Evaluating the Effectiveness of Human-Centered AI Systems in Education

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Resumen This thesis examines how AI can improve human-computer interaction (HCI) and user experience in education. A systematic literature review (SLR) and LATILL case study show how AI can be used in education. The SLR examines existing literature to determine how AI affects user experience and HCI in education, highlighting personalization and adaptability of learning experiences, improved task performance, and improved user experience for teachers and students. AI implementation in education faces obstacles. Using CEFR levels and linguistic traits, the LATILL project uses a user-centered design to give students personalized guidance and support. It transforms language instruction and fosters engaging and successful learning by encouraging educator collaboration and resource sharing. This study emphasizes the importance of user experience and HCI principles in designing AI-driven educational systems. AI and user-centered design can improve learning, student engagement, and educational outcomes.

Keywords: Artificial Intelligence, Generative AI, Human-computer Interaction, User-experience, Education, Personalized Learning, SLR, Systematic literature

1. Introduction

The term .ªrtificial Intelligence"was coined during the Dartmouth Conference in 1956, where scientists like Warren McCulloch, Walter Pitts, and Alan Turing laid the foundation for AI. Neural networks and computational brain models formed the basis for AI. Since then, AI has been used in various fields [11][10][9][46]. The question of whether AI will surpass human intelligence and become superintelligent is ongoing. AI-based systems can use more powerful algorithms and capabilities to overcome the biological limitations of the human brain. This could lead to the creation of better AI systems, accelerating technological advancement [5]. Computer-based AI with human-like minds has many advantages compared to biological brains. Moore's Law ensures that hardware becomes exponentially faster and more capable, allowing AI to reason and analyze information faster than humans. Additionally, AI can access vast amounts of data stored on expanding hard drives, enabling thorough research and consideration of relevant information without slowdowns [14][13]. AI's software-based

nature makes it easy to duplicate and network. Once trained, AI can replicate itself, eliminating the need for repetitive training. Networking a group of AIs with diverse skills and compatible motivations can create a super-committee that outperforms any human committee, excelling in information sharing and problem-solving [5]. AI has various definitions and is used to solve cognitive problems, develop systems with human-like abilities, and mimic human cognition and behavior. It enables machines to approximate human reasoning, adapt to the environment, and perform tasks requiring human intelligence [24].

AI has been introduced into education, where human and AI teachers collaborate to teach subjects like English. AI tools have the potential to teach any subject. They can transform education by providing convenience, interactive and personalized learning experiences, global classrooms through virtual reality, and AI-based chatbots for personalized online learning and assessment [47][48][45].

Using computer technology in the teaching and learning of second or foreign languages is known as intelligent computer-assisted language learning (ICALL) [1]. It is a branch of computer-assisted language learning (CALL) that creates intelligent tutoring programs to give language learners individualized feedback [17]. Natural language processing (NLP), spell and grammar checkers, feedback, student models, and future directions are all possible components of ICALL systems [68].

Generative AI has improved over the years with advances in generative adversarial networks (GANs) and deep neural networks. These advancements allow computer-generated media to resemble human-produced media, opening up opportunities in various industries, including education [8][6][7]. Integrating AI into educational settings requires a focus on user interface and experience. A Systematic Literature Review (SLR) examines how AI is used in education and affects user experience, seeking to improve the user experience when integrating AI technologies into education [12].

The study focuses on using AI in educational settings to improve user experience. It includes an overview of key concepts in hiddensection 10, a systematic literature review, an analysis of research questions, implications, and importance in hiddensection 10, a case study of the LATILL project's technologies in hiddensection 10, and conclusion and suggestions for future research in hiddensection 10.

2. Theoritical Background

J.C.R. Licklider's visionary concept of a symbiotic relationship between humans and computers, as outlined in his 1960 paper "Man-Computer Symbiosis,"[1] has resurfaced in the fields of Augmented Intelligence and Human-Computer Interaction (HCI). Influential figures like Alan Kay[4] and Douglas Engelbart [3] have embraced Licklider's ideas, shaping the field of HCI and influencing user-centered technology design. The cooperative relationship between humans and

[1] `https://en.wikipedia.org/wiki/Intelligent_computer-assisted_language_learning`

computers, combining their strengths to enhance problem-solving capabilities, lies at the core of Licklider's vision. Augmented Intelligence design, focusing on human-centered approaches and ethical considerations, reinforces this symbiotic collaboration, empowering individuals and maximizing human potential in human-computer interactions [2].

HCI, a multidisciplinary field, is dedicated to designing, evaluating, and implementing interactive technologies to enhance how people interact with computers and other technology. It plays a significant role in education, contributing to designing and developing interactive computing systems that enhance the learning experience. HCI researchers collaborate with educators and instructional designers to create user interfaces for educational software and digital learning platforms that are intuitive, visually appealing, and easy to navigate. Usability studies and user-centered design principles are applied to ensure the interfaces meet learners' specific needs and preferences. Furthermore, HCI principles are crucial in software development, as they involve continuously analyzing user feedback and data to improve educational systems, resulting in more personalized and effective learning experiences. The application of HCI in education extends to leveraging emerging technologies such as augmented reality (AR) and virtual reality (VR) to create immersive and interactive learning experiences [25][23][38][26][33][32][40][22].

In the context of AI technologies, various advancements have contributed to enhancing the user experience in educational settings. Affective computing enables machines to understand and react to human emotions, allowing personalized learning experiences and emotional support[34]. AR and VR technologies offer immersive and interactive learning experiences, allowing students to explore complex concepts and receive hands-on training [35]. Computer vision enables computers to comprehend and interpret visual data, supporting tasks like image and video analysis [37]. Conversational AI facilitates natural language interactions between learners and AI systems, providing personalized guidance and tutoring [44]. Deep learning extracts complex patterns from data, allowing for personalized learning experiences and advancements in student engagement [43]. Intelligent assessment automates educational evaluation, providing individualized feedback and supporting data-driven decision-making [39]. Machine learning analyzes large datasets and automates tasks, enhancing personalized learning and adaptive learning platforms [41]. Speech recognition technology transforms spoken words into text, facilitating voice-activated interfaces and accessibility in education [39].

Intelligent Computer-Assisted Language Learning (ICALL) combines language learning with computer science, utilizing AI technologies like NLP and ITS to create interactive language learning experiences [66]. These systems offer personalized instruction, immediate feedback, and tailored exercises, enhancing language acquisition [67]. By incorporating technology, ICALL provides authentic language input, cultural exposure, and opportunities for communicative language use. NLP algorithms enable error detection and grammar analysis, while ITS employs learner modeling and adaptive learning to provide individualized instruction [64]. Platforms like Duolingo, Rosetta Stone, Babbel, Lingoda, and

Busuu leverage gamification and interactive lessons to engage learners and offer immersive language learning experiences.

Natural language processing enables computers to understand and produce human language, supporting tasks like language learning applications and text analysis [36]. In NLP, text summarization is a technique used to automatically generate concise and coherent summaries of longer text documents. There are two main approaches to text summarization: extractive and abstractive. Extractive summarization involves selecting important sentences or phrases from the original text, while abstractive summarization involves generating a summary containing words, phrases, and sentences not present in the original text. Various NLP frameworks and libraries are available for text summarization, including NLTK, Gensim, spaCy, and TextBlob. These libraries provide models and tools for tasks such as tokenization, lemmatization/stemming, stop word removal, sentence simplification, word substitution, sentence fusion/splitting, grammatical simplification, and rephrasing/paraphrasing. As explained in [18], Spacy is known for efficient tokenization and part-of-speech tagging, while NLTK is a comprehensive NLP toolkit suitable for beginners. Gensim focuses on topic modeling and document similarity analysis, and TextBlob offers a simplified API for common NLP tasks. The table highlights each library's key features, ease of use, performance, and multilingual capabilities.

Machine translation (MT) is another area within NLP that involves using algorithms to translate large amounts of text. While MT has improved with machine learning and neural networks, it still has limitations in handling complex texts, idiomatic expressions, cultural nuances, and domain-specific terminology. There are many translators, such as Translators, Deep-translator, Googletrans, and DeepL. "Translatorsïs well-supported and versatile but lacks customization and language detection. "Deep translator"supports multiple APIs, but language detection requires a private key. "Googletransïs simple but unmaintained. "DeepL"has limited Python support but high-quality translations.

