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It Is Not the Huge Enemy: Preservice Teachers' Evolving Perspectives on AI

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Abstract: The application of Artificial Intelligence (AI) to teacher training is a rather recent phenomenon and there is a need for more research on its use in teacher education. This paper examines the use and interpretation of AI by student language teachers during a 10-week telecollaborative course between students from two universities, one in the USA and the other in Spain (n = 46). The course focused on Technology-Enhanced Project-Based Language Learning (TePBLL) and was divided into different 'technological blocks'. This article is centered around the AI technology block. The analysis is based on three exit tickets (reflection prompts) that demonstrate participants' thoughts and changing perspectives towards AI. Through thematic analysis of the open-ended responses, this study shows that participants initially appeared skeptical before moving to tentative optimism after first studying theory and examples of the application of AI, followed by the creation of AI-based lessons and activities. The student teachers identify AI as a means to personalize and make language learning more efficient while expressing concerns related to its overuse, ethical issues and potential for undermining critical thinking and creativity. This small study looks at the evolution of the student teachers' concepts about and perspectives towards AI-enhanced language teaching and learning before, during and after they engage in the technology block. The findings suggest that hands-on training that includes lesson design helps student teachers view AI as a complementary tool for many aspects of their teaching, although this can only be achieved through an adequate pedagogical application.

Keywords: artificial intelligence; language learning; teacher education

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1. Introduction

Much of what has been written about Artificial Intelligence (AI) in education promises that great changes will come in how we teach by enabling learning by doing, teaching by doing and engagement through the creation of personalized learning resources. However, Y. Zhou (2024) expresses the following:

> Too much has been written and spoken about artificial intelligence (AI), especially generative AI, in education. Since the public release of ChatGPT in November 2022, AI has taken the central stage in educational discussions. (. . .) But most of the discussions, regardless of their scholarly quality, are primarily focused on using AI in the traditional arrangement of schools (. . .). The assumption is that everything the traditional school has operated with shall remain the same (. . .). (p. 2)

In his reflective piece, Zhou argues that AI will not transform education as long as AI is seen as yet another resource "in the traditional classroom" (p. 12), without further

consideration of how AI may improve and update pedagogical approaches (Celik, 2023). Research shows that the integration of digital technologies into education is significantly influenced by teachers' perspectives (Liu & Wang, 2024). In reference to AI-enhanced teaching, Cavalcanti et al. (2021) propose that AI cannot be effectively deployed by teachers without sufficient pedagogical knowledge on the use of AI resources. Citing a study by Wang et al. (2021), Celik (2023, p. 2) states that "the more teachers recognize the utilities of AI-based tools, the more they use such tools to foster learner motivation and engagement".

As regards AI-enhanced language education, research highlights the impact of AI on language learning, with tools such as intelligent tutoring systems, automated feedback, and multilingual games (Hew et al., 2023; Liang et al., 2021; Woo & Choi, 2021); and it is argued that AI can foster autonomy, personalized learning, fluency (Annamalai et al., 2023; Liang et al., 2021; Moulieswaran & Kumar, 2023a, 2023b; Warschauer & Xu, 2024) and innovative teaching practices (Abdelkader et al., 2024). However, in their argument for AI-supported personalized learning, Betaubun et al. (2023) posit that while technology-enhanced learning systems have "gained traction" in higher education, "traditional learning systems often focus primarily on technical aspects, neglecting pedagogical issues and failing to adapt to the specific needs of students and lecturers" (p. 61). As AI becomes an increasingly predominant component in professions (and leisure), AI literacy is frequently highlighted as equally vital as other literacies, including reading and writing (Casal-Otero et al., 2023). This implies that AI literacy must also be a component in teacher education and training (Ng et al., 2023).

While there is ample discussion that AI programs can help increase effectiveness by automating daily teaching activities (Sánchez Vera, 2024), leaving educators more time for creative approaches, as Y. Zhou (2024) has pointed out, teachers' perspectives and approaches will likely play a significant part regarding the acceptance and effective implementation of AI in language teaching. Studies on teachers' adoption of technology indicate that integration remains limited unless educators recognize its importance and feel confident in their ability to use it effectively (Ertmer, 2005; Ng et al., 2023). The activity design and AI affordances and limitations, as well as pedagogical considerations, can have a significant impact on the effective integration of AI in language teaching and learning (Amaral & Meurers, 2011). Although advancements in integrating AI into education have been made, there remains a notable lack of understanding regarding how future educators perceive and interact with AI tools (Karataş & Yüce, 2024). Understanding teachers' emotions, perspectives, and attitudes toward innovation is essential to help them adopt a new instructional approach or emerging technology like AI (Hopcan et al., 2023; Zhi et al., 2023). This understanding is vital as it directly impacts their preparedness and willingness to employ AI in creating accessible, adaptable, and personalized learning opportunities in various educational contexts (Wang & Lu, 2023; Zhi et al., 2023).

Citing several studies (e.g., Kim et al., 2022; Moorhouse et al., 2023), Lee and Jeon (2024) argue that limited attention has been given to training teachers in the use of AI resources (e.g., chatbots) for language instruction and that further research is needed. There have been a few recent studies that have examined how preservice teachers perceive the use of artificial intelligence (AI) in education. These investigations highlight both opportunities and challenges. For example, Zhang et al. (2023) found that many preservice teachers are open to using AI tools, particularly when they are practical and easy to integrate into teaching (although the study found differences based on gender, with female preservice teachers demonstrating more anxiety towards its use). Observations about preservice teachers' concerns regarding ethical issues and practical limitations are supported by Karataş and Yüce (2024), who observed that while tools like ChatGPT can make teaching more accessible and efficient, they also bring challenges, such as maintaining academic

integrity and ensuring balanced usage. Similarly, Eyüp and Kayhan (2023) noted that preservice teachers sometimes feel anxious about the implications of AI, including its possible effects on their future roles and responsibilities.

The evolving AI-enhanced digital landscape demands a well-rounded approach to teacher education that emphasizes AI literacy and explores pedagogical implications of its use in teaching and learning (Karataş & Yüce, 2024). Moreover, though there have been a few recent studies on preservice teachers' perspectives regarding AI (cf. Hur, 2024; Karataş & Yüce, 2024; Shin, 2020), there is a lack of research looking specifically at language teacher education.

Based on qualitative data collected from 46 student teachers, this study aims to respond to these questions:

- How do preservice language teachers perceive the integration of AI tools in language teaching?
- What pedagogical challenges and opportunities do they identify for their future classrooms?
- What role (if any) does language teacher education play regarding their predispositions to implement AI-enhanced learning tools in their future teaching practices?

