

The Impact of AI-driven Contextual Input and Output on Second Language Acquisition

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Abstract. As the AI (Artificial Intelligence, AI) technology, especially the language model and the rapid development of intelligent learning system in the field of language education, contextualized input and output have gradually become an important path to promote Second Language Acquisition (SLA). Based on the theory of input hypothesis and output hypothesis and social culture and interactive approaches, this article system combed the AI drive learning environment, language input, output, and the change of the interactive mechanism and its influence on second language acquisition. Research suggests that AI can enhance the understandability and relevance of input through adaptive recommendation, multimodal presentation, and virtual situation simulation. At the output level, AI dialogue system, real-time error correction and scaffolding support for language learners provides a high frequency, low anxiety generated opportunities, complexity and accuracy in grammar, syntax and vocabulary, expression fluency and pragmatic appropriateness, etc, to promote the language output quality improvement. More importantly, AI integrates input, output and feedback into a dynamic loop process, thereby reshaping the occurrence conditions of traditional second language acquisition to a certain extent. In the affirmation of the potential of the AI in language learning at the same time, the paper also points out its authenticity, learner differences in interactive adaptation and technology rely on is still limited, and emphasizes on the importance of teachers' professional guidance to realize man-machine coordinated. This article aims to provide references for the research and instructional design of second language teaching supported by AI from both theoretical and practical perspectives.

Keywords: Artificial intelligence, Contextualized input, Contextualized output, Second language acquisition, Interaction mechanism

1. Introduction

With the rapid development of Artificial Intelligence (AI) technology, especially the large language model, intelligent recommendation system and conversational system in the field of education, language teaching is gradually shifting from a teacher-centered and teacher-textbooks model to an intelligent learning ecology featuring collaboration between learners and technology. Against this backdrop, "contextualized input" and "contextualized output" have once again become core topics in second language acquisition research. Traditional emphasis on second language acquisition theory

and comprehensible input, language output and interaction in a key role in the development of language, but time is limited by the classroom, teaching resources and learner differences, real and sustained contextualized language practice is often difficult to achieve [1]. The introduction of AI technology has to some extent changed this situation. Through adaptive algorithms, corpus analysis and human-computer interaction mechanisms, AI can dynamically adjust the input difficulty according to the learner's level and provide opportunities for high-frequency language output in virtual or semi-real scenarios [2]. Compared with traditional teaching environments, AI-driven learning systems are more likely to achieve immediate connection between input and output, thereby forming a continuous and cyclical language usage process. However, whether AI really facilitates second language acquisition needs to be examined within a mature language acquisition theoretical framework. Existing research shows that the technology itself does not directly lead to the acquisition effect; its value depends on whether it can effectively support the cognitive processing, social interaction and meaning construction processes [3]. Therefore, it is necessary to systematically analyze the AI-driven contextual input and output mechanisms from the perspective of theoretical integration. Based on this, on the basis of input hypothesis, output hypothesis and socio-cultural theory, this paper systematically discusses the influence mechanism of contextualized input and output supported by AI on second language acquisition, and further analyzes the integration mode of input, output and interaction in the AI learning environment, aiming to provide theoretical reference for language teaching research and practice in the AI era.

2. Review of theoretical basis

2.1. Input hypothesis and the development of contextualized input

Input hypothesis, language acquisition is the key to learner continuous exposure to a slightly higher than the existing level of comprehensible input ($I + 1$) [1]. This view highlights the fundamental role of understanding in language development, but it has also been criticized for overemphasizing the understanding of language forms while neglecting context, interaction and social factors [2]. In the traditional classroom environment, the input is mainly textbook text and teacher's explanation, and language is often separated from the specific communicative purpose and social context. As a result, although learners can understand the syntax and lexical meaning, they have difficulty in mastering the conditions for the use of language in real communication.

The proposal of contextualized input is precisely a response to this limitation. Contextualization does not merely mean "having a context", but rather emphasizes the systematic connection between language form, pragmatic function and social context [3]. When the language input embedded concrete tasks, roles, relationships and communication purposes, learners are more likely to understand language as "resources" can be used rather than abstract rules. In an AI-supported learning environment, this concept has gained new realization conditions. Through the level of learners, learning path and continuous analysis of error mode, AI system can dynamically adjust the input difficulty and content type, make the input more close to the learner's recent developments [4,5].

Furthermore, AI-supported multimodal input further deepens the explanatory space of the input hypothesis. Studies show that when the language input at the same time combined with visual cues, voice prompt information and situation, learners in the process of understanding of the cognitive load decreased significantly, thus more easily on the distribution of attention to meaning construction [6,7]. Therefore, AI has not altered the theoretical core of the input hypothesis but has

instead enhanced the operability and sustainability of contextualized input at the practical level. First Section This section must be in one column.

