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Navigating educational transformation: Understanding learning styles' preferences of Egyptian students in the post-pandemic era

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Abstract: This study investigated the Learning style preferences of Egyptian EFL learners post-COVID-19. It aims to examine differences emerging in multimodal and bimodal learning preferences based on demographic variables of age and gender and consider the cultural educational context in Egypt during and post the pandemic era. Utilizing the VARK Model, Mayor's Multimodal Learning Theory, and the Connectivism Learning Theory a survey comprising 19 questions was disseminated to 211 Egyptian EFL students from various age groups. Findings reveal a predominant preference for multimodal learning, particularly visual and read/write styles, with significant variations between genders. Female learners exhibited a stronger inclination towards kinesthetic styles, while males preferred visual methods. Younger learners and female students showed a stronger preference toward the multimodal approach that integrates technology-mediated learning, whereas older students and male learners were in favor of the more traditional modes of learning. The study highlights the importance of integrating traditional instruction wit multimedia resources, particularly for younger learners who thrive in interactive settings. Recommendations include encouraging collaboration between public and private educational sectors, increase the community services and initiatives for community-based learning to address the diverse needs of unprivileged learners. The study advocates for an innovative and holistic teaching approach to enhance engagement and motivation, achieve quality education, and cultivate an informed, skilled generation capable of contributing to the sustainable future of Egypt 2030.

Keywords: *Demographic factors, Egyptian EFL learners, Learning style preferences, Post-pandemic era, Technology-mediated learning.*

1. Introduction

The rapid spread of a viral outbreak in late 2019 led to a global crisis by early 2020, compelling educational establishments to swiftly pivot from traditional classrooms to digital learning environments. This sudden shift revealed both obstacles and untapped potential, particularly in language education, as instructors and learners had to reimagine their pedagogical approaches. Gaining insight into students' learning styles in the age of digital technology has become "crucial for improving academic results during this extraordinary period." [1]. In Egypt, the shift to online learning (OL) during the spread of Coronavirus caused unique hurdles and unearthed valuable discoveries, particularly for English language students. Egyptian learners had to explore novel digital platforms and adjust the way they learn to fresh teaching approaches. The post-pandemic era presents a chance to investigate their burgeoning inclinations and learning methods, which are pivotal for their academic flourishing and future professional trajectories in an increasingly interconnected global landscape [2]. This research aims to explore the favored learning methods of Egyptian EFL learners following the COVID-19 pandemic. This research examines students' preferred learning styles and how they are affected by the

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variables age and gender using VARK's Model, Mayor's Multimedia Learning Theory (MMLT), and the Connectivism Learning Theory (CLT). VARK's multimodal approach illustrates how various learner groups interact with learning English in a post-pandemic setting. It divides learning preferences into Visual, Aural, Read/Write, and Kinesthetic categories. The Multimedia Learning Theory was developed by Mayor, et al. [3] and it emphasized the positive effect of using multimedia resources and information technology for effective learning experiences and better academic achievements. Online resources include video channels, podcasts, blogs, educational games, and online articles that cater to their preferred learning styles to understand content and become active learners The CLT aligns with VARK's framework and MMLT and complements them. This theory was proposed, it implies that learning occurs through social networking connections facilitated by technology. In this theory acquisition of adequate digital literacy skills are emphasized. Understanding the diverse learning preferences and demographic influences of EFL learners enable stakeholders in education to implement teaching strategies and to design curricula and learning activities that address the needs of different student populations. There has been criticism against VARK's model, arguing that it oversimplifies learning styles into four types only without considering that learning is a multifaced process and that students usually learn through a combination of learning preferences. Cultural backgrounds of students and gender differences should also be taken into consideration. Individual differences such as cognitive styles and fixed mindsets or stereotyping in certain environments, specifically developing countries in the Middle East, such as Egypt need to be considered [2, 4]. Further, despite the global impact of the pandemic on education, there is limited research on how these changes have influenced the learning styles preferences of students with different demographic characteristics – age and gender. Therefore, this research aims to fill out this gap in literature by investigating Egyptian EFL students learning preferences based on VARK's Model, MMLT and CLT to understand the multifaced learning preferences of students' post-pandemic era. Meaningful insights can be concluded from the findings in an attempt to contribute to the improvement of instructional practices and learning outcomes of EFL learners. In the Egyptian context, this is highly essential since cultural and educational dynamics uniquely shape learning experiences.

2. Literature Review

2.1. Theoretical Background

Learning styles refer to the cognitive, affective, and physiological traits that determine how individuals perceive, interact with, and respond to learning environments [5, 6]. Various models and definitions exist, with the VARK model being one of the most widely recognized [7]. This paper is based on two theoretical frameworks: VARK's Model, the Multimedia Learning THeory and the Connectivism Learning. Sari, et al. [8] discuss both VARK's model and a multimodal approach to online English teaching during the pandemic crisis. The authors emphasize the importance of recognizing diverse learning preferences to enhance educational outcomes and provide effective instruction [8]. They describe each of the VARK modalities as follows, Visual Learners: These learners benefit from diagrams, charts, and visual representations of information, Auditory Learners: These individuals prefer listening to explanations and discussions, Reading/Writing Learners: They learn best through reading texts and writing notes, and Kinesthetic Learners: These learners need hands-on experiences and physical activities to grasp concepts. "A multimodal approach, which integrates visual, auditory, reading/writing, and kinesthetic learning activities, can significantly improve students' engagement and understanding" [8]. CLT has emerged recently in response to the on-going change of educational practices in this digital era [9]. CLT posits that learners gain knowledge and learn not only via traditional methods such as textbooks but also through the use of social media, online platforms and social network communities. CLT is a promising approach to educators who are challenged to help learners adapt to the ongoing and complex changes in the world around them. The Connectivism Learning theory aligns with this approach since its key prinicples state the following: 1. Diverse perspectives leads to effective knowledge and leraning, 2. Applications can be tools for learning. 3.

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Learning occurs when specific nodes are connected or information sources; 4. It is essential to have the capacity to learn more. 5. Fostering connections is crucial to sustain learning. 6. Recognizing connections between ideas, fields and concepts is a core skill. 7. "connectivist learning activities" aims for up-to-date knowledge. 8. Decision-making is a "learning process" [10]. Research findings suggest connectivism could be a convenient be framework for motivating students to develop knowledge through online tools' enablers, discussions and social networks while linking to sustainability concepts. The Multimedia Learning Theory was developed by Mayor in 1997 based on Cognitivism. Mayor highlighted three major principles for effective learning through multimedia. First, the two channels or multimedia principle (audio and visual) in which information is processed. In this principle, Mayor argue that combined visuals and words benefit learners than using only words. Second, the limited capacity refer to the fact that each channel can manage a specific amount of information. To achieve successful outcomes, learning should involve, filtering, organizing and incorporation of new information with the existing knowledge. Third, active learning is a process in which students use prior knowledge to enhance comprehension and retention.

