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A Systematic Review of the Relationship between Second Language Acquisition and Artificial Intelligence-Natural Language Processing

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مراجعة منهجية للعلاقة بين اكتساب اللغة الثانية والذكاء الاصطناعي – معالجة اللغات الطبيعية

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Abstract:

The current review investigates the ways in which natural language processing (NLP) and artificial intelligence (AI) improve second language acquisition (SLA). The data, which focuses on studies from 2012 and onwards emphasizes how AI and NLP can be used to provide feedback, enhance speech, pronunciation, grammar, and create immersive SLA and learning environments.

Keywords: SLA, AI, NLP, CALL

الملخص:

تتناول الدراسة مناقشة الدراسات السابقة فيما يتعلق بدور الذكاء الاصطناعي ومعالجة اللغات الطبيعية في تطوير اكتساب اللغة الثانية. شكلت الدراسات المنشورة من عام ٢٠١٢ حتى الآن البيانات الأولية التي اعتمدت عليها الدراسة. وأكدت هذه البيانات الدور الذي يلعبه الذكاء الاصطناعي وعمليات معالجة اللغات الطبيعية في التغذية الراجعة وتعزيز مهارة التحدث ومهارة النطق وقواعد اللغة والبيئة التعليمية المحفزة للاندماج في تعلم واكتساب اللغة الثانية.

الكلمات المفتاحية: اكتساب اللغة، الذكاء الاصطناعي، معالجة اللغات الطبيعية، تعلم اللغة بمساعدة الحاسوب

Introduction

A systematic review is a precise and methodical process for combining data from several studies to address a particular research topic (Gough, 2012). Over the past few years, numerous studies have delved into topics such as Second Language Acquisition (SLA), Artificial Intelligence (AI)/Natural Language Processing (NLP), and some have even intersected both realms (e.g., Betal, 2023; De la Vall & Araya, 2023; Khurana et al., 2023; Marcel, 2024). The current review follows a systematic review method to show the links between SLA and AI/NLP. It starts with providing definitions and background of SLA and AI. It tries to highlight the connections of these two fields. Then it will have the method section to explain further the systematic review method and the inclusion and exclusion criteria. An in-depth

analysis of reviewed studies is then provided. Finally, this review offers suggestions for further implications.

Second Language Acquisition (SLA)

The process by which humans acquire a second language is known as second language acquisition (SLA), commonly known as L2 acquisition. Any language acquired in addition to one's native tongue is referred to as a second language; while the term "Second Language Acquisition" is used to describe this process, third, fourth, or even subsequent languages can also be acquired (Gass et al., 2020).

Artificial Intelligence (AI)

The field of artificial intelligence deals with the development of computer systems that are capable of doing tasks that are often associated with human intelligence, such as speech recognition, machine learning, and natural language processing. Language training is one of the many sectors where AI technology is finding increasing use. In the framework of SLA, AI may offer individualized learning experiences, targeted feedback, assistance with speech training, and language competence assessment (Betal, 2023).

Relationship between SLA and AI

SLA is strongly linked to prominent fields such as linguistics, psychology, sociolinguistics, neurolinguistics, sociology, anthropology, communication, artificial intelligence/natural-language processing, cognitive science, and philosophy (Gass et al., 2020). Previously, acquiring a second language has been a difficult process that takes a lot of time and energy from the acquirers. However, recent developments in AI may offer enhanced techniques to improve SLA outcomes. The use of AI in augmenting SLA and its potential future applications are examined by Betal (2023). AI technology is opening up new possibilities to improve language learning and support efficient SLA as it develops. To fully use AI's potential in SLA, however, issues with authenticity, individualization, and ethical considerations need to be resolved. Betal (2023) looked at the possible and existing uses of AI and talked about how it affects SLA, pointing out advantages and disadvantages.

