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ARTICLE

Collaborative Learning Based on Virtual and Augmented Reality Technology in Teaching English for Specific Purposes

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ABSTRACT

Virtual and Augmented Reality (VAR) has emerged as an innovative pedagogical tool, widely adopted to enhance language learning. This study examines its integration into English for Specific Purposes (ESP) curriculum, emphasizing immersive environments that foster engagement, comprehension, and authentic language use. VAR-assisted ESP utilizes tools such as VR goggles, headsets, Google Cardboard, Virtual Speech, and Polly for scene creation, allowing students to engage with dynamic and personalized learning experiences through mobile applications and 360-degree videos. Key advantages include increased motivation, adaptability, and enhanced collaboration. Despite these benefits, several research gaps remain. The long-term impact of VAR on ESP learning retention and authentic professional communication skills is yet to be explored. Additionally, studies rarely examine VAR's applicability across diverse ESP disciplines such as law, medicine, business, and engineering. Institutional readiness, cost analysis, and sustainability of VAR implementation present further challenges. Psychological and social aspects, including language anxiety, confidence, and student inclusion, also require further investigation. This study's conceptual insights highlight the need for direct observation and empirical VAR-based studies to validate its effectiveness. Addressing these gaps will provide educators and researchers with valuable perspectives for optimizing VAR-assisted ESP instruction. Policymakers and educators must design curricula tailored to ensure transformative, inclusive, and effective language learning practices that support communicative competence, professional application, and intercultural understanding.

Keywords: Collaborative Tool; Cultural Competence; ESP-Teacher Role; Immersive Learning; Virtual and Augmented Reality

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1. Introduction

Virtual and augmented reality (VAR) is a pedagogical-assisted technology that has been used over the past few decades by several nations [1,2]. This pedagogy presents a dynamic and immersive approach to teaching English, both individually and in groups, particularly for specific purposes (ESP). ESP aims to provide students with the language skills and strategies necessary to achieve success in specific fields by integrating theories of communicative language teaching, needs analysis discourse analysis, and task-based learning [3–5]. ESP teaching emphasizes the importance of tailoring language instruction to meet students' unique needs, objectives, and circumstances for specific purposes. In doing so, teachers teaching students for whom English is not a first or second language poses a challenge [6–9]. Modern VAR technology has become the preferred pedagogical solution to this challenge [10,11].

A comprehensive study of the application of VAR in teaching ESP, as documented by Ahmed Madini and Alshaikhi [12], revealed that VR facilitated postgraduate students' retention of ESP vocabulary, leading to improved competency levels. Monteiro and Ribeiro suggested that VR could stimulate students' motivation to learn vocabulary through realistic immersion [13]. Pavlova et al. further argued that VR is a novel tool for teaching ecological concepts in English [14]. Specifically, they highlighted that immersive virtual environments effectively assisted students in grasping specialized vocabulary related to their careers. Klimova investigated the potential of VR to help non-native language students acquire new knowledge and skills and enhance their motivation, self-confidence, and problem-solving abilities [15].

The utilization of VAR technology has been empirically demonstrated to assist students in achieving ESP communication skills, addressing their needs, and enhancing their competence. For instance, Monteiro and Ribeiro's application of VR scenario immersion in English learning demonstrated its efficacy in motivating students to acquire these skills [13]. Holden employed VAR for interactive storytelling with the goal of enhancing the educational experiences of sixth-grade students both within and beyond the traditional classroom setting [16]. The implementation of this technology allows learning opportunities to extend to museums or other extracurricular environments, with the aim of preventing the material from becoming monotonous and engaging students in interactive virtual activities. According to a study by Butarbutar and Wu et al. [17,18], VR simulations have the potential to significantly alleviate student anxiety regarding English speaking in real-life situations.

The findings of this study indicate that the implementation of VAR technology can significantly improve English language learning through the delivery of immersive, interactive, and personalized learning experiences that captivate students and streamline their language acquisition journey. Research on collaborative learning using VAR technology for ESP objectives can make both practical and theoretical contributions. Specifically, it can provide insights into effective language learning practices, while also enhancing our understanding of learning theories and educational technologies.

