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**Preservice Moroccan Language Teachers' Perspectives
on Integrating Generative Artificial Intelligence into
their Teaching**

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Abstract

The end of 2022 marked the introduction of OpenAI's ChatGPT (Chat Generative Pre-trained Transformer) application, an emerging artificial intelligence (AI) technology that utilizes extensive language models to generate responses and engage with users. This research delves into the swiftly evolving role of AI in education and its potential impact on teaching and learning by examining the perspectives of Moroccan preservice teachers regarding the integration of ChatGPT into teaching practices. The study employs the

Unified Theory of Acceptance and Use of Technology (UTAUT) as a framework to explore the key factors influencing the incorporation of ChatGPT into teaching. Using an adapted UTAUT survey instrument and conducting semi-structured interviews with 80 Moroccan preservice language teachers, the research sheds light on their perceptions. The findings indicate that our respondents generally hold a positive view of ChatGPT's utility, with determinants such as perceived usefulness and social influence playing crucial roles in their decision to adopt ChatGPT. Interestingly, Facilitating Conditions did not exhibit any significant effect. Notably, 50% of preservice teachers express their intention to recommend ChatGPT as a learning tool to their students.

Keywords: ChatGPT, Preservice Moroccan language teachers, Intention, learning.

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1. Introduction and context

The emergence of Chat Generative Pre-Trained Transformer (ChatGPT), a generative artificial intelligence program developed by OpenAI, garnered considerable attention. ChatGPT, a sophisticated language model designed to facilitate more natural and conversational human-computer interactions, has quickly gained global recognition for its ability to produce coherent, logical, and informative responses

(Zhai, 2022). Within just two months of its launch, ChatGPT reached an impressive user base of 100 million (Reuters, 2023).

The introduction of ChatGPT into the educational landscape has been marked by both rapid adoption and controversy. While its potential applications in higher education are vast, some universities have chosen to implement bans due to apprehensions about potential student plagiarism (Nolan, 2023). The primary concern surrounding ChatGPT's role in education revolves around academic integrity. Faculty members express worries about an increased risk of plagiarism and cheating as students leverage ChatGPT to compose essays and exams. This concern holds particular significance for courses heavily reliant on written submissions or information recall, where ChatGPT's text output based on user prompts could offer substantial assistance.

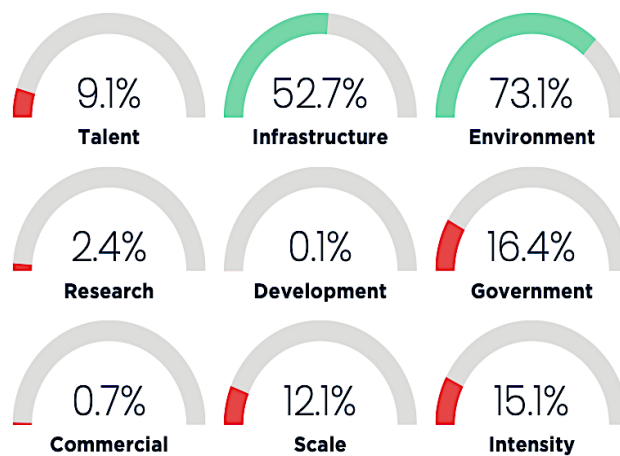
AI is experiencing significant development in Morocco. Indeed, the results of the “Global AI Index” in 2022 show that the leading countries in AI exploitation are the United States, China, and Singapore. In Africa, Egypt is the country progressing most rapidly in AI development. Morocco ranks 57th globally and 4th in Africa, following Egypt, South Africa, and Tunisia.

According to the same index, Morocco is well-positioned in terms of infrastructure and holds the top spot in Africa. This infrastructure includes a consistent electricity supply and high-speed connectivity.

Additionally, Morocco secures a favorable position in the operational environment, ranking second in Africa, just after South Africa. This operational environment considers aspects such as trust in AI and practitioner diversity, contributing to facilitating AI development. However, other parameters such as talent, research, and development require additional efforts to achieve an even more competitive position.