Tom Taulli (2019) wrote a comprehensive book titled "Artificial Intelligence Basics." It provides an interesting and simple introduction to key ideas, for instance, robots, deep learning, NLP, machine learning, and so on. In addition to offering doable implementation strategies and authentic case examples, the writer applies his expertise to further explore the more general problems related to AI. These include social trends, moral dilemmas, and the possible impacts of artificial intelligence on governments, businesses, and daily life.

According to Khurana et al. (2023), NLP has drawn a lot of interest recently for its computational ability to represent and analyze human language. Applications for it have expanded to several sectors, including question answering, machine translation, email spam detection, information extraction, summarization,

and the medical profession. In order to identify the stages, this review first goes over the various NLP levels and NLP components. Next, it goes over the background and development of NLP. After that, it goes into great length about the state of the art, outlining the numerous uses for NLP as well as existing trends and difficulties. Lastly, it offers a review of a few NLP assessment measures, models, and datasets that are currently accessible.

Method of Review

As a systematic review, this paper followed inclusion and exclusion criteria (see appendices 1, 2, and 3 for further details and explanations) for the data gathered from published studies. Data is gathered online through a variety of websites and search engines, such as Google Scholar, Saudi Digital Library, ResearchGate, Springer, ScienceDirect, etc. The studies that were not too old and had similar ideas were included in the current review. The ones that were conducted to talk about SLA and AI but don't support current projects' ideas or point of view were excluded.

The review paper will provide answers to a primary and two sub-questions: How can NLP assist in acquiring a second language? (as a primary question). This question wants to know about the ways computers (NLP) can be used to help in acquiring another language. What are the developments in the way AI/NLP helps in acquiring a Second Language? (as sub-question 1). The answer to this question would provide information about the advancements in the field of AI or NLP. How do these advancements enhance and support learners' objectives? (as sub-question 2). The information pertaining to this inquiry would reveal the efficacy of advancements and the ways in which they facilitate the goals of learners.

As was already indicated, the three questions posed by the current investigation are connected to one another and the information. For example, the central query (How can NLP assist in acquiring a second language?) is related to the second question since developments in the way NLP and AI help in acquiring a second language would provide details on the kinds of activities that can be completed using AI/NLP to facilitate SLA. For example, how AI/NLP may assist people in learning how to pronounce a second language. To address the main topic of this review, the response to this question will now highlight the third question and include systematic (step-by-step) information.

Literature Search and Inclusion and Exclusion Criteria

This systematic review includes several impressive references to provide comprehensive information about SLA, AI, and NLP towards answering the questions posed by the current investigation. Such studies try to fit the inclusion criteria of the current project, and combining these great studies would provide step-by-step data and a deep systematic review.

A study titled "Natural Language Processing and Language Learning" was carried out by Meurers in 2012. The automatic processing of human language is the focus of NLP, a relatively new

science that began about fifty years ago. As a field of study that blends linguistics, computer science, psychology, and NLP is also known as computational linguistics. Lexical, morphological, and syntactic components of language have historically received the most emphasis when it comes to the language-related characteristics covered by NLP, but in the past 10 years, meaning, discourse, and the relationship to the extralinguistic environment have all gained prominence. NLP is used by intelligent language tutoring systems (ILTSs) to provide students with personalized feedback while they work on tasks, typically in the form of workbook-style exercises. The learner model may be updated and the content sequenced differently for each student based on the results of the NLP analysis. Though, in theory, feedback can also highlight appropriately employed forms, or it might target features of meaning or the appropriateness of a learner's answer given the information provided by an activity, the analysis usually focuses on language faults produced by the learner. Then, for every possible answer, the intended system feedback for each situation may be stated clearly (Meurers, 2012).

Zilio et al. (2017) introduce SMILLE, a system that relies on input changes and the noticing hypothesis to solve the unacknowledged grammatical information in online publications chosen by a particular user. Through input improvements, the system can draw the user's attention to grammar, potentially increasing the intake per input ratio for metalinguistic information. The system receives an internet document and uses a parser and hand-written rules to detect the grammatical structures in it. The freedom of the user to choose the input text adds interest to the experience and lets the user express their interests. The method can enhance 107 distinct fine-grained grammatical structure types based on the Common European Framework for Languages (CEFR). An analysis of a few of those structures revealed an 87% overall accuracy.

