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A METHODOLOGY FOR DEVELOPING SPEAKING SKILLS OF SPECIALIZED SCHOOL STUDENTS THROUGH ARTIFICIAL INTELLIGENCE TECHNOLOGIES

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Abstract

The global advancement of artificial intelligence (AI) has transformed educational systems, particularly language learning environments that demand innovative approaches to teaching speaking skills. Specialized schools, which focus on academic excellence and discipline-specific training, require pedagogical models that leverage technology to enhance communicative competence. This article presents a comprehensive academic examination of AI-based methodologies for improving speaking skills in specialized school students. It draws on communicative, sociocultural, and cognitive theories of language learning; synthesizes recent empirical research; identifies existing challenges in traditional speaking instruction; and proposes an integrated methodology for AI-supported speaking development. The methodology includes stages of needs analysis, instructional planning, AI-mediated practice, automated assessment, and reflective learning. The study contributes to both theoretical understanding and practical approaches to AI-driven pedagogy, offering implications for curriculum design, teacher professional development, and the future of language education in specialized school contexts.

Keywords: artificial intelligence, innovative approaches, discipline-specific training, automated assessment, reflective learning, AI-driven pedagogy, offering implications.

1. Introduction

The increasing integration of artificial intelligence (AI) across sectors has created new opportunities for enhancing the quality, accessibility, and personalization of education.

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Within the field of English language teaching (ELT), AI tools have gained prominence as supportive technologies capable of providing individualized feedback, analyzing linguistic performance, detecting errors, and simulating real-life conversations. For specialized schools—educational institutions designed to develop professional, technical, or academic competencies in science, mathematics, engineering, technology, arts, or languages—the demand for advanced English-speaking proficiency is significantly higher than in general schools.

Speaking skills are particularly critical because specialized school students must participate in academic discussions, present research, engage in debates, and interpret complex disciplinary discourse. However, traditional speaking instruction in many contexts remains constrained by factors such as exam-oriented curricula, limited instructional time, teacher-centered pedagogies, and insufficient exposure to authentic communicative environments.

AI technologies present a timely solution to these pedagogical challenges. Intelligent tutoring systems, automated speech recognition (ASR), conversational agents, natural language processing (NLP), and virtual reality (VR) can create rich, adaptive, and scalable environments for improving speaking skills. These tools enable students to receive immediate feedback, engage in repeated practice, participate in immersive simulations, and build confidence in a safe, low-stress environment.

This article aims to develop a comprehensive methodology that integrates AI technologies into the teaching of speaking skills for specialized school students. The study addresses the following research questions:

What does existing literature reveal about AI-supported speaking instruction?

What challenges do specialized school students face in developing speaking skills? How can AI technologies be systematically integrated into speaking instruction?

What are the implications, limitations, and practical recommendations for educators?

2. Literature Review

2.1 Artificial Intelligence in Language Education

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AI has become a transformative force in language learning due to its ability to automate evaluation, personalize instruction, and simulate authentic communication. Researchers such as Li (2023), Liu & Wong (2022), and Zhou (2021) note that AI supports multidimensional learning by enabling pronunciation training, grammar analysis, discourse support, and intelligent conversational practice. Unlike traditional methods, AI offers real-time corrective feedback and allows unlimited practice opportunities.

Studies have shown that AI-driven adaptive learning systems can effectively provide customized learning experiences that cater to individual students' requirements, capabilities, and learning preferences (Corbett & Anderson, 1995; Mitrovic et al., 2016). Additionally, intelligent tutoring systems, a type of AI-based system, have been proven to support student learning, especially in subjects like mathematics and science (Graesser et al., 2011; VanLehn, 2011).

2.2 Speaking Skills in Specialized School Contexts

Speaking is a productive skill that requires fluency, accuracy, pronunciation control, pragmatic competence, and strategic communication. Specialized school students often need English for presentations, scientific discussions, professional simulations, and subject-related communication. According to Nunan (2015), speaking skills are improved when students participate in interactive and meaningful tasks. In specialized schools, tasks must be aligned with disciplinary needs—for instance, math students practice problem-solving discussions, while medical students role-play doctor–patient interactions.

2.3 Theoretical Foundations for AI-Supported Speaking Development

2.3.1 Communicative Language Teaching (CLT)

CLT emphasizes authentic communication, interaction, and meaning negotiation. AI chatbots and conversational systems create opportunities for simulated real-life interaction aligned with CLT principles.

2.3.2 Sociocultural Theory

Vygotsky's theory highlights the role of mediation and scaffolding in learning. AI acts as a technological mediator that provides guided support within the learner’s zone of proximal

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development (ZPD). This includes personalized hints, adaptive tasks, and scaffolded feedback.

2.3.3 Cognitive Load Theory (CLT)

Complex speaking tasks may overwhelm learners. AI reduces cognitive load by breaking tasks into manageable stages, offering step-by-step guidance, and supporting multimodal input (audio, visual, text).

2.3.4 Data-Driven Learning

AI collects large amounts of learner performance data and identifies linguistic patterns. Chen (2020) argues that this data-driven feedback enhances metacognition, as learners can track progress and analyze their own weaknesses.

3. Challenges in Teaching Speaking in Specialized Schools

Although specialized schools are academically strong, they often face obstacles in developing English-speaking skills:

3.1 Limited Classroom Speaking Time

Large classes and exam-focused teaching reduce opportunities for oral communication practice.

3.2 Performance Anxiety

STEM-focused students often fear making mistakes and prefer accuracy over fluency, which leads to reduced speaking output.

3.3 Teacher-Centered Instruction

Traditional methodologies rely heavily on teacher explanation rather than student production.

3.4 Lack of Authentic Exposure

Schools in non-English-speaking countries provide limited exposure to native or professional English-speaking contexts.