Generative AI, also known as GAI, is a technology that generates content within responses, surpassing human-like interactions of Conversational AI. Unlike Conversational AI, which relies on programmed responses, it independently produces fresh, original content. In generative AI, large Language Models (LLMs) and diffusion models are used to generate new text, images, and media.

LLMs, such as GPT-4, BLOOM, StableLM, LLaMA, Dolly, and Alpaca, have transformed natural language processing. They have educational applications where they can enhance learning experiences and create personalized content. LLMs have generated interactive educational materials, supported foreign language learning, improved questioning skills, and created chatbot tutors. The versatility of LLMs allows them to perform tasks across multiple languages and domains, thanks to zero-shot and few-shot learning techniques.

Diffusion models, such as Stable Diffusion, Midjourney, and DALL-E, offer an alternative approach to image generation. They gradually transform noisy images into target images by iteratively reducing the noise. Diffusion models have advantages over traditional GANs regarding stability during training and control over the image generation process. Each diffusion model has unique cha-

racteristics and training techniques, such as using VQ-VAE-2 in DALL-E to condition the model on text prompts for generating specific visual outputs.

These generative AI technologies open up new possibilities in various fields, including education, by providing enhanced content generation and personalization capabilities.

3. Systematic Literature Review (SLR)

3.1 Methodology

The study conducted a Systematic Literature Review (SLR) using the PRISMA model [31] and the SLR methodology by Kitchenham [29][27]. The SLR focused on evaluating and interpreting primary research in the field of AI technologies in educational domains, with a specific emphasis on enhancing user experience and human-computer interaction. The review followed a well-established methodology, including the mapping study guidelines by Petersen [28]. Relevant papers were selected based on specific criteria to provide a comprehensive overview of the different AI technologies used in education. The SLR protocol is described in this hiddensection, covering the review's planning, conducting, and reporting phases.

3.2 Review Planning

The review planning phase of an SLR involves formulating research questions, creating a review protocol, and documenting important details. This phase sets the foundation for a structured and rigorous review by guiding the objectives, scope, methodology, and data extraction techniques. Documenting key information enhances transparency and replicability.

3.2.1 Research Questions Research questions were formulated to gather information on AI's application, assessment, effects, and future potential in education, particularly in enhancing the user experience. A literature mapping was conducted to analyze the research domain. The mapping questions (MQs) and research questions (RQs) related to the search were:

MQ1 How is the publication distribution of AI in education research studies over the few years?
MQ2 What type of papers have been published?
MQ3 In which domains and education levels are the distribution of research papers on AI in education being used?
RQ1 How is AI being used to improve the quality of human-computer interaction in education?
RQ2 What are the impacts on students and teachers regarding user experience when implementing AI in education?
RQ3 What are the future outlooks for using AI tools to enhance the user experience of students and teachers in educational technology?

3.2.2 Inclusion and exclusion criteria Inclusion criteria (IC) and exclusion criteria (EC) are important for ensuring the selection of relevant and high-quality studies in the systematic literature review (SLR). For this research, the ICs specify that only English articles published between 2019 and 2022 are included. The studies must be full-text available, peer-reviewed, and indexed in Scopus or Web of Science. They should focus on integrating AI in education, user experience, and human-computer interaction. The ECs exclude studies unrelated to AI in education or lack explanations of user experience and human-computer interaction in education. These criteria ensure a focused and comprehensive review of the field of AI in education. The following details the criteria used:

- **IC1** Studies published in English
- **IC2** Studies published between 2019 and 2022
- **IC3** Peer-reviewed journal articles, book chapters, and conference proceedings
- **IC4** The full text is available
- **IC5** The study must use AI-based technologies
- **IC6** The study must include in Education and Learning
- **IC7** The study must include in User-experience and Human-computer interaction in education
- **EC1** Studies published in languages other than English
- **EC2** Studies published before 2019 or after 2022
- **EC3** Not primary research (e.g., review)
- **EC4** The full text is not available
- **EC5** Not mentioning user-interface but about Implementing AI-embedded technologies
- **EC6** Not related to education and learning
- **EC7** Not explaining the User-experience and Human-computer interaction in education

3.2.3 Data Sources Scopus and Web of Science (WoS) were selected as key databases for the research due to their wide research scope, reliability, flexible search capabilities, and relevance to the study's context. These databases provide valuable and comprehensive academic publications related to the research topic.

3.2.4 Query Strings As outlined below, the search strings for each selected source were constructed based on the references provided in Tables 2 and 3. Boolean operators (AND/OR) connected the terms, and the wildcard (*) accommodated singular and plural forms. The search was specifically targeted toward human-computer interactions in integrating AI in education, ensuring that the retrieved works were highly relevant and offered insights into the use of AI to enhance interactions between humans and computers in educational settings.

- **Scopus:** TITLE-ABS-KEY ((education* OR .AIED") AND (.ªrtificial intelligence.OR .AI") AND (üser experience.OR üser-experience.OR "Human-computer interaction.OR Üser-centered design") AND (learn* OR student* OR teach*)) AND PUBYEAR ¿2018 AND PUBYEAR ¡2023
- **Web of Science:** ts=((education* OR .AIED") AND (.ªrtificial intelligence.OR .AI") AND (üser experience.OR üser-experience.OR "Human-computer interaction.OR Üser-centered design") AND (learn* OR student* OR teach*))

3.2.5 Quality Assessment While inclusion and exclusion criteria ensure the relevance of articles in a review, they do not assess the quality of papers about the research questions. To evaluate the quality of papers in the final literature review, four criteria are employed. Three criteria are graded on a scale of 0 to 3, and one criterion is graded on a scale of 0 to 1. Only papers that score in the top quartile, representing 25 % of the possible total score, are included in the review. These criteria assess the accuracy and relevance of papers in addressing the research questions, ensuring a comprehensive literature review.

3.3 Review Process

The PRISMA flow diagram (Figure 1) depicts the systematic literature review process and the data extraction actions. It indicates that no additional records were included in the review.

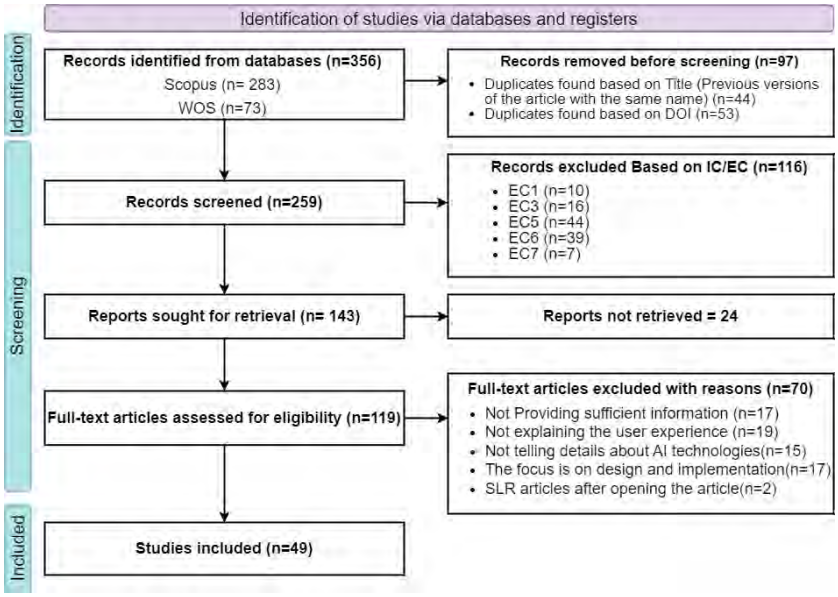

Figura 1: PRISMA 2020 Flow diagram [31].

During the review process, the following steps were taken:

- **Phase 1: Identification -** A total of 356 records were retrieved from the selected databases (283 from Scopus and 73 from WOS).
- **Phase 2: Screening -** Duplicate records (97 in total) were removed, and 259 records were screened. Among them, 116 records were excluded and did not meet the inclusion/exclusion criteria. The full-text articles of the remaining 143 records were examined for eligibility, but 24 articles were inaccessible. This left 119 articles for further review. Out of these, 70 articles were removed during the quality assessment.