Regrettably, limited research has been conducted on collaborative learning in teaching the VAR technology-assisted ESP. Consequently, this study presents a narrative review of the literature and responds to calls to investigate how English language teachers (ELT) have applied AR in language classrooms [19]. Additionally, this study aims to explore the perceptions, potentialities, challenges, roles, and methods used by teachers and students to implement VAR in teaching English for ESP.

1.1. Virtual and Augmented Reality (VAR) Teaching VAR-Assisted ESP

Virtual Reality (VR) and Augmented Reality (AR) are distinct technologies with unique characteristics [20]. VR generates immersive computer-generated environments with which users can interact, as if they were physically present within them [13]. In contrast, AR technology superimposes digital content on a real-world environment [21], allowing users to perceive and interact with both the real world and additional digital elements. When these two technologies are combined [22], they result in a hybrid technology known as Virtual Augmented Reality (VAR). VAR enables users to experience fully immersive virtual environments while interacting with digital elements overlaid onto their actual surroundings. This integration creates a blended experience that can be utilized for various objec-

tives such as gaming, education, and training. For example, in a VAR application, users can wear a VR headset to explore a digitally created environment while also observing and engaging with digital objects or information overlaid onto their real-world surroundings using AR technology [22].

Based on Belda-Medina's work [2], the theoretical foundations of constructivism and situated learning offer sound justification for incorporating VAR technology into ESP teaching, particularly in boosting retention. VAR technology enables the creation of interactive, relevant, and context-driven learning experiences, thereby promoting students' participation, comprehension, and long-lasting retention of English language abilities in professional or academic settings.

1.2. Teaching VAR-Assisted ESP

The importance of teaching ESP has increased significantly in recent years, particularly in professional sectors such as tourism, business and economy, administration, and law, where effective communication is essential. Owing to technological advancements, the integration of VAR has provided new opportunities for educators to enhance ESP teaching. This fusion of education and technological innovation has the potential to transform the way students acquire and apply language proficiency to professional fields. Hence, educators must explore and understand the practical implications of using VAR in teaching ESP to meet students' specific needs in various professional domains.

The potential for collaborative learning in virtual and augmented reality environments has been the focus of several studies on English language learning. According to Hanna et al. and Shih and Yang [23,24], the use of these technologies enhances students' communicative competence and language skills. Huang et al. additionally demonstrated the effectiveness of virtual reality in supporting dyadic learning of English for tourism purposes [25]. Lin et al. proposed a mobile teaching system that combines virtual and augmented reality for English audio-visual learning [26], showcasing potential for further innovation in this area. Collectively, these studies underscore the potential of collaborative learning in virtual and augmented reality for English-specific purposes.

Cai demonstrated that using augmented reality (AR) applications leads to substantial improvements in language skills [19], with a combined effect size of 0.93, which is considered large. On the other hand, a pooled effect size of 0.42, which denotes a small-to-medium effect, suggests that the impact on motivation was smaller. Moderator analysis revealed that factors such as educational level and duration of the intervention significantly influenced the impact of AR on motivation. For instance, elementary school students experience a substantial effect on both language acquisition and motivation. In addition, exposure to AR applications for up to a week was particularly effective in boosting students' motivation levels.

The COVID-19 pandemic has highlighted the importance of digital educational technologies, prompting educational institutions to re-evaluate their methods of instruction. In light of this, there is an increasing emphasis on utilizing VR and AR technologies in the learning process, particularly in foreign language education. Xinzhen examined the history and development of virtualistics and delineated the essential concepts in this field [27]. They viewed VR as a promising tool for foreign language learning and conducted a thorough analysis of the benefits of integrating VR and AR into teaching techniques. These technologies facilitate visual learning, increase student engagement, and promote collaboration among students, even among those who are geographically distant. The study concluded that educators, students, and researchers must embrace VR and AR technologies to harness their potential in foreign language education, particularly in technical universities.

