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Developing Speaking Fluency through Metaverse-Assisted Learning in Engineering Students

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ABSTRACT

Speaking fluency is one of the important communication skills that engineering students must master in the era of globalization and Industrial Revolution 5.0. However, engineering students still experience difficulties in speaking English fluently because of limited vocabulary, lack of speaking practice, low confidence, and limited use of interactive learning media. This study aimed to improve students' speaking fluency through metaverse-assisted learning. The research employed Classroom Action Research (CAR) using the Stephen Kemmis and Robin McTaggart model consisting of planning, action, observation, and reflection stages. The study was conducted in two cycles involving first-semester students at Bumigora University. The data were collected through observation, interviews, speaking tests, and field notes. The speaking assessment focused on pronunciation, vocabulary usage, grammatical accuracy, and fluency. In Cycle I, students became more active and confident during speaking activities through virtual self-introduction, role-play, group discussion, and project presentation using Roblox avatars and YouTube short-story videos. However, some students experienced difficulties in pronunciation and vocabulary usage. Therefore, the researcher revised the learning activities in Cycle II by adding pronunciation practice, vocabulary scaffolding, simulations, and collaborative discussion activities. The results of Cycle II showed significant improvement in students' speaking performance. Students communicated more fluently, used more varied vocabulary, and actively participated in classroom interaction. The average speaking score improved from 62.4 in the preliminary study to 84.2 in Cycle II, categorized as good. The findings also indicated that metaverse-assisted learning created a more interactive, collaborative, and enjoyable learning environment.

Introduction

In the context of international relations, English is considered the most dominant and widely spoken language in the world, making it the primary language used in global

communication(Rose & Galloway, 2019). In the era of globalization and Industrial Revolution 5.0, English functions as an international language in business, science, technology, education, and diplomacy(Ashrafova, 2025). The dominance of English in almost every aspect of life makes English proficiency an important necessity for university students, including engineering students. Engineering students are not only required to master academic and technical skills, but also international communication skills, especially speaking as one of the essential 21st-century communication skills(Fadhil et al., 2025). Speaking ability plays an important role for engineering students because they are often involved in project presentations, technology seminars, academic discussions, collaborative research, and professional communication in the global workplace. Through good speaking ability, students are able to express ideas, explain technical concepts, and interact effectively in academic and professional environments. Therefore, speaking competence becomes one of the important skills that engineering students must possess in order to face global competition and digital technological development(Sivasankar et al., 2025). However, in reality, the speaking ability of engineering students is still relatively low, especially in terms of fluency. Most students experience difficulties in expressing ideas spontaneously because of limited vocabulary, lack of speaking practice, insufficient learning media that support communication practice, and fear of making grammatical and pronunciation mistakes(Ratnasari, 2020). These conditions cause students to become passive during speaking classes and less confident when speaking English. Students often provide short responses and hesitate when expressing opinions during classroom discussions.

Based on preliminary observations conducted with first-semester engineering students at Bumigora University, it was found that most students still experienced difficulties in speaking English fluently. The pre-test results showed that the average students' speaking fluency score was 62.4, categorized as fair. The speaking assessment covered pronunciation, vocabulary usage, grammatical accuracy, and fluency. These findings indicate that students need more innovative and communicative learning strategies to develop their speaking ability more effectively. Another problem in speaking instruction is the use of conventional teaching methods that provide limited authentic communication experiences for students. Speaking activities in the classroom are generally limited to simple dialogues and ordinary presentations, resulting in low student motivation to speak actively. Meanwhile, 21st-century learning emphasizes the importance of integrating digital technology to create interactive, collaborative, and immersive learning experiences(Haleem et al., 2022). One of the technological innovations that has recently developed in education is the metaverse. The metaverse is a three-dimensional virtual environment that allows users to interact through digital avatars in real time(Gleich & Schöbel, 2026). In English language learning, the metaverse can create real communication simulations such as virtual meetings, project presentations, group discussions, and other professional situations. According to Stylianos Mystakidis(De Felice et al., 2023), the use of the metaverse in education can improve social interaction, collaborative learning, and student engagement in digital learning.