- **Phase 3: Included -** After the review process, 49 articles met the criteria for inclusion and quality and were selected for further analysis.

3.4 Data Extraction

The data extraction form, available at the provided Google Drive link (`https://bit.ly/dataset-mapping`), will be utilized to analyze the 49 selected primary studies. These studies will be examined in the order of their titles. The data extraction form includes information such as article ID indicator, authors, titles, quality scores, and more for each study.

3.5 Results of the SLR

The collected data include descriptive information, approach-related information, quality-related information, the use of AI in Education, and its impact on human-computer interaction. The following analysis provides detailed insights from the 49 selected primary studies, addressing the mapping questions and presenting the results that answer the research questions.

3.5.1 Results of Mapping Questions

MQ1: Publication distribution of AI in education research studies over the years

As shown in Figure 2, which presents the interest in integrating AI technologies in education from 2019 to 2022, particularly in 2022, a noticeable trend appears, and 16 studies have been published. Out of the 49 studies, 20.4 % (ten studies) were published in 2019, and also 2020 was the same; 26.5 % (thirteen studies) in 2021, and 32.7 % (sixteen studies) in 2022 were published. These findings show that the importance of AI in education is a challenging and trending topic, and researchers are exploring and contributing to this area, and it is expected that further research and advancements in integrating AI technologies in education.

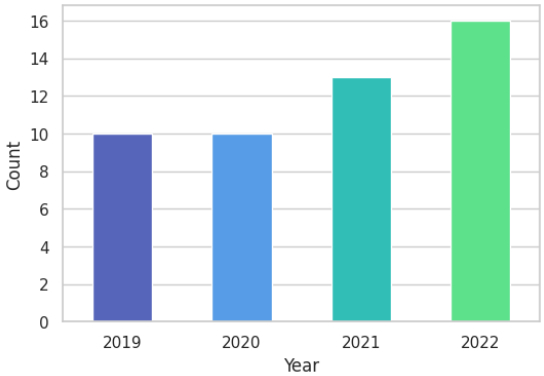

Figura 2: Distribution of publications per year

MQ2: Type of published papers

The complete list of paper types extracted from the records is shown in Table 1. Only papers that have gone through peer review in journals, conferences, or book chapters are considered after the inclusion and exclusion criteria have been considered.

Tabla 1: Papers grouped by the publication type

Type	**Total**	**Papers**
Article	12	P33, P25, P44, P16 ,P14, P18, P34, P23, P22, P35, P41, P45
Conference paper	37	P20, P27, P30, P32, P10, P36, P02, P04, P06, P09, P13, P24, P28, P29, P31, P37, P38, P42, P08, P40, P03,P21, P01, P11, P17, P43, P47, P15, P19, P46, P48, P49, P07, P05, P12, P26, P39

MQ3: Educational domains and levels

Table 2 details the effects of artificial intelligence in education across different domains and levels of education.

Tabla 2: Different Educational Domains and Levels that AI was used

Domain	**Level**	**Articles**
Academic Management	Higher Education	(P31)
	Secondary Education	(P35)
	Various Levels	(P37,P43)
Art Education	Higher Education	(P16, P19,P26)
E-Learning	Higher Education	(P22, P34, P36)
	Maritime Education	(P40)
	Various Levels	(P10)
General Education	K-12	(P2, P46)
Language Learning	Higher Education	(P6, P8, P13, P23, P32)
	Various Levels	(P9, P33, P48)
Legal Education	Higher Education	(P44)
Medical Education	Higher Education	(P24, P38, P42)
Personalized Learning Environment	Higher Education	(P5, P17)
	Preschool Education	(P29)
	Various Levels	(P4)
Physical Education	Primary Education	(P18, P27)
	Various Levels	(P21, P25)
Pilot Training	Aviation Industry	(P11)
STEM	Higher Education	(P3, P7, P12, P28, P30, P45, P47)
	Preschool Education	(P41)
	Various Levels	(P01)
Various Domains	Higher Education	(P39)
	Secondary Education	(P20)
	Various Levels	(P15, P49)

The observations from Table 2 are as follows: AI is utilized across various educational areas and levels, highlighting its versatility and broad application. It is present in domains such as Academic Management, Art Education, E-Learning, Language Learning, Medical Education, and more, including Higher Education. AI's impact extends to K-12 education, focusing on STEM, academic management, various domains, General Education, and Physical Education.

Furthermore, AI is used in diverse fields like pilot training, legal education, maritime education, and personalized learning environments. STEM education, particularly in higher education, demonstrates significant AI integration. AI also heavily influences language learning, with numerous mentions indicating its impact across different educational levels.

3.5.2 Results of Research Questions

RQ1: AI tools used to improve HCI in education

Figure 3 provides an overview of AI technologies used in education research over the past four years, highlighting the importance of research and the steady development of AI tools and technologies in the field. Deep Learning and Machine Learning techniques have shown significant growth and impact, with an increasing number of papers focusing on their application and positive effects on education. NLP continues to be a field of interest, with a consistent increase in research papers each year. Other AI techniques such as Computer Vision, Speech Recognition, AR&VR, and Intelligent Assessment have also attracted researchers' attention and shown promising contributions to education. Conversational AI, particularly in the form of chatbots, has gained increasing interest and is expected to have broad applications in content creation and user engagement. Additionally, the emerging field of affective computing has garnered attention and seen a rise in publications, indicating its growing importance and potential for further research. These AI technologies, including affective computing, conversational AI, deep learning, machine learning, NLP, computer vision, speech recognition, AR&VR, and intelligent assessment, will continue to drive developments in educational AI in the coming years.

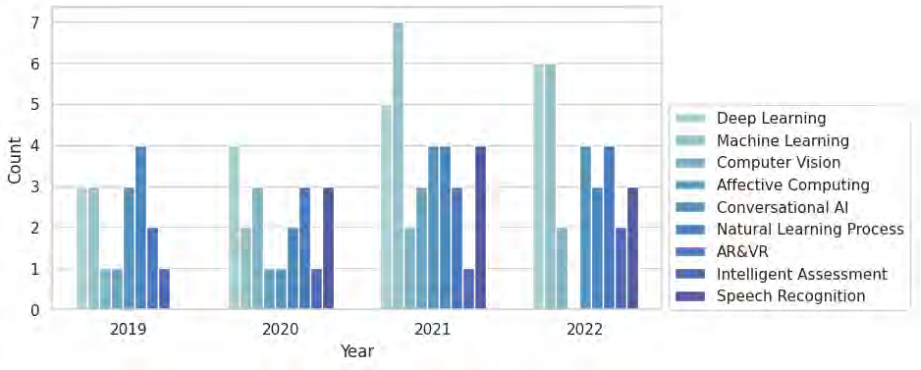

Figura 3: Number of different AI Technologies in each study per year

Table 3 details the trends and research on various AI applications in education. It highlights areas that have drawn more attention and those that may need additional research. Research papers in these fields highlight the significance of incorporating AI tools in education to improve evaluation processes, personalized learning experiences and support effective and efficient communication between users and technology. it reveals persistent interest and research focus

on AI technologies in education, consistent presence, and ongoing developments in AR&VR, computer vision, and NLP. Deep Learning and Conversational AI have seen an increase in research papers over time, indicating growing exploration of their potential in education. However, areas like Intelligent Assessment show a decline in research publications after 2020, and Affective Computing requires further recent research. These observations highlight the dynamic nature of research in AI technologies in education.