VR has become increasingly prevalent in educational settings, delivering advantages such as enhanced student motivation, practical learning scenarios, and opportunities for skill development including public speaking. Although there were initial obstacles, such as expensive hardware, the emergence of more affordable VR headsets, such as the Oculus Quest 2, has helped overcome these challenges. However, many VR applications lack solid pedagogical foundations. In ESP, VR can be utilized to provide virtual excursions in professional contexts, promote experiential learning, simulate genuine conditions, and assist in vocabulary retention. Dubskikh et al.'s paper puts forth theoretical concepts that illustrate how the "IMMERSE" educational metaverse language learning platform can improve ESP learning by presenting real-life situations, high

immersion, interactivity, and language immersion practice, thereby offering students more contextualized language practice opportunities [28].

VR is characterized by immersive and interactive experiences as well as an emphasis on fun and engaging scenes. Research on the theory of information processing and learning has demonstrated that information delivered through ESP teaching using VR technology is more effectively received by students than information delivered through traditional ESP teaching methods [29]. Yuan performed a study investigating students' perceptions and the effectiveness of incorporating technology into language teaching and learning practices [30], with a specific focus on teaching English for Specific Purposes (ESP) at a non-linguistic higher education institution. This study aimed to determine students' self-reported perceptions and the effectiveness of a technology-supported English language learning environment via survey questionnaires and observations. The study was designed to test the hypothesis that technology-mediated language classrooms can be effective, provided that students possess positive attitudes toward digital technology integration in classroom teaching and learning, students' autonomy of study and motivation are enhanced, and teacher-dominated lesson practices are minimized.

To sum up, the importance of teaching ESP has grown considerably, especially in professional fields, such as tourism, business, administration, and law, where effective communication is essential. The incorporation of VAR in education offers new opportunities to enhance ESP teaching and potentially transform language proficiency acquisition and application in professional contexts. Collaborative learning in virtual and augmented reality environments has the potential to improve communicative competence and language skills.

This study was designed to address the following research questions:

(1) How do teachers and students perceive learning through the VAR technology-assisted ESP?

(2) How do teachers apply the VAR technology-assisted ESP, including tools, teaching roles, and their merits and challenges?

2. Materials and Methods

2.1. Materials

This study conducted a systematic review of 30 academic sources from esteemed databases, including Google Scholar, Scopus, Taylor and Francis, and Science Direct. These sources include peer-reviewed journal articles, conference proceedings, and research papers that focus on English for Specific Purposes (ESP) and Virtual Augmented Reality (VAR)-assisted education. The selection criteria prioritized relevance, methodological rigor, and contribution to the integration of VAR in ESP teaching. The extracted data encompassed theoretical frameworks, study methodologies, sample sizes, experimental findings, and implications for pedagogical practice. By synthesizing insights from diverse academic contributions, this review establishes a comprehensive foundation for evaluating the potential of VAR to enhance language learning and professional communication.

2.2. Methods

2.2.1. Study Design

This study adopts a narrative literature review (NLR) technique to synthesize and analyze extant research on VAR-assisted ESP teaching. The NLR approach was employed to systematically investigate key trends, arguments, and gaps in the implementation of Virtual and Augmented Reality (VAR) in ESP instruction. By reviewing a comprehensive selection of academic sources, this study aimed to construct a coherent narrative that highlights the impact, challenges, and effectiveness of VAR in language learning.

2.2.2. Data Collection

Relevant studies were systematically retrieved from academic databases, including Google Scholar, Scopus, Taylor and Francis, and Science Direct. The selection focused on studies published between 2019 and 2024, ensuring the inclusion of only recent and pertinent studies on VAR-assisted ESP education. The inclusion criteria em-

phasized methodological rigor, relevance to ESP teaching, and contribution to the understanding of VAR integration. Thirty studies meeting these criteria were selected for review.

2.2.3. Data Analysis

Data extracted from the selected studies included findings, research methodologies, sample sizes, and conclusions. These were synthesized to identify common themes, theoretical perspectives, and pedagogical implications. The analysis aims to establish a comparative framework by highlighting key debates, agreements, and gaps in the literature. The synthesized information provides insights into how VAR technologies enhance language acquisition and professional communication, and offers recommendations for future research and practical applications in ESP education.