SpeechBuddy is an app designed for learning English that was created by Chantarutai (2018). The programme offers English language instruction based on users' English proficiency requirements and uses NLP and Automatic Speech Recognition (ASR) techniques to run an algorithm to assess learners' speaking and pronunciation skills. With the use of this program, English language learners may enhance their speaking abilities without having to interact with native speakers. English language learners may practice speaking in front of a computer using this program, which will record and display their speech patterns and suggest ways for them to get better at speaking depending on the findings. As a result, English language learners may study the language at home using an application that provides personalized learning materials. To sum up, SpeechBuddy not only improved the students' English-speaking abilities but also gave them confidence to practice the language and helped

them adopt a more optimistic outlook on learning the language.

The challenge of SLA modelling is presented by Settles et al. (2018). The aim is to forecast errors that second language learners are likely to make at random times in the future based on their past blunders. Settles et al. (2018) describes a sizable corpus of more than seven million words created by more than 6,000 English, Spanish, and French language learners utilizing the well-known online language learning tool Duolingo. The article then summarizes the findings of a shared task challenge that involved fifteen teams and synthesized research from a variety of disciplines, including machine learning, linguistics, and cognitive science, with the goal of researching the SLA task using this corpus.

Taulli's (2019) provides an accessible introduction to AI targeting people who want to learn the basics of AI but may not have a technical background. Taulli discusses a range of topics related to AI, such as its background, uses, and social ramifications and outlines the history of AI, from early philosophical debates to the creation of contemporary AI systems. After that, Taulli explores the various varieties of AI, including broad and narrow AI, and clarifies the meaning of machine learning and deep learning. In the same context, Taulli examines the practical uses of AI in a range of sectors, including banking, healthcare, entertainment, and transportation. He talks about the application of AI to boost productivity, refine decision-making, and open up fresh avenues for creativity. Taulli also discusses cultural and ethical concerns about AI, such as those pertaining to job displacement, prejudice, and privacy. He stresses that to reduce dangers and guarantee that AI helps society as a whole, responsible AI development and regulation are crucial. Taulli (2019) gives readers a thorough introduction to AI that is approachable and simple to comprehend, making it a great place for anybody to start learning about this quickly developing topic.

An introduction to the area of Computer-Assisted Language Learning (CALL) is provided by Phil Hubbard's (2021) book "An Invitation to CALL: Foundations of Computer-Assisted Language Learning". He explores the historical evolution, theoretical foundations, and real-world uses of technology, including AI, in language instruction. Hubbard starts out by examining the history of CALL, from its inception to the mid-20th century rise of computing technology and its eventual assimilation into methods of teaching languages. He focuses on the important theoretical underpinnings of CALL techniques, such as constructivism and communicative language instruction, highlighting the importance of technology in enabling meaningful language learning experiences. Hubbard (2021) explores a range of CALL methods and resources, such as mobile applications, internet platforms, and multimedia software, demonstrating how they might improve language learning possibilities both within and outside of the classroom. When incorporating technology into language training,

He also discusses pedagogical issues such as task design, learner autonomy, and digital literacy. Additionally, Hubbard explores how new technologies, like virtual reality and AI, affect language acquisition and provides predictions for developments in the area.

Significant advancements in AI and a focus on individualized learning have had a substantial influence on the area of SLA. With the application of AI to the field of CALL, more adaptive language learning technologies are being created; nonetheless, concerns have been raised about inadequate information and teacher training. Teachers require a thorough understanding of the most recent advancements in AI-based language learning tools in order to make the most of these resources. Most of these technologies were used to detect mistakes, give feedback, and evaluate language proficiency. They employed NLP and machine learning. Learners showed improvements in their language skills and knowledge after utilizing these tools.