Figure 1

Morocco Global AI Index readiness (2022)

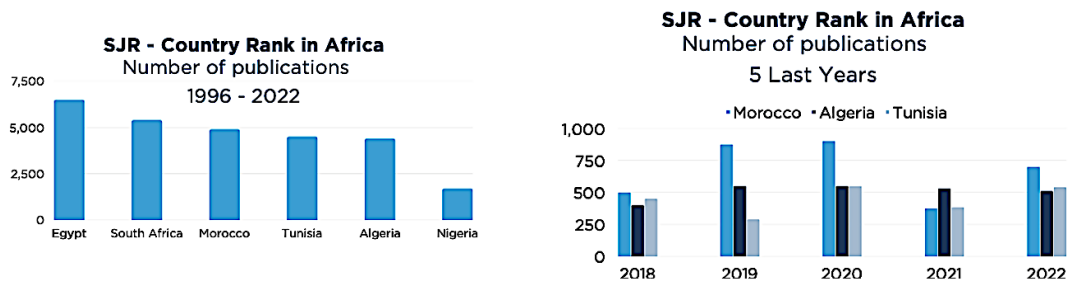


In terms of scientific research, and according to the same index, Morocco has produced over 4,500 publications in the field of AI between 1996 and 2022, placing it among the top three leading

countries in AI research in Africa, after Egypt and South Africa (Figure 2).

Figure 2

Publications in the field of AI in Morocco (2022)



In terms of AI ethics, UNESCO and Morocco initiated a multipartite discussion on October 23, 2023, in Rabat, as part of their strategic partnership on "The Use and Development of Responsible Artificial Intelligence in Morocco." This reflection aims to define major guidelines to establish a national vision for responsible AI. In this regard, Morocco is among the first countries to formally express its commitment to UNESCO's recommendation. As a result, the country benefits from institutional support under the project "Harnessing the Power of AI to Promote Equal Opportunities in the Digital World." In the same vein, the Mohammed VI Polytechnic University (UM6P), through the International Center of Artificial Intelligence in Morocco, inaugurated the AI Dome on November 9, 2022, in Rabat. This new

infrastructure, among the largest in Africa, aims to be a research laboratory entirely dedicated to promoting artificial intelligence on a national and continental scale. This Center is currently working on developing a digital educational assistant in partnership with the Innovation Fund for Development and the French startup Nukkai. This AI-based solution aims to provide personalized learning content, allowing students with diverse backgrounds to continue their online learning.

The aim of the study is to explore the perception of preservice Moroccan language teachers regarding adopting ChatGPT in their teaching practices. Understanding these indicators will be useful in developing courses and programs related to technical and pedagogical strategies, addressing the gap in empirical studies on AI integration into higher education, and contributing to the literature related to preservice teacher training in Morocco in the era of e-education. Specifically, this study aims to fill a gap in the existing research of generative AI within a higher education context, contributing to the expanding body of knowledge in this field.

The main research question guiding this study is: What are the perceptions of preservice Moroccan language teachers regarding the use of ChatGPT in their future teaching practices? The outcomes of this research hold significance for teachers, researchers, and policymakers, facilitating a more profound understanding of the implications of incorporating ChatGPT into educational environments.

2. Literature Review

Chatbot systems function as intelligent agents and engage with users by providing answers to their questions and delivering appropriate responses. They act as virtual conversational partners and are capable of understanding user inputs, including social and emotional cues. Chatbots have undergone significant evolution over time. Pioneering chatbots emerged several decades ago, and with advancements in technology, contemporary chatbots like Apple Siri, Microsoft Cortana, and recently ChatGPT have been introduced. ChatGPT has been hailed as one of the most remarkable AI chatbots ever made available to the public. A recent national survey of more than 1000 K-12 U.S. teachers (Impact Research, 2023) found that within two months of the launch of ChatGPT, more than half (51%) of teachers reported using ChatGPT, with 40% using it at least once a week, and 53% expecting to use it more in the coming year.

Chatbot systems function as intelligent agents, engaging users by providing answers to their questions and delivering appropriate responses. These virtual conversational partners have evolved significantly over time, with pioneering chatbots emerging several decades ago. Recent advancements in technology have introduced contemporary chatbots such as Apple Siri, Microsoft Cortana, and the notably impressive ChatGPT. ChatGPT, in particular, has garnered widespread acclaim as one of the most remarkable AI chatbots available to the public. A national survey conducted with over 1000

K-12 U.S. teachers (Impact Research, 2023) revealed that within two months of ChatGPT's launch, more than half (51%) of teachers reported using it. Among them, 40% used it at least once a week, and 53% expressed their intention to use it more frequently in the coming year.