3. Results

3.1. How Do Teachers Perceive Teaching VAR-Assisted ESP

Teachers generally view VAR technology-assisted ESP as a way to enhance student engagement (Enhanced Engagement) and understanding (Enhanced Understanding) through immersive language environments (Immersive Language Environment). They value its ability to provide simulated practice (Simulated Practice) and real-time feedback (Real-Time Feedback). However, some may express concerns over technical challenges (Technical Challenges) and accessibility issues (Accessibility Concerns).

3.2. How Do Students Perceive Learning of Teaching VAR-Assisted ESP

Students often find the learning experience more exciting (Excitement and Engagement) and contextual (Contextualized Learning) when using VR mobile applications (VR Mobile Applications) and 360-degree videos (360-Degree Videos). These technologies allow for personalized learning paths (Personalized Learning Path) and real-world applications (Real-World Application), which improve retention (Improved Retention). However, potential distractions (Potential Distractions) can also arise.

3.3. How Do Teachers Apply the VAR Tools in Teaching ESP

Teachers utilize various tools such as VR goggles and headsets (VR Goggles and Headsets), Google Cardboard, VirtualSpeech, and platforms like Polly for building VR scenes. These tools are integrated with the curriculum (Integration with Curriculum) to support interactive collaborative learning (Interactive Collaborative Learning) and foster authentic language practice (Authentic Language Practice) [53].

3.4. What Are the Merits and Demerits of Teaching VAR-Assisted ESP

Merits:

- Personalized learning environments (Customization and Personalization).
- Promoting student motivation and engagement (Promoting Engagement and Motivation).
- Flexibility in learning (Enhancing Accessibility and Flexibility).
- Opportunities for collaboration (Collaborative Opportunities).

Demerits:

- Technical challenges (Technical Challenges).
- Accessibility concerns (Accessibility Concerns).
- Potential for distractions (Potential Distractions).

3.5. What Are the Roles of Teachers in Teaching the Teaching VAR-Assisted ESP

Teachers play roles such as instructional designers (Instructional Designer), learning facilitators (Learning Facilitator), and feedback providers (Feedback Provider). They also adapt learning materials to ensure they are contextual and relevant, while helping students develop cultural competence (Fostering Cultural Competence, as shown in **Figure 1**.