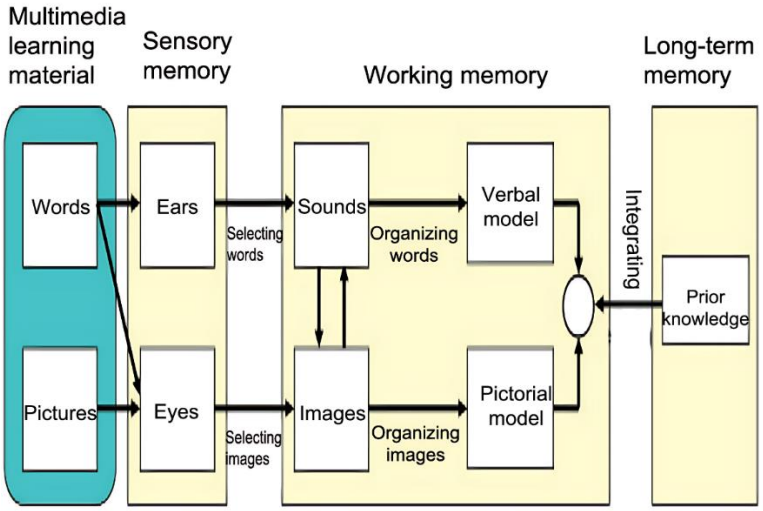

Figure 1.
Mayor's Multimedia Cognitive Learning Theory [11].

In this study, a multimodal approach refers to employing multiple senses in language teaching. Multimodal teaching enables learners to perceive, comprehend, encode, and store input information that lays the groundwork for both conscious and automatic information output [12]. In the coming literature review, insights from numerous studies that investigated multifaced learning preferences among learners are demonstrates to elucidate how learners engage with designed materials. The focus is to understand students' preferences through various models, specifically during challenging times such as the spread of COVID-19 pandemic.

2.2. Review of Literature Before and During Pandemic Context

Before the pandemic, most educational institutions in Egypt primarily relied on face-to-face teaching methods. Effective use of technology was limited to private institutions which can fund eLearning systems, the use of eBooks and online applications [2]. However, the necessity for social distancing led to the adoption of online platforms like Zoom, Teams, and Google Meet and to the emergence and extensive use of adaptive learning platforms that customize and personalize learning, including Kahoot, Socrative, Quizlet and various online applications [13, 14]. This shift posed challenges for students accustomed to traditional learning environments, and necessitates fast

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adaptation to new methods of instruction [4, 6, 15]. Applying a multimodal method and the use of social media and online resources to teaching the English language have supported students' learning and the grasp and retention of knowledge during the pandemic [8]. Multimedia learning has been investigated by researchers (MMLT) and it continues to evolve in educational settings. Several studies confirmed that learners usually have positive learning experience when utilizing multimedia materials. Ercan [16] used experimental research to investigate the effect of multimedia resources on 62 primary stage students. Students were studying a science topic about food and nutrition and they were divided into a control and an experimental group. Results showed that the experimental group outperformed the control group in the posttest scores. This confirmed Mayor, et al. [3] that students' academic achievement and attitude towards learning improve when using multimedia tools.

Esther [17] investigated the learning styles of ESL students in Ado Ekiti Local Government, exploring their learning style preferences. There was a primary inclination towards the visual and auditory learning modes among ESL learners. The author attributed these findings to the nature of language acquisition in which exposure to the foreign/ second language through visual aids and auditory inputs is crucial to improve EFL/ESL language learning. Incorporating multimedia resources and interactive practice was thus recommended for better language learning outcomes. In an experimental study, Lee [6] compared the oral presentation performance of 21 Taiwanese EFL learners' who received instruction via "technology-mediated multimodal approach" to the performance of 29 EFL learners in the control group. It was evident that multifaceted training impact on 21 learners compared to 29 students in the control group. Results of the independent T-test showed that the experimental group sample performed slightly better. In addition, in their responses to the survey about the effectiveness of using VARK + technology-mediated with VARK's multimodal approach, students showed positive perceptions. Theoretically, the study confirms the significance of the prevalence of "multimodal theory" to Foreign Language learning, especially in teaching oral presentation skills. Thus, virtually, the study highlights the valid role of technological-enhanced VARK's learning styles for teaching EFL presentation skills. In language learning, the use of Information Technology and Communication tools, YouTube was proved to enhance writing fluency of students. Alobaid [18] found that exposure to smart learning environments in multimedia resources over the period of five months through daily communications has improved learner's writing skills. Aspects that have improved include accuracy, organization of ideas, but there were some aspects that showed slight improvements. The findings suggest that multimedia educational tools can be more effective than traditional methods in enhancing language learning outcomes, particularly in writing fluency. In another study, the impact of Kahoot as a game-based learning tool on English as a Foreign Language (EFL) learners' vocabulary recall and retention. Key findings revealed that students who used Kahoot exhibited significantly improved vocabulary recall and retention compared to traditional methods. The methodology involved a quasi-experimental design with two groups: an experimental group using Kahoot and a control group receiving conventional instruction. Pre- and post-tests were administered to measure vocabulary performance, and statistical analyses confirmed the effectiveness of Kahoot in enhancing learning outcomes. Overall, the study demonstrated that interactive game-based tools can significantly facilitate vocabulary acquisition in language learners. In Ally, et al. [19] the shift to OL during the pandemic necessitates adapting different teaching and learning strategies in lesson plans. Findings revealed that accommodating to different learning styles through VARK's multimodal model (visual, auditory, kinesthetic, reading resulted in maintaining students' engagement and learning outcomes in remote learning environments. Similarly, James, et al. [20] emphasizes the trend towards multimodal learning preferences in EFL learning. Their results showed that students rely on multiple modes of visual, auditory and kinesthetic learning styles. This multimodal approach has proved effective in foreign language acquisition in which varied inputs can enhance comprehension and retention.

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2.3. Impact of COVID-19 on Learning Style Preferences

The rapid shift to online learning (OL) during the pandemic required students to adapt their learning styles to suit digital platforms. Studies have shown mixed impacts on students' motivation and academic achievements, highlighting the need for flexible instructional design that accommodates diverse learning preferences [4, 8, 21]. Wafa Kheir argues that the shift to online education required changes in how teaching methods and lessons were delivered. Teachers had to adopt new strategies to effectively involve students from a distance, such as utilizing multimedia materials, interactive tasks, and asynchronous communication methods [22].