A few recent studies (Foroughi et al., 2023; Malinka et al., 2023; Montenegro-Rueda et al., 2023; Ngo, 2023) have shown that integrating generative AI tools such as ChatGPT into education has potential benefits and challenges. A study of university students who had prior experience using ChatGPT for academic purposes found that they held a favorable view of applying ChatGPT to their academic endeavors. They identified benefits such as saving time, accessing information more easily across various domains, personalized tutoring and feedback, and assistance with idea generation. Malinka et al. (2023) studied the impact of integrating ChatGPT in university computer programming courses and demonstrated the effectiveness and usability of ChatGPT for handling programming assignments, exams, and homework using collected data. Foroughi et al. (2023) found that students' intention to use ChatGPT, however, is moderated by performance expectancy, effort expectancy, motivation, and perceived learning value. Moreover, Ngo (2023) identified several challenges that students encountered when using ChatGPT, mainly related to being able to evaluate the quality of information sources and accurately cite references.

In a systematic review conducted by Montenegro-Rueda et al. (2023) and examining the impact of ChatGPT in education, researchers collected data by reviewing studies published since the application's launch in November 2022. Utilizing three prominent education-related databases worldwide (Web of Science, Scopus, and Google Scholar), their findings indicate that the implementation of ChatGPT in educational settings has a positive influence on the teaching and learning process. However, they emphasize the crucial need for proper training of teachers in utilizing this tool. While ChatGPT holds the potential to enhance the educational experience, its effective implementation relies on teachers' familiarity with its functionality.

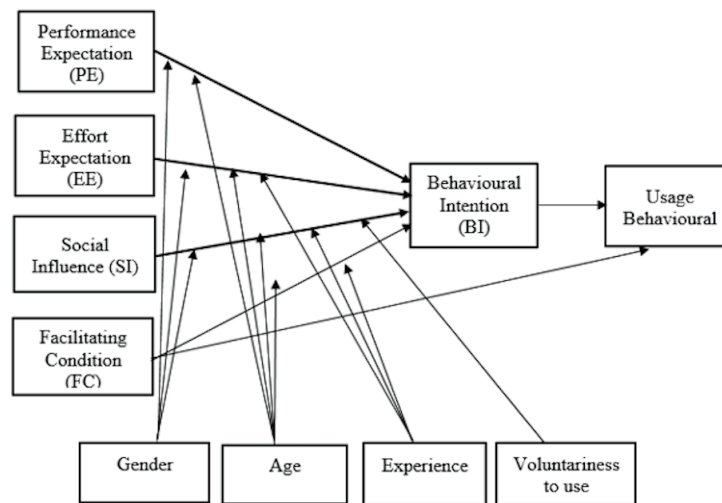
3. Theoretical Framework

The Unified Theory of Acceptance and Use of Technology (UTAUT) was formulated in 2003 by Venkatesh, Morris, Davis, and Davis with the objective of amalgamating diverse existing models addressing users' acceptance and adoption of technologies. The UTAUT model, depicted in Figure 3, marks a significant milestone in the literature on technology acceptance and has since been validated and applied in numerous studies. Williams et al. (2015) conducted a literature review of 174 articles published between 2004 and 2015, showcasing the extensive use of UTAUT across diverse settings and technologies. It demonstrated a high explanatory power, predicting technology acceptance and use at a rate of approximately 40-70%. While initially designed as a quantitative model, the UTAUT framework has been

employed in various research studies to explore the adoption of emerging technologies through qualitative research methods (Bixter et al., 2019; Hasija & Esper, 2022; Rempel & Mellinger, 2015).

Figure 3

The Unified Theory of Acceptance and Use of Technology (UTAUT) – Source: Venkatesh, Morris & Davis (2003)



The UTAUT model has five direct determinants of behavior, with three related to usage intentions and two related to actual usage. They are defined as follows:

- Performance Expectancy (perceived utility): The extent to which an individual perceives that utilizing the technology will lead to enhanced performance or better results.
- Effort Expectancy (ease of use): The perceived ease of use of the technology and the degree to which the individual believes that using it will be effortless.