Tabla 3: Paper (IDs) published in each year across different AI Technologies

AI technologies	**2022**	**2021**	**2020**	**2019**
Affective Computing		(P06, P17, P37)	(P02)	(P04)
AR&VR	(P23, P40, P41, P45)	(P06, P09, P29)	(P21, P28, P42)	(P03, P46)
Computer Vision	(P14, P38)	(P27, P37)	(P12, P21, P28)	(P46)
Conversational AI	(P05, P16, P22, P36)	(P09, P26, P43, P47)	(P02)	(P08, P32, P39
Deep Learning	(P18, P33, P35, P38, P49, P45)	(P10, P26, P27, P37, P44)	(P01, P12, P30, P31)	(P08, P15, P48)
Intelligent Assessment	(P05, P13)	(P06)	(P20)	(P08)
Machine Learning	(P14, P16, P22, P34, P35, P36)	(P06, P10, P11, P17, P44, P47, P49)	(P20, P30)	(P19, P24, P46)
NLP	(F05, F36, F38)	(P10, P17, P47,P49)	(P12, P20)	(P08, P24, P32, P39)
Speech Recognition	(P13, P25, P38)	(P01, P07, P12)	(P01, P07, P12)	

RQ2: The impacts of AI in education on students and teachers

The use of AI in education has significantly impacted the user experience for teachers and students. Table 4 highlights important findings about the impact of AI technologies in education from the user-experience part. AI tools have provided teachers with valuable administrative and management support, as discussed in 20.4 % (10 of the papers). They facilitate the creation of personalized educational programs and help to streamline administrative tasks and resource allocation. Teachers can concentrate more on providing high-quality instruction and interacting with others by reducing administrative work.

The number of research papers focusing on how AI can improve teachers' understanding and support of students, as seen in 34.7 % of the papers (17 of the papers), highlights the importance of further research in this area to explore how AI tools can help teachers gain insights into students' needs, emotions, and progress. Researchers can learn more about this subject and create innovative approaches by getting more deeply, which will help improve educational practices through effective AI integration. Furthermore, as mentioned in 14.3 % of the articles (7 of the papers), AI tools offer suitable tools for evaluation and feedback, enabling teachers to give students helpful feedback and support their growth. It was mentioned in 22.45 % of the articles (11 of the papers) that AI tools could improve teachers' ability to engage and inspire students and offer technical support and design teaching methods. The significant interest in studying how AI can improve the user experience is shown by 36.7 % of the papers (18 of the papers) focusing on the impact of AI in education and by 30.6 %

of the papers (16 of the papers) devoted to personalized learning and knowledge acquisition. It reveals a developing trend in research by highlighting the significance of looking into and creating AI-based solutions that are personalized for students' individual requirements, ultimately improving their learning experiences and outcomes [P1, P10, P16, P26]. Additionally, 32.6 % (16 of the papers) of the publications support immersive, interactive learning environments using computer vision, virtual reality, and augmented reality. With the help of these technologies, education becomes more enjoyable, interactive, and engaging for students, encouraging greater participation and memory retention. By adapting resources and content to user needs and preferences, AI also supports personalized learning experiences. Enabling self-regulated learning [P20, P43], which gives students more control over their learning process and pace, has an additional effect on students. Additionally, AI tools provide real-time feedback and guidance, supporting students instantly and fostering their academic success [P21, P25, P27, P30, P33, P34, P39]. AI systems considering students' needs and emotional factors can enhance psychological well-being. AI helps students feel good and motivated by fostering a welcoming and inclusive learning environment [P8, P15, P40, P43].

Tabla 4: Impacts of using AI in education on teachers and students

Persona	Impacts	Articles
Teachers	**Administrative and Management**	
	• *Comprehensive management tool*	(P16, P43)
	• *Optimization of resource allocation and individualized learning programs*	(P4, P30, P36)
	• *Reduced workload for instructors*	(P39, P49)
	• *Teaching Quality Improvement*	(P31, P34, P48)
	Effective evaluation and feedback for learning outcomes	(P6, P8, P13, P15, P29, P34, P39)
	Interactive and Immersive Learning Environment	(P9, P10, P11)
	Teacher Engagement and Motivation	
	• *Enhancing teachers' ability to engage and motivate students*	(P9, P15, P20, P7, P12, P22, P28)
	• *Providing technical support and strategy design for teaching*	(P13, P30, P31, P49)
	Understanding and Support for Students	
	• *Enhanced understanding of students' emotions and instructional practices*	(P4, P6, P7, P26, P31, P37, P39, P43, P49)
	• *Monitoring student progress and identifying areas for additional help*	(P6, P10, P14, P19, P29, P35, P37, P39)
Students	**Continuous improvement of education**	(P1, P10, P16, P26)
	Enhanced User Experience	(P1, P3, P5, P6, P7, P9, P11, P13, P15, P16, P22, P23, P24, P28, P31, P35, P37, P43, P48)
	Facilitation of self-regulated learning	(P17, P20, P43)
	Gender and disability equality	(P3, P46)
	Immersive and Interactive Learning	(P3, P6, P7, P11,VP14, P18, P21, P26, P28,VP39, P40, P41, P42, P45)
	Personalized Learning and Knowledge Acquisition	(P1, P5, P8, P10, P12, P19, P20, P21, P25, P27, P29, P34, P36, P40, P49)
	Psychological impact	(P8, P15, P40, P43)
	Real-time Feedback and Guidance	(P21, P25, P27, P30, P33, P34, P39)

RQ3: The outcomes of using AI tools in education

The use of AI tools in education has the potential to enhance the user experience for both students and teachers greatly. Assessments with eight papers (16.3 % of the articles) highlight how AI systems improve student performance by providing real-time evaluation and feedback, enabling personalized guidance and improvement opportunities. Accessibility and flexibility in education, mentioned in 16 papers (32.6 % of the studies), are significantly improved by AI solutions that make educational platforms and resources accessible to more students, fostering creativity and engagement. Digital literacy, mentioned in two papers, equips students with essential digital skills to thrive in a technological society. Improved human-computer interaction, accounting for six papers (12.2 % of the studies), enhances the usability and effectiveness of educational platforms and tools, leading to improved learning outcomes and user satisfaction.

According to 49 % of the studies, AI enhances learning experiences by increasing students' motivation and engagement, creating immersive and interactive learning environments. Personalized guidance, AI-powered tools, and customized content delivery tailored to each student's needs contribute to improved learning outcomes and a better user experience. Fairness in education is addressed through AI's contribution to gender and disability equality and its ability to overcome geographical restrictions, as highlighted in three papers. By addressing the diverse needs of students and ensuring equal opportunity for all, AI technologies contribute to an inclusive and equitable learning environment. Pedagogical or instructional outcomes, emphasized in 28 studies (57 % of the studies), demonstrate how AI adjusts education to individual needs, encourages active learning, and offers personalized, real-world learning experiences. Personalized resource allocation using AI optimizes the allocation of educational resources based on each student's needs, improving the user experience by providing the right resources at the right time and maximizing learning potential.

The use of AI tools in education has the potential to enhance the user experience for both students and teachers greatly. Here are some outcomes associated with using AI tools to enhance the user experience in education described in Table 5. One is assessments with eight papers (16.3 % of the articles); teachers can better track and support student collaboration. By providing real-time evaluation and feedback, enabling personalized guidance and improvement opportunities, AI systems improve student performance. Students actively engage in collaborative activities and receive prompt feedback through dynamic and interactive assessments, which improves the user experience. AI also significantly improves accessibility and flexibility in education, with 32.6 % of the studies (16 papers). AI solutions make educational platforms and resources accessible to more students. This removes financial, geographic, and physical barriers to ensure all students can access educational materials and participate in learning activities. AI technology boosts student engagement by fostering creativity and imagination. Another area mentioned in [P21, P30] is digital literacy. Students gain essential digital skills from improved AI and digital competency. This improves the user experience by helping students use digital resources for learning and thrive in a technological society. Another aspect of the user experience is improved human-computer interaction, which accounts for 12.2 % of the studies

(6 papers). AI technologies enhance the usability, intuitiveness, and effectiveness of educational platforms and tools by enhancing human-computer interaction. As a result, learning outcomes are improved, and user satisfaction is raised.