2. Methodology

The data compiled for this study come from student teachers' responses in regularly submitted exit tickets based on the AI technology block. It is important to note that we use the term student teacher to refer to learners who are studying a teaching degree at the moment and are enrolled in the course referenced in this text. This may include learners who have no teaching accreditation (sometimes referred to as preservice teachers) as well as experienced teachers who have returned to complete a master's course (see content and participants in Section 3).

To analyze the data, thematic analysis (Braun & Clarke, 2006) is applied to the open-ended survey answers which were given to the student teachers as exit tickets. For exit tickets 1 and 3, themes and sub-themes are counted and ranked according to frequency. For exit ticket 2, which focuses on listing pedagogical activities and suggestions for improvement, frequency is not taken into consideration because of the diversity of proposals that were submitted by the students. A fuller explanation of the exit tickets is provided in Section 3 and their content is outlined in detail at the beginning of the analysis of each ticket (Section 4).

Thematic analysis is a widely used approach to study qualitative data in social sciences (Braun & Clarke, 2006). It is particularly useful for this study as it helps focus on identifying and understanding the major themes and sub-themes in qualitative data corpus and can lead to a wide-angle view of and insight into the emergent patterns (Boyatzis, 1998; Elliott, 2018), for instance, the perspectives of the student teachers in our dataset. This method involves a systematic process of coding and theme development, which can be conducted inductively or based on prior research and theory (Boyatzis, 1998). Verification procedures, such as peer debriefing and maintaining an audit trail, are crucial for ensuring the credibility of the analysis (Scharp & Sanders, 2018).

The steps taken for the thematic analysis consisted of first becoming familiar with the data by the two researchers/authors of the paper. Initial notes of phrases or ideas that encapsulated the responses were used to organize the data into meaningful groups (themes). These themes were then cross-examined, culled, and counted before deciding on sub-themes that best categorized the data groups. This approach aligns with the six-phase process proposed by Braun and Clarke (2006), which includes familiarization with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report. Such a structured yet flexible approach allows for a

comprehensive understanding of the data, facilitating the identification of patterns and insights relevant to the research objectives.

3. Context of Data Collection

The data were collected during the implementation of a two-class course, designed and carried out telecollaboratively between two universities, one in the USA (n = 29) and the other in Spain (n = 17). The students are studying to become language teachers (in the USA, some of the students already have experience in teaching). The languages they will teach vary. All of the student teachers in Spain are in their final year of their degree, studying to become English as a Foreign Language (EFL) teachers in primary education (with the exception of one exchange student from Norway). The students in the USA are enrolled in a master's degree in foreign language teaching and come from different countries; thus, they have a wider diversity of languages they will be teaching (e.g., Spanish, Russian, Chinese, EFL).

The course is focused on how to plan, develop, implement, and assess Technology Enhanced Project-Based Language Learning (TePBLL), with the use of vanguard technologies. During their 10-week Virtual Exchange (VE), students are presented to, engage with and critically reflect on three 'technology blocks' that last approximately 1 month each. These are based on Artificial Intelligence (AI), Augmented Reality (AR) and 360° images, and Virtual Reality (VR). During each 'technology block', students are first introduced to different resources and teaching examples of its use before they are asked to select one tool to create, in online groups, a teaching proposal that utilizes the technology in that block. Throughout each block, students are asked to complete 'exit tickets' (approximately one per 1.5 weeks) that they then use to develop deeper reflections on the technology at the end of each block.

The analysis in this article is based on the student teacher responses to the three exit tickets for the block on Artificial Intelligence. An exit slip (also known as an exit ticket, which is the term we used) is a quick, informal assessment tool used at the end of a lesson or class to gauge students' understanding, gather feedback, or prompt reflection (Leigh, 2012). It has been found that exit tickets can support pupils' understanding and increase their sense of accountability for their own learning (Basco, 2021). Typically, students respond to a brief question, prompt, or task on a piece of paper or digitally before leaving the classroom. In our case, the exit tickets were digital (we used google forms) and the students had a timeframe of approximately 72 h to answer each one. Not all of the students answered each exit ticket, although the lowest completion rate was 92% (exit ticket 2).

The analysis of the data was conducted within the framework of the university's doctoral program in education, which includes an annual review process covering data management and ethical considerations. The research strictly complies with the university's *Code of Good Practice*, which aligns with the principles outlined in the Belmont Report (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1979), ensuring respect for persons, beneficence, and justice.

Students involved in the study provided informed consent at the beginning of the course. They explicitly agreed to allow the use of anonymized data from their assignments, with the understanding that this data usage would not affect their final marks, and they could withdraw their consent at any moment. Names of the student teachers were removed before the data were analyzed.

4. Analysis

4.1. Exit Ticket 1

Students answered exit ticket 1 soon after beginning the technology block on AI. At this point, students had been introduced to and experimented, hands on, with an AI tool (beta version) designed for language lessons. They had also been asked to research and choose two AI tools they felt were potentially useful for language learning or practice. They presented their chosen AI resources to their classmates before choosing one, in groups, to design an AI-supported language activity and/or full lesson (they had not yet completed this final activity).

In the first exit tickets, learners were asked these three questions:

- How do you currently use AI in your life? What uses (as learner, as teacher, in general)?
- What do you think about AI in language education?
- How do you think you will use AI as a teacher?

Students were also asked "*Is there anything new or surprising for you thus far?*" and "*other comments*" (this was optional and therefore was not analyzed because not everyone chose to respond).

4.1.1. Daily Uses of AI

In response to the first question about their current use of AI, the responses indicate that the student teachers feel they are already integrating AI into their lives as both educators and learners. As can be seen in Table 1, their predominant use is for learning support, although they also indicate that they are using AI as a teaching aid (some for their internships; others are already teachers in schools who are doing an MA). Interestingly, although the question did not directly ask the respondents to explain any misgivings, some answers were circumspect regarding the attributes of AI (e.g., discomfort due to a lack of familiarity, fears of dependence or related ethical issues). These findings are similar to Shin's (2020) findings that preservice teachers expressed concerns about potential adverse effects on students, such as the negative impact on their learning skills due to their over-reliance on AI technology.

Table 1. Uses of AI in daily life.

