death decisions daily. Furthermore, their knowledge and expertise have a direct impact on the physical and mental well-being of individuals and communities. In addition to their critical role, the long hours and emotional toll of medical professions cannot be overlooked. The responsibility they bear and the sacrifices they make to ensure

Adorable Hamster 5 months ago
In my opinion, the teaching profession deserves the highest

Mohammad M.S 5 months ago
Anyone of us is preparing himself for his future profession in life, according to every person's preferences. personally, I think that teachers and surgeons should get the

Blushing Hedgehog 5 months ago
This year there are many different professions and each one has a job and a suitable salary.
There are many people who do not receive the highest salaries

Post-test (10th grade) – students' responses

Padlet
Areen Jabarin • 9 • 2mo
Post test- 10th grade
Made with charm

عبدالخالق
In my opinion, children under the age of 10 should not have cell phones. At that young age, they are still learning basic life skills and may not be ready to handle the responsibility that comes with owning a phone. Cell phones can expose them to cyberbullying, social media pressure, or harmful content online. Instead, parents can use safer options like kids' smartwatches to keep in touch. Waiting until middle school gives children more time to grow and learn how to use technology wisely.

Nabeha
I disagree with the idea of giving cell phones to children under the age of 10. In my opinion, they are not yet ready for the responsibilities and risks that come with owning a phone. First, children in this age group should focus on their social and emotional development, which is best achieved through face-to-face interactions. Second, excessive phone use can lead to issues such as poor sleep, addiction, and a lack of physical activity. In the end, smartphones can expose young children to online dangers and inappropriate content. Finally, giving children smartphones at too young an age can hinder their ability to concentrate on schoolwork and other important activities.

Hala 2
In my opinion, kids under 10 should not have cell phones because they are not responsible enough to use them wisely. They might spend too much time on screens instead of studying or socializing with family and friends. First, Phones can also harm their health. Too much screen time can affect their eyesight and sleep. Additionally, young children may not understand online dangers, which puts them at risk of cyberbullying or inappropriate content. While some argue that having a phone helps in emergencies, parents can provide a simple phone for calls only. In the end, children under 10 should not have cell phones due to their negative effects on learning, health, and safety.

Hala
I agree that children under the age of 10 should not have cell phones for the following reasons. First, young children are not responsible enough to use phones correctly. They might spend too much time playing games or watching videos instead of focusing on their homework. In addition, phones can be dangerous because children may talk to strangers online without knowing the risks. Too much screen time can also hurt their eyes and health. In the end, children should enjoy their childhood by playing outside, reading books, and spending time with their families instead of always using phones.

Should Children Under 10 Have Cell Phones?
In my opinion, children under the

Post-test (11th grade) – students' responses

Podlet

Areen Jabarin • 30 • 3mo

Post-test 11th grade

Made with no regrets, whatsoever

Omaima

Whether children under the age of 10 (around 5th grade) should have cell phones depends on factors like maturity, necessity, and parental supervision.

Reasons Against:

1. Distraction from Studies – Younger children may struggle with self-control, leading to excessive screen time and distractions from homework.
2. Online Safety Risks – Exposure to inappropriate content, cyberbullying, and online predators is a concern if children aren't monitored properly.
3. Reduced Social Skills – Excessive phone use can replace face-to-face interactions, potentially harming social development.
4. Cost & Responsibility – Phones can be expensive, and young children may not be responsible enough to avoid losing or damaging them.

Yara

I don't think kids under 10 should have cell phones unless it's absolutely necessary, like for safety reasons or staying in touch with their parents in special situations. At this age, children should focus on real-life experiences, playing, learning, and socializing with friends and family instead of spending too much time on screens. Having a phone too early can expose them to online dangers, distractions, and even affect their sleep, mental health, and physical activity. It's better for them to wait until they are older and more responsible so they can use technology in a safer and more balanced way.

Hala Rami

In my opinion, I don't think children under the age of 10 should own a mobile device. At this age, direct interaction with family and friends is required to develop their social skills, in addition to being preoccupied with screens. Phones can also expose them to inappropriate content or addictive video games. However, parents can provide a device specifically for emergency calls. For this reason, a mobile phone is the most conscious and responsible way for a child to use it.