Kolb [23] discusses in his work Experiential Learning: Experience as the Source of Learning and Development that Egyptian students, similar to many students worldwide, probably encountered difficulties and hesitations when transitioning abruptly to online education. These challenges might have arisen from factors such as limited access to technology, internet connectivity issues, and unfamiliarity with online platforms. The sudden shift to online learning presented both challenges and opportunities, affecting students, educators, and institutions in various ways. "The COVID-19 pandemic has changed education forever. In response to significant demand, many online learning platforms are offering free access to their services, including platforms like BYJU'S, a Bangalore-based educational technology and online tutoring firm founded in 2011, which is now the world's most highly valued ed-tech company" [24]. In Egypt, Khalaf [25] delved into Egyptians learning preferences before and after the spread of the viral pandemic. In his findings, some thrived in a remote learning environment, enjoying the flexibility and autonomy it offered; these are usually self-regulated learners who can manage their time well online [26]. However, other students struggled with the lack of structure and face-to-face interaction, which are critical for students who perform better in traditional, hands-on learning approaches.

2.4. The Psychological and Social Impact

The impact of the transition to distance learning on students' psychological and mental health was reported by the American Psychological Association, "students have experienced increased levels of stress, anxiety, and depression due to the abrupt change in their learning environments and the uncertainty of the pandemic" [27]. The way students in Egypt adapt to online learning can be influenced by cultural factors unique to the region. These factors include cultural norms related to education, family dynamics, socioeconomic status of learners and social expectations, which play a significant role in shaping students' experiences and approaches to online learning [28, 29]. Accordingly, adoption of hybrid learning models was preferred with the progress of the globe recovery from the pandemic. Hybrid learning combines both online and in-person learning. It can accommodate to various learning preferences [30]. The hybrid learning model have proven to assist students adjust to the blended learning approach which leverages both "digital resources and face-to-face interactions" for an effective learning experience and achievement of learning outcome. Interestingly, previous research has shown younger students may adapt more readily to technology-mediated learning, while older students might prefer traditional methods. Gender differences also play a role, with female learners often showing a preference for traditional, text-based learning styles, and males favoring more interactive, technology-based approaches [31]. This indicates that factors, such as age and gender may significantly influence learning preferences. OL posed challenges for Egyptian students, particularly in terms of digital literacy, access to technology and internet connectivity, which varied depending on socio-economic factors and geographical location [4]. In Egypt, many public schools continue to rely heavily on traditional learning methods that are not often supported with adequate integration of technology – this is the cultural norm. Students receive instruction and study from textbooks and notes. Egypt is a developing country with insufficient budget allocated to provide for quality education in most public schools [32] there is shortage of instructors in public schools and the available teachers need adequate training to effectively integrate technology in their lesson plans and teaching practices to cater for different learning styles [13]. Additionally, overcrowded classrooms in public schools, redundancy of curricula, shortage of well-trained teachers worsen the situation and hinders individualized instruction; this limits the opportunities for quality education via interactive learning experiences [33]. Consequently, most Egyptian learners depend on private tutoring and their main interest is to be taught to

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pass the final exam [13]. This aligns with Pritchard [34] comment that in Egypt the way both teachers and learners perceive OL was shaped by their attitudes towards individual learning, authority and perception of cooperative and collaborative work. Therefore, this study could contribute to previous and recent research by providing more insights into Egyptian students' learning style preferences post-COVID-19 in an attempt to reveal how learners of different age groups and genders adapt to the use of multimedia and technology-based learning. The impact of the Egyptian cultural context and demographic factors are also investigated. The following are the key questions that the study aims to answer:

1. What are the learning styles preferences of Egyptian EFL Learners?
2. How do demographic factors, such as age and gender influence Egyptian students' learning styles?
3. Which learning environment do learners of different age groups and gender prefer: traditional versus technology-mediated learning environments?

3. Research Methods

3.1. Research Design

This research adopts a non-experimental, quantitative research design. A semi-structured questionnaire was developed and adapted from VARK's learning styles questionnaire [35, 36]. The study mainly used descriptive statistics to calculate the frequency, mean and standard deviation of the participants' responses to describe their behavior and characteristics. The SPSS statistical tests were to calculate the reliability and validity of the questionnaire's responses and to analyze research findings with respect to sample's responses to the three research questions.

3.2. Sample of Population

Participants in this research work were 211 Egyptian EFL learners. They were sampled from three universities in Egypt, one public and two private universities. Convenient sampling procedures were followed to collect the responses from social media platforms of departments of psychology and foreign languages in two private and one public universities in Egypt in February 2024 [37]. The participants' age range was divided into three groups for the purpose of the study: less than 18, 18-25, and 35 or older. The sample included 153 female learners and 58 male learners

3.3. Data Collection and Analysis

The questionnaire consisted of 19 questions. It was designed on Google forms. There were three questions to collect demographic data about age, gender and status. Ten close-ended questions with multiple choice options were developed to gather needed data about the learning style preferences of students using various prompts adapted from VARK's questionnaire [35] and six 5-point Likert scale questions directly inquiring about their preferred styles, and whether they prefer independent or collaborative learning; traditional or technology mediated learning. In these six questions, students had to choose a response from (strongly disagree, agree, neutral, disagree, strongly disagree). The questionnaire was first piloted to 10 students to receive comments and feedback about the prompts and choices in the questions. Some comments were considered and several questions were added to the survey. Consent forms were collected via email for participants who agreed to contribute to the study. The statistical analysis techniques employed to address the research questions included assessing the reliability and validity of sample's responses, utilizing descriptive statistics, such as frequency tables means, and standard deviations. Independent T-test and F-test were conducted to examine the influence of gender and age-related differences on the participants' responses.

4. Results

In this section, analysis of the research findings is presented with regards to the three research questions. First, descriptive statistics are illustrated in Table 1, 2 and 3, followed by the presentation and analysis of the research findings.

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4.1. Results of Demographic Data and Responses Reliability

Table 1 and 2 shows the descriptive statistics of gender and age of the sample. The females represent 72.5% of the data while the males represent 27.5%. For the variable age, the number of age category (18 to 25 years) presents (48.3%); (more than 35 years) presents (43.2%), and the number of (less than 18 years) presents (8.5%) According to the responses of the sample.

Table 1.
Descriptive statistics of the variable gender.

N	Items	Frequency	%	Rank
1	Male	58	27.5	2
2	Female	153	72.5	1
Total		211	100%	-

Table 2.
Descriptive statistics of the variable age.

N	Items	Frequency	%	Rank
1	less than 18	18	8.5	3
2	18 to 25	102	48.3	1
3	More than 35	91	43.2	2

With respect to status, 30.3% of the sample identified themselves as postgraduate students. This significant proportion underscores the strong inclination towards advanced studies. The respondents engaged in undergraduate studies make up 27.5% of the sample which is a crucial stage in students' lives to build knowledge and skills for their future careers. The third category comprises high school students. This group constitutes 24.2% of the respondents. Lastly, the category labeled as "Other" accounts for 18% of the responses. This group likely includes individuals engaged in non-traditional or alternative educational paths, such as vocational training, professional certification programs, or self-directed learning.