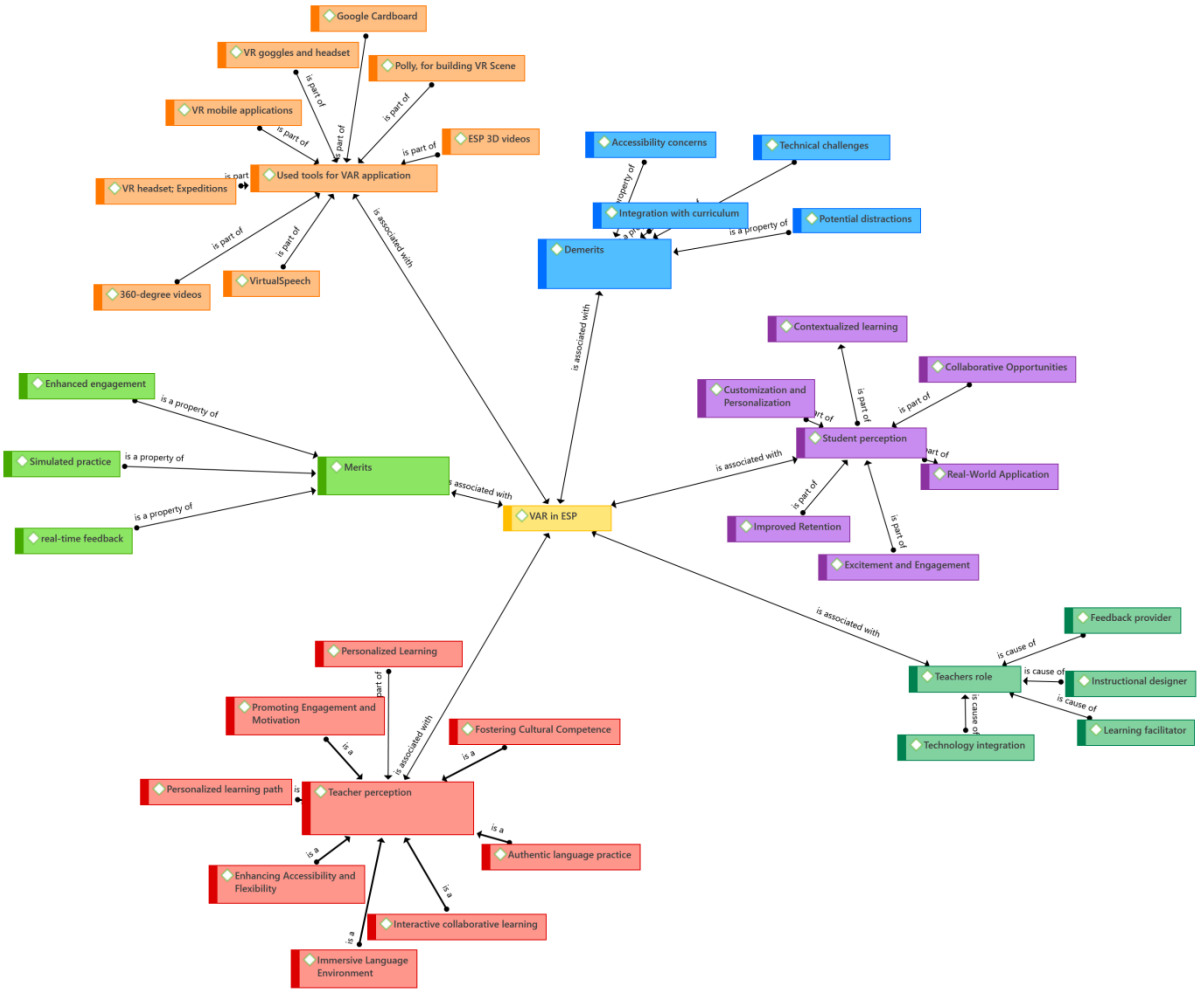


Figure 1. VAR Immersion in ESP Classroom.

4. Discussion

4.1. How Do Teachers Perceive Teaching VAR-Assisted ESP

The study revealed that teachers generally hold a favorable view of the use of ESP-assisted VAR technology as it improves the efficiency of learning and fosters a more dynamic and cooperative learning atmosphere [29,30]. The advantages of VAR technologies in assisting students in acquiring professional proficiency in a foreign language and cultivating positive attitudes towards technology in language learning corroborate this perspective [27,31].

(1) Immersive Language Environment; VAR technology can create immersive environments where students interact with virtual objects, scenarios, and characters. In the context of English language learning, these environments simulate real-life situations found in airports, hotels, and restaurants, providing students with opportunities for authentic language practice.

(2) Interactive Collaborative Learning: VAR platforms facilitate immersive and interactive collaborative learning. These platforms promote group discussions, role-playing activities, and collaborative problem-solving tasks, using English as the primary means of communication. By creating a virtual environment, VAR platforms enable students to engage dynamically with each other, fostering a collaborative learning experience.

(3) Real-Time Feedback: VAR applications offer immediate feedback on language usage, pronunciation, and grammar. For instance, virtual language tutors and avatars can correct students' errors, provide improvement recommendations and necessary explanations, enhancing the learning process.

(4) Personalized Learning Paths are technologies that adapt to students' individual needs and preferences. These paths are developed based on the learner's proficiency level, learning style, and interests, allowing students to engage with content at their own pace while receiving targeted support in areas where they may struggle. This tailored approach ensures a personalized learning experience, enabling students to progress at their own speed and receive necessary assistance.