Leen

In my opinion, I think children under the age of 10 should not have cellphones for several reasons. First, phones can be a major distraction, taking kids away from important activities like studying and playing with friends or family. Additionally, the internet can expose children to inappropriate content and unsafe people, putting their safety at risk. At this age, children need to develop social skills through face-to-face interaction, which can be hindered by excessive screen time. Furthermore, prolonged use of phones can lead to health issues like eye strain, headaches, and sleep problems. Children may also become addicted to technology, affecting their mental and physical well-being. Moreover, they may not fully understand the responsibility of owning a phone and how to use it safely, making them vulnerable to online dangers like cyberbullying. For these reasons I don't think they should have phones.

Shaimaa agbaria

In my opinion, children under the age of 13 should not have cell phones. At this young age, they need to focus on playing, learning, and socializing in real life rather than spending time on screens. Cell phones can distract them from their studies and physical activities. Additionally, the internet can expose them to inappropriate content and online dangers. Instead, parents should provide alternative ways to communicate, like family phones, until children are mature enough to use a phone responsibly.

Reaam

Children under the age of ten should not have phones. Phones are very dangerous and have many negatives as well as positives, but at this age, a phone should not be owned for various reasons. Owning a phone leads the student to move away from his studies and become distracted from them, and this is a very bad thing. Also, using a phone at this age while they do not know anything because they are young will lead them to enter forbidden sites or through the phone they can bully each other. A phone at this age is forbidden because it is dangerous for them.

Retal

In my opinion, children under the age of 10 shouldn't have mobile phones because young children don't need phones. They should focus on playing, studying, and spending time with their families. If they need to communicate with their parents, they can use the

MHMD NAEL

I don't think children under 10 should have cell phones because it can affect their mental, social, and emotional development. At

Leen

I believe that children under the age of ten should not have a cellphone for many reasons,

1. Impact on mental and social development: Phones may hinder the development of social skills.

Appendix (N)

Sample Student Writing : Pre and post-Test 10th, 11th grade

Student 1: Pre-test (10th grade)

1. **Content (10 points):**

- **Score:** 8/10
- **Analysis:** The essay provides a well-rounded discussion on why medicine deserves the highest pay. However, it lacks personal examples or specific details supporting the claim, which would enhance the argument.

2. **Language (8 points):**

- **Score:** 6.7/8
- **Analysis:** The language is mostly accurate, with some minor issues in sentence structure and word choice. Vocabulary usage is appropriate for the level, but could be more varied.

3. **Organization (8 points):**

- **Score:** 6.4/8
- **Analysis:** The essay has a clear structure, including an opening, body, and conclusion. However, transitions between ideas are minimal, which slightly affects the flow.

4. **Mechanics (4 points):**

- **Score:** 2.8/4
- **Analysis:** There are some errors in punctuation and formatting (e.g., missing commas and overly long sentences).

Error Analysis

- **Spelling Errors:** None identified.
- **Grammar and Language Errors:**
 - Sentence: "The practice of medicine involves various specialties, such as general practice, surgery, pediatrics, cardiology, and many more, each serving specific healthcare needs."

- Issue: Overly long sentence with no variation. Could be split into two for clarity.
- Suggested Revision: "The practice of medicine includes various specialties, such as general practice, surgery, pediatrics, and cardiology. Each serves specific healthcare needs."
- **Vocabulary Misuse:** None explicitly identified but could use more advanced expressions for variety.
- **Punctuation Errors:**
 - Missing commas in some sentences.
 - Example: "Medicine is a diverse and vital field that focuses on maintaining, improving, and restoring human health."
- Correction: This sentence is correct but could benefit from adding a concluding phrase to tie it back to the topic.

Opening, Body, and Conclusion Analysis

- **Opening:** Provides a clear introduction to the topic but lacks a strong thesis statement explicitly connecting to the writer's opinion about why medicine should have the highest pay.
- **Body:** Includes valid points about the field's diversity, responsibilities, and rewards. However, it lacks personal examples or deeper reasoning to make the argument compelling.
- **Conclusion:** Summarizes the importance of medicine but does not restate the writer's opinion or reinforce the argument effectively.

Total Score: 24/30

Sample Student Writing – Pre-Test 11th grade

1. **Content (10 points):**

- **Score:** 8.5/10
- **Analysis:** Leen provides a valid argument for why the medical profession deserves the highest salaries. She also acknowledges the challenges of other professions, which adds depth to her perspective. However, the essay could benefit from more

specific examples or elaboration, particularly regarding the challenges faced by doctors. The reasoning is sound but somewhat general.