- **Social Influence:** The extent to which an individual perceives that people who are important to them think they should use the technology.
- **Intention to Use:** The individual's intention to adopt the technology in a given context.
- **Facilitating Conditions:** The presence of facilitating factors, such as equipment, resources, or human resources, that make it easier to use the technology effectively.

The moderating variables (age, experiences, gender, voluntariness to use) of the UTAUT model will be exempt in this study based on the following justification:

- **Age and gender:** The moderating variables of age and gender are not included in this study since all the recruited preservice teacher participants are under 30 years old. Regarding gender, we based our decision in this study on the annual survey conducted by the Moroccan National Telecommunications Regulatory Agency in 2020 that revealed widespread use of digital technologies among young Moroccans, irrespective of gender.
- **Experience:** Regarding the moderating variable of experience, because this study is about using Chat GPT which is a new form of generative AI, it is assumed to be a new practice for our study participants.
- **Voluntariness to use:** We define the intention to adopt ChatGPT in our study as purely voluntary since we aim to study the informal uses of this technology.

In summary, the adapted model for this research focuses on the following variables:

Dependent variable: Intention of use.

Independent explanatory variables:

- Perceived Usefulness (Expected Performance)
- Perceived Ease of Use (Expected Effort)
- Social Influence
- Facilitating Conditions

Based on this model, we propose the following hypotheses:

- **H1:** There is a positive relationship between the degree to which preservice Moroccan teachers perceive the usefulness of ChatGPT and their intentions to use it in their teaching.
- **H2:** There is a positive relationship between the degree to which preservice Moroccan teachers perceive the ease of ChatGPT use and their expressed intentions to use it in their teaching.
- **H3:** The variable of social influence positively influences preservice Moroccan teachers in their intention to use ChatGPT.
- **H4:** Facilitating conditions have a positive influence on the adoption of ChatGPT among preservice Moroccan teachers.

4. Methodology

This study used an exploratory, mixed methods approach. Quantitative data were collected through a survey including two parts. The second part of the survey is based on the UTAUT framework. Qualitative methodology using a semi-structured interview was designed to gain

valuable insight into the individual perspectives of participants on integrating ChatGPT in education.

4.1. Context and Participants

The study location was the Regional Center for Education and Training Professions in the Oriental region of Morocco. The study employed a non-probabilistic purposive sampling method, which involves dividing the sample of the study into subgroups or strata. A level of balance was maintained in the distribution of our sample as we considered the range of disciplines represented in our study participants: French and English languages disciplines. All participants hold a bachelor's degree and are under 30 years old as these are both prerequisites to enrollment in the study location.

The initial recruitment survey was emailed to 150 preservice teachers enrolled at this institution. We anonymized all survey responses to protect participant confidentiality. All participants who indicated that they frequently use ChatGPT in their coursework were selected to participate in the survey phase of this study. At the end, 80 preservice Moroccan teachers were selected based on an initial recruitment survey that confirmed their frequent use of ChatGPT in their coursework.

To gain insight into how preservice teachers perceive and experience ChatGPT, semi-structured interviews were conducted. Qualitative

methodology using a semi-structured interview resulted in participants sharing their individual perspectives on integrating ChatGPT in education. We recruited and selected twelve interview participants from survey respondents. For semi-structured interviews, our goal was to elicit diverse perspectives and therefore selected participants for interviews that represented a balance of various disciplines.

4.2. Data Collection and Analysis

4.2.1. Survey Tool

We reviewed and pilot-tested the survey to ensure the questions were clear, unbiased, and covered all the relevant topics and research objectives. The survey tool was pilot-tested on a small group of fifteen future Moroccan teachers from different disciplines who use ChatGPT. We calculated the reliability of our instrument using Cronbach's alpha to measure the internal consistency of the instrument using SPSS software (version 22). The internal consistency of the instrument considering all 14 items was $\alpha=0.87$, indicating strong internal consistency. The survey, consisting of two parts, was created by using Google Forms due to its user-friendly interface, comprehensive features, and ease of distribution to respondents:

- Part 1: Set of questions about a) how familiar participants are with the use ChatGPT; b) the extent to which they think ChatGPT can be beneficial for their teaching, and c) whether the respondents intend to recommend the use of ChatGPT to their future students as part of their learning experience.