Theme		Frequency
Learning Support		48
	Sub-themes	
	Idea Generation and Inspiration	18
	Writing and Language Assistance	12
	Concept Clarification	10
	Research Aid	8
Teaching Aid/Resource Preparation		26
	Sub-themes	
	Lesson Planning and Activity Ideas	15
	Language Learning Support	6
	Assessment and Evaluation	5

Table 1. *Cont.*

Theme		Frequency
General Use (Teaching, Learning, etc.)		32
	Sub-themes	
	Information Retrieval	14
	Productivity and Efficiency	10
	Problem Solving	8
Circumspection towards AI		
Theme		
Lack of Familiarity or Comfort		24
	Sub-themes	
	Cautious/Reluctant Integration	12
	Limited Experience with AI	8
	Fear of Misuse	4
Concerns: Creativity/Dependency		10
	Sub-themes	
	Fear of Creativity Loss	6
	Fear of Dependency on AI	4
Ethical and Practical Reservations		3
	Sub-themes	
	Privacy and Safety Concerns	3

Several responses alluded to AI's value as a learning aid (e.g., simplifying or clarifying complex ideas, explaining statistical assignments, helping with academic writing, researching topics, etc.). They also indicated that AI was useful for brainstorming, generating new ideas, and overcoming creative blocks (as both learners and teachers). Along these lines, AI was described as helpful in generating lesson plans and activities, helping to personalize learning activities for students and to structure evaluation criteria, thereby supporting fair and accurate assessments. These findings align with other studies that found that following several weeks of training, preservice teachers had a positive perception of AI for material development, simplifying tasks (Karataş & Yüce, 2024) and other areas such as "education purpose and content, education method and environment, professor learning activities, and education application and expectation" (Park, 2020, p. 710).

> "*Nowadays, as a learner, AI sometimes helps me with writing assistance (for example Grammarly) or with some study support (ChatGPT). I work as an English teacher in summer camps and AI helps me with lesson planning, brainstorming, improving the activities and personalizing learning.*"

At the same time, there were some cautionary tones in the responses. Comparable to participants' answers in Hur's 2024 study, a smaller number of respondents claimed to have little or no experience with AI and a lack of familiarity with the resource was linked to fears of using AI incorrectly or unsafely, perhaps leading to dependence on the resource, leading to a decrease in creativity in general (less capacity for problem solving and critical thinking).

> "*Artificial intelligence (AI) is something that I have never used on my initiative. The few times I have used ChatGPT, for example, it is because it has been requested on a university project. Personally, I would not say I like to use artificial intelligence, as I feel like I do not know enough to use it correctly. I am scared of using AI because much knowledge is required in order to use these programs safely.*"

Despite some reservations, the student teachers seem to feel it is their role to ensure that AI is used appropriately with their students. These findings echo Hur's (2024) study on preservice teachers' feelings that AI is an inevitable 'partner' in future teaching.

> "*I do not currently use AI as a resource in my daily life. Even so, It is true that is being used in my context with more and more regularity every day. (. . .) Despite I am not keen on the use of AI, in the last month I have realized that it is the future. In consequence, it is of utmost importance to learn how to use it in a responsible way to be able to teach it and take profit of its benefits.*"

4.1.2. Perspectives of AI for Language Teaching

When asked about their perspective of AI for language teaching (Q2), the student teachers seem to perceive AI as a promising but complex tool in language education. On the one hand, they value the possibility of AI as supplementary to teaching and as support for personalized and engaging learning (see Table 2), while on the other hand, they are somewhat wary about dependency, highlighting the need for balanced use and for integrating the use of AI as an integrated, complementary role in language education in order to maximize the benefits while minimizing potential drawbacks.

Table 2. AI for language teaching.

Theme		**Frequency**
AI as Supplementary Learning Tool		**16**
	Sub-themes	
	Complement, Not Replacement	10
	Support for Beginners	3
	Multi-Functionality	3
Personalized Learning		**15**
	Sub-themes	
	Personalization for Specific Needs	7
	Always Available	5
	Adaptable, Personalized Feedback	3
Ethical and Practical Concerns		**13**
	Sub-themes	
	Cheating and Dependence	6
	Critical Thinking and Control	4
	Potential to Replace Human Teachers	3

Table 2. *Cont.*

Theme		Frequency
Learner Engagement		**12**
	Sub-themes	
	Gamified Learning	6
	Diverse Learning Tools	4
	Motivation (Young Learners)	2
Concerns: Screentime; Health		**6**
	Sub-themes	
	Impact on Children's Health	4
	Balance Digital/Non-Digital Learning	2
Autonomy Practice/Skills		10
	Sub-themes	
	Skill Building in Core Areas	5
	Feedback for Self-Improvement	3
	At-Home Language Practice	2
Teacher AI Literacy		8
	Sub-themes	
	Need for Teacher Proficiency	4
	Awareness AI Benefits/Drawbacks	3
	Ethical Use Training for Students	1
AI in Future Language Education		9
	Sub-themes	
	Inevitable	4
	Expanding Opportunities	3
	Balance Innovation with Caution	2

The most frequent response was related to the theme of AI as a supplementary learning tool to mainstream (what some called 'traditional') education methods. They are convinced that AI can enhance teaching and learning but cannot replace quality classroom learning. This resonates with other studies regarding the complementary role of AI (Liang et al., 2021) or as the participants in Karataş and Yüce's (2024, p. 311) study state, AI "should assist, not substitute, human interaction in education". The student teachers in this study recognize its potential for supporting language acquisition but emphasize that AI should supplement rather than replace direct instruction from teachers.

> "*AI is not a tool to substitute face-to-face learning but rather to accompany and complement it.*"
>
> "*It has to be an extra tool to their main sources (textbooks, etc.), not the main one.*"
>
> "*Teachers will always be needed in a classroom to guide children's learning progress as well.*"

Corroborating the results of Karataş and Yüce (2024) and Shin (2020), the student teachers also view AI's possibility of offering personalized, on-demand learning and feedback as key advantages, highlighting its potential to customize resources, provide tailored practice and offer feedback in order to address learners' unique needs outside regular class hours.

> "*AI can provide personalized learning experiences in order to meet individual needs. This can help students stay engaged and motivated. Also, AI can provide feedback on language assignments, allowing teachers to spend more time on personalized instruction.*"

At the same time, the respondents indicate that they have some concerns about ethical issues, such as their dependency on AI, its improper use for homework, copying, and a lack of critical thinking (see similar results by Eyüp & Kayhan, 2023; Hur, 2024). There are also worries about over-reliance on AI leading to reduced creativity and autonomy, and some feel that it is their role to carefully guide learners in its use.