Tabla 5: Outcomes of AI tools on the user experience in education

Categories	Description	Outcomes	Articles
Assessment	*AI positively impacts assessment outcomes by improving student collaboration and providing real-time evaluation and feedback.*	• Monitor and support student collaboration more effectively	(P3, P15, P35, P36)
		• Real-time evaluation and feedback	(P13, P18, P21, P34)
Accessibility and Flexibility	*AI enhances accessibility and flexibility in education, making it more affordable, accessible, and inclusive for learners.*	• Cost-effective and accessible manner	(P3, P16, P20, P24, P29, P34, P39, P43)
		• Improved interaction, creativity, and imagination compared to traditional learning methods	(P9, P27, P36, P37, P42, P45, P46, P48)
Digital Literacy	*AI contributes to developing digital literacy skills by providing access to advanced AI characteristics and digital competency.*		(P10, P30)
Enhanced Human-Computer Interaction	*Enhanced human-computer interaction through AI technologies improves communication and collaboration between students, teachers, and educational platforms.*		(P2, P4, P14, P22, P33, P32)
Enhanced Learning Experience	*AI enhances the overall learning experience by increasing student engagement, motivation, providing personalized guidance, and improving instruction effectiveness.*	• Increased Engagement	(P16, P17, P25, P28, P29, P39, P41, P43, P47, P49)
		• Learning efficiency	(P2, P8, P10, P17, P19, P21, P22, P23, P25, P26, P32, P40, P45, P49)
Fairness	*AI promotes fairness by addressing gender and disability equality in education and overcoming geographical limitations.*	• Gender and disability equality	(P3, P46)
		• Overcoming Geographical Limitations	(P13)
Pedagogical or instructional	*AI supports innovative teaching methods, practical learning experiences, and personalized instruction, transforming pedagogy.*	• Personalized Learning Experience	(P2, P3, P5, P10, P17, P19, P21, P22, P36, P40, P44)
		• Practical learning experiences	(P12, P13, P19, P21, P27, P30, P36, P38, P40, P42)
		• Offers innovative teaching methods	(P3, P13, P16, P29, P31, P45, P47)
Personalized resource allocation	*AI enables personalized resource allocation, optimizing the distribution of educational resources to meet individual student needs.*		(P4, P6, P11, P16, P17, P24, P25, P32, P44)

3.6 Discussion

A total of 49 selected articles were thoroughly analyzed to address the research questions posed in the study. The analysis reveals that integrating AI into education involves different aspects. Still, this study emphasizes the user interface and experience to enhance user interaction and educational tools. Numerous other studies have concentrated on designing, developing, and using AI tools in education in addition to this one [63][62][61][60][55][54][53][49]. The design of embedded systems and environments based on AI, such as smart campuses, has

been one of the many topics covered in these studies [51][56][57][58][59]. Some articles explore using gamification in educational settings, utilizing AI methods to produce interesting and interactive learning opportunities [50][52].

The data analysis highlights the significance and growth of AI in education, particularly in STEM and language learning domains. It is evident that AI is being applied in various areas and is expected to continue expanding. Additionally, AI exhibits notable applications in e-learning and physical education [P1, P5, P9, P12, P19, P21, P24].

The Cognitive Immersive Language Learning Environment (CILLE), described in Article P24, combines Artificial Intelligence (AI) and Extended Reality (XR) to enable naturalistic, multi-modal conversations for comprehensive foreign language acquisition, which is illustrated through a study on teaching Chinese as a foreign language. General education, as mentioned in [P2, P46], utilizes AI to teach students, and many articles [P35, P2, P46, P29, P18, P27, P41, P20] focus on using AI to teach different levels of K-12 education in various domains. While most articles concentrate on integrating AI into higher education, it is essential to consider the potential utilization of AI tools across different educational levels. Moreover, educational purposes extend beyond academic learning. For example, in P2, DL, and Speech Recognition were used to teach plant science, and AI was applied in a botanical garden to facilitate learning about plants. Additionally, platforms like STEP [2] (mentioned in P45) enhance traditional maritime learning cycles by making them more engaging and interactive with AR & VR. Furthermore, P12 presents an ML-aided pilot training and education framework. AI tools, such as ML, DL, and ITS, are also utilized in Art Education for higher education students [P17, P20, P31].

The use of AI in education has significantly impacted the user experience for both teachers and students. AI tools provide teachers with valuable administrative and management support [P16, P34], enabling personalized educational programs [P4, P30, P36] and reducing administrative workload [P39, P49]. Additionally, teachers have access to better materials, improving the quality of teaching [P31, P32, P48]. Further research is needed to explore how AI can help teachers gain insights into students' needs, emotions, and progress, with 17 papers (34.7 %) focusing on this area. AI tools also facilitate evaluation and feedback, helping teachers provide meaningful support and guidance to students (mentioned in 7 papers [14.3 %]). Additionally, AI improves teachers' ability to engage and inspire students and offers technical support and innovative teaching methods (mentioned in 11 papers [22.45 %]). There is a growing interest in exploring the impact of AI in education and personalized learning, with 18 papers (36.7 %) and 16 papers (30.6 %), respectively, focusing on these areas.

Furthermore, many articles [P9, P10, P11, P3, P6, P7, P11, P14, P18, P21, P26, P28, P39, P40, P41, P42, P45] highlight using computer vision, virtual reality, and augmented reality to create immersive and interactive learning environments for both students and teachers. Immersive education enhances learning outcomes by creating a highly engaging and interactive learning environment

[2] (http://www.smarteducationplatform.it/)

that promotes active participation and deep understanding of the subject matter. AI also supports personalized learning experiences, enabling self-regulated learning, providing real-time feedback and guidance, and fostering students' psychological well-being [P8, P15, P40, P43]. The impacts of AI in education are broad and multifaceted. One notable impact is the automation of administrative tasks, which frees up teachers' time, enabling them to dedicate more attention to personalized instruction and support. This automation contributes to the efficiency and organization of the educational system [P17, P20, P26].

AI benefits students by enhancing personalized learning experiences, motivation and engagement, immersive and interactive learning environments, accessibility and flexibility, and learning effectiveness [P3, P8, P14, P23]. By addressing individual needs, encouraging a sense of fairness, and offering support for diverse learners, AI technologies also help to promote inclusivity and equity in education [P6, P13, P27].

Researchers in P3 and P46 suggested AIED assist students with disabilities and mentioned the significance of equality among students from various backgrounds. This strategy aims to develop a just educational system where all students have equal learning opportunities regardless of background.

It is also crucial to recognize how interconnected and mutually reinforcing these effects of AI on education are. Although each AI tool contributes differently to the overall user experience, they are all interdependent and shape the learning environment. For instance, the comprehensive management tool and resource allocation optimization decrease teachers' workload and produce a more effective and organized system, which benefits students' learning experiences. Similarly, interactive and immersive learning environments powered by AI technologies boost students' motivation and engagement while enhancing the effectiveness of instruction and interactions between teachers and students.

Integrating AI tools in education has many potential outcomes for the user experience. One key outcome is the improvement in assessments. With the help of AI, teachers can better track and support student collaboration. AI systems offer real-time evaluation and feedback, providing timely insights into student performance. This enables individualized guidance and opportunities for improvement. By creating a more dynamic and interactive assessment process that actively involves students and provides prompt feedback, AI enhances the user experience [P3, P13, P15, P18, P21, P34, P35, P36]. Another significant outcome is the increased accessibility and flexibility of education. AI solutions make educational platforms and resources more easily accessible to a wider range of learners. By eliminating physical, financial, and geographic barriers, AI ensures that all students can interact with educational materials and participate in learning activities. This improved accessibility and flexibility not only enhances the user experience but also encourages imagination, creativity, and engagement in the classroom [P3, P9, P16, P20, P24, P27, P29, P34, P37, P39, P42, P43, P45, P46, P48]. AI also plays a crucial role in developing digital literacy skills among students. By providing access to advanced AI characteristics and digital competency, AI enhances students' abilities to navigate the digital world. This, in turn,

improves the user experience by fostering students' competence and confidence in using digital resources for learning [P10, P30].

One of the key aspects of user experience in AI-enabled education is improving human-computer interaction. AI technologies enhance the usability, intuitiveness, and effectiveness of educational platforms and tools, improving communication and collaboration between students, teachers, and educational platforms. This improved human-computer interaction improves learning outcomes and enhances user satisfaction [P2, P4, P14, P22, P32, P33]. AI significantly impacts the overall learning experience by increasing student motivation and engagement. Through personalized guidance, AI-powered tools, and customized content delivery, AI creates a more immersive and interactive learning environment. Students benefit from personalized learning experiences, adaptive content, and data-driven insights, leading to improved learning outcomes and a more satisfying user experience [P2, P8, P10, P16, P17, P19, P21, P22, P23, P25, P26, P28, P29, P32, P39, P40, P41, P43, P45, P47, P49].