According to Zhai and Wibowo (2022), conversational chatbots are being used more often in the field of learning and teaching as a result of the development of information and communication technology, particularly in the area of SLA. The application of AI chatbots in second language learning has been investigated, mostly through pedagogical techniques. There has not been much research done on the effects of humor, taking learners' cultural backgrounds into account, or developing empathic ways for handling learners' emotional distress. To enhance learners' learning results, Zhai and Wibowo (2022) examines the literature on AI and second language chatbots and develops sympathetic tactics. They discovered that the implementation of AI L2 chatbots to improve learners' learning outcomes is positively impacted by three dimensions: cultural, sympathetic, and hilarious dimensions. They discovered that there is much space for advancement in the creation of AI chatbots for L2 instruction. Identifying how learners perceive and respond to the learning content, incorporating cross-culturally sympathetic responses into conversational L2 chatbots, and examining the impact of cross-cultural humor on language proficiency are just a few recommendations made for improving the use of AI L2 chatbots.

Betal (2023) explores the relationship between AI and SLA, seeking to understand how AI might enhance and supplement SLA. He describes the present status of SLA and the major problems that learners have, including a lack of immersion, restricted access to native speakers, and trouble staying motivated. He then looks at how AI technologies, such as chatbots, machine learning, and NLP, might help with these issues. Betal talks about how AI-driven language learning systems may offer individualized instruction based on the requirements and preferences of each student. To increase motivation and engagement, these systems can include interactive exercises, real-time feedback, and customized learning paths. AI-powered language training programs may also

mimic talks with virtual native speakers, giving students excellent opportunities to practice speaking and communicating. Moreover, Betal emphasizes how AI may support language immersion through augmented reality (AR) and virtual reality (VR) technology. Learners may practice their language skills in realistic circumstances without having to leave the classroom. Furthermore, by instantaneously translating text and speech between languages, AI-enabled language translation systems can improve understanding and communication. Betal also addresses the ethical issues and potential difficulties that come with incorporating AI into SLA, like the digital gap, privacy issues, and algorithmic biases in AI. It highlights how crucial it is to develop AI responsibly and how continuous research is required to improve AI-based language learning programs. Finally, he emphasizes how AI has the ability to revolutionize SLA by delivering individualized, engaging, and interactive learning experiences.

AI learning systems have the potential to become even more potent and useful as language learning aids by solving these issues and constraints. Improving the efficacy and efficiency of learning user experience solutions depends on their integration (De la Vall & Araya, 2023).

The fields of AI and linguistics that deal with NLP and natural language generation (NLG), which are meant to help computers comprehend and produce human language, are covered by Khurana et al. (2023). NLG is concerned with producing meaningful text from internal representations, whereas NLP is concerned with comprehending human language. Khurana et al. (2023) also highlights how important NLP is to enhancing communication between humans and computers without requiring users to learn new languages. Machine translation, discourse analysis, automated summarization, morphological segmentation, optical character recognition, named entity recognition, and part-of-speech tagging are just a few of the NLP tasks that it supports. Applications of these problems in the real world include optical character recognition and machine translation. This emphasizes the interdisciplinary nature of NLP, including computer science, philosophy, psychology, and linguistics together while considering NLP problems, assessment criteria, datasets, and techniques.

Marcel (2024) explores the fusion of AI, as a fast-developing field, with foreign language instruction and learning. To satisfy the needs of contemporary learners, the conventional classroom model is changing and incorporating a variety of media, including print materials, in-person encounters, and creative pedagogy. Language learning is changing as a result of AI, especially chatbots and algorithmic tutors that provide individualized learning experiences that mimic real-world interactions. Marcel (2024) shows how AI systems, such as ChatGPT, which is a deep learning algorithm, may improve language learning results. Although he highlights the potential advantages of AI in fostering

multilingualism and offering customized teaching methods, he supports a fair strategy that respects the role of the human instructor. He talks about how AI is not as good as human teachers when it comes to handling subtle cultural nuances and offering sympathetic assistance. An overview of the several language learning applications (Babbel, DALL-E, Duolingo, Rosetta Stone, Memrise, Drops, and Mondly) accommodate varied learning preferences and methods underscoring the wide range of resources accessible to language learners. Overall, Marcel's study highlights the revolutionary possibilities of AI in language acquisition while underlining the ongoing significance of human interaction and pedagogical knowledge in promoting learning opportunities.