2. **Language (8 points):**

- **Score:** 6.4/8
- **Analysis:** The language is clear, but there are minor grammatical issues and awkward phrasing that could be improved. The vocabulary is appropriate for the level, though it lacks variety. Some sentences are overly simplistic and could be expanded for greater impact.

3. **Organization (8 points):**

- **Score:** 6.4/8
- **Analysis:** The essay is well-organized, with a clear introduction, body, and conclusion. However, transitions between ideas are minimal, making the flow of the argument slightly disjointed. The conclusion ties the essay together effectively.

4. **Mechanics (4 points):**

- **Score:** 3.2/4
- **Analysis:** There are minor punctuation errors, such as missing commas. Formatting is mostly consistent, but some sentences could benefit from better punctuation to enhance clarity.

Error Analysis

- **Spelling Errors:** None.
- **Grammar and Language Errors:**
 - *"a cleaner stays in the sun and gets very tired, another example, teachers remain standing most of the time and bear different opinions from students..."*
 - Correction: *"A cleaner works under the sun and often becomes exhausted. Similarly, teachers spend most of their time standing and handling diverse opinions from students."*
 - *"because it has High responsibility in addition to the effort and time required to reach this profession, the long working hours, and the funds."*

- Correction: *"because it carries a high level of responsibility, alongside the significant effort, time, and financial investment required to enter this profession, as well as the long working hours."*
- **Punctuation Errors:**
 - Missing commas in compound sentences.
 - Inconsistent capitalization ("High responsibility" should be "high responsibility").

Opening, Body, and Conclusion Analysis

- **Opening:** The introduction is engaging, as it acknowledges the challenges of all professions before focusing on the medical field. This provides a balanced start.
- **Body:** The body discusses the reasons why the medical profession deserves higher salaries, touching on responsibility, effort, and challenges. However, the points could be elaborated further with specific examples or statistics to strengthen the argument.
- **Conclusion:** The conclusion summarizes the argument effectively and ties the points together nicely. Adding a more impactful final statement would enhance it.

Overall Score: 24.5/30

Sample Student Writing (post-Test 10th grade)

Post test (10th grade)

Topic: *In your opinion, do you think children should have cell phones under the age of 10 (5th grade)? Why or why not? Explain your opinion. (70–90 words)*

1. Content (10 points):

- **Score:** 8.5/10
- **Analysis:** student B presents a clear and structured argument against giving cell phones to young children. She covers six logical reasons including social, health, and safety concerns. While her reasoning is sound, the response lacks personal examples that could have made the argument more persuasive. The conclusion is brief and would benefit from a restatement of key points.

2. Language (8 points):

- **Score:** 7.2/8
- **Analysis:** The language used is clear and mostly accurate. Leen shows good vocabulary range and sentence structure, with minor phrasing that could be improved for a more formal tone. For example, “Phones may hinder the development of social skills...” could be better expressed as: “Excessive phone use at a young age may impede social development.” Overall, the language demonstrates a strong command of English.

3. Organization (8 points):

- **Score:** 6.8/8
- **Analysis:** The essay follows a clear structure with an introduction, six main points, and a short conclusion. Transitions between ideas could be improved with linking words like “Furthermore” or “Moreover.” The conclusion, although present, does not fully reinforce the main message.

4. Mechanics (4 points):

- **Score:** 3.2/4
- **Analysis:** Minor issues in punctuation and formatting were noted, such as missing commas or inconsistency in numbered points. These do not significantly affect comprehension, but fixing them would improve the polish of the response.

Total Score: 25.7 / 30

Sample Student Writing (post-Test 10th grade)

Topic: *In your opinion, do you think children should have cell phones under the age of 10 (5th grade)? Why or why not? Explain your opinion. (70–90 words)*

1. Content (10 points):

- **Score:** 8.75 / 10
- **Analysis:** Student A presents a clear, logical argument against early phone use. He highlights valid reasons, such as distraction from school, exposure to harmful content, and reduced face-to-face interaction. His mention of supervised phone use

for emergencies adds nuance. The argument would be stronger with personal examples or supporting statistics.

2. Language (8 points):

- **Score:** 7.2 / 8
- **Analysis:** His language is clear and suitable for the level. Sentence structure is generally strong, and the vocabulary is appropriate and occasionally varied. Minor fluency improvements could be made by refining some phrasing and adding depth to certain points.

3. Organization (8 points):

- **Score:** 7.2 / 8
- **Analysis:** The essay is well-organized, with a clear introduction, body, and conclusion. Each point follows the previous one logically. Transitions between ideas could be slightly improved to enhance overall flow.