Furthermore, AI contributes to fairness in education by addressing gender and disability equality and overcoming geographical limitations. By catering to the diverse needs of students and ensuring equal opportunities for all, AI technologies promote an inclusive and equitable learning environment. This fosters a sense of fairness, encourages diversity and inclusivity, and provides a supportive and accessible educational experience for all learners, enhancing the user experience [P3, P13, P46].

Pedagogical or instructional practices also see a significant impact from AI. AI supports innovative teaching methods, practical learning experiences, and personalized instruction, transforming traditional pedagogy. It enables personalized learning experiences, real-world learning opportunities, and cutting-edge teaching methods. These outcomes provide teachers with the tools to deliver effective, engaging, and interactive instruction, ultimately improving the user experience for both teachers and students [P2, P3, P5, P10, P12, P13, P16, P17, P19, P21, P22, P27, P29, P30, P31, P36, P38, P40, P42, P44, P45, P47].

Lastly, AI enables personalized resource allocation, optimizing the distribution of educational resources based on individual student needs. By analyzing data and identifying specific requirements, AI ensures that students receive the right resources at the right time. This personalized resource allocation maximizes learning potential and offers a customized educational experience, enhancing the user experience [P4, P6, P11, P16, P17, P24, P25, P32, P44].

Integrating AI approaches in education presents challenges that directly impact the user experience. Data and analysis emerge as a critical factor affecting the user experience, as emphasized by 57.1 % of the articles. Building comprehensive databases and conducting accurate data analysis is essential for successful AI implementation. The availability of reliable data and the ability to interpret it correctly contribute to producing valuable insights and improving learning outcomes. Ensuring the accuracy and validity of AI-generated information is crucial to address ongoing clarification and correction needs [P5, P6, P15, P19, P21, P24, P27, P30, P35, P36, P38, P39, P42, P43, P47, P48, P49].

Ethical and privacy concerns also pose challenges that affect the user experience in AI-enabled education. Approximately 8.3 % of the studies highlight these concerns, particularly related to the disclosure of personal information and the potential for machines to gain insights into human emotions. The absence of universal standards and guidelines for AI in education further exacerbates these concerns. Addressing these ethical conundrums, establishing robust frameworks to protect privacy, and promoting responsible use of AI technologies is imperative to ensure a positive user experience [P4, P18, P19, P43, P47].

Integration represents a significant obstacle to adopting AI in education, as discussed in 61 % of the articles. Challenges in this category include the cost of implementation, difficulties in integrating AI technology with existing educational systems, and the need for adequate resources in digital learning environments. Overcoming these obstacles requires extensive digital transformation and efficient information management. Additionally, professionals in education must adapt to and embrace AI advancements to maximize the potential benefits for the user experience [P1, P6, P7, P9, P10, P13, P14, P17, P20, P25, P26, P28, P29, P30, P34, P36, P40, P41, P44, P45].

Learning and adaptation are critical aspects that significantly impact the user experience in AI-enabled education. Approximately 22.4 % of the studies emphasize the importance of fostering self-learning abilities among students and the need for accurate emotion recognition and analysis to create personalized learning experiences. Adaptive training tailored to students' needs enhances their educational background and contributes to a more positive user experience [P4, P12, P25, P28, P32, P33, P37, P38, P43, P46].

Pedagogical and research challenges also influence the user experience, as highlighted in 22.4 % of the studies. Overcoming implementation difficulties, designing effective AI experimental teaching content, and addressing inequalities and gaps in current learning systems are crucial for ensuring equitable access to AI-based education. Research and development efforts in these areas are necessary to enhance the user experience and improve educational outcomes [P9, P10, P12, P23, P27, P29, P31, P39, P44, P46, P49]. Lastly, technology and human interaction play a significant role in shaping the user experience. Building trust in human-computer collaboration and interaction is essential for successfully integrating AI in educational settings. Fostering productive and fruitful learning experiences requires establishing a positive relationship between users and AI technologies [P1, P17, P20, P31, P38].

The distribution of articles across different categories reveals varying levels of research attention. While areas like data and analysis, implementation and integration, and ethical and privacy concerns have received more research focus, categories such as learning and adaptation, technology and human interaction, and pedagogical and research challenges have relatively fewer papers, suggesting potential research gaps. Further studies in these areas are necessary to address the identified challenges, establish best practices, and ensure AI's ethical and effective application in education, ultimately enhancing the user experience.

4. Case Study: LATILL Project

According to a systematic review discussed in hiddensection 10, AI technologies have been applied in education, particularly in language learning, to enhance communication between teachers and students, improve learning outcomes, and provide personalized guidance. The LATILL Project is a case study that utilizes AI to assist German Foreign Language (GFL) teachers in responding to students' questions and offering tailored support. This project focuses on creating digital tools for GFL teachers, incorporating features like search and analysis to identify level-appropriate texts based on the Common European Framework of Reference for Languages (CEFR) [15]. The LATILL platform aims to enhance language programs by promoting a self-regulatory approach to foreign language reading and implicit lexico-grammatical learning [30].

The LATILL project is supported by the Erasmus+ programme of the European Union and involves collaboration with various institutions. Its main objectives include providing open educational resources for German language teachers, emphasizing current and authentic reading materials suitable for different proficiency levels. The project aims to promote innovative teaching methods, learner-oriented materials, and key competences in reading skills. It also focuses on ensuring teaching quality, fostering teacher cooperation, and supporting professional development. The project encompasses an educational platform, a CEFR Reference Corpus for German, didactical materials with methodological recommendations, and a teacher professional development program.

One noteworthy feature of the LATILL platform is the integration of generative AI techniques for creating and developing text bundles. These bundles consist of related texts generated by the system upon user request. AI technologies, such as translation, summarization, and text adaptation, enhance the platform's content and expand its corpus of authentic texts. Additionally, the platform offers an image-generation service to create specific sentences, which further enhances learners' comprehension. In the following hiddensection of this case study, we will go further into the details of the LATILL project, discussing subjects such as the process of developing the platform itself, the methodology employed, user stories and their significance, user testing and its outcomes, and potential future directions for the project.

4.1 User stories

During the development process of the LATILL platform, 41 user stories provided by domain experts played a crucial role in guiding the identification of important platform features. The platform primarily targets teachers of German as a second or foreign language, but it can also benefit pre-service teachers. The platform allows both registered and anonymous users, ensuring inclusivity and accessibility. The prioritized features of the platform were carefully analyzed to meet the requirements mentioned in the user stories. Detailed information about each text, including copyright information and source links, is available in the results viewer. Users can save texts, sort search results, and organize texts based on their preferences. Texts can be exported in popular formats like Word and

PDF, and users can submit texts for analysis and access previously analyzed texts. The platform also provides instructional materials, methodological advice, customizable activities, and a search engine for additional resources. The platform's user-friendly interface allows users to personalize settings and improve user comfort and accessibility. By addressing the specific needs outlined in the user stories, the LATILL platform provides valuable tools and assistance to teachers, ultimately enhancing students' educational experiences.

4.2 Platform development

The LATILL project focused on designing and implementing an educational platform for German as a foreign language (GFL) teachers. The platform development process involved creating functional and non-functional prototypes to enhance features and the user interface. Cutting-edge AI technologies, such as NLP and generative AI, were integrated into the platform to provide advanced functionalities like text translation, summarization, and image generation. The platform includes a German text search tool with customizable filters, a comprehensive results viewer, user accounts for text management and storage, and the ability to upload texts for analysis. Methodological tips for working with authentic texts are also provided, and users can personalize the interface settings according to their preferences. The platform development followed the SCRUM methodology [16], emphasizing incremental and iterative development. The platform's backend was built using Django, a robust Python web framework known for its effectiveness and scalability.