> "*While AI has benefits, we should not let a machine make the path too easy for teachers and students.*"

> "*It is useful, but it has downsides too. I would want them to use AI by encouraging them be conscious while doing so. They must utilize it by taking ethical considerations into account and being responsible. That is why I must guide them as their teacher.*"

Another aspect of AI that the student teachers value is its potential to create engaging, interactive, and fun language activities. These qualities are seen as especially valuable for younger learners who will be motivated through gamification and other interactive exercises.

> "*In my opinion, AI is a good opportunity for students to learn better and in a more interactive way, although it should not be the focus of the learning.*"

Similarly, they appreciate AI for its potential opportunities for autonomous language practice outside the classroom, particularly in developing writing, speaking, reading, and listening skills. The respondents also note that AI can provide feedback, supporting continuous improvement and learner responsibility.

> "*Honestly, I think it's a great tool for learning and teaching as it can provide many ways to help both students and teachers with the foreign language.*"

> "*Students can immediately see why their words are misspelled or better ways to write their texts. By watching corrections they get used to spelling the right way. But if not used correctly there is a chance that students are unable to write coherent texts without them.*"

At the same time, some of the respondents worry about excessive screen time that may come with AI use, particularly for younger students. There is an insistence on the need to balance AI's use to avoid negative health impacts.

> "*I worry about how it can consequently result in excessive hours in front of blue screens, which can be damaging for children.*"

> "*Everything in excess is bad.*"

The student teachers recognize the role of the teacher to mitigate these potential pitfalls. Supporting the findings by Hur (2024), the participants in this study stress the importance of teacher training and AI digital literacy in order to effectively incorporate AI into education. This implies developing skills in AI, not only the teachers but also the students, to harness its benefits responsibly and maximize its educational potential.

> "*Educators have to be very conscious of its use and become 'experts' on the use of these tools.*"

"*Teachers should learn how to use these programs safely before using them with children.*"

"*It is important that teachers get more training on how to use it for education instead of just avoiding it.*"

Overall, a forward-looking theme emerges. The student teachers predict that AI will play an increasingly central role in language education, and they express a willingness to explore and adapt AI to new educational contexts.

"*AI is the future and will have big importance in all areas, including education.*"

4.1.3. (Future) Use of AI for Language Teaching

Finally, for exit ticket 1, the third question was as follows: "*How do you think you will use AI as a teacher?*" In answer to this question (see Table 3), the student teachers demonstrate a balanced perspective regarding the integration of AI into language teaching. On the one hand, they are optimistic (or, in some cases, more resigned to the inevitability) about AI's potential to drive classroom innovation. Many of them think that AI will make language learning more interactive, engaging, and personalized through gamification, differentiated instruction, and rapid feedback tailored to individual student needs. For themselves, AI will help them simplify routine tasks (e.g., grading, content and material development), ensuring more time for them to interact meaningfully with their students. However, this optimism is tempered by concerns about overdependence on the use of AI which may undermine critical and creative thinking and learner autonomy. This renders the need to seek out training and information about AI before fully embracing it as a tool in their future teaching.

Table 3. Anticipated AI use as a teacher.

Theme		Frequency
Classroom Innovation		20
	Sub-themes	
	Interactive Tools	9
	Gamified Exercises	6
	Real-Time Adaptation	5
Differentiated Instruction		18
	Sub-themes	
	Tailored Learning Paths	8
	Adaptive Feedback	6
	Support for Diverse Levels	4
Efficiency and Productivity		15
	Sub-themes	
	Automated Grading	7
	Resource Generation	5
	Streamlined Assessments	3

Table 3. *Cont.*

Theme		Frequency
Ethical Considerations		12
	Sub-themes	
	Preventing Over-Reliance	5
	Fostering Critical Thinking	4
	Integrity in AI Use	3
Teacher AI Literacy		10
	Sub-themes	
	Need for Ongoing Training	4
	Awareness of AI's Role	4
	Safe and Responsible AI Use	2

A prominent theme is the belief that AI will drive classroom innovation, making learning more interactive and engaging. In particular, the student teachers anticipate using AI to enhance traditional teaching such as gamification and helping them to make real-time adaptations to their students' progress and needs. For them, AI will support teaching that truly motivates learners with games and other interactive tools. This capacity to quickly adapt also lends itself to differentiated teaching and learning through AI-supported, tailored feedback and additional language practice for students according to their individual needs as well as providing adapted content and activities to more advanced students who are ready for more challenging materials.

> "*AI could allow me to differentiate lessons more effectively, offering easier tasks for some and more complex ones for others, all while giving real-time feedback that helps students learn at their own pace.*"

Along the lines of the studies mentioned above (Hur, 2024; Karataş & Yüce, 2024; Shin, 2020; Zhang et al., 2023), these future teachers also view AI as a potential resource for them to be more efficient in their teaching. They mention using AI to streamline assessment, giving them more time for personalized teaching as well as using AI to take over more routine tasks (along the lines of those mentioned above in differentiated teaching) as well as helping teachers produce and create materials. The main point is that AI can free up time for them to focus their teaching on creatively and critically engaging with their students and add profundity in their support of the learning process.

> "*Automating grading and generating resources with AI would help me focus more on interacting with my students directly, which is always limited due to the time taken by administrative tasks.*"

Despite the above-mentioned benefits, the student teachers also express caution about the use of AI. In particular, they seem concerned with ethical issues, as well as the impact of AI learners' critical thinking and autonomy (Eyüp & Kayhan, 2023; Hur, 2024). They emphasize that while AI can support learning, it is essential to use it judiciously, ensuring students do not become overly dependent on AI for easy solutions.

> "*We have to be careful that students don't rely too much on AI for answers. It's important to use AI to enhance learning, not to replace essential thinking and problem-solving skills.*"

For the participants, the need for continued training on AI in order to have a clear understanding of AI's benefits and limitations will be essential for them; otherwise, they may not be able to integrate these technologies responsibly and effectively into their own teaching practices. Significantly, they are aware that this means more than only becoming familiar with the resources and the ways in which AI might enhance their teaching process and their students' learning, but also, they must be aware of and probe further into concerns about AI such as data privacy, AI bias, and the appropriate use of AI-generated content (Hur, 2024; Karataş & Yüce, 2024). Without this knowledge and awareness, they fear they will not be able to set clear boundaries for themselves or their learners and its use may be more harmful than beneficial. In short, the student teachers are aware of the need for digital literacy for both themselves and their learners.