Table 3.
Reliability and validity of the sample's responses using alpha Cronbach.

Variables of Study	Reliability	Validity
Total: Preferred learning styles of learners	0.821	0.906

The reliability coefficient, Alpha Cronbach was used to measure the stability of the sample's total responses. Table 3 indicates that the reliability of the total sample is 0.821, exceeding the threshold of 0.70. This demonstrates a strong reliability for the study sample, which is also reflected in its validity, reaching a value of 0.906.

4.2. Research Question 1: Egyptian EFL Students' Learning Styles' Preferences

The frequency of students' responses for seven close-ended questions designed to elicit individuals' learning preferences in different contexts were calculated to find the average percentage for students' learning styles' preferences.

Table 4.
Frequency distribution of sample's learning styles' preferences.

No.	Learning style	Frequency	%	Rank
1	Visual	67	31.8 %	2
2	Aural	31	14.7 %	3
3	Read/write	89	42.2 %	1
4	Kinesthetic	24	11.3 %	4
Total		211	100%	-

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Table 4 outlines the frequency distribution of VARK's learning style modes: visual, aural, read/write, and kinesthetic. Data from the total sample of participants showed that the most preferred learning style among Egyptian EFL learners is the read/write style, with 42.2% (89 out of 211) of the learners favoring this method. This indicates a strong inclination towards learning through reading and writing activities, such as reading textbooks or notes, writing essays, and engaging in exercises that involve written instructions and responses. This preference is probably attributed to the traditional educational practices in Egypt, which often emphasize literacy and rote learning.

The second most preferred learning style is visual; it is chosen by 31.8% (67 out of 211) of the learners. Visual learners benefit from seeing information presented in diagrams, charts, and other visual formats. These results suggest that Egyptian learners find it easier to comprehend and retain information when it is visually represented. This preference can be linked to the increasing use of multimedia and visual aids in modern classrooms.

Aural learning was preferred by 14.7% (31 out of 211) of the learners, ranking the third learning style. Aural learners absorb information effectively through listening, which includes lectures, discussions, and audio recordings. The relatively lower percentage might reflect the limited use of auditory teaching tools in traditional Egyptian classrooms, where lectures are often the primary source of aural input.

Kinesthetic learning style received the least preference, with 11.3% (24 out of 211) of the learners. Kinesthetic learners thrive on hands-on activities and learning through physical activity. The minimal percentage may highlight the lack of opportunities for active, movement-based learning in conventional EFL teaching environments in Egypt. Lecture halls are usually not equipped to allow for group work that involve physical activities. In Table 5 and 6, the participants' multimodal and bimodal learning preferences are presented in percentages.

Table 5.
Frequency distribution for multimodal learning styles.

No.	Multimodal learning style	Frequency	%	Rank
1	Visual/ Read and write/ Kinesthetic	135	64%	1
2	Visual/ Read and write/ Aural	31	14.7%	3
3	Aural/ Kinesthetic/ Visual	31	14.7%	3
4	Aural/ Kinesthetic/ Read and write	47	22.3%	2

Results in Table 5 revealed that indicates the item (visual/ read and write/ kinesthetic) learning preferences had the first rank the first order presented with (64%). This multimodal preference is followed by the (aural/ kinesthetic/ read and write) with a percentage (22.3%), and finally the (visual/ read and write/ aural), (aural/ kinesthetic/ visual) multimodal learning preferences had equal percentage of (14.7%). Nevertheless, in Table 7, the close percentages among questions #1 (82.6%), question #3 (81.6%) and question #4 (89.8%) confirm these results, showing that the sample has multimodal learning preferences modes (visual, kinesthetic and read/write).

The highest bimodal learning preferences for the Egyptian participants were for visual/ read and write and kinesthetic/ read and write (See Table 6). Kinesthetic/ read and write took the first rank with 78.7%, followed by the visual/read and write (78.2%). In the third rank came visual/kinesthetic with 64%. Equal percentages were for the read and write/ aural (22.3%) and aural/kinesthetic (22.3%) learning preferences. He least percentage was for the aural/visual (14.7%).

Table 6.
Frequency distribution of bimodal learning preferences.

No.	Bimodal learning styles	Frequency	%	Rank
1	Visual/ Read and write	165	78.2%	2
2	Read and write/ Aural	47	22.3%	4
3	Kinesthetic/ Visual	135	64%	3

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4	Kinesthetic/ Read and write	166	78.7%	1
5	Aural/Visual	31	14.7%	5
6	Aural/Kinesthetic	47	22.3%	4

Table 7.
Descriptive statistics on students' learning styles.

N	Items	Mean	Std. deviation	Relative importance
1	Do you think you are a visual learner who mostly prefers watching videos, graphs and charts for learning and understanding new content?	4.13	0.99	82.6%
2	Are you an aural learner who learns best by listening to songs, podcasts or tutorials?	2.88	1.07	57.6%
3	Do you think hands-on activities that require physical movement are the best learning style for you to learn new concepts and information?	4.08	1.10	81.6%
4	In your opinion, reading and writing notes are the perfect learning styles to attain information and recall them during exams?	4.49	0.62	89.8%
5	Is learning through technological resources better for you than traditional learning in the classroom; does it help you understand information and attain better results?	3.35	1.22	67%
6	Do you prefer learning independently to learning collaboratively?	3.14	0.83	62.8%
7	Total responses for learning styles	3.89	0.48	77.8%

Table 8.
Statistical differences between male and female learners' learning styles using the independent t-test.

Item	Gender	N	Mean	Std.	t	P-value	Result
1- Do you think you are a visual learner who mostly prefers videos, graphs and charts for learning and understanding new content?	Male	58	4.57	0.49	7.117	0.01*	Sig.
	Female	153	3.69	1.17			
2- Are you an aural learner who learns best by listening to songs, podcasts or tutorials?	Male	58	3.30	0.89	6.306	0.01*	Sig.
	Female	153	2.45	1.06			
3- Do you think hands-on activities that require physical activities are the best way for you to learn new concepts and information?	Male	58	3.72	1.38	5.021	0.01*	Sig.
	Female	153	4.44	0.49			
4- In your opinion, reading and writing notes are the perfect learning styles to attain information and recall them during exams.	Male	58	4.28	0.70	5.170	0.01*	Sig.
	Female	153	4.70	0.45			
5- Is learning through technological resources better for you than traditional learning in the classroom; does it help you understand information and attain better results?	Male	58	3.29	1.48	0.636	0.52	N .Sig.
	Female	153	3.40	0.89			
6- Do you prefer learning independently to learning collaboratively?	Male	58	3.28	1.03	2.591	0.01*	Sig.
	Female	153	2.99	0.52			
7- Total Responses Learning styles	Male	58	3.96	0.64	2.215	0.01*	Sig.
	Female	153	3.81	0.22			

Note: *Significant at the (0.05) level.