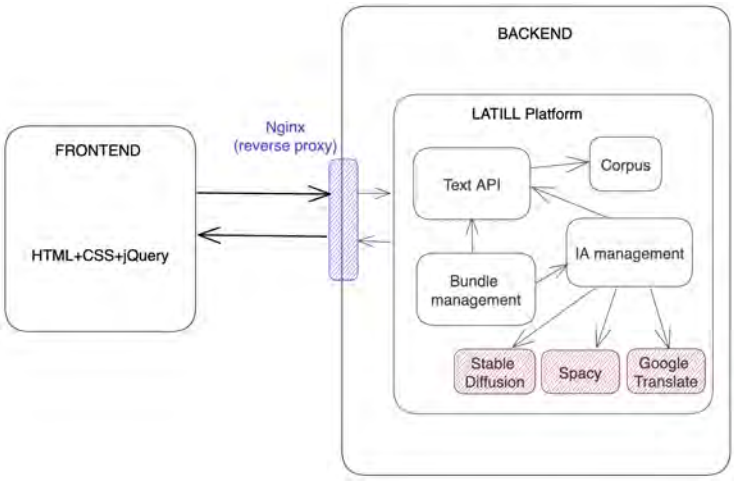

Figura 4: The architecture of the LATILL Platform

The architecture of the LATILL platform, as depicted in Figure 4, incorporates various components and technologies. The front end utilizes HTML, CSS, and jQuery to create an engaging and interactive user interface, structuring content, controlling visual presentation, and adding dynamic functionality. The backend of the platform includes several key components. The text API

enables seamless integration with external sources to retrieve relevant texts, while the corpus management module organizes and manages the ÇEFR Reference Corpus for German.[a]s the source of up-to-date texts. The bundle management feature allows users to create customized sets of texts for specific learning purposes. To optimize image creation and AI-related tasks, the platform leverages cutting-edge technology, such as the RTX4090 graphics card and CUDA, for fast computations and graphics processing. The performance of the RTX4090 and the parallel computing capabilities of CUDA are utilized to ensure efficient and effective computations for image generation and AI tasks. AI management, including the stable diffusion algorithm, Spacy, and deep-Translator, facilitates image generation, simplification, and translation.

4.2.1 Prototypes

Prototypes in platform development are mockups used to validate design concepts and gather user feedback. They visualize the user interface and functionality, allowing developers to test interactions and refine the design. Prototypes facilitate user testing and help identify usability issues, ensuring the final product meets user expectations.

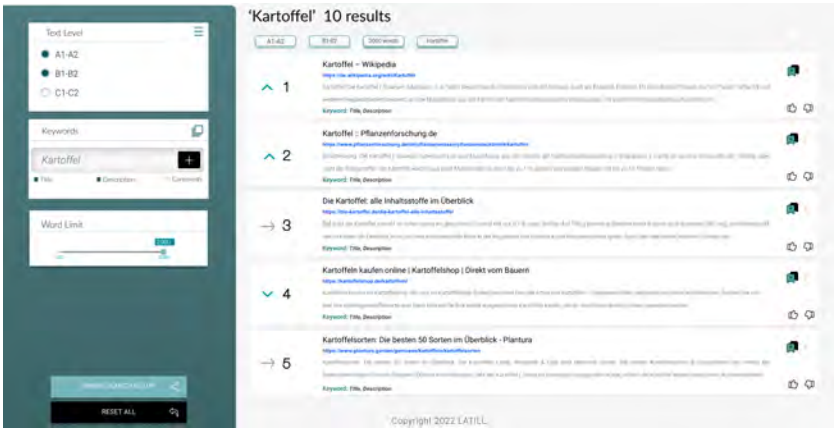

Figura 5: Search results in the nonfunctional prototype

1. Non-functional Prototype:

To shape the idea and improve the final product's vision, a non-functional prototype was created for the LATILL platform. This low-fidelity mockup emphasized the platform's structure, layout, and user experience, developed using the collaborative design tool, Figma [3]. Key features of the platform were implemented during the prototype development stage, as depicted in Figure 5.

2. Functional Prototype:

A functional platform prototype allows for user feedback and early validation, refinement, and optimization of design, usability, and performance. The LATILL platform utilizes generative AI to automatically generate diverse text bundles, saving time and effort in preparing different variations for educational scenarios.

[3] `https://www.figma.com`

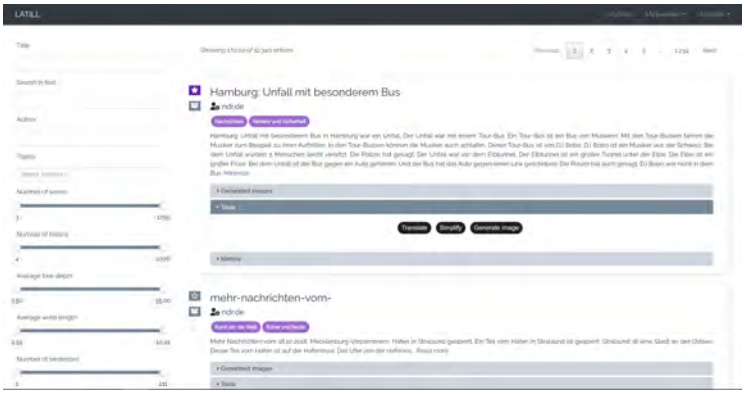

Figura 6: Main page of the first version of LATILL

4.3 User test

The LATILL platform was tested by five German teachers, who performed tasks such as filtering texts, translating them, summarizing them, and creating images from them. The participants were between 40 and 70 years old and encountered difficulties in finding certain functions, particularly related to image generation. Improvements are needed in several areas of the LATILL platform. Firstly, the filtering system must be reviewed to eliminate irrelevant filters and focus on those crucial for text simplification and language learning. The user interface will be simplified, and platform performance will be enhanced. Secondly, carefully considering the color scheme used for generated images is important to increase their educational value and engagement. Enhancing the user experience includes highlighting search terms in the results to facilitate finding relevant textual passages. Users will find it easier to adjust filters while comparing the original and simplified texts through fixed filters on the side of the interface and a reset filter button. Including translated text alongside the original text enables language learners to compare and comprehend the target language. Making the tools available whenever needed improves user accessibility and creates a more personalized and efficient learning environment. For longer texts, breaking them into manageable hiddensections and creating multiple images for each hiddensection helps language learners comprehend complex information step by step. Continual improvements in the text simplification and image generation processes are necessary, focusing on preserving the main ideas while making the text simpler through enhancements in the underlying algorithms. The heatmap analysis using Hotjar[4] revealed that participants used only a small set of filters, further supporting the need for filtering system improvements. Participants expressed satisfaction with the translation feature of the AI tools. Overall, the image generation feature showed promising results, although participants required several attempts to obtain satisfactory outcomes. However, the text simplification feature received criticism for producing summaries that were considered too brief

[4] `https://www.hotjar.com/`

and not capturing the essence of the original text. Despite these challenges, participants acknowledged the LATILL platform's potential as a valuable tool for teaching German as a foreign language and expressed overall satisfaction with its functionality.

Figura 7: Heatmap of the user interaction captured with Hotjar

4.4 Current Version

The platform underwent significant upgrades based on evaluation and user testing, resulting in improved corpus quality and filter accuracy. The development team analyzed user feedback and observations to enhance functionality and user experience. The interface was redesigned to be more intuitive and user-friendly, aligning with user expectations and preferences. AI-based tools, including translation, text simplification, and image generation, were developed and continuously improved for accuracy and effectiveness in language learning and teaching. The figures below depict visual representations of the platform's diverse functionalities and features.

- **Text Filters:** The upgraded filters hiddensection of the platform is presented in Figure 8. The color boxes show different topics that each document has.

Figura 8: Filters of the search

- **Tools:** Some changes related to the tools hiddensection were done, and the new interface is shown in the following figures:

  1. **Text Translation:** The Translation hiddensection of the tools is the same because the user tests and evaluation did not recommend further changes, Figure 9.

Figura 9: Text Translation tool

  2. **Text Simplification:**

     By analyzing the structure and content of the text, the feature generates a summary that captures the essential information while eliminating unnecessary details. However, it is important to note that the text simplification tool is currently still under development and will be available in future versions of the platform. In Figure 10, a visual representation showcases the simplification tool, where the selected text is transformed into a more straightforward and easily understandable sentence that encapsulates the text's main idea.