(5) Authentic Language Practice: VAR simulations offer authentic language practice opportunities by allowing students to engage in interactions with native speakers in realistic settings. With VR and AR, students can practice ordering food in a virtual restaurant, negotiating prices in a virtual market, or participating in virtual job interviews, thereby improving their English language skills in a contextually relevant manner. This perspective aligns with the findings of Vasbieva and Saienko [32], who proposed an authentic approach to enhancing students' vocabulary and promoting their speaking abilities. This is supported by Butarbutar [33,34], who investigated the impact of an authentic strategy on students' English proficiency.

(6) Fostering Cultural Competence; VAR technologies give students chances to immerse themselves in diverse English-speaking cultures and customs, enhancing their ability to communicate effectively in a globalized environment.

(7) Promoting Engagement and Motivation; The interactive nature of VAR technology allows for gamifying language learning, incorporating elements of competition, exploration, and discovery to boost learner motivation and participation in their language learning journey.

(8) Enhancing Accessibility and Flexibility: VAR technology can be accessed remotely, enabling students to engage in language learning activities from any location with an internet connection, thus accommodating busy schedules and overcoming barriers related to physical location or access to traditional language learning resources.

This study found that educators view the incorporation of ESP-supported Virtual Augmented Reality technology favorably, attributing its potential to improve learning outcomes [29]. Nonetheless, lack of familiarity with these technologies may impede their optimal use [35]. Despite this, both educators and students have exhibited a favorable disposition toward incorporating AR in the educational setting [36]. The integration of augmented reality has been found to promote inventive teaching methodologies, although it also entails certain challenges [37]. Our findings are relevant to Cupitra-García and Duque-Bedoya's work [38], in which he argues that incorporating communicative competencies into professional fields in teaching ESP is advantageous. He emphasized the importance of activities that promote both communicative awareness and proficiency. These goals can be accomplished using VAR technologies that focus on enhancing students' comprehension of language features in relation to their specific fields, such as key genres and how language conveys meaning in communicative situations. However, the student's role is as an "observer of ESP communication" rather than an "ESP communicator." Therefore, the VAR addresses this issue.

4.2. How Do Students Perceive the Learning of Teaching VAR-Assisted ESP

The study noted that students perceived that ESP-assisted VAR technology may be favorable if it allows for the customization and personalization of learning experiences. Specifically, students may appreciate the ability to explore various aspects of a concept at their own pace, or tailor their learning to their individual interests. Furthermore, they perceive that **Teaching VAR-assisted ESP** is likely influenced by a range of factors, including prior experience, quality of instruction, content relevance, and usability of the technology. Therefore, they added that teachers and educational institutions must play a crucial role in ensuring positive learning experiences with VAR technology by providing effective support, guidance, and resources.

The present research indicates that students believe that ESP educators should guarantee that VAR technology has several effects, including excitement and engagement, enhanced understanding, improved retention, real-world application, collaborative opportunities, customization, and personalization. These perceptions imply that VAR technology facilitates practical language skills, and that students require customized communicative strategies to learn ESP. Consistent with Littlewood [39], it has been established that three-dimensional variable projection (3D VAR) is a promising method for actively involving students in the

process of language acquisition [20].

Students perceived that ESP-assisted VAR technology could engage and excite them because of its interactive and immersive nature. This technology offers hands-on learning experiences that make education more enjoyable and memorable. Similarly, Parmaxi fosters a "real-world continuum" as a reflection of the complexity of whether teaching should be conducted in the real world or virtually [40]. Parmaxi's investigation emphasized that VR can improve students' performance and motivation to participate in learning. This study found that VR stimulates the psychic so that learning is more enjoyable and boredom is avoided.

According to the students in this study, VR encouraged them to work more collaboratively, mimicking real-world experience. This aligns with the findings of Belda-Medina [2], who supported constructivist and situated learning theory that VR is a collaborative opportunity for ESP students. Students may find value in the collaborative possibilities offered by ESP-assisted VR technology, such as working together in virtual teams or discussing concepts in augmented reality environments. This can foster a sense of community and teamwork among students. VR environments can facilitate social interactions and collaboration among students, mirroring the social aspects of situated learning. Students can engage in collaborative tasks, communicate with virtual characters or peers, and receive feedback within the virtual environment, thereby enhancing their language learning experience through interaction.