Drawing upon VARK (Visual, Aural, Read/Write, Kinesthetic) Multimodal framework, Table 8 reveals a predominant preference for read/write learning styles among Egyptian learners. The mean scores (4.2) for males, (4.7) for females and t-value 5.170 at p-level 0.01. Another significant finding was the gender-based variation for visual learning preference, with males exhibiting a higher mean score (4.57) compared to females (3.69). This suggests that male learners are more inclined towards engaging with videos, graphs, and charts to comprehend new content. The statistical significance ($t = 7.117$, $p = 0.01$) further underscores this preference.

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In contrast, female learners demonstrated a stronger inclination towards kinesthetic learning, which involves hands-on activities. The mean score for females was notably higher (4.44) compared to males (3.72), with a significant t-value of 5.021 (p = 0.01). This preference indicates that female learners find practical, experiential learning methods more effective for understanding new concepts. They are also well-known for being multi-taskers [15]. For aural learning, male learners scored higher (mean = 3.30) compared to female learners (mean = 2.45), with a significant t-value (t = 6.306, p = 0.01). This suggests that male learners benefit more from auditory inputs like songs, podcasts, and tutorials. Conversely, females displayed a stronger preference for read/write learning styles, with a mean score of 4.70, surpassing the male score of 4.28. The significance of this finding is represented by (t = 5.170, p = 0.01) emphasizes the importance of incorporating reading and writing activities into the EFL curriculum for Egyptian learners.

4.2.1. The Influence of Age on Learners' Preferred Learning Styles

The preferences in learning styles among Egyptian EFL learners are also influenced by age.

Table 8.
Statistical differences between male and female learners' learning styles using the independent t-test.

Item	Gender	N	Mean	Std.	t	P-value	Result
1- Do you think you are a visual learner who mostly prefers videos, graphs and charts for learning and understanding new content?	Male	58	4.57	0.49	7.117	0.01*	Sig.
	Female	153	3.69	1.17			
2- Are you an aural learner who learns best by listening to songs, podcasts or tutorials?	Male	58	3.30	0.89	6.306	0.01*	Sig.
	Female	153	2.45	1.06			
3- Do you think hands-on activities that require physical activities are the best way for you to learn new concepts and information?	Male	58	3.72	1.38	5.021	0.01*	Sig.
	Female	153	4.44	0.49			
4- In your opinion, reading and writing notes are the perfect learning styles to attain information and recall them during exams.	Male	58	4.28	0.70	5.170	0.01*	Sig.
	Female	153	4.70	0.45			
5- Is learning through technological resources better for you than traditional learning in the classroom; does it help you understand information and attain better results?	Male	58	3.29	1.48	0.636	0.52	N .sig.
	Female	153	3.40	0.89			
6- Do you prefer learning independently to learning collaboratively?	Male	58	3.28	1.03	2.591	0.01*	Sig.
	Female	153	2.99	0.52			
7- Total Responses Learning styles	Male	58	3.96	0.64	2.215	0.01*	Sig.
	Female	153	3.81	0.22			

Note: *Significant at the (0.05) level.

Table 9.
Comparison of age differences using one-way ANOVA (F-test).

Items	Age	N	Mean	Std.	F-value	P-value	Result
1- Do you think you are a visual learner who mostly prefers watching videos, graphs and charts for learning and understanding new content?	less than 18	18	3.00	1.01	30.258	0.01*	Sig.
	18 to 25	102	4.23	0.98			

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	35 or older	91	4.49	0.50			
2- Are an aural learner who learns best by listening to songs, podcasts or tutorials?	less than 18	18	2.50	0.50	9.396	0.01*	Sig.
	18 to 25	102	3.14	1.18			
	35 or older	91	2.53	0.85			
3- Do you think hands on activities that require physical movement are the best way for you to learn new concepts and information?	less than 18	18	3.50	0.50	6.366	0.01*	Sig.
	18 to 25	102	4.26	1.29			
	35 or older	91	3.98	0.70			
4- In your opinion, reading and writing notes are the perfect learning style to attain information and recall them during exams.	less than 18	18	4.50	0.50	0.002	0.99	N.Sig.
	18 to 25	102	4.49	0.70			
	35 or older	91	4.48	0.50			
5- Is learning through technological resources better for you than traditional learning in the classroom; does it help you understand information and attain better results?	less than 18	18	2.50	0.50	11.410	0.01*	Sig
	18 to 25	102	3.61	1.21			
	35 or older	91	3.22	1.30			
6- Do you prefer learning independently to learning collaboratively?	less than 18	18	2.00	0.40	47.851	0.01*	Sig.
	18 to 25	102	3.36	0.85			
	35 or older	91	3.25	0.43			
7- Total responses for learning style	less than 18	18	3.37	0.12	27.034	0.01*	Sig.
	18 to 25	102	4.03	0.55			
	35 or order	91	3.87	0.21			

Note: **Significant at the (0.01) level.

The F-test was used for statistical analysis of the participants' learning methods and learning style preferences across age groups as shown in Table 9. *Visual learning preferences* showed significant differences across age groups, with the F-test value of 30.258 and a p-value less than 0.05, indicating significant statistical results. The data suggests that the age group of 35 or older has the highest preference for visual learning (mean = 4.49), followed by the 18 to 25 age group (mean = 4.23), and those under 18 (mean = 3.00). This indicates that adults are more inclined towards visual learning methods compared to teenagers. This preference can be attributed to the increasing integration of visual aids in higher education and professional environments, which this age group is more exposed to.

Aural learning preferences also exhibited significant differences with an F-test value of 9.396 and a p-value less than 0.05. Here, individuals aged 18 to 25 showed the highest preference (mean = 3.14), followed by the 35 or older age group (mean = 2.53), and those under 18 (mean = 2.50). This suggests that undergraduates and younger adults prefer auditory learning methods more than high school students. The high engagement of the 18 to 25 age group with digital audio content and streaming services might explain this trend; this generation has been called digital natives for their familiarity with updated technological applications [2, 38].

Kinesthetic Hands-on learning that also involves physical movement showed significant differences with an F-test value of 6.366 and a p-value less than 0.05 across the three age groups. The 18 to 25 age group again demonstrated the highest preference (mean = 4.26), followed by the 35 or older age group (mean = 3.98), and those under 18 (mean = 3.50). This trend suggests that younger adults favor experiential learning activities. This preference could be linked to the practical and interactive approaches commonly employed in modern educational practices and vocational training programs targeting this demographic age group. Interestingly, *the preference for reading and writing* as a learning style did not show significant differences across age groups, as indicated by an F-test value of 0.002 and a p-value greater than 0.05. This lack of variance suggests a general agreement among all age groups regarding the effectiveness of reading and writing for information retention and recall during exams.