Findings

An in-depth analysis of the reviewed references with regard to the main inquiry, "How can NLP assist in acquiring a second language?" and the related sub-questions concerning advancements in the way AI/NLP helps in Second Language Acquisition and their implications for learners' objectives reveals numerous significant findings:

1. NLP for Personalized Feedback and Learning: Studies such as Meurers (2012) and Settles et al. (2018) demonstrate how language learners may benefit from personalized feedback provided by NLP. NLP analysis may pinpoint mistakes and potential development areas in learners' language use, enabling more individualized training and feedback. By focusing on certain language abilities and meeting individual requirements, this individualized method improves the learning process.

2. Attention to Grammar and Metalinguistic Information: Zilio et al. (2017) show how learners' attention may be drawn to grammatical structures and metalinguistic information by using NLP systems such as SMILLE. Through input text analysis and grammar feedback, NLP technologies improve language acquisition goals by making it easier to learn grammar.

3. Improving Speaking and Pronunciation: Chantarutai (2018) presents SpeechBuddy, an app that assesses students' proficiency in speaking and pronouncing words correctly by utilizing Natural Language Processing (NLP) and Automatic Speech Recognition (ASR). Using this technology, students may practice speaking English and receive feedback on how they pronounce words, which helps them reach their aim of strengthening oral communication skills.

4. Personalized Instruction and Adaptive Learning: A number of research works, such as Woo and Choi (2021) and Betal (2023), address how AI-driven language learning systems provide personalized instruction catered to the needs and preferences of each student. These systems use NLP and machine learning algorithms to tailor exercises, content, and feedback to students' goals, learning styles, and degrees of skill. Engagement, motivation, and learning results are maximized with this customized approach.

5. Enhanced Language Immersion and Communication: Betal (2023) also discusses how

artificial intelligence (AI) tools, like chatbots and virtual reality (VR), may imitate natural language settings and make it easier to communicate with virtual native speakers. AI improves learners' options for language practice and communication, supporting their goals of acquiring fluency and cultural competency by generating immersive language situations and facilitating real-time engagement.

6. Future Directions and Challenges: Researchers such as De la Vall and Araya (2023) and Khurana et al. (2023) address issues such as algorithmic biases, the need for improved human interaction, and the complexity of the data when it comes to AI/NLP in language acquisition. They do, however, also draw attention to how AI and NLP technologies might be used to overcome these obstacles and improve educational opportunities. In order to better promote language acquisition, future advances may combine VR and AR, improve NLP approaches, and improve adaptive learning algorithms.

7. Hybrid Approach to Language Learning: Marcel (2024) highlights how human training and AI may be used to improve language learning. Marcel supports a hybrid strategy that recognizes the value of AI in delivering personalized learning experiences but also values the importance of human instructors in addressing cultural differences and giving compassionate assistance. This well-rounded strategy maximizes language learning results by fusing AI technology with traditional classroom instruction (Marcel, 2024).

Overall, NLP's vital nature across many learning processes is highlighted by vast studies on its significance in SLA. NLP is a key technology in language learning, with applications ranging from improving grammar understanding and speaking fluency to supporting customized instruction and immersive experiences. Educators and students may more efficiently meet individual requirements, expedite language acquisition, and accomplish learning goals by using AI and NLP techniques. In the future, a hybrid method that combines human instruction with AI-driven personalized learning holds the potential to maximize language learning results and give students all over the world a well-rounded and adaptable learning environment.