2.2. Output hypotheses and language generation supported by AI

Output hypothesis emphasizes that language output is not only the acquisition as a result, is the important mechanism of the promoting acquisition [8]. During the output process, learners need to make precise choices of language forms. This process helps them become aware of the deficiencies in their own language systems, thereby triggering deeper language processing. Output opportunities in traditional teaching situations, however, are often limited to class time, class size, and evaluation of pressure, many learners lack enough practice in oral and written expression [9].

The AI dialogue system has alleviated this problem to a certain extent. By simulating real or semi-real communicative situations, AI provides an output space for learners to try again and again, enabling them to conduct language experiments in a low-anxiety environment [10,11]. This high-frequency and sustainable output practice helps learners gradually achieve language automation and enhance their confidence in expression.

More importantly, the output supported by AI is usually combined with an immediate feedback mechanism. When the system corrects, restates or clarifies the semantics of the learner's language output, new input is generated immediately, thus forming a "output - feedback - re-input" loop process [12,13]. This mechanism not only responds to the theoretical propositions of the output hypothesis, but also provides a more operational path for its application in real teaching situations.

2.3. Social and cultural theory and the perspective of human-computer interaction

Social cultural theory to language acquisition as a cognitive development process was achieved by social interaction, stents, collaboration, and the role of meaning negotiation in learning [14]. Under this framework, learning is not an isolated individual behavior but occurs with the support of specific social relations and cultural tools. Traditional research has mostly focused on the role of teachers and peers in interaction, while the emergence of AI has expanded the conceptual boundaries of "interactive other".

Recent studies have pointed out that although AI does not possess complete human sociality, it can play a stent-like role in language learning [15,16]. Through tips, demonstration, feedback and guidance, the AI can to a certain extent, support learners were difficult to independently language task. From a social and cultural perspective, this kind of human-computer interaction does not replace interpersonal interaction, but provides learners with a sustainable and adjustable auxiliary interactive resource.

More importantly, the interactive environment provided by AI has a high degree of stability and repeatability, enabling learners to gradually internalize language knowledge in multiple meaning negotiations [17,18]. This feature makes AI an important intermediary tool for connecting cognitive processing with social interaction.

3. AI-driven contextualized input, output, and interaction mechanisms

In the study of second language acquisition, contextualized input usually refers to embedded in specific context and communicative purpose, can help learners to understand the relationship between language form and function of language material. Although existing literature has not yet been driven "AI contextualized input" as a fixed term defined, but a lot of contextualized input,

technology intermediary input and adaptive language learning research provides a theoretical basis for the concept.

Based on the above research, this article will AI driven contextualized input is defined as: by the artificial intelligence system based on learners' language level, learning behavior and task requirements, dynamically generated or screening, embedded in specific use situation of language input. Different from traditional teaching material or static digital resources, this type of input emphasizes alignment between learner proficiency and situational demands, highlight the language form and the function of the relationship between meaning and purpose. In this process, AI plays the role of a decision agent in regulating input difficulty and context construction, context construction and content selection, so as to realize the integration of "understandable input" and "context relevance" at the technical level.

Output promotes linguistic development in accuracy, complexity, and metalinguistic awareness. , its core lies in the learners in the context of meaningful language use the language generation, and the lack of awareness in the process of language ability. Similar to 'contextualized input', 'AI-driven contextualized output' is not a established concept in existing research, but rather a comprehensive generalization of studies on technologically supported language output.

In this paper, AI-driven contextualized output is defined as the language production process of learners in the communicative tasks and situations constructed or supported by artificial intelligence system, which is usually accompanied by immediate feedback, prompt or scaffold support. AI not only provide opportunities for the output of learners, but also through dialogue, simulation, automatic feedback and mission to guide, guide the learners in close to the real conditions of use under the situation of language generation. Such output emphasizes the combination of language output and communicative purpose, make the output process at the same time become a reflection of language practice and language field, thus to some extent, improved the promoting role of output in second language acquisition.

3.1. AI-driven contextualized input

In the AI support language learning environment, language input is no longer a unified, static teaching resources, but data dynamically generated based on learners personalized content. Through learning analytics and natural language processing technologies, AI systems can continuously track learners' language proficiency, learning paths, and error patterns, and accordingly push more relevant and understandable language materials [19]. This input mechanism not only focus on language difficulty matches, more emphasis on language form and the fit between specific communicative situation.

Compared with traditional textbook input, AI-driven contextual input is more likely to be embedded in real or semi-real pragmatic scenarios, such as simulated dialogues, task-oriented texts and contextualized videos. This input form will help learners to understand the meaning of language at the same time, gradually establish the cognitive language use conditions, thereby reducing the phenomenon of "but not to solve the problem with" [20]. From the perspective of input processing, the introduction of situational cues also helps to reduce cognitive load, enabling learners to allocate more attention to meaning construction.