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The stability in this preference might reflect the long-standing tradition and effectiveness of reading and writing as foundational educational tools.

Preferences for learning through *technological resources* revealed significant differences with an F-test value of 11.410 and a p-value less than 0.05. The age group 18 to 25 had the highest mean preference (mean = 3.61), followed by the 35 or older age group (mean = 3.22), and those under 18 (mean = 2.50). This indicates a stronger preference among younger adults for technology-enhanced learning compared to traditional classroom settings. The integration of digital tools and e-learning platforms in educational systems may contribute to this trend, because of their flexibility and other merits that has made them an indispensable part of students' learning experience. The result of the F-test (2.238) at p-value less than 0.05 showed a preference for individual rather than group learning. Students were from 18-25 years old showed the highest tendency for individual learning (mean=3.36). They were followed by those who aged 35 and above (mean=3.25), and students under 18 (mean = 2.00). This shows that younger adults have a stronger tendency towards learning individually, i.e., on their own. This preference might be attributed to the fact that students at that age need to accommodate to hectic schedules and other responsibilities in their daily routines which can be offered by self-directed learning environments. When considering overall learning styles across different age groups, significant differences were again observed with an F-test value of 2.238 and a p-value less than 0.05 for the benefit of the18 to 25 age group had the highest mean (mean = 4.03). It was followed by the 35 or older age group (mean = 3.87), and those under 18 (mean = 3.37). This further underscores the variance in learning style preferences across different age groups. These findings align with previous research, which has shown that learning preferences and strategies can vary significantly based on age, as younger learners tend to be more receptive to diverse and modern learning methods compared to older learners [38]. Moreover, these findings are confirmed in Table 8 (See Appendix), the male and female learners' responses showed no significant differences for technological resources; the mean scores for this category were 3.29 for male participants and 3.40 for female learners, indicating a general acceptance of digital tools as a supplementary educational resource. This highlights the need for integrating multimodal learning approaches that leverage technology to cater to diverse learning styles.

4.3. Research Question 3: Preferences for Traditional Versus Technology-Mediated Learning Environments

Table 10 presents the frequency distribution of the total sample preference for using digital tools in learning English versus the traditional methods. The general trend was for using digital resources in learning English 51.2%, followed by the neutral trend 33.2% and 15.6% for the traditional methods. This aligns with the EFL learners' preference for a flexible learning environment (46.1%), followed by the quiet and social environment with close percentages, 28.9%and 25 % respectively.

Table 10.
Frequency distribution of preference of learning English using technology.

N	Items	Frequency	%	Rank
1	Neutral	70	33.2	2
2	Technological resources like podcasts, movies and music	108	51.2	1
3	Traditional methods like textbooks, notes and articles	33	15.6	3
Total		211	100%	-

Moreover, these findings are confirmed in Table 8, the male and female learners' responses showed no significant differences for technological resources; the mean scores for this category were 3.29 for male participants and 3.40 for female learners, indicating a general acceptance of digital tools as a supplementary educational resource. This highlights the need for integrating multimodal learning approaches that leverage technology to cater to diverse learning styles. Another notable finding in Table 8 (See Appendix) was related to the preference for independent learning among males, with a mean score of 3.28 compared to females' 2.99. The significant t-value (2.591, p = 0.01) suggests that male learners favor solitary study methods, which may align with their visual and aural learning

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preferences. In contrast, the slight preference for collaborative learning among females could be attributed to their kinesthetic and read/write learning styles, which often benefit from group activities and discussions. Using Chi-square statistical test, age also influenced learning preferences of Egyptian EFL learners, particularly in the context of traditional versus technology-mediated learning (Chi-square = 7.424, $p < 0.05$). The 18-25 age group showed the highest preference for using technological resources, followed by the 35 or older age group, while the last preference for technology was observed in the under-18 age group.

5. Discussion

5.1. Dominant Learning Style Preferences and Egyptian Cultural Context

In recent years, educational research has increasingly focused on the impact of integrating technology via eLearning, mobile phones and various applications and understanding the multimodal learning preferences of students, particularly EFL learners [6, 14, 19]. Accommodating various learning preferences can significantly promote students' learning and academic achievement. The theoretical framework of the paper and its developed questionnaire is based on VARK's model, the MMLT and the CLT. Both are useful in understanding how individuals prefer to receive and process information [39]. The sample's responses to the questionnaire has shown that students' dominant learning style is read/write, but it has also shown that students learning preferences do vary according to demographic factors, such as age and gender, but are still affected by the cultural context in Egypt.

Results from several studies discussed in this paper reveal a strong inclination toward multimodal learning preferences which aligns with Mayer's multimedia principle – two channels and active learning. Table 5 highlights a significant preference for "visual, read/write, and kinesthetic modalities", with the highest preference rate of 64%. This is followed by a multimodal combination of "aural, kinesthetic, and read/write modalities" at 22.3%. Interestingly, visual, read/write, and aural preferences, along with aural, kinesthetic, and visual preferences, share an equal preference rate of 14.7%. These findings are documented by top percentage responses for specific questions. In the bimodal learning preferences, Egyptian students reveal distinct trends. The bimodal "kinesthetic and read/write" was found as the most favored, with a preference rate of 78.7%. It was closely followed by the "visual and read/write" bimodal at 78.2%. The third most preferred combination is "visual and kinesthetic", standing at 64%. Notably, the "read/write and aural" and the "aural and kinesthetic" share an equal preference rate of 22.3%. The least preferred bimodal is "aural and visual" with a percentage 14.7%. These findings confirm the prevalence of "multimodal learning preferences" among the Egyptian sample of population. These findings are supported by Ally, et al. [19] and Lee [6] who emphasize the importance of accommodating "multimodal learning preferences" and the use of technology-mediated activities in educational contexts. Adopting flexible teaching strategies is highly recommended in remote learning and during times of crises, such as COVID-19 pandemic. In language instruction, Esther [17] further advocates for a more personalized approach to teaching that addresses individual learning styles. These results are further verified by Prithishkumar and Michael [39] and Bualat, et al. [40] who emphasize the importance of considering different learning styles and multimedia learning to improve students' comprehension and retention of information and enhance educational outcomes. *The Impact of the Traditional Educational Settings on Students' Learning Preferences*

The study revealed that among Egyptian EFL learners, the read/write learning style is predominant; 42.05% of the participants preferred this style. This indicates that a substantial number of learners in the Egyptian cultural context favor learning environments where information is presented through textual formats. The read/write learning modes are the most traditional. Reading from printed books, articles, documents, eBooks, answering worksheets, test and final exams are common ways to learn in the Egyptian educational context. According to Pritchard [34] a read/write preference engage effectively more than one perceptual sensory, such as print and haptic – they see the print written word and write to take notes [17]. In this style, visual modes can be involved and this allows them time to use their imagination and reflect on what they have read by writing, taking notes, and answering