Conclusion

To sum up, this systematic review clarifies the relationship between artificial intelligence (AI), natural language processing (NLP), and second language acquisition (SLA) and provides significant new insights into the ways in which these technologies might support SLA.

The current review addressed both primary and secondary issues to get an understanding of the field's advances and how they relate to learners' aims. It also investigated several facets of AI/NLP use in SLA. A thorough analysis of the studies made it clear that NLP is essential for offering adaptive learning opportunities, paying attention to grammar, improving speaking and pronunciation, and giving individualized feedback.

The findings point to a bright future for AI/NLP integration in SLA, with more innovation and research anticipated to solve present issues and improve language learning prospects upon further investigation.

Here are some suggestions for areas in need of further investigation, methodological enhancements, and applications for researchers and educators:

1. Examining the long-term effects of AI-powered language learning assists on language retention and competency. Longitudinal studies that monitor students' development over time might provide insightful information.

2. Examining how AI chatbots affect students' emotional motivation and involvement in language acquisition. More successful deployments may result from an understanding of how these technologies impact learners' attitudes and perceptions.

3. Examining how humor and cultural awareness fit into AI chatbots designed to teach languages. Studies may concentrate on the effects of humor and cultural references on learners' engagement and language learning results.

4. Using rigorous experimental designs to evaluate the effectiveness of AI-driven language learning tools, such as randomized controlled trials. Sturdy methods would improve the validity and reliability of study results.

5. Using mixed-method techniques to collect data that is both qualitative and quantitative. Surveys, interviews, and observational data combined may offer a more thorough picture of how language learners interact with AI-based learning resources.

6. Investigating how varied learner groups may be accommodated by AI-driven language learning systems by conducting cross-cultural research. Customizing tools for diverse cultural settings may enhance their efficiency and use.

7. Providing educators with the guidance and assistance they need to successfully incorporate AI-powered language learning resources into language teaching. Teachers might improve their teaching skills by using these technologies with the support of professional development programs.

8. Provide better practices and recommendations for the ethical use of AI in language learning environments. For AI to be implemented responsibly, learner privacy, equity, and inclusion must be given top priority.

9. Encouraging cooperation among researchers, educators, and developers to jointly create AI-powered language learning resources that cater to particular educational requirements and preferences. Solutions that are more effective and user-centered can be produced by including stakeholders in the design process.

By taking these suggestions into account, researchers and educators might broaden the field of AI-driven language learning and optimize its benefits for language learners worldwide.

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Appendix 1: Inclusion and Exclusion Criteria 1

Parameters	Inclusion Criteria	Exclusion Criteria
Topic	Providing comprehensive information about the relationship and advancements in SLA and AI, focusing on the ways AI/NLP can help in acquiring L2 effectively.	Lacking information about the links and developments in AI and SLA, conducted having some other ideas.
Type	Academic theoretical research (journal papers, books, PhD thesis, authentic articles, professional papers, and abstracts)	Unclear studies with ambiguous information.
Source	Websites having citations (Google Scholar, Saudi Digital Library, ResearchGate, Springer, ScienceDirect, Zlibrary, etc.)	Wikipedia, webpages, blogs, etc.
Language	Written in English only.	Written in a different language.
Style and vocabulary	Clear, simple, and easy to understand	Ambiguous
Time frame	Published in 2012 and onward, paying attention to the developments in both fields.	Published otherwise

Appendix 2: Inclusion and Exclusion Criteria 2

Study Pinpoints	Topic	Is the topic accurate to the study?
	Published in	When was the study published?
	Source	From which source was the data found?
	Author (s)	Who is the author of the article?
Study Features	Language	Which language was used to conduct the study?
	Context	In which context did the study take place?
	Style and vocabulary	What was the writing style of the study and what type of vocabulary was used?
	Research duration	Was the study cross-sectional or longitudinal?
	Geographical location	Where the study did take place?
	Sample size	What was the study's sample size?
	Theoretical and conceptual framework	Which conceptual and theoretical frameworks were used in the research?
Participants	Inclusion and exclusion parameters	Were there any parameters for including and excluding the studies? If yes, what were the parameters?
	Strongest matches	How were the strongest matches found by the studies? What were the strategies for used in the study?
Results	Main findings	What were the main findings? Were these outcomes significant?