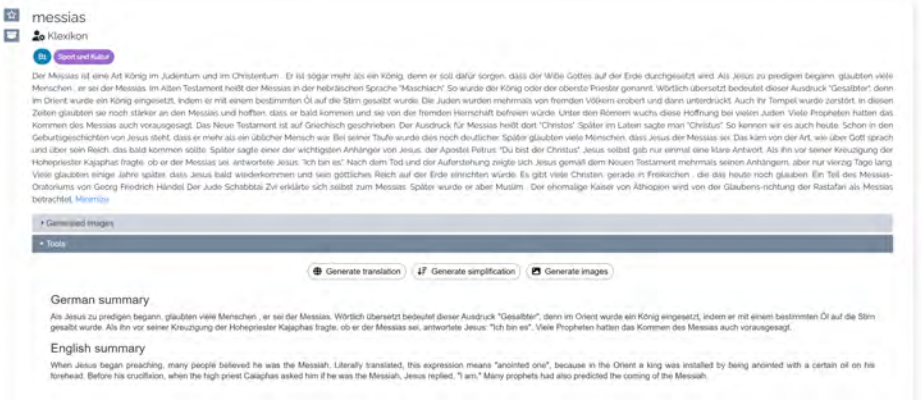

Figura 10: Text Simplification tool

3. **Image generation:** To make this tool more user-friendly, some changes were done regarding the interface shown in figure 11

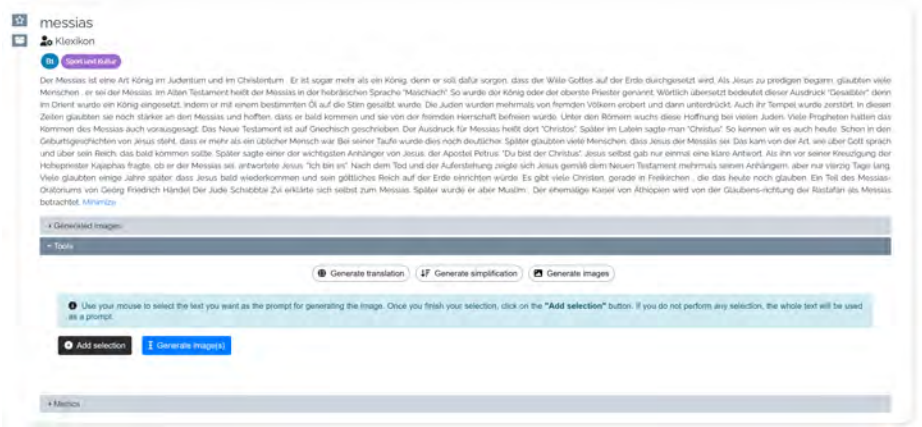

Figura 11: Image generation tool

Figures 12a, 12b, and 12c show the image generated for the selected prompts below from the document:
Prompt 1: *"Das Neue Testament ist auf Griechisch geschrieben"*
Translate: "The New Testament is written in Greek"
Prompt 2: *"Nach dem Tod und der Auferstehung zeigte sich Jesus gemäß dem Neuen Testament mehrmals seinen Anhängern, aber nur vierzig Tage lang. Viele glaubten einige Jahre später, dass Jesus bald wiederkommen und sein göttliches Reich auf der Erde einrichten würde. Es gibt viele Christen, gerade in Freikirchen"*
Translate: .After the death and resurrection, according to the New Testament, Jesus showed himself to his followers several times, but only for forty days. Many believed a few years later that Jesus would soon co-

me again and establish his divine kingdom on earth. It there are many Christians, especially in free churches"

Prompt 3: *.Auch ihr Tempel wurde zerstört. In diesen Zeiten glaubten sie noch stärker an den Messias und hofften, dass er bald kommen und sie von der fremden Herrschaft befreien würde. Unter den Römern wuchs diese Hoffnung bei vielen Juden. Viele Propheten hatten das Kommen des Messias auch vorausgesagt. Das Neue Testament ist auf Griechisch geschrieben. Der Ausdruck für Messias heißt dort Çhristos"."*

Translate: "Their temple was also destroyed. During these times they believed even more strongly in the Messiah and hoped that he would come soon and free them from foreign rule. Under the Romans, this hope grew among many Jews. Many prophets also foretold the coming of the Messiah. The New Testament is written in Greek. The term for Messiah there is Çhristos"."

(a) Prompt 1 (b) Prompt 2 (c) Prompt 3

Figura 12: Three samples of generated images

- **Metrics:** Figure 13 shows that the platform provides text linguistic metrics. The metrics provide quantitative measurements related to the text, such as the number of words, number of tokens, average tree depth (a measure of sentence complexity), average word length, number of sentences, number of syllables, number of characters, readability score (a measure of how easy the text is to read), syllables per word, and average sentence length. These metrics can help users analyze and compare texts based on their linguistic properties and readability.

Figura 13: Metrics

- **Bundles:** The platform offers bundle configuration options, as depicted in Figure 14. After conducting tests and evaluations, as explained in hidden-

section, it was determined that important changes needed for the bundles are in the user interface. These changes aim to provide a more user-friendly interface allowing easier access to the tools within the bundles.

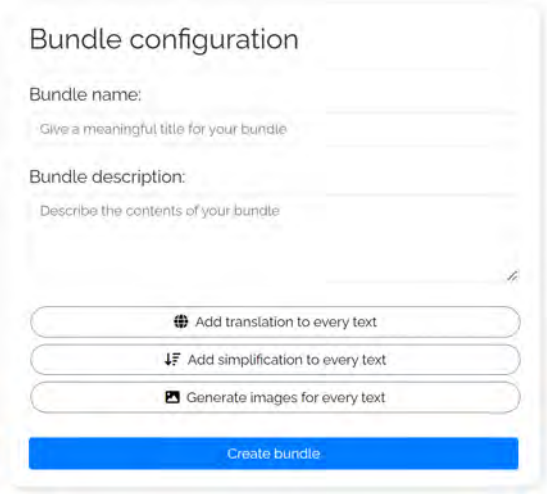

Figura 14: Bundles configuration

This platform uses AI to improve language learning, as shown in the figures in this hiddensection. Improved accessibility, comprehension, and user engagement result from using AI in text simplification, translation, and image generation. The platform is constantly improving its corpus, user interface, and AI tools to achieve excellence in learning. The most recent version shows improvements in filter performance, interface refinements, and ongoing work on AI-based tools. The team is committed to considering user feedback and meeting their changing needs to deliver a more thorough and user-centric experience.

5. Conclusions

This thesis has clarified the advantages of integrating AI into educational settings to improve user experience. Significant findings and implications have been discovered through a systematic literature review and a case study focusing on a language learning platform. The SLR found that integrating AI into education has numerous positive effects on teachers and students. AI tools offer invaluable administrative assistance, individualized learning plans, better lesson plans, improved evaluation and feedback capabilities, and increased student engagement and inspiration. AI makes learning more effective for students by enabling personalized learning experiences, improved motivation and engagement, immersive and interactive learning environments, and greater accessibility and flexibility. These effects work together to create a transformative learning environment that meets the various needs of students.

An example of how AI is used in practice to improve user experience is shown in the case study of the LATILL Project, a platform for language learning. The platform is constantly being improved due to user feedback and needs, demonstrating a dedication to developing an extensive and user-centric learning environment. An improved language learning experience results from improved corpus quality, filter improvement, interface enhancements, and ongoing AI-based tool development. Future work and research in the field of artificial intelligence in education will likely focus on many areas. These include examining how generative AI can be integrated while addressing ethical issues, performing long-term impact analyses, looking into how AI can be integrated with various pedagogical concepts, concentrating on user-centered design principles, and dealing with implementation difficulties.

The platform's future plans also emphasize ongoing efforts to improve the user experience. These plans now include Language Models for text simplification, allowing students to access texts that have been condensed to their level of language proficiency. Finding the most effective diffusion model to enhance image quality also aims to produce more aesthetically pleasing and educational learning materials. These upcoming improvements show the platform's attention to meeting the changing demands of language learners to deliver an improved and all-encompassing language learning experience by integrating Generative AI tools like LLMs and improved image diffusion models.

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