4.3. How Do Teachers Apply the Tools Used to Teach Teaching VAR-Assisted ESP

VAR has the potential to revolutionize language learning by enhancing contextual understanding and providing immersive experiences. To achieve this, teachers use interactive simulations and role-playing activities that incorporate VR goggles, headsets, ESP 3D videos, 360-degree videos [41], and Google Cardboard. For instance, teachers use VR expeditions as a narrative tool, and Polly creates VR scenes. Furthermore, several VR mobile applications are available for use, such as VirtualSpeech [13], VR Courses, Mondly VR: Learn Languages in VR, and VR Learn English App [15].

The implementation of VAR in language learning offers numerous benefits. It enhances students' ability to comprehend and retain information, improves their communication skills, and provides them with a more engaging and interactive learning experience [42–46]. Moreover, it allows students to experience real-life situations in a controlled environment and to learn from their mistakes without any real-life consequences. The results of this study are consistent with Hasyim et al. [47], who indicated that virtual role-play is a valuable method for undergraduate students to simulate counselling experiences. Their study demonstrates the effectiveness of this approach in both traditional campus-based settings and online environments.

The outcomes of our study were applicable to Đurić [8], who suggested that simulating real-life situations and offering authentic feedback are crucial for effective communication with a specific professional target. Additionally, he emphasized that this is a challenge for ESP teachers. We agree with his assertion that ESP professionals require real-time participation and constructive feedback, and our findings align with this.

4.4. What Are the Merits and Demerits of Teaching VAR-Assisted ESP

After reviewing previous relevant studies, the current study revealed that the following are some merrits of ESP-assisted VAR technology—for instance, developing ESP language communication skills can improve learning ESP efficiency: both teachers and students have overwhelming support-positive attitudes, rich ESP vocabularies, development of problem-solving creativity, increased person's self-confidence, and reduction of anxiety of second language learning, creating a sense of community among students with common interests and learning needs, collaborative problem-solving tasks [43], interactions with native speakers, error correction, remote access, virtual adventure, and develop 21st century skills.

The study revealed four primary areas in which the benefits and drawbacks of ESP in aiding VAR technology can be categorized. First, VAR technology can enable students to engage in realistic and interactive situations linked to their specific fields of study or profession, thereby enhancing their engagement and motivation. Second, ESP-focused VAR applications can present students with authentic contexts and scenarios pertinent to their profes-

sional requirements, thereby facilitating deeper comprehension and retention of specialized vocabulary and concepts. Third, VAR technology allows students to practice real-life tasks and skills in a safe and controlled virtual environment, thereby providing valuable opportunities for hands-on experience without the risks associated with real-world scenarios. Finally, VAR applications can adjust to individual students' needs and preferences, offering personalized feedback and guidance tailored to each learner's proficiency level and learning objectives.

This study is supported by Edwards-Stewart et al.'s findings [20], which highlight the significance of VAR in enhancing students' understanding, knowledge transfer, construction of knowledge, and the successful completion of collaborative projects. Our outcomes align with the theoretical basis of VAR, specifically constructivist and situated learning theories [2].

Despite the advantages of **Teaching VAR-assisted ESP**, educators should consider several drawbacks. These include technical challenges such as the need for specialized expertise and resources to implement, maintain, and troubleshoot the technology, which may pose difficulties for institutions with limited infrastructure or expertise. In this vein, we agree with Parmaxi [40], who posit that teachers needed to train teacher to face technical challenges in VAR implementation. Moreover, there are accessibility concerns, as not all students may have access to the necessary technology or resources required for VAR-assisted learning, which could exacerbate the digital divide and prevent some students from fully participating in ESP programs. Furthermore, integrating VAR technology into ESP curricula requires careful planning and coordination to ensure alignment with learning objectives, content standards, and assessment criteria, which may present logistical challenges for educators. Finally, while VAR technology can enhance engagement, it may also introduce distractions or cognitive overload, if not implemented thoughtfully, potentially detracting from the learning experience rather than enhancing it.