> "*AI is evolving quickly, so staying updated on how to use it in the classroom will be essential. I need to be prepared to guide students in understanding both the advantages and potential pitfalls of AI.*"

Overall, participants in the two classes express a balanced view that is both optimistic about AI's potential to enrich language teaching while, at the same time, cautious about its limitations, ethical challenges, and their own preparedness to effectively utilize AI. They see their future roles as teachers inevitably involving the integration of AI, as it is 'here to stay' but that it must be understood as an additional resource, not a replacement to quality teaching. In order to achieve this, these future teachers underscore the importance of training, continuous education and personal research. Their responses suggest a wary readiness to adapt AI to their future teaching, with the aspiration to use it in a way that it truly benefits their students' language learning process.

4.2. Exit Ticket 2

By the time students responded to exit ticket 2, the students had worked on a draft of their AI activity/lesson and received peer and teacher feedback and had listened to a talk from two experienced teachers who integrated AI into a telecollaborative project. The students were given the following instructions for their reflection in exit ticket 2:

Use an AI tool to request five ideas for X group of learners (X refers to a specific age, language level and any other characteristics you would like). Copy and paste the answer here.

'X' is for each respondent to decide. You may choose a specific level in primary, secondary, etc.

Critically engage with key points of the AI answer. Point out what you think is correct, what you feel is inaccurate, too generic, etc. Identify where you would change the response and explain why.

For the sake of brevity, the activities are not fully explained here, only a list of the main categories according to activity type and target level (age):

- Storytelling (young learners);
- Games and scavenger hunts (young learners);
- Explaining content (young learners);
- Uncommon, engaging and fun activities (young learners, special needs; low-level language learners);
- Drama, role-playing, and interviews (young learners; older learners with specific interests; low-level language speakers);
- Coloring and miming (very young learners under 5 years of age);
- Homework ideas (young learners);
- Using technology for unmotivated learners (young learners);
- Oral production (older learners);

- Using AI for improved writing (university-level EFL learners);
- Debates, discussions, presentations, and group projects (upper-level EFL learners);
- Creative writing: comics, stories, descriptions, news trailers, films, newspapers, poetry, etc. (lower and upper language learners).

Likewise, because of the nature of the question, creating a table is unwieldy and too long. Instead, we highlight the main critical points brought out by the student teachers.

Several of the students found the activities 'fun' and 'dynamic' but 'classic' or 'traditional'. Other criticisms included the lack of sufficient information or descriptions of how the activities could be implemented in the classroom.

> "*While this activity engages students' senses while using descriptive vocabulary, more information is needed to know how to use this acitivty [sic] in an English classroom.*
>
> *Suggestions: We could have a follow-up acitivty [sic] where students do a glossary about the vocabulary used to describe the elements.*"
>
> "*This is a positive and engaging activity for students with dyslexia, although it might be too generic, to make it less genetic and more detailed it could provide some examples of the activities or provide suggestions on books or stories that could be used for this activity.*"

They found that the numerous examples were useful, even if they did not always agree with the focus of the overall activity or found them too 'generic' or 'superficial' (see also Hur, 2024; Karataş & Yüce, 2024). Similarly, some of the respondents found the answers to be repetitive or lacking purpose, thus were not sufficiently meaningful for the learners. Similarly, some respondents pointed out that AI did not propose 'pre-tasks', 'follow-up' or other means of coherently sequencing or tying together activities (e.g., creating 'final output') in order to ensure the learners could perceive their own progress and purpose of the activities.

> "*Overall information is quite generic, but what I liked is that a lot of examples are provided, which makes the student's learning easier.*"
>
> "*the activity is creative, although it resembles the first one, only changing the format. Again, it could be more specific.*"
>
> "*I would add a real purpose to the actions to make the activity more meaningful for the students to remember and be engaged. For example, include a real context for each action. Clapping, in a theatre, jumping because you want someone who's too far away to notice you, running from someone as you are playing a game in the playground. . . This way we are adding meaning to the movement and encouraging them to use the words in their daily lives.*"
>
> "*(. . .) create a final product for ensure the students remember the words and the meanings.*"
>
> "*I think that before carrying out this activity there should be a previous work in which students will be learning the vocabulary needed in each image/situation/context. I would add some previous sessions where some verbs and nouns will be taught. This way students will have a scaffolding to analyze the images.*"

Several of the student teachers demonstrated that they recognized they had not given adequate prompts; however, they were still able to improve on the AI-generated teaching proposals, including bringing in a transdisciplinary approach.

> "*Final reflection: These ideas were very helpful, and pretty concise; I would suggest it provides more examples, and it could give some examples on how to grade it or assess it.*
>
> *I like that all the activities use a different type of focus: visual arts, through performance, writing skills, etc.*"

> "*I would rewrite the prompt to be more detailed.*
>
> *1. Specify not only the age of the group, but also the occupation*
>
> *2. Mention whether the group activity will be online, or offline*
>
> *3. Think of a common goal learners should achieve. Focus the activity on the goal.*"
>
> "*This activity could be done in collaboration with the math class as they will have to buying.*"

The answers seem to reflect earlier points made by the respondents; that is, AI is a good resource and quite useful, but it cannot replace quality teaching. As one student teacher puts it, "*when using AI, it gives us a very generic and simple idea, but as teachers we have to go further, and think outside the box*."

4.3. Exit Ticket 3

At the time of completing exit ticket 3, the students had completed and submitted their final version of their AI activity/lesson after having demonstrated the activity to their classmates for a final round of feedback and reflection. The third and final exit tickets asked the following:

- How has your understanding of this topic of AI evolved? What new perspectives do you have?
- Critically engage with your group's AI lesson. What is one positive aspect that you think should be highlighted? Why?
- Critically think about your group's AI lesson. What is one aspect that you would change? Why?

As indicated in Table 4, the responses for the second and third questions from exit ticket 3 varied widely and many of them were more related to pedagogical aspects of their activity design rather than focusing on AI use in the teaching of languages; therefore, we only consider the responses to the first question in exit ticket 3.

In responding to how their perspectives of AI had evolved, the student teachers appear to have moved from initial skepticism or a limited understanding of AI to a more nuanced, optimistic, and critical perspective (see also Karataş and Yüce's (2024) and Park's (2020) studies regarding the nuanced evolution of student teachers' perspectives on AI after a designed pedagogical intervention). In exit ticket 1 (completed at the beginning of the AI tech block), many of the participants in our study declared that they felt that AI was principally 'an easy way out' of tasks for students. According to their responses in exit ticket 3, they now see AI as a potentially transformative tool that can enhance teaching and learning, provided it is used thoughtfully and strategically. They are more aware of their own roles, as educators, to ensure that AI is used to support learning and even to initiate more collaborative, transdisciplinary approaches to language teaching.