4. Mechanics (4 points):

- **Score:** 3.5 / 4
- **Analysis:** The essay is largely free of grammatical or spelling errors. Some long sentences could be shortened for clarity. Minor punctuation improvements would enhance readability
- **Total Score:** 26.65 / 30

Appendix (O)

Official Rubric for Module C Writing Tasks Used in Pre- and Post-Test Evaluation



State of Israel
Ministry of Education
Pedagogical Secretariat
Language Department
English Language Education

<i>MODULE C – WRITING RUBRIC</i>				
<i>CRITERIA</i>	<i>CORRECT</i>	<i>PARTIALLY CORRECT</i>	<i>MINIMALLY CORRECT</i>	<i>INCORRECT</i>
<i>CONTENT AND ORGANIZATION</i>	<ul style="list-style-type: none"> • on topic • information is relevant • content is understood • text is well organized 	<ul style="list-style-type: none"> • partially on topic • information is partially relevant • content is partially understood • text is partially organized 	<ul style="list-style-type: none"> • minimally on topic • information is minimally relevant • content is minimally understood • text is minimally organized 	<ul style="list-style-type: none"> • not on topic • information is not relevant <p style="font-size: small; text-align: right;"><i>In most cases, when both the above bullets are applicable, it will result in zero for the entire task.</i></p>
<i>10</i>	10	7	3	0
<i>VOCABULARY</i>	<ul style="list-style-type: none"> • correct use of words • appropriate use of instances of language chunks and phrases (such as phrasal verbs and collocations) 	<ul style="list-style-type: none"> • partially correct use of words • partially appropriate use of instances of chunks and phrases 	<ul style="list-style-type: none"> • minimally correct use of words • minimally appropriate instances of chunks and phrases 	<ul style="list-style-type: none"> • incorrect use of words • inappropriate use of chunks and phrases
<i>8</i>	8	5	2	0
<i>LANGUAGE USE</i>	correct use of: <ul style="list-style-type: none"> • basic tenses and/or basic language structures • word order • pronouns and prepositions 	partially correct use of: <ul style="list-style-type: none"> • basic tenses and/or basic language structures • word order • pronouns and prepositions 	minimally correct use of: <ul style="list-style-type: none"> • basic tenses and/or basic language structures • word order • pronouns and prepositions 	incorrect use of: <ul style="list-style-type: none"> • basic tenses and/or basic language structures • word order • pronouns and prepositions
<i>8</i>	8	5	2	0
<i>MECHANICS</i>	correct use of: <ul style="list-style-type: none"> • spelling • punctuation, capitalization • no run-on sentences 	partially correct use of: <ul style="list-style-type: none"> • spelling • punctuation, capitalization • some run-on sentences 	minimally correct use of: <ul style="list-style-type: none"> • spelling • punctuation, capitalization • frequent run-on sentences 	Incorrect use of: <ul style="list-style-type: none"> • spelling • punctuation, capitalization • consistent use of run-on sentences
<i>4</i>	4	2	1	0

(Question = 30 points)

Appendix (P)

Tables

Table 11

Questionnaire Findings

#	Questionnaire Result	Supporting Studies	Contrasting Views	Comment and APA Citation
1	Teachers view Grammarly as helpful for accuracy and vocabulary enhancement.	(Yim & Wegerif, 2024; Shi, Ding, & Choi, 2024)	(Newton & Newton, 2020) warn about superficial gains	Many teachers acknowledged Grammarly's strengths as an AI-assisted writing tool. However, as Newton and Newton (2020) point out, learning depth can be weakened if AI is not used critically.
2	Concern about overdependence and weakened independent writing	Tseng & Warschauer (2023); (Newton & Newton, 2020)	Wu et al. (2021) suggest that AI fosters independent creativity	Teacher reservations are supported with literature warning against the risk of student passivity, highlighting the importance of structured teacher guidance (Tseng & Warschauer, 2023).
3	Access and digital literacy gaps affect the AI integration	Liu & Yu, 2022; Ahn & Oh, 2024; Pataranutaporn, P., & Maes, P. (2024)	–	Technical limitations were shown in other studies, emphasizing the need for setup and rich training (Yu, 2022).