- Part 2: Adapted version of the UTAUT survey for our specific research purposes composed of fourteen items that require responses on a five-point Likert scale (ranging from "1: Strongly Disagree," "2: Disagree," "3: Neutral," "4: Agree," "5: Strongly Agree") as follows:

We conducted a thorough review and pilot testing of the survey instrument to ensure clarity and coverage of all relevant topics aligned with our research objectives. The pilot test involved fifteen prospective Moroccan teachers who use ChatGPT. The reliability of our instrument was assessed using Cronbach's alpha to measure internal consistency, and the result, calculated with SPSS software (version 22), yielded a strong internal consistency with $\alpha=0.87$.

The survey, divided into two parts, was developed using Google Forms due to its user-friendly interface, comprehensive features, and ease of distribution to respondents:

- Part 1: This section includes questions about a) participants' familiarity with the use of ChatGPT; b) their perceptions of the potential benefits of ChatGPT for teaching; and c) whether respondents intend to recommend the use of ChatGPT to their future students as part of their learning experience.
- Part 2: This segment comprises an adapted version of the UTAUT survey designed specifically for our research objectives. It consists of fourteen items that require responses on a five-point Likert scale, ranging from "1: Strongly Disagree" to "5: Strongly Agree."

Table 1

UTAUT Items

Performance Expectancy (perceived usefulness)	PU1	Using ChatGPT could increase my productivity as a teacher
	PU2	Using ChatGPT would facilitate the achievement of my teaching objectives
	PU3	ChatGPT will facilitate learning for my students
Effort Expectancy (perceived ease of use)	EU1	Using ChatGPT requires little additional effort on my part as a teacher
	EU2	I find ChatGPT easy to use
	EU2	It is easy for me to become skilled at using ChatGPT
Social Influence	SI1	Preservice teachers in my cohort have influenced me to use ChatGPT for educational purposes
	SI2	My friends think that I should use ChatGPT for educational purposes.
	SI3	My teachers do not think I should use ChatGPT for studying due to its limitations (inaccurate information, wrong language translation, wrong answers, plagiarism).
Facilitating Conditions	FC1	I don't have the required technical competencies to use ChatGPT effectively
	FC2	I have the necessary hardware and software resources (computer, internet access, etc.) to use ChatGPT in my teaching
	FC3	If I encounter difficulties with ChatGPT, I have a way to get assistance or help
Intention of Use	IU1	I intend to use ChatGPT in my teaching in the future
	IU2	I am willing to make additional efforts to use ChatGPT effectively in my teaching in the future

4. 2. 2. *Semi-structured Interviews*

Semi-structured interviews with open-ended questions were conducted to obtain a deeper understanding of future Moroccan teachers' perceptions regarding their use of ChatGPT in teaching. We used a semi-structured interview protocol outlining a proposed sequence of questions and the interview script. Each interview was scheduled for 30 minutes and was based on participants' schedule and availability. All interviews were audio-recorded and transcribed. The questions are outlined below:

- What are the key opportunities for using ChatGPT in education?
- How easy is it to integrate ChatGPT into teaching?
- What factors influence your decision to use ChatGPT in teaching?
- What challenges do you face with the use of ChatGPT in teaching?
- What skills do teachers and students need to make the most of ChatGPT and similar technologies in teaching and learning?

We selected a subset of six individuals from the initial pool of survey participants to participate in the semi-structured interview phase. Their responses were transcribed, open-coded, and systematically categorized to discern recurring patterns and themes.