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exercises [17]. However, these findings contrast the research outcomes of Ally, et al. [19]. In their study, the majority of students in medical school had a "multimodal learning preference" during COVID- 19 in which the kinesthetic style ranked the most preferred, followed by the visual and aural learning styles that were supported by animated PowerPoint presentations and audio files to support their learning and engagement asynchronously [19]. Similarly, in their study, Prithishkumar and Michael [39] found that the majority 86.9% of medical students had multimodal learning style preferences while 13. 1% had unimodal learning preference after distributing VARK questionnaire to all students. Common "bimodal" learning style preferences were aural/kinesthetic 33.3% and aural/read and write 16.5%. In contrast to students enrolled in theoretical disciplines, such as arts and humanities, it is crucial for students enrolled in science disciplines such as medical schools to practice clinical training, observe patients and conduct experiments. This is probably the reason why the highest percentage in Prithishkumar and Michael [39] is for aural/kinesthetic bimodal rather than aural/read and write. Different gender showed no significant differences in the findings. Students had different learning modalities in their understanding and process of information. In the present research Chi-square test results have shown that there was a relationship between younger adults and post graduates and analyzing written text by highlighting key points, taking notes or answering questions about the content; the age group as the value of Chi-square reached (14.759) and a contingency coefficient (0.256) at significant p-level 0.02. This modality aligns with the mainly followed traditional academic settings in the Egyptian culture that emphasize reading comprehension and written assessments [4, 41].

Following closely is the visual learning style, preferred by 31.5% of Egyptian EFL learners, followed by the aural 14.87% and the smallest percentage was for the kinesthetic 11.55%. These findings confirm that visual learners comprehend and retain information best when presented in graphical or pictorial formats [35]. This mode of learning involves learning by cues, videos, charts that stimulate students' eyes. Color coding and using labels on specific parts of texts are a part of visual learning. Designing interactive activities that incorporate pictorial elements, such as role-playing, simulations, and practical experiments can support these students to understand and retain concepts besides promoting their fluency in using the foreign or second language. During COVID-19, most students relied on recorded lectures to study the content. They also used eLearning platforms and online interactive quizzes in which students drag and drop or match and accomplish tests to receive feedback; thus, this period might have had an impact on learner's preferred leaning styles. Again, watching videos or doing interactive quizzes involve hearing and encourage hands-on and kinesthetic learning which reflect a multimodal style to learning. This again clarifies why the visual learning style is mostly favored by Egyptian learners. The third percentage in the rank is for auditory learning (14.87%). Auditory learners learn through audio inputs and this can be integrated via in-person instruction in class, peer discussion, audiobooks and podcasts. In this mode, learning mainly depends on hearing; one human sensory element is mainly involved to grasp the information. The last learning style mode is kinesthetic (11.55%). This mode engages learners in an activity, such as delivering demonstrations, onsite visits. Usually in teaching, this mode is combined with either the visual or auditory to provide "in-depth" learning experience. Therefore, the reason why the auditory and kinesthetic learning modes received the least percentages is that they do not offer the possibility of integrating other modes of learning that can be suitable for effective teaching and learning strategies.

The implications of these findings are multifaceted. Firstly, they underscore the necessity for educational stakeholders to consider cultural and demographic contexts when designing instructional materials and methods. One significant study by El-Deghaidy and Nouby [42] examined the relationship between cultural context and learning preferences among Egyptian university students. They found that Egyptian learners often exhibit a preference for read/write learning styles, which emphasizes textual materials and writing-based activities [42]. Another insightful study by Hassan and Ahmed [43] explored demographic variations in learning preferences across age and gender in Egypt. They discovered that while read/write styles are prevalent overall, younger learners and females often demonstrate a stronger preference for visual and kinesthetic learning approaches [43]. In particular, the

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preference for read/write learning styles suggests that resources tailored to these modalities could be more effective for Egyptian learners, thereby enhancing engagement and comprehension. Furthermore, recognizing the diversity in learning preferences across age and gender can inform more personalized and inclusive teaching strategies, ensuring that all learner groups are adequately supported.

5.2. The Impact of Age and Gender on Learning Styles' Preferences

Gender dynamics play a key role in shaping learning styles' preferences within the EFL Egyptian context. While the results of this research confirm that both genders generally favor the read/write style, female have shown a greater preference for collaborative and discussion-based learning methods, integrating auditory and kinesthetic elements more prominently. This necessitates integration of auditory activities that cater to these learners effectively.

In Jana, et al. [44] it was found that most of the 303 elementary students, randomly chosen from elementary schools in India, prefer the unimodal visual learning style. Social class and age difference affected their choice of learning styles unlike their grade level at school and gender factors. The students' abilities to elaborate were affected by their learning style unlike creativity and originality which were perceived invariant. These results are affirmed in both Mohamed, et al. [45] as well as Hassan and Ahmed [43] conducted in Egypt; they found that while read/write styles were prevalent overall, younger learners and female learners often demonstrated a stronger preference for visual and kinesthetic learning approaches compared to their male counterparts [43]. Therefore, tailoring materials that adapt these learning modalities could be more effective for learners. Culturally responsive pedagogy is also recommended for EFL learners in different regions, specifically Egypt. Curricula design and tailoring of activities that reflect and incorporate the local culture and context of students would enhance relevance and would certainly motivate and engage EFL students in the learning process Abdelrahman and Kamel [13]. In their research, Abdelrahman and Kamel [13] argues that lesson plans that integrate the local literature and cultural themes have proven effective in supporting a more inclusive learning environment that appeal and support all learner groups.

5.3. Technological Adaptation and Multimodal Learning

During the Covid-19 pandemic, both students and instructors in Egypt faced numerous obstacles, necessitating the shift to remote learning via digital tools. Later there was a transition to blended learning approaches to better align with the diverse learning strategies of students. Despite the challenges and lack of training that students and instructors encountered during this period, the mandated extensive use of digital learning tools, virtual classrooms, and online discussion forums compelled students to adapt their learning styles to fit a technology-mediated environment. This has significantly improved their digital literacy and flexibility in utilizing online educational resources [46].

Both gender groups in the present research acknowledged the value of digital tools in enhancing their EFL learning. The mean scores were 3.29 for male participants and 3.40 for female students. Age of students had also an impact on their perceptions of technology-mediated learning environments. Conducting the F-test among the three age groups showed significant differences among them ($F=11.410$; p-value <0.05). The age group 18 to 25 had the highest mean preference (mean = 3.61), followed by the 35 or older age group (mean = 3.22). These findings highlight the positive impact of integrating personalized and customized learning to students. Younger learners less than 18 were probably still influenced by the traditional instruction they have received at high schools. Moocs, Edomodo, Duolingo and Dreambox that have been emerged and were used during the pandemic have motivated and engaged learners to learn tenses and improve their language [47]. Findings of the researchers also reported satisfaction of most learners with the adaptive personalized learning.