The use of the metaverse in speaking instruction provides more realistic and communicative learning experiences compared to conventional learning. Students can practice speaking in virtual environments without feeling afraid of speaking directly in front of the class. In addition, interactive virtual environments can increase students' learning motivation, participation, and self-confidence during speaking activities(Lin et al., 2025). Metaverse technology itself consists of several forms, such as ready-for-metaverse platforms (The Sandbox), open worlds (Meta and Roblox), focused virtual worlds (Fortnite and World of Warcraft), showrooming worlds, mirror worlds such as Google Earth, and lifelogging

virtual environments. The implementation of metaverse-assisted learning is also closely related to the Affective Filter Hypothesis proposed by Stephen Krashen. This theory explains that language learning becomes more effective when students feel relaxed and experience low anxiety(Hajimia et al., 2020). In virtual environments, students can communicate through avatars, reducing fear and nervousness when speaking English. As a result, students become more confident and actively involved in communication activities.

In addition, this study applies the principles of Student-Centered Learning (SCL), where students become the center of the learning process while lecturers act as facilitators, motivators, mediators, learning designers, evaluators, collaborators, and technology integrators. Through the SCL approach, students are encouraged to actively construct knowledge through interaction, collaboration, and direct communication. Collaborative activities in metaverse environments are also supported by the social constructivism theory proposed by Lev Vygotsky, which emphasizes that learning occurs through social interaction and collaborative experiences. Several previous studies have shown that metaverse technology is effective in supporting language learning. Research conducted by Wulandari(Wulandari et al., 2025) revealed that immersive virtual learning environments based on the metaverse improved EFL students' speaking fluency and communication confidence. Another study by Lee and Hwang(Lan, 2025) stated that the use of the metaverse in language learning increased student participation and active communication. These findings indicate that interactive virtual environments have strong potential to support speaking instruction in higher education. Based on preliminary observations of engineering students, it was found that most students were still passive in speaking English and had difficulties expressing ideas fluently. Therefore, an innovative learning strategy is needed to create a more interesting, interactive, and communicative learning environment. In this study, the researcher implemented metaverse-assisted learning to improve engineering students' speaking fluency. This study employed Classroom Action Research (CAR) using the model developed by Stephen Kemmis and Robin McTaggart. The research was conducted in two cycles consisting of planning, action, observation, and reflection stages. Through the implementation of metaverse-assisted learning, this study is expected to become an effective alternative strategy for improving engineering students' speaking fluency in English learning at the university level(Siregar, 2025).

Research Methods

This study employed class action research (CAR) using the Kemmis and McTaggart model. The research was conducted in two cycles. It consists of four steps: (planning) based on the preliminary observation and diagnostic speaking assessment, students demonstrated low speaking fluency, limited vocabulary, pronunciation difficulties and low confidence in oral communication, (action) activities were implemented during speaking classes. Students interacted through avatars in Roblox virtual environments and completed communicative tasks requiring active English use. Supplementary learning materials were provided to support topic understanding and vocabulary development, (observation) data revealed that approximately 70% of students actively participated in discussions, while interview results indicated that students felt more comfortable speaking through avatars. However, several students still struggled with pronunciation accuracy, vocabulary selection, and maintaining fluency during extended speaking tasks and (reflection) Analysis of observation sheets, field notes, interviews, and speaking-test results revealed that although student confidence

increased, linguistic difficulties remained significant. The second cycle still has the same rules, (planning) additional pronunciation practice, targeted vocabulary exercises, peer-feedback sessions, and structured speaking simulations were integrated into the learning activities, (action) students engaged in collaborative discussions, simulation-based communication tasks, project presentations, and peer interaction activities designed to promote more spontaneous language production, (observation) more than 85% of students actively contributed to discussions and presentations. Students demonstrated increased confidence, smoother speech delivery, improved pronunciation, and more varied vocabulary usage. Interview responses also indicated that students perceived the virtual environment as motivating and supportive for language practice, (reflection) the reflection stage showed that the revisions implemented in Cycle II successfully addressed the weaknesses identified in Cycle I. This model applied to the engineering students especially computer science classes A and B. In one class there are 50 students, so that's way it can be participants of CAR. The students were on first semester in an English-speaking class at Bumigora University. The data collection used observation of classroom activity, interview classroom discussion, speaking test and field notes. The data analysis used quantitative data from the speaking test were analyzed using score improvement. Qualitative data from observation, field note and interviews. When the quantitative data have been analyzed, the researcher interprets using qualitative.