Resonating with the results found in other studies (Hur, 2024; Shin, 2020), through the theoretical and empirical introduction to AI resources, the student teachers stated that their perception of AI had changed, ranging from merely seeing the possibilities AI could bring to their classrooms to considering AI as a partner in creativity and collaboration. Whereas some had initially considered AI in a rather negative light, by the third exit tickets, the most frequent theme that emerged from their answers dealt with its pedagogical benefits.

> "*This topic has contributed to my understanding of how AIs can be pedagogically incorporated into language learning environments. Seeing different AI tools and how to use them for both language learning and lesson preparation was very beneficial.*"
>
> "*At the very beginning of the course I wasn't familiarized with AI, now I see all the positive aspects and that this brings. I was concerned that AI would be a set back in*

educative practices but now I've learned to use it and to know that the most important part is the learnings the students acquire."

"*beyond automation, AI is becoming a collaborator in creative processes, whether through generating art, music, or helping educators design innovative activities. I used to think that AI was a tool for teachers (for planning or creating materials) and, if not, for students but only in technology classes or similar subjects. Now I see that it has potential that goes far beyond the technology class and can be used in other projects and subjects to enrich lessons and learning experiences.*"

Table 4. Evolution of understanding of AI.

Theme		**Frequency**
Pedagogical Benefits of AI		99
	Sub-Themes	
	Enhancing Lesson Planning	24
	Promoting Student Engagement	19
	Personalized Learning	18
	Supporting Diverse Learners	15
	Time-saver (for Teachers and Learners)	11
	Enhancing Creativity	7
	Interdisciplinary	5
Change in Perceptions of AI		61
	Sub-Themes	
	Recognizing Broader Applications	31
	Overcoming Initial Misconceptions	24
	Shift in Attitude	6
More Critical Perspective		40
	Sub-Themes	
	Avoiding Dependence	16
	Awareness of Limitations	14
	Importance of Responsible Use	10
Hands-on experience of AI Tools		22
	Sub-Themes	
	Learning About New Tools	18
	Practical Application	4
Shifting Role of Teachers		13
	Sub-Themes	
	Teachers as AI Integrators	7
	Teacher–AI Collaboration	6

The study participants affirmed that they found AI far more versatile than they had originally thought. According to them, it can help support the teacher more inclusively, save time when planning and while teaching (easing the more mundane, repetitive tasks) and, as mentioned above, open horizons to more collaborative, interdisciplinary learning.

> *I realized that AIs are actually closer than I think they were. I could use them not only to ease searching for information, it is extremely helpful to come up with classroom contents such as PPTs, activities, and even "teacher jokes"*
>
> *I did not realize that AI could be applied to so many fields or provide such a wide array of diverse tools.*
>
> *Having seen a few presentations by my colleagues, I have come to appreciate the user-centric design of many AI tools. What books and standard class materials lack can be easily supplemented through a well-designed integration of AI. We have seen several excellent AI tools that students can use independently for extra practice with immediate, personalized feedback.*

As one student teacher explains, for her, AI is no longer 'the enemy'; it has become a way to provide students with more expansive, 'intercompetencial' knowledge that helps learners connect and integrate concepts for a deeper understanding and insights.

> *At first, I thought that AI would be a huge enemy over education because I thought children would use it for cheating and not for learning. However, after the sessions we have had, now I have another perspective. I can say that as a teacher that I may use these resources and tools for learning language. (. . .) So, as a future teacher, I'm interested in taking profit of the activities that we developed as it can help maintain student's attention on our planned projects. This way, their learning will become bigger and their intercompetencial knowledge will also increase and with these the ability of relate all their knowledge when it's necessary.*

5. Discussion

These results underscore the subtle ways that student language teachers approach AI integration in classroom practice. Through the exploration, discussion and use of AI tools in designing a language learning activity, the participants discovered its transformative power to support and promote enhanced language learning. They also found that AI activities can motivate students more. This aligns with emerging evidence that AI-powered tools, including chatbots and intelligent tutoring platforms, facilitate student involvement and agency (Annamalai et al., 2023; Warschauer & Xu, 2024). At the same time, as Liang et al. (2021) point out, these future teachers are aware that AI cannot replace them; it can only help them become better teachers if they adapt their own teaching practices to be more responsive to the students, using the AI resources as a resource to do so. "*Teachers will always be needed in a classroom to guide children's learning progress as well.*"

Our study finds significant overlaps with other studies focused on preservice teachers' attitudes towards AI. Firstly, similar to Shin's (2020) study, our study indicates that student teachers are concerned about the potential negative effects of AI on students, particularly regarding the over-reliance on technology, which could affect learning skills and creativity. This may be in part due to insufficient experience with AI, leading to fears of misuse or overdependence on technology, potentially stifling creativity and critical thinking. These findings are similar to Hur's 2024 study that highlights how a lack of familiarity can result in caution and hesitation regarding AI's integration into teaching. Along these lines, our study, like Eyüp and Kayhan's (2023), Hur's (2024) and Karataş and Yüce's (2024), acknowledges that preservice teachers must be aware of ethical issues, such as data privacy,

AI bias, and the proper use of AI-generated content. These concerns are important for ensuring that AI is used ethically and responsibly in education.

At the same time, as with findings by Karataş and Yüce (2024) and Park (2020), there is a tendency towards more positive perceptions of AI after undergoing training, particularly in areas like material development, simplifying tasks, and enhancing various aspects of teaching and learning environments. Also, echoing the findings of Karataş and Yüce (2024) and Shin (2020), the participants in this study see AI's ability to offer personalized, on-demand learning and feedback as key advantages. Moreover, the student teachers in this study see AI as 'inevitable' or, as Hur's (2024) participants declare, unavoidable 'partners' in future teaching, and consequently, they emphasize the importance of teacher training and digital literacy, particularly in AI, to effectively integrate it into the learning process.

While most research has focused on AI-supported writing, reading, and vocabulary acquisition, in their activities, the students recognized other potential uses, for instance, to promote oral communication (in older students). This is in alignment with another study that shows that ChatGPT and voice assistants can facilitate oral communication in English-speaking students, thus contributing to the promotion of efficient and pragmatic language usage (W. Zhou, 2023). The participants also appreciated the fact that AI could provide immediate, individualized feedback to enable adaptive learning (Betaubun et al., 2023), in particular when dealing with special needs students or when there is high diversity in the classroom.