Further, Kaoud, et al. [4] also supports the present research findings as they found that younger learners often exhibit greater enthusiasm and adaptability towards digital tools, contrasting with older students who may display apprehension or preference for traditional methods. Younger students are more likely to favour interactive and visually stimulating environments because it is a unique, valuable

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learning experience for them [31]. Conversely, mature learners might encounter difficulties due to less familiarity with emerging technologies and lack of training programs. Older learners tend to favor structured approaches that integrate real-world examples and practical applications over theoretical frameworks [38]. Thus, age should be considered as a key factor in designing curricula and learning activities to enhance learning outcomes across diverse student populations and to accommodate to the diverse technological proficiency levels within a learning cohort. These findings underscore the importance of providing equal opportunities to learners of different ages and social backgrounds – from various public and private institutions- to experience instruction that cater to their diverse learning styles and attitudes. These educational practices should integrate updated multimedia tools and customized platforms besides well-developed relevant curricula that reflect students' interest in both their local culture and the world's globalization. A holistic teaching approach can appeal to learners' different needs and yields better learning outcomes; it fosters a more inclusive and effective educational environment that aligns with sustainable development goals related to high quality education and gender equality [6, 46].

6. Conclusion

The study aimed at understanding Egyptians' learning style preferences following the COVID-19 pandemic. It explored how demographic factors, such as age and gender affect these preferences. A a survey of 19 questions was administered to 211 EFL learners of different age groups to inquire about their preferred learning styles of learning English as a foreign language. There were questions about how they perceive collaborative versus independent work and learning via technological resources and applications. The research provides valuable insights into how Egyptian EFL learners prefer to learn. The (Visual/ read and write/ kinesthetic) multimodal learning preference had the highest percentage followed by the (aural/ kinesthetic/ read and write) with a percentage. The highest bimodal learning preferences were for (visual/ read and write – 78.2%) and (kinesthetic/ read and write – 78.7%) at very close percentages. The predominant learning style for female and male learners was the traditional read/write; yet, the female participants showed a highest inclination towards kinesthetic learning styles than male participants who rated visual learning style as their best. Most of the participants appreciated the use of technology and online resources for learning, especially younger learners, which indicate that a combination between both traditional instruction and online resources accommodate and provides flexibility for various learning preferences and demographic factors. This is particularly beneficial for younger learners who thrive in interactive environments, and older learners who prefer a structured-based approach to learning. Thus, in this digital era, integrating diverse methods for presenting information and delivering lesson plans is essential to sustain students' engagement and motivation.

Additionally, the study reveals implications regarding the necessity for a more equitable educational systems that cater socio-economic disparities that affect EFL learners in the Egyptian society. Students from lower socio-economic backgrounds in public school or remote regions in Egypt often face challenges, such as overcrowd classrooms, limited access to technology and educational materials. Initiatives that call for "community-based learning", such as after-school programs, language clubs, volunteer-led tutoring, summer and winter camps, and computer training workshops are recommended. In these workshops and learning programs, students can improve their language and digital literacy skills by using different online applications to practice the language.

Collaboration between both the public and private education sectors should be fostered. Policy frameworks that mandate the inclusion of differentiated instruction in teacher training programs is recommended to put these initiatives into action and bridge the educational gap [46]. Several private universities, such as the American university in Cairo –AUC (e.g., Educamp), the British University and Egypt -BUE (School of Continuing Education and Free of Charges annual summer camps) organize community-based learning programs. Their free and low-cost workshops and programs aim to support students who struggle in the traditional classroom setting to develop their skills and knowledge. Three Educamps at the AUC were administered. Their goal was to integrate sustainable

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development principles into education. Issues such as climate change, disaster risk reduction, biodiversity, poverty alleviation, and sustainable consumption were addressed. Innovative teaching strategies were adopted to engage and empower learners to adopt sustainable practices. It also fosters competencies such as critical thinking, scenario planning, and collaborative decision-making. Similarly, at the BUE School of Continuing Education, workshops and learning programs are designed to help learners promote their English language skills, and digital literacy. The BUE Library invites undergraduates from public universities to attend free Information Technology and Artificial Intelligence Literacy workshops in the summer. There are also free workshops about creative writing and public speaking that are offered or free by the Faculty of Arts and Humanities to the community. Although the Egyptian government does not mandate ESD in schools, its implementation via such community service initiatives is vital for achieving the sustainability goals outlined in Egypt's Vision 2030 [48]. This again affirms the proposed key principles of the Connectivism Learning Theory where learning takes place through connections, social networking communications, and collaboration.

While the current study offers significant insights, it has some limitations that warrant consideration. The sample size of 211 participants, although reasonable, may not fully represent the entire population of Egyptian EFL learners; future research could benefit from larger and more diverse samples to improve the generalizability of the results. In addition, the reliance on self-reported data from the VARK questionnaire may introduce potential biases or inaccuracies in participants' responses. To address this, subsequent studies could combine self-report measures with observational data for validation. Lastly, the exclusive focus on EFL learners suggests a need for research into learning style preferences across other subjects or educational contexts, which would contribute to a more comprehensive understanding of the phenomenon.

Further research approaches are recommended to enhance our understanding of learning style preferences. For instance. Longitudinal studies would be particularly valuable, allowing researchers to track changes in students' responses to the VARK questionnaire over time. This would shed light on how individual learning styles evolve and adapt. Additionally, comparative studies examining the learning style preferences of Egyptian EFL learners alongside those from different cultural backgrounds could broaden our insights into the factors influencing these preferences. Collaborating with international researchers to conduct similar studies could help identify cross-cultural variations. Incorporating qualitative research methods, such as interviews or focus groups, would further enrich the findings by exploring the personal experiences, cultural influences, and educational backgrounds that shape students' learning preferences.

In conclusion, understanding individual differences and demographic influences is essential for improving educational practices in Egypt. Adoption of these practices that recognize these aspects can enable educators utilize available resources effectively to create engaging and inclusive learning environments. Implementing a multimodal, technology-mediated approach alongside culturally relevant topics, combined with active community-based initiatives, not only resonates with students' interests and preferred learning styles but also supports underprivileged learners from lower socio-economic backgrounds. Encouraging community services and community-based learning is vital for promoting language and digital skills among students, enabling them to navigate the modern world effectively. Such initiatives empower learners to become active participants in their communities, fostering a deeper understanding of the Sustainable Development Goals (SDGs). Ultimately, this holistic approach will cultivate a generation of informed, skilled, and socially responsible individuals capable of contributing to a sustainable future of Egypt 2030.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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