Appendix 3: Research questions

Research Questions	Data	Analysis	Findings	Discussion **1**
How can NLP assist in acquiring a second language?	NLP combines linguistics, computer science and psychology in computational linguistics. NLP helps in meaning, discourse, extralinguistic context, lexical, morphological, and syntactic aspects. ILTSs use NLP to provide personalized feedback, update and arrange/sequence content (Meurers, 2012). Zilio et al. (2017) present SMILLE a NLP system used to improve grammar learning and metalinguistic awareness. SpeechBuddy evaluates speaking abilities using NLP & ASR, providing personalized feedback and practice chances without contact with NSs (Chantarutai, 2018). Settles et al. (2018) tackle the problems associated with SLA modelling using large corpus via online language learning platforms and NLP to predict learners' errors based on previous mistakes. Betal (2023) shows how AI-powered language learning tools, virtual talk to NSs and personalized teaching using ML & NLP is used in SLA. De la Vall and Araya (2023) talk about potential of AI specifically NLP in language learning. Marcel (2024) talks about how AI & human instructors can work together.	NLP helps in SLA by providing personalized feedback (ILTSs) (Meurers, 2012); improving grammar learning (SMILLE) (Zilio et al., 2017); enhancing speaking abilities (SpeechBuddy) (Chantarutai, 2018); predicting and correcting errors (SLA modelling via corpus and NLP) (Settles et al., 2018); immersive learning experiences (AI and NLP tools) (Betal, 2023; De la Vall & Araya, 2023); chatbots and algorithmic tutors (Marcel, 2024).	Overall, customized instructions, feedback, mistake analysis, and immersive learning experiences are all possible by NLP in language learning systems which greatly help in SLA.	ILTSs is one of the main contributions of NLP in L2 learning. NLP also helps in improving grammar and speaking skills. SMILLE & SpeechBuddy use NLP to point out grammatical errors, provide personalized feedback and evaluate speaking skills, which enhance metalinguistic awareness and offer practice opportunities without direct contact with native speakers. NLP helps in SLA modeling using large online corpus from language learning platforms and predict learners' errors based on previous mistakes, which helps learners to improve with specific and personalized instructions. NLP integration with augmented and virtual reality (AR/VR) enhance language immersion and provides personalized learning experiences. AI and humans can work together by assisting each other where needed. Future research and developments are required to overcome challenges and further integrate NLP with AR & VR. Plus, steps should be taken to ensure the reliability and accuracy of NLP analysis and feedback for effective L2 learning.

What are the developments in the way AI/NLP helps in acquiring Second Language?	Meurers (2012) provides information about how ILTSs is a development in AI/NLP that helps SLA. Zilio et al. (2017), highlights the way developing an advanced system SMILLE using NLP helps in grammar and metalinguistic awareness. SpeechBuddy developed by Chantarutai (2018) provides practice and feedback on speech production using NLP & ASR. Settles et al. (2018), use NLP for error prediction using large corpus to handle SLA modeling. Focusing on customized training, exercises, and interactions with virtual NSs using NLP & ML Betal (2023) AI-based language learning systems. De la Vall and Araya, (2023) address the potential of AI in L2 learning, emphasizing the need of further study and development including the integration of NLP with virtual reality. Zhai and Wibowo (2022) talks about conversational AI chatbots in SLA, emphasizing the value of humor and culture. Marcel (2024), stresses the need and role of human teachers, especially to manage cultural differences and provide sympathetic support.	Key developments: ILTSs (personalized feedback) (Meurers, 2012); SMILLE (enhance grammar learning and metalinguistic awareness) (Zilio et al., 2017); SpeechBuddy (evaluate speaking ability) (Chantarutai, 2018); Error prediction (SLA modelling) (Settless et al., 2018); Personalized training (AI & NLP language learning tools) (Betal, 2023); Integration with virtual and augmented reality (De la Vall & Araya, 2023); Conversational AI chatbots (humor & cultural) (Zhai & Wibowo, 2022); ChatGPT and so on (Marcel, 2024).	Collectively several applications ranging from grammar instructions to speaking proficiency, personalized learning experiences and much more are AI/NLP developments to help SLA.	The combination of AI & NLP into SLA had several significant advances in recent years. Key points: personalized feedback and instruction, grammar learning and metalinguistic awareness, speaking proficiency assessment and practice, error prediction and SLA modeling, customized training and immersive experiences, integration with VR & AR, conversational AI chatbots. These developments have great implications for L2 learning, offering personalized, efficient and immersive experiences for learners.AI & NLP provide many benefits including individualized instruction, improved grammar, enhanced speaking proficiency, error prediction, practice exercise, immersive experiences and cultural sensitivity. These advancements have made language learning more accessible, effective and enjoyable for learners worldwide.