3.5 Insufficient Feedback

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Teachers cannot provide real-time, individualized feedback to every student during class.

3.6 Diverse Learning Needs

Specialized school students demonstrate diverse proficiency levels and require tailored speaking tasks.

AI technologies can address these challenges by offering scalable solutions that supplement classroom teaching.

4. AI Technologies for Speaking Skill Development

4.1 Automated Speech Recognition (ASR)

Applications such as ELSA Speak, Google Speech API, and Microsoft Azure provide detailed feedback on pronunciation, intonation, stress, and rhythm. ASR's instant correction helps learners refine segmental and suprasegmental features. 4.2 Natural Language Processing (NLP)

NLP enables AI to understand grammar, vocabulary choice, semantic meaning, and discourse structure. It evaluates coherence, cohesion, accuracy, lexical diversity, and pragmatic appropriateness.

4.3 Conversational Chatbots

Chatbots simulate real-time communication. They encourage fluency by prompting spontaneous responses. Studies show chatbots significantly improve speaking confidence and reduce anxiety.

4.4 Virtual Reality (VR) and Augmented Reality (AR)

VR provides immersive experiences such as participating in conferences, debates, or workplace simulations. AR adds interactive visual elements to speaking tasks.

4.5 Intelligent Tutoring Systems (ITS)

ITS platforms create personalized learning paths, provide adaptive tasks, and track learner progress through dashboards accessible to both students and teachers.

5. Proposed Methodology for AI-Based Speaking Development in Specialized Schools

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This section outlines a five-stage AI-supported methodology designed specifically for specialized schools.

5.1 Stage 1: Needs Analysis and Learner Profiling

5.1.1 Diagnostic Assessment

AI-based placement tests evaluate pronunciation, fluency, vocabulary, and grammar.

5.1.2 Identification of Academic Specialization Needs

Tasks are aligned with students' fields (e.g., scientific presentations for STEM students).

5.1.3 Digital Literacy Assessment

Learners' familiarity with AI tools must be assessed before implementation.

5.2 Stage 2: Instructional Planning

5.2.1 Curriculum Mapping

Integrate AI tools with curriculum goals and national education standards.

5.2.2 Task Design

Tasks combine:

accuracy (ASR),

fluency (chatbots),

situational communication (VR),

collaborative projects (AI-supported platforms).

5.2.3 Time Allocation

Adopt a hybrid model of teacher-led and AI-mediated practice.

5.3 Stage 3: AI-Mediated Speaking Practice

5.3.1 Pronunciation Development

Learners practice phonemes, stress, rhythm, and intonation through ASR apps.

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5.3.2 Fluency Development Through Chatbots

AI measures: speech rate, hesitation markers, use of fillers, grammatical range,coherence.

5.3.3 VR-Based Situational Speaking Tasks

VR environments simulate: scientific group meetings,business negotiations,medical consultations, engineering problem-solving sessions.

5.3.4 Collaborative AI-Supported Communication Tasks

Students record group discussions, presentations, and debates which AI analyzes.

5.4 Stage 4: AI-Driven Assessment and Analytics

5.4.1 Pronunciation Analytics

AI provides graphs showing accuracy over time.

5.4.2 Lexical and Grammatical Metrics

Tools evaluate:

lexical diversity (type-token ratio),

grammatical complexity (clause structures),

cohesion markers.

5.4.3 Fluency Analytics

AI measures:

WPM (words per minute),

pauses and hesitation frequency,

fluency growth.

5.4.4 Teacher Dashboards

Teachers review analytics to modify instruction.

5.5 Stage 5: Reflection and Autonomous Learning

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5.5.1 Speaking Portfolios

Students maintain digital portfolios containing:

voice recordings,

AI feedback reports,

self-reflections.

5.5.2 Goal Setting

AI reports help students create weekly improvement goals.

5.5.3 Peer Collaboration

Students compare progress and engage in peer feedback sessions.

6. Discussion

The proposed methodology supports constructivist learning, allowing students to become active participants in their own language development. AI tools increase learner autonomy and provide more exposure to authentic speaking tasks compared to traditional instruction. The integration of VR environments addresses the need for contextualized speaking practice. Analytics empower teachers with evidence-based insights, which enhances instructional decision-making. However, successful implementation requires teacher training, infrastructure investment, and responsible digital practices. Teachers must develop competencies in digital pedagogy, AI tool evaluation, task design, and data analysis.
7. Pedagogical Implication.Curriculum Development

AI should be integrated into speaking curricula to support instructional goals,Teacher Professional Development ,Continuous training is needed to ensure teachers can effectively use AI tools.

Learner Autonomy :AI tools extend speaking practice beyond class time, promoting self-directed learning ,Data-Informed Instruction,Teachers can use AI analytics to plan targeted interventions,Equity Considerations,Schools must ensure equal access to technology for all learners.

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8. Limitations

Technological Requirements: Schools may lack high-quality devices or internet.

AI Sensitivity: Not all AI tools accurately interpret accents or non-native speech.

Ethical Issues: Data privacy and cybersecurity must be addressed.

Teacher Adaptation: Some teachers may resist technological change.

Overreliance Risk: AI cannot replace human interaction and communicative spontaneity.

9. Conclusion

AI technologies provide rich opportunities for enhancing speaking instruction in specialized schools. The methodology proposed in this article integrates theoretical foundations, AI tools, instructional planning, assessment strategies, and reflective learning. It positions AI as a supportive mechanism that supplements teacher expertise rather than replacing it. As AI becomes more sophisticated and accessible, its role in language education will continue to grow. This paper contributes a practical framework for educators, policymakers, and researchers seeking to modernize speaking instruction and prepare learners for academic and professional environments.

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