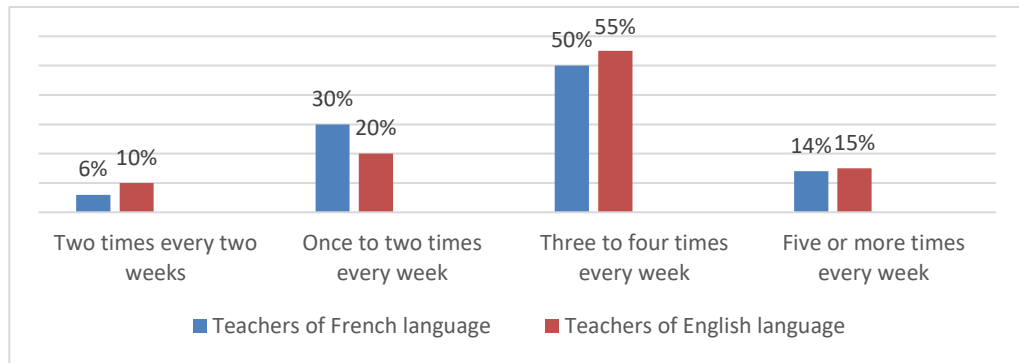
5. Findings and discussion

5.1. Key findings from the survey analysis

The 80 participants were comprised of the following disciplines: 50 preservice teachers of French language and 30 preservice teachers of English languages. The figure below shows the frequency of ChatGPT use among perspective teachers of different subjects, including French and English languages, Sciences, and Mathematics. The statistics indicate that English language teachers seem to use ChatGPT quite frequently, with the majority using it three to four times a week. French language teachers also use ChatGPT regularly, with a significant portion using it three to four times a week.

Figure 4

Frequency of ChatGPT use among our sample of study

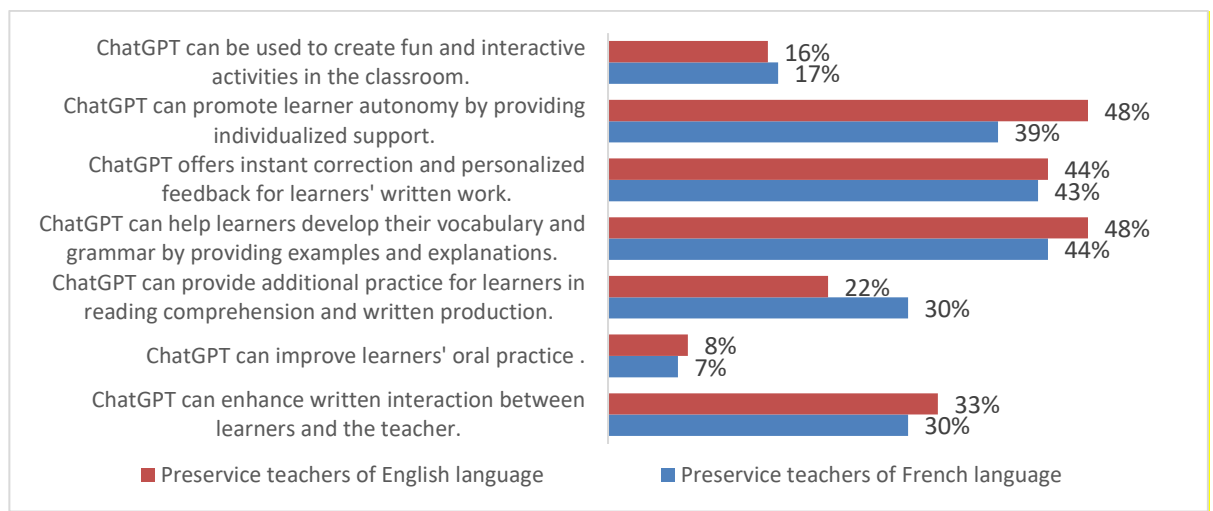


Responses as shown in figure 5 reveal a significant percentage of preservice teachers of languages (30%) who believe that ChatGPT can enhance written interaction between learners and teachers in language learning. This suggests that ChatGPT can be a valuable tool for improving written communication skills. The majority (44% - 48%) view ChatGPT as a tool to help learners develop their vocabulary and grammar. This aligns with the idea that ChatGPT can provide examples and explanations to support language learners. A substantial number (43% - 44%) agree that ChatGPT offers instant correction and personalized feedback for learners' written work. This feature can be beneficial for language learners seeking immediate guidance. Finally, many respondents (39% - 48%) believe that ChatGPT can promote learner autonomy by providing individualized support. This aligns with the idea that learners can use ChatGPT as a self-study tool. Ali et al. (2023) explored the impact of ChatGPT on learning motivation

among teachers and students of English as a foreign language (EFL) in Saudi Arabia through quantitative research design. Findings showed that ChatGPT generally motivated learners to develop their reading and writing skills, but had a neutral effect on their listening and speaking skills.