Table 1. Speaking score

Criteria	5	4	3	2	1
Pronunciation	Clear and accurate	Minor errors	Some errors	Frequent errors	Un-telling
Vocabulary	Wide and appropriate range	Adequate	Limited	Very limited	Extremely limited
Grammar	Accurate structures	Minor errors	Some errors	Frequent errors	Persistent errors
Fluency	Smooth and natural speech	Occasional hesitation	Moderate	Frequent pauses	Fragment speech
Scoring Formula **Final Score = (Total score : 20) x 100**					

Findings

The researcher gets the findings have did observation which revealed that most students experienced difficulties in speaking English fluently. They intended to hesitate in expressing ideas, used vocabulary and lacked of media to try to exercise speaking fluently. The speaking English classroom was student-centered learning. That the lecturer is a facilitator, motivator, mediator, design of learning, evaluator, collaborator and technology integrator. Based on the pre-test, the average student's speaking fluency score was 62,4 that categorized as fair. While speaking, the assessment focused on pronunciation, vocabulary usage, grammatical and fluency. The preliminary findings indicated several problems: 1. Students were afraid of making grammatical and pronunciation mistake, 2. The lacked for authentic communication practice, 3. Classroom interaction was limited engaging, 4. Low confidence even speaking practice.

Cycle 1

Planning

The researcher designed metaverses for speaking activities that encouraged students to communicate actively in virtual environments, including: virtual self-introduction (video recording), group discussion, role-play, technical presentations and collaboration tasks. The researcher prepared a lesson plan, observation sheets, speaking rubrics and vocabulary media virtual scenarios.

Action

The activity in the speaking classroom was conducted using digital avatars from roblox games and YouTube video short stories. The students participated in speaking practice related to engineering topics. During the activities, they try to analyze the content to tell story with their own word. The lecturer as a facilitator and guided students communication task.

Observation

The result showed that students demonstrated high and compared to conventional classroom learning. Several students who are passive speakers before became active discussion because they feel more comfortable. Then, the researcher found several improvements such us more actively speaking, confidence, speaking classroom became more collaborative and communication even though they hesitated expressing ideas, limited pronunciation accuracy, vocabulary usage and short responses.

Reflection

The researcher concluded that usage of metaverse-assisted learning positively influenced student's speaking fluency. However, they need improvements in vocabulary, pronunciation and practice.

Cycle 2

Planning

The researcher revised the learning from cycle 1 based on the reflection, including additional pronunciation practice, vocabulary scaffolding, problem-solving discussion, simulations and peer interaction.

Action

The student participants engage in more advanced speaking activities within the metaverse. They conducted a project presentation, virtual simulation and collaborative discussion. Students are more actively involved with peer and practice delivering arguments, explanations and problem solving. The visual environment encouraged students to interact naturally.

Observation

The result cycle 2, the students have a significant improvement in speaking performance. The communication is more fluent, vocabulary usage is more varied and active in the discussion classroom. Furthermore, students show positive attitude toward metaverse-assisted learning because enjoyable learning experience used virtual environment.

Reflection

The implementation of metaverse-assisted learning successfully achieved the research objectives. So, the student is able to improve their speaking fluently. The average speaking score 84,2 categorized as good.

Students' Responses

The researcher used interviews and tests to assess the students' results in speaking fluently. More students state that the virtual environment made speaking activities more interesting, avatar usage reduces nervousness, collaboration activities improve communication skills and provide more opportunities to practice English communication. A student stated:

> *"I felt more confident to speak English because I was communicating through an avatar, so I was not afraid of making mistakes".*

Another student mentioned:

> *"Metaverse learning made speaking practice more interactive and realistic compared to ordinary classroom activities".*

Discussion

The findings of this study showed that metaverse-assisted learning improved students' speaking fluency in the speaking classroom. Before the implementation, most students experienced difficulties in speaking English fluently, hesitated when expressing ideas, had limited vocabulary usage and lacked opportunities to practice speaking in various communication contexts. Students were also afraid of making pronunciation and grammatical mistakes, which affected their confidence during speaking activities. These conditions caused classroom interaction to become passive speaker and short responses during discussions.

The preliminary speaking score confirmed these classroom problems. The average speaking fluency score was 62.4, categorized as fair. The assessment focused on pronunciation, vocabulary usage, grammatical accuracy and fluency. The low score indicated that students still needed appropriate learning strategies and media to support speaking practice. In this case, the researcher implemented metaverse-assisted learning to create a more interactive and communicative learning environment. The implementation of metaverse-assisted learning in Cycle I showed positive changes in students' participation and confidence. Students became more active during speaking activities such as virtual self-introduction, role-play, technical presentation and collaborative discussion. The use of Roblox avatars and YouTube short-story videos created a more enjoyable atmosphere for speaking practice. Students felt more comfortable expressing ideas because the virtual environment reduced their nervousness while practicing speaking English. These findings are closely related to Krashen's Affective Filter Hypothesis, which explains that students learn languages more effectively when they feel relaxed and less anxious. In conventional classrooms, many students were afraid of making mistakes because they had to face their classmates directly. However, the use of avatars in the metaverse environment helped

students feel psychologically safer. As a result, they were more willing to participate in discussions and communication activities.