How do these advancements actually enhance and support learners' objectives?	ILTSs provides personalized feedback for specific help and directions on language problems (Meurers, 2012). SMILLE uses NLP to highlight grammatical structures in online texts which helps promote metalinguistic awareness and enhances language comprehension (Zilio et al., 2017). Using NLP & ASR SpeechBuddy evaluates learners' speaking abilities and provide feedback and practice exercises which improve oral competence and confidence (Chantarutai, 2018). Settles et al. (2018), talk about the use of Second Language Modeling that helps by predicting mistakes and eventually helps language learning. Betal (2023), investigates how AI-based language learning systems using NLP & ML provide personalized teaching, interactive exercises and imitate conversations. De la Vall and Araya (2023), look into how AI & NLP applications can handle different language learners and offer adaptive learning experiences, which will improve learning outcomes. Marcel (2024), investigates how chatbots and algorithmic tutors can aid learners' goals. It provides a summary of various language learning apps.	AI & NLP advancements aid learners' goals by providing specific help and directions (Meurers, 2012), enhancing grammar learning, metalinguistic awareness and language comprehension (Zilio et al., 2017), practice exercises and personalized feedback (Chantarutai, 2018), targeted intervention (Settles et al., 2018), enhancing motivation, engagement and immersion in language learning (Betal, 2023), providing adaptive learning experiences (De la Vall & Araya, 2023), managing and supporting cultural and sympathetic knowledge (Marcel, 2024).	Overall, these developments facilitate language learning not only achieving learners' goals but also providing an opportunity of practice and learn language in customized and immersive contexts.	By offering individualized feedback, encouraging metalinguistic awareness, improving speaking skills, addressing SLA modelling challenges, boosting motivation and engagement, and providing adaptive learning experiences, and knowledge of cultural and sympathetic differences, the combination of AI & NLP into L2 learning has significantly advanced learners' goals. Overall, the advancements in AI and NLP have revolutionized language learning by giving students individualized, compelling, and successful learning experiences. These technologies significantly contribute to the facilitation of language learning and competence by targeting certain language acquisition goals and problems. To further improve and optimize these systems for even higher efficacy in language instruction, more study and development is needed. **[Discussion 2]** Significant advances have been made in language learning through the combination of Artificial Intelligence (AI) and Natural Language Processing (NLP). This has resulted in better speaking proficiency evaluation, personalized training, improved grammar understanding, and predictive mistake modelling. Through interactive exercises and simulated discussions, these

				technologies enhance motivation and engagement, facilitate personalized learning experiences, and allow adaptive learning techniques that adjust to each learner's progress and preferences. Notwithstanding these developments, issues like the demand for more organic interactions and higher accuracy voice recognition still exist. However, future research and development might significantly improve the efficacy of AI-driven language learning systems, revolutionizing language teaching and improving the efficiency and accessibility of second language acquisition for learners globally.