Figure 5

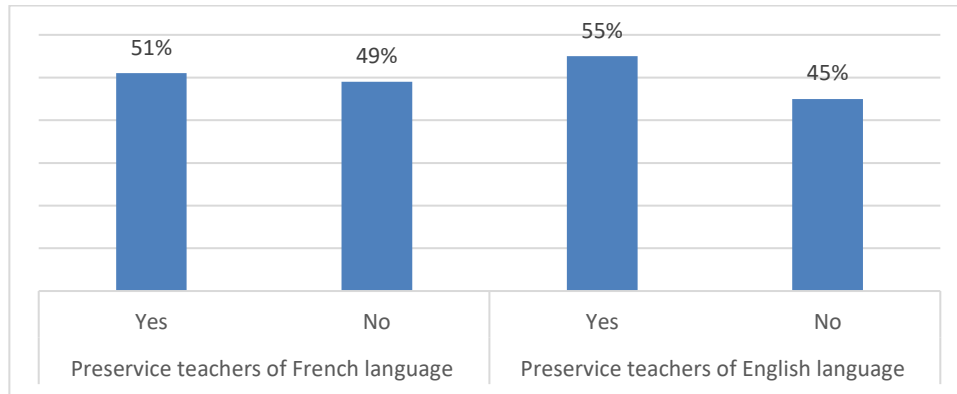
Beliefs about the benefit of ChatGPT in teaching and learning for our preservice teachers of languages



Regarding the intention to recommend the use of ChatGPT to their students, 51% of preservice French language teachers and 55% of English language teachers plan to recommend ChatGPT to their students. This suggests a favorable attitude toward the integration of ChatGPT into teaching (figure 6).

Figure 6

Preservice teacher's intention to recommend ChatGPT to their students



The second part of the survey (Table 2) revealed that participants' overall mean score was above the average level of 2.5 with a standard deviation close to 0 in most of the items. This means that most preservice teachers have similar opinions or intentions regarding the use of ChatGPT in their teaching.

The statistics demonstrate that performance expectancy significantly influences the intention to use ChatGPT in their teaching. Such results have been confirmed in previous research findings, such as those of Al-Emran et al. (2023), Bitzenbauer (2023) and Rahaman (2023).

The effort expectancy toward the use of ChatGPT is multifaceted and can vary based on individual experiences and perceptions. Indeed, some limitations for our preservice language teachers may necessitate additional effort, such as human oversight, to ensure accuracy and

reliability. The same opinions have been highlighted by Kasneci (2023) and Dijkstra et al. (2022).

The results indicate that there is a social influence impact regarding the intention to use ChatGPT among our participants, as confirmed by Sing et al. (2022) and Terblanche & Kidd (2022).

Facilitating conditions as shown in Table 2 do not influence the decision of our preservice teachers to use ChatGPT. Beyond access to a computer and the Internet, users do not cite any need for advanced technical infrastructure and competencies.

Table 2

Mean and standard deviation of items and variables

Teachers per subject	Variables	Items	Mean of Items	Mean of variables	Standard deviation of variables
Preservice teachers of French language	Performance Expectancy (perceived usefulness)	PU1	4.25	4.31	0.06
		PU2	4.30		
		PU3	4.39		
	Effort Expectancy (perceived ease of use)	EU1	3.26	2.78	0.35
		EU2	2.70		
		EU2	2.40		
	Social Influence	SI1	4.82	4.47	0.2
		SI2	4.05		
		SI3	4.56		
	Facilitating Conditions	FC1	3.70	3.61	0.16
		FC2	3.38		
		FC3	3.75		

	Intention of use	IU1	4.06	4.47	0.41
		IU2	4.89		
Preservice teachers of English language	Performance Expectancy (perceived usefulness)	PU1	4.14	4.27	0.09
		PU2	4.38		
		PU3	4.31		
	Effort Expectancy (perceived ease of use)	EU1	3.27	2.85	0.29
		EU2	2.69		
		EU3	2.60		
	Social Influence	SI1	4.55	4.51	0.27
		SI2	4.83		
		SI3	4.17		
	Facilitating Conditions	FC1	3.69	3.39	0.37
		FC2	3.62		
		FC3	2.86		
	Intention of use	IU1	4.69	4.77	0.08
		IU2	4.86		
		IU2	4.91		