The study participants saw that AI could help them generate and produce content, materials and even lesson plans (Sánchez Vera, 2024); however, they were critical of the 'generic' ideas produced by AI (Hur, 2024; Karataş & Yüce, 2024): "*I would add a real purpose to the actions to make the activity more meaningful for the students to remember and be engaged.*" When prompted to reflect on these ideas, they were able to come up with more innovative and creative ways for AI use that could be integrated into highly participative lessons, implying that they will be able to integrate its application through a more constructivist lens (Cabero-Almenara et al., 2024). "*This topic has contributed to my understanding of how AIs can be pedagogically incorporated into language learning environments. Seeing different AI tools and how to use them for both language learning and lesson preparation was very beneficial.*"

Still, the student teachers are aware of its potential pitfalls. They warned of AI overload, moral problems, and the loss of critical and creative intelligence. Such worries fit into the larger literature that highlights the importance of fair AI integration while preserving the human aspect of teaching (Nguyen & Tran, 2023; Sidiropoulos & Anagnostopoulos, 2024).

This study corroborates studies on preservice teachers and AI (Hur, 2024; Karataş & Yüce, 2024; Park, 2020), which argue that following their immersion in its application and hands-on use of the tools for activity design, student teachers find AI to be a welcome additional resource for supporting the learning process. Inevitably, the appropriate training of teachers to help them work around obstacles and to take full advantage of AI potential is critical. These results also highlight the need for detailed training programs that place a strong emphasis on ethics and pedagogy.

6. Conclusions

There was a perceptible shift in perceptions following the hands-on experience with AI. Moving from AI 'as the enemy', overall, the student teachers feel that AI tools can significantly enhance language learning by motivating students, promoting involvement, and fostering agency, although they are fully aware of the challenges they will probably face in the future regarding AI dependence and its overuse, which may be detrimental to learners' capacity for problem solving and creative thinking. They valued AI's capacity to provide adaptive learning experiences and support diverse classrooms, including special

needs students, and to help them produce materials, content and assessment strategies. At the same time, they seemed certain that AI will not replace them as teachers, as long as they use it to support and improve their teaching practices by enabling more responsive, adaptive, and student-centered approaches. As one student put it during a class, "AI will only replace us if we are BAD teachers".

This study contributes to the expanding conversation on AI in teacher education by exploring how student teachers use and experience AI technologies. It is recognized that this study is limited in the number of participants and scope; however, even though the results are tentative, they lean towards the positive. Participants recognize AI as capable of personalizing learning, increasing productivity, and facilitating language acquisition in novel ways through chatbots and intelligent tutoring systems (Annamalai et al., 2023; Warschauer & Xu, 2024). This small study demonstrates the importance of effective teacher training programs for overcoming misconceptions, fears and challenges of AI use in language education. Teacher education must demonstrate how to maximize AI's benefits, with a strong emphasis on ethics and pedagogy to ensure its fair and thoughtful integration. Teacher education should also address AI literacy and prepare teachers to use AI responsibly and creatively in order to make the most of it.

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References

Abdelkader, A. A. M., Hassan, H., & Abdelkader, M. (2024). The role of artificial intelligence in designing higher education courses: Benefits and challenges. In M. D. Lytras, A. Alkhaldi, S. Malik, A. C. Serban, & T. Aldosemani (Eds.), *The evolution of artificial intelligence in higher education* (pp. 83–97). Emerald Publishing Limited. [CrossRef]

Amaral, L. A., & Meurers, D. (2011). On using intelligent computer-assisted language learning in real-life foreign language teaching and learning. *ReCALL*, *23*(1), 4–24. [CrossRef]

Annamalai, N., Ab Rashid, R., Hashmi, U. M., Mohamed, M., Alqaryouti, M. H., & Sadeq, A. E. (2023). Using chatbots for English language learning in higher education. *Computers and Education: Artificial Intelligence*, *5*, 100153. [CrossRef]

Basco, R. (2021). Exit slips as a predictor of academic performance. *Journal of Education, Management and Development Studies*, *1*(2), 52–61. [CrossRef]

Betaubun, M., Rokhmah, D. E. L., & Budiasto, J. (2023). Personalized pathways to proficiency: Exploring the synergy of adaptive learning and artificial intelligence in English language learning. *Technium: Romanian Journal of Applied Sciences and Technology*, *17*(1), 60–66. [CrossRef]

Boyatzis, R. E. (1998). *Transforming qualitative information: Thematic analysis and code development*. Sage Publications.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. [CrossRef]

Cabero-Almenara, J., Palacios-Rodríguez, A., Loaiza-Aguirre, M. I., & Rivas-Manzano, M. d. R. d. (2024). Acceptance of educational artificial intelligence by teachers and its relationship with some variables and pedagogical beliefs. *Education Sciences*, *14*(7), 740. [CrossRef]

Casal-Otero, L., Catala, A., Fernandez-Morante, C., Taboada, M., Cebreiro, B., & Barro, S. (2023). AI literacy in K-12: A systematic literature review. *International Journal of STEM Education*, *10*(1), 29. [CrossRef]

Cavalcanti, A. P., Barbosa, A., Carvalho, R., Freitas, F., Tsai, Y. S., Gasevíc, D., & Mello, R. F. (2021). Automatic feedback in online learning environments: A systematic literature review. *Computers & Education: Artificial Intelligence*, *2*, 100027. [CrossRef]

Celik, I. (2023). Towards intelligent-TPACK: An empirical study on teachers' professional knowledge to ethically integrate artificial intelligence (AI)-based tools into education. *Computers in Human Behavior*, *138*, 107468. [CrossRef]

Elliott, V. (2018). Thinking about the coding process in qualitative data analysis. *The Qualitative Report*, *23*(11), 2850–2861. [CrossRef]

Ertmer, P. A. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration? *Educational Technology Research and Development*, *53*(4), 25–39. [CrossRef]

Eyüp, A., & Kayhan, S. (2023). Preservice Turkish language teachers' attitudes toward artificial intelligence in education. *Journal of Educational Technology Research*, *11*(4), 43–56. [CrossRef]

Hew, K. F., Huang, W., Du, J., & Jia, C. (2023). Using chatbots to support student goal setting and social presence in fully online activities: Learner engagement and perceptions. *Journal of Computing in Higher Education*, *35*, 40–68. [CrossRef]