3.2. AI-driven contextualized output

At the output level, the AI dialogue system provides learners with a high-frequency and low-anxiety language generation environment. Learners can repeatedly practice expression in different task

situations and gradually improve their language fluency and accuracy through continuous attempts and corrections [10]. Compared with the traditional classroom one-off output pressure is limited by time and evaluation, the continuous output more conducive to language development of automation.

Immediate feedback is a key link in the AI output mechanism. AI system can provide timely for learners' language output and specific error correction, rewrite or significance to clarify, prompting learners notice the mismatch between form and meaning [12,13]. When feedback and contextualized task closely, output activities are more likely to translate into effective language learning experience, rather than mechanical exercises.

3.3. An integrated mechanism of input-output-interaction

In the AI learning environment, input, output and interaction are no longer separate teaching links but form a continuously operating dynamic circular system. Learners through contextualization input language sense, through contextualization output test and use existing language knowledge, and in constant interaction with the AI and immediate feedback constantly adjust their own language system [8]. This process reflects the cognitive processing and social interaction, the depth of the fusion language learning centered on knowledge transfer model, to participate in meaning construction and practice oriented learning process.

From the point of whole second language acquisition mechanism, the input - output - the integration of interactive mode, learning environment helps explain AI language acquisition efficiency. Contextualized input provides contextual support for language comprehension, output prompts learners to process language forms in detail, and interaction and feedback mechanisms establish a dynamic regulatory channel between the two, making language development cyclic and progressive. However, the effectiveness of this mechanism is not automatically generated technology but is highly dependent on the quality of teaching design, the active participation of learners and teachers' professional guide [2].

From the perspective of teaching application, this integration mechanism holds significant implications for the design of second language classrooms. First of all, when teachers introduce AI tools, they should avoid using them separately for "input presentation" or "output practice", but should organically integrate input, output and interaction into a continuous teaching sequence around the complete teaching objectives. For example, contextualized input can be used for meaning construction and language preparation before the task, AI-supported output activities can be used for task implementation, and feedback-based human-computer or interpersonal interaction can serve for post-task reflection and consolidation. Secondly, the immediate feedback and repeatable interaction features provided by AI can serve as an important extension of classroom teaching, helping learners continuously participate in language practice outside of class and thereby alleviating the problem of limited classroom time. Finally, teachers should play the role of "instructional designer" and "learning regulator" in this process, guide learners to screen, compare and reflect on AI feedback, avoid mechanized learning activities, and ensure that technology truly serves the development of language ability.

4. Teaching implications and practical applications

In teaching practice, the AI driven contextualized input and output should be considered for structural supplement in the traditional classroom, rather than the simple superposition of technology. First, teachers can use the AI system extension learners contact time and space of the target language, language learning from extended to extra-curricular class situation and autonomous

learning environment. In this process, contextualized input and output tasks should be designed around clear communicative goals to prevent learning activities from becoming formalistic exercises.

Secondly, the intervention of AI provides a practical path for differentiated teaching. Due to the significant differences between learners in language foundation, learning rhythm and strategy use, it is often difficult to meet the needs of all learners at the same time under the uniform schedule of classroom teaching. The AI system can take on the function of personalized practice and feedback to a certain extent, while the teacher can focus on the overall teaching planning, monitoring the learning process and guiding the development of high-level language ability, so as to form a more reasonable division of labor.

In addition, teachers need to guide learners to make reflective use of AI output and feedback in practice. If learners treat AI suggestions as absolutely correct answers, their ability to independently evaluate language use may be weakened. Therefore, the teaching design should encourage learners to compare different expression, evaluation feedback rationality, and, when necessary, through interpersonal interaction in consultation with correction. In this way, AI can truly promote learners' language awareness, critical thinking and long-term development.

5. Conclusion

This paper around the AI driven contextualized input and output, to its role in second language acquisition mechanism system is analyzed. Studies suggest that AI by raising the correlation of input and comprehensible output and expand opportunities and strengthen the real-time interaction, to a certain extent, reconstructed the traditional input and output in second language acquisition and the relationship between the feedback. However, this technology driven learning environment did not change the basic law of language acquisition, the effect is still dependent on the learner's cognitive engagement, emotional input and the rationality of the design of teaching.

Therefore, future research is necessary from a single technical evaluation towards more learners perspective analysis framework, system under different learner variables how to adjust the AI support language input, output, and the practical effects of the interaction in order to avoid the AI as universally applicable solutions. In addition, the situation of AI constructed to what extent can support pragmatic competence, intercultural awareness and identity construction, remains to be verified through long-term, contextualized research.

In general, AI-driven contextualized input and output provide an important opportunity for second language teaching. However, the best application of AI-driven contextualized input and output is not fully technical, but complementary to interpersonal interaction and classroom practice under the guidance of teachers' professional judgment and teaching objectives.

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