5.2. Key findings from the semi-structured interview analysis

This section condenses the acquired insights from the semi-structured interviews into the primary themes and their corresponding subthemes, offering a well-organized and all-encompassing summary of the findings. Each thematic category incorporates the most pertinent data analyses and is elucidated by its associated sub-themes. From the primary data gathered through 6 semi-structured interviews, with an equal distribution among the four disciplines (French and English languages, Sciences and Mathematics), a total of 40 unique codes were derived. The iterative coding process resulted in two themes: advantages and limitations of using ChatGPT along with their corresponding subthemes outlined below:

Advantages of ChatGPT:

- ChatGPT is a helpful tool for searching and supporting teaching and learning.
- Ease of ChatGPT's use,
- ChatGPT could complement the role of teachers in certain situations.
- ChatGPT could be used as a complement to teaching, especially in remote teaching situations.
- Time-saving,
- Delivering customized tutoring and feedback,
- Elucidating writing concepts,

Limitations of ChatGPT:

- Unable to assess the quality and trustworthiness of sources,
- Challenges exist when substituting words and using idioms appropriately,
- Limitations when it comes to handling human emotions, human interaction, and understanding the mindset of students,
- Unable to evaluate complex mathematical expressions effectively.
- Potential bias in content,
- Unable to assess the credibility of sources,
- Disregard for ethical considerations,
- Absence of human interaction,
- Risk of learners becoming overly reliant on ChatGPT.

The interviews yielded positive feedback affirming the benefits of using ChatGPT in education:

- "ChatGPT has revolutionized the way we deliver education. It will help me personalize learning for my students, providing instant, on-demand support, and making my classrooms more dynamic and effective."
- "As a future teacher, I see ChatGPT as a fantastic tool for answering questions and generating explanations. It's like having a virtual teacher assistant in my classroom."

- "The integration of ChatGPT into our curriculum will foster creativity and promote problem-solving skills among students."

However, concerns were also expressed during the interviews, reflected in the following negative quotes:

- "The increasing use of ChatGPT by students might replace the need for human interaction in the classroom. We risk losing the personal touch of teachers that makes teaching and learning so fruitful."
- "ChatGPT is a useful tool, but sometimes it provides incorrect or incomplete information. I'm afraid my students may become totally reliant on ChatGPT."

These quotes reflect some of the advantages and potential challenges associated with the use of ChatGPT in teaching. It is important to acknowledge both the advantages and disadvantages when discussing its impact on education. These findings laid the groundwork for a more in-depth analysis in a future study.

6. Conclusion

Investigating the perceptions of preservice Moroccan teachers regarding the use of ChatGPT contributes valuable insights to the growing body of research on AI in Morocco. While participants generally express positive attitudes toward incorporating ChatGPT for educational purposes, they identify several challenges. Notable among these challenges are issues related to assessing the quality and reliability of sources, accurately citing sources, and encountering limitations in human interactions. There is a clear need for further

efforts in preservice teacher education to facilitate intentional, ethical, and meaningful integration of AI into teaching and learning.

Our study underscores the utility of the Unified Theory of Acceptance and Use of Technology (UTAUT) as a framework for analyzing the adoption of generative AI. Performance expectancy and social influence emerge as significant factors influencing the intent to use ChatGPT in the study. However, the findings suggest that some preservice teachers may require additional support, either in the form of human or technical assistance, to enhance their ease of use with ChatGPT. Training programs, such as those focused on prompt engineering, may be beneficial for preservice teachers. The observation that facilitating conditions had no impact on preservice teachers' intent to use ChatGPT indicates that this tool is accessible.

Nevertheless, it is crucial to acknowledge the limitations of the study, including its focus on preservice teachers with a bachelor's degree and exposure to ChatGPT in Morocco. This may limit the generalizability of findings to other educational levels and locations, particularly those without broadband access. Future research could enhance the comprehensiveness of insights by including the perspectives of in-service teachers, exploring ChatGPT's use across different subject areas, and informing the development of preservice teacher content and methods courses.

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