Hopcan, S., Türkmen, G., & Polat, E. (2023). Exploring the artificial intelligence anxiety and machine learning attitudes of teacher candidates. *Education and Information Technologies*, *29*(6), 7281–7301. [CrossRef]

Hur, J. W. (2024). Fostering AI literacy: Overcoming concerns and nurturing confidence among preservice teachers. *Information and Learning Sciences*. [CrossRef]

Karataş, F., & Yüce, E. (2024). AI and the future of teaching: Preservice teachers' reflections on the use of artificial intelligence in open and distributed learning. *International Review of Research in Open and Distributed Learning*, *25*(3), 304–325. [CrossRef]

Kim, H., Yang, H., & Lee, J. H. (2022). Design principles and architecture of a second language learning chatbot. *Language Learning & Technology*, *26*(1), 1–18. Available online: http://hdl.handle.net/10125/73463 (accessed on 21 October 2024).

Lee, S., & Jeon, J. (2024). Enhancing pre-service EFL teachers' TPACK through chatbot-integrated lesson planning projects. *Language Learning & Technology*, *28*(1), 1–20. Available online: https://hdl.handle.net/10125/73598 (accessed on 13 November 2024).

Leigh, S. R. (2012). The classroom is alive with the sound of thinking: The power of the exit slip. *International Journal of Teaching and Learning in Higher Education*, *24*(2), 189–196.

Liang, J. C., Hwang, G. J., Chen, M. R. A., & Darmawansah, D. (2021). Roles and research foci of artificial intelligence in language education: An integrated bibliographic analysis and systematic review approach. *Interactive Learning Environments*, *31*(7), 4270–4296. [CrossRef]

Liu, G. L., & Wang, Y. (2024). Modeling EFL teachers' intention to integrate informal digital learning of English (IDLE) into the classroom using the theory of planned behavior. *System*, *120*, 103193. [CrossRef]

Moorhouse, B. L., Wong, K. M., & Li, L. (2023). Teaching with technology in the post-pandemic digital age: Technological normalisation and AI-induced disruptions. *RELC Journal*, *54*(2), 311–320. [CrossRef]

Moulieswaran, N., & Kumar, N. S. P. (2023a). Amelioration of Google Assistant—A review of artificial intelligence stimulated second language learning and teaching. *World Journal of English Language*, *13*(1), 86–91. [CrossRef]

Moulieswaran, N., & Kumar, N. S. P. (2023b). Google Assistant-assisted language learning: ESL learners' perception and problem toward AI-powered Google Assistant-assisted English language learning. *Studies in Media and Communication*, *11*(4), 122–130. [CrossRef]

National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research. (1979). *The Belmont report: Ethical principles and guidelines for the protection of human subjects of research*; U.S. Department of Health and Human Services. Available online: https://www.hhs.gov/ohrp/regulations-and-policy/belmont-report/read-the-belmont-report/index.html (accessed on 15 November 2024).

Ng, D. T. K., Leung, J. K. L., Su, J., Ng, R. C. W., & Chu, S. K. W. (2023). Teachers' AI digital competencies and twenty-first century skills in the post-pandemic world. *Educational Technology Research and Development*, *71*(1), 137–161. [CrossRef] [PubMed]

Nguyen, T. H. B., & Tran, T. D. H. (2023). Exploring the efficacy of ChatGPT in language teaching. *AsiaCALL Online Journal*, *14*(2), 156–167. [CrossRef]

Park, J.-H. (2020). The case study on artificial intelligence based maker education for pre-service teacher. *Journal of Digital Contents Society*, *21*(4), 701–709. [CrossRef]

Sánchez Vera, M. d. M. (2024). La inteligencia artificial como recurso docente: Usos y posibilidades para el profesorado. *Educar: Revista de la Secció de Ciències de l'Educació*, *60*(1), 33–47. [CrossRef]

Scharp, K. M., & Sanders, M. L. (2018). What is a theme? Teaching thematic analysis in qualitative communication research methods. *Communication Teacher*, *32*(2), 124–128. [CrossRef]

Shin, D. (2020). An analysis prospective mathematics teachers' perception on the use of artificial intelligence (AI) in mathematics education. *Communications of Mathematical Education*, *34*(3), 215–234. [CrossRef]

Sidiropoulos, D., & Anagnostopoulos, C.-N. (2024). Applications, challenges, and ethical issues of AI and ChatGPT in education. *arXiv*, arXiv:2402.07907. [CrossRef]

Wang, Y., & Lu, X. (2023). Research on the evaluation and cultivation design of AI literacy to promote the development of cognitive Intelligence among pre-service teachers. In *Proceedings 2023 International Conference on Culture-Oriented Science and Technology, CoST 2023* (pp. 116–120). Xi'an, China, October 11–14, Institute of Electrical and Electronics Engineers. [CrossRef]

Wang, Y., Liu, C., & Tu, Y. F. (2021). Factors affecting the adoption of AI-based applications in higher education. *Educational Technology & Society*, *24*(3), 116–129. Available online: https://www.jstor.org/stable/27032860 (accessed on 23 October 2024).

Warschauer, M., & Xu, Y. (2024). Artificial intelligence for language learning: Entering a new era. *Language Learning & Technology*, *28*(2), 1–4. Available online: https://hdl.handle.net/10125/73569 (accessed on 18 October 2024).

Woo, J. H., & Choi, H. (2021). A systematic review of AI-based language learning tools. *Journal of Educational Technology Development and Exchange*, *22*(11), 1783–1792. [CrossRef]

Zhang, C., Schießl, J., Plößl, L., Hofmann, F., & Gläser-Zikuda, M. (2023). Acceptance of artificial intelligence among pre-service teachers: A multigroup analysis. *International Journal of Education Technology in Higher Education*, *20*(49), 1–22. [CrossRef]

Zhi, R., Wang, Y., & Wang, Y. (2023). The role of emotional intelligence and self-efficacy in EFL teachers' technology adoption. *The Asia-Pacific Education Researcher*, *33*(4), 845–856. [CrossRef]

Zhou, W. (2023). ChatGPT integrated with voice assistant as learning oral chat-based constructive communication to improve communicative competence for EFL learners. *arXiv*, arXiv:2311.00718. [CrossRef]

Zhou, Y. (2024). Artificial intelligence and education: End the grammar of schooling. *ECNU Review of Education*, 1–12. [CrossRef]