Table 12*Interview Themes findings*

#	Interview Insight	Supporting Studies	Contrasting Views	Comment and APA Citation
1	AI feedback increases student confidence and experimentation	Wu et al. (2021); (Shi, Ding, & Choi, 2024)	Newton & Newton (2020) warn of over-guidance	Teacher testimonies reflected earlier findings showing AI feedback boosts student willingness to try and revise, particularly in low-risk environments (Wu et al., 2021).
2	Need for teacher mediation when interpreting AI feedback	(D'Mello & Graesser, 2023); Tang (2024)	–	This supports the broader pedagogical consensus that AI cannot replace critical human guidance in learning contexts (Tang, 2024).
3	Creativity may be constrained if students rely too heavily on AI suggestions.	Newton & Newton (2020). Tseng & Warschauer (2023)	Wu et al. (2021) found that AI promotes divergent thinking	Divergent opinions reflect an ongoing debate: while some teachers saw creativity declining, others viewed Grammarly as a creativity scaffold when properly mediated (Tseng & Warschauer, 2023).

Appendix (Q)

Certificate of acceptance of the research extracted from the dissertation
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Arab EFL Teachers in Haifa District

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Date: November 18, 2025

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An-Najah National University, Palestine

Article Acceptance

We are pleased to inform you that your manuscript entitled:

The Effect of AI Tools on Writing Skills and Creative Thinking: Perceptions of Arab EFL Teachers in Haifa District

has been reviewed and accepted for publication in the Humanities & Natural Sciences Journal, Volume 6. Issue 12 in December 01, 2025. (ISSN:2709-0833).

Thank you very much for your submission to our journal.

Similarity ratio using (Turnitin)	6%
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The significance and contribution of the conclusion or findings and recommendations to the support and development of scientific research	Yes
Coherence and fluidity of the research and clarity of the writing language	Yes

Best Wishes

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جامعة النجاح الوطنية
كلية الدراسات العليا

اثر الذكاء الاصطناعي في تحصيل الطلبة في
مهارات الكتابة والتفكير الإبداعي كما يفسره معلّمو
اللغة الإنجليزية العرب في منطقة لواء حيفا

إعداد

عرين خالد محمود جبارين

إشراف

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أ. د. علام موسى

قدمت هذه الأطروحة استكمالاً لمتطلبات درجة الدكتوراه في التّعلم والتّعليم، كلية الدراسات العليا، جامعة
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الملخص

هدفت هذه الدراسة إلى فحص أثر أداة الكتابة المعتمدة على الذكاء الاصطناعي "Grammarly" في تحسين كفاءة الكتابة لدى متعلمي اللغة الإنجليزية كلغة أجنبية، بالإضافة إلى استكشاف تصورات معلمي اللغة الإنجليزية حول دور الذكاء الاصطناعي في تنمية التفكير الإبداعي لدى الطلبة. اعتمدت الدراسة منهجاً مختلطاً، جمع بين التصميم شبه التجريبي القائم على اختبار قبلي-بعدي، وبين استخدام استبانة ومقابلات شبه منظمة. تكونت العينة من 60 طالباً وطالبة من الصفين العاشر والحادي عشر من ذوي التحصيل المرتفع، و92 معلماً ومعلمة للغة الإنجليزية من المدارس الثانوية في منطقة حيفا. أظهرت النتائج وجود فروق دالة إحصائية في تحسن مهارات الكتابة لدى الطلبة بعد استخدام أداة "Grammarly"، مع اختلافات ملحوظة تبعاً للجنس، والصف الدراسي، ومستوى اللغة الإنجليزية الأساسي. وقد أقر معظم المعلمين بالفوائد التقنية لاستخدام أدوات الذكاء الاصطناعي في تطوير الكتابة، لكن تصوراتهم بشأن تأثيرها على الإبداع جاءت متباينة؛ إذ رأى بعضهم أنها تفتح المجال أمام الأصالة، في حين عبّر آخرون عن قلقهم من الاعتماد المفرط عليها. توصي الدراسة بتوسيع نطاق استخدام أدوات الذكاء الاصطناعي في المدارس، وتوفير تدريب مهني للمعلمين، ودمج أنشطة كتابة مدعومة بالذكاء الاصطناعي ضمن مناهج اللغة الإنجليزية لتعزيز مهارات الكتابة وتحقيق استقلالية المتعلم.

الكلمات المفتاحية: الذكاء الاصطناعي، متعلمو اللغة الإنجليزية كلغة أجنبية، Grammarly، كفاءة الكتابة، مهارات التفكير الإبداعي، التكنولوجيا التعليمية، التحصيل الأكاديمي، تصورات المعلمين، Padlet، منطقة حيفا.