The findings in Cycle I also support the principles of Student-Centered Learning (SCL). During the implementation, the lecturer did not dominate classroom activities but as a facilitator, motivator, mediator, learning designer, evaluator, collaborator, and technology integrator. Students became the center of the learning process because they actively explored ideas, analyzed video content, shared opinions, and communicated with peers. The lecturer only guided students during speaking tasks and provided support when necessary. This learning condition encouraged students to become more independent and active learners. Although students indicate improvement in Cycle I, but there were several weaknesses were still identified such as hesitate while speaking, pronunciation accuracy and vocabulary usage were still insufficient. The students needed more intensive practice and language support. Therefore, the researcher revised the learning activities in Cycle II by adding pronunciation drills, vocabulary scaffolding, problem-solving discussions, simulations, and peer interaction activities.

The implementation of Cycle II demonstrated significant improvement in students' speaking fluency. Students communicated more naturally and confidently during project presentations, collaborative discussions, and virtual simulations. Their vocabulary became more varied, pronunciation improved and they were able to maintain longer conversations with fewer pauses. Classroom interaction also became more active and collaborative because students were more comfortable participating in speaking activities. Cycle II supports the theory of Student Center Learning (SCL), which emphasizes that language learning occurs effectively through authentic communication and meaningful interaction. Through metaverse-assisted learning, students practiced speaking in realistic communication situations instead of memorizing separate vocabulary or grammar patterns. They learned how to express opinions, explain ideas, solve problems and interact with peers using English in communicative contexts. The collaborative speaking activities also reflect Vygotsky's social constructivist theory, which states that learning occurs through social interaction and collaboration. In the metaverse environment, students learned from peers through group discussions, project presentations, and communication tasks. The interaction among students helped them develop speaking fluency because they continuously practiced negotiating meaning and responding to conversations.

Another important finding of this study was students' positive responses toward metaverse-assisted learning. Most students stated that the virtual environment made speaking activities more interesting and enjoyable. Students also explained that avatar usage reduced nervousness and increased confidence during speaking practice. One student mentioned that speaking through avatars made them less afraid of making mistakes, while another student stated that metaverse learning was more interactive and realistic compared to ordinary classroom activities. These findings indicate that metaverse-assisted learning not only improved speaking fluency but also increased students' motivation and engagement in learning English. The immersive virtual environment encouraged students to participate actively because learning activities felt more meaningful and enjoyable. Engineering

students, who are generally familiar with technology and digital platforms, responded positively to the integration of metaverse technology into speaking instruction.

The improvement of students' speaking scores also confirmed the effectiveness of metaverse-assisted learning. The average score increased from 62.4 in the preliminary study to 84.2 in Cycle II, categorized as good. This improvement demonstrated that continuous practice through interactive virtual communication successfully developed students' fluency, confidence, pronunciation, and vocabulary usage. Overall, the findings revealed that metaverse-assisted learning can become an effective alternative strategy for improving speaking fluency in EFL classrooms, particularly for engineering students. The combination of immersive virtual environments, collaborative communication, and student-centered learning created more meaningful speaking experiences and encouraged students to communicate actively in English.

Conclusion

This study concludes that metaverse-assisted learning effectively improved the speaking fluency of engineering students in English-speaking classes. The implementation of virtual speaking activities encouraged students to communicate more actively, confidently, and collaboratively in English. The interactive virtual environment reduced students' anxiety and hesitation during speaking practice, allowing them to express ideas more naturally and fluently. In addition, the integration of metaverse technology supported the implementation of Student Center Learning (SCL), where students became actively involved in discussions, simulations, role-play, and project presentations while the lecturer functioned as facilitator and learning guide. The improvement in students' speaking performance indicates that immersive virtual learning environments can provide meaningful communication experiences and increase students' engagement in EFL classrooms. Therefore, metaverse-assisted learning can be applied as an alternative strategy in higher education, especially in speaking courses for engineering students and other technology-oriented learners. Future researchers are recommended to explore the use of different metaverse platforms, involve larger participants, and investigate the long-term impact of virtual learning environments on students' communication skills and language development.

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