However, the effective incorporation of VAR into language learning requires significant investment in hardware and software. Furthermore, teachers need to be trained in the use of these technologies to ensure that they can effectively use them in their teaching. Nevertheless, it benefits in language learning make investment worthwhile.

4.5. What Are the Roles of Teachers in Teaching VAR-Assisted ESP

The study demonstrated that the role of the teacher in teaching ESP, assisted by VAR, entails the creation of engaging and relevant learning experiences, seamless integration of technology, facilitation of language acquisition and interaction, and provision of constructive feedback to promote students' language development within their specific professional contexts. The teacher is responsible for the design and development of customized instructional materials and activities that cater to the unique language needs and objectives of students in their respective professional fields. They identified the essential vocabulary [33], language structures, and communication skills necessary for successful communication within students' specialized contexts. Additionally, the teacher selects or develops VAR content that supports learning goals and provides authentic contexts for language practice.

As a technology integrator, the teacher selects and integrates VAR tools and applications into the ESP curriculum to enhance language learning experiences. They ensure that students have access to the necessary hardware and software, provide guidance on the effective use of VAR devices, and address technical issues, as needed. The teacher explored innovative methods for leveraging VAR technology to establish immersive and interactive learning environments that foster language acquisition and skill development.

As teachers in a facilitative role, teachers assist and support students as they engage in language activities and experiences that are enhanced by VAR. The teacher establishes a supportive learning environment by offering clear instructions, demonstrating language use, and providing guidance on effective communication strategies within a virtual or augmented reality setting. Furthermore, the teacher encourages collaboration and interaction among students, motivating them to communicate and work with their peers while navigating VAR simulations or completing tasks. In addition, the teacher evaluated students' language use and proficiency in VAR-assisted activities, providing prompt and constructive feedback to support their language growth. They may use various feedback methods,

such as verbal feedback, written comments, or annotations within the VAR environment, to identify areas of strength and areas that need improvement. Furthermore, the teacher monitors students' progress over time, alters instruction and support strategies based on individual needs, and encourages reflective practices to foster continuous improvement.

Teachers' significance in teaching English for specific purposes, supported by virtual and augmented reality, is of paramount importance for fostering an engaging and productive learning atmosphere. According to Li [50], these technologies possess the potential to enhance language learning, with Li emphasizing the use of AR in virtual environments and Pan discussing the application of VAR in various English teaching contexts [50]. Zhang and Hung et al. highlight the importance of these technologies in creating a simulated language environment and improving language perception and comprehension [51,52]. Teachers play a vital role in incorporating these technologies into their teaching facilitating student interaction with the virtual environment, and guiding students to utilize these tools to enhance their language-learning experience.

5. Conclusions

The present investigation incorporated the NLR to exploit VAR in the ESP. Therefore, this represents a limitation of our study as it did not refer to practical applications in the field. By addressing these limitations, reflecting on their implications, and exploring prospective research trajectories, scholars and educators can continue to advance the domain of VAR-assisted ESP instruction and contribute to the development of effective, inclusive, and transformative language-learning experiences. Hence, we propose VAR-based empirical evidence that includes direct observations in the ESP classroom. To this end, we recommend employing ESP-assisted VAR for English as a foreign-language learner.

Educators and instructors are encouraged to consider the potential benefits of incorporating VAR into their language acquisition instruction. By providing immersive and interactive learning experiences that are relevant to students' professional contexts, VAR can increase learner engagement and motivation, ultimately resulting in improved language acquisition outcomes. Moreover, VAR can facilitate the development of authentic language use by simulating real-world communication scenarios and providing students with opportunities to practice language skills in a context, thereby enhancing their communicative competence. VAR can also promote cross-cultural understanding and communication by exposing students to diverse cultural contexts and perspectives within virtual environments, thereby fostering intercultural competence

Policymakers and curriculum developers should explore innovative teaching methods and instructional strategies to incorporate VAR technology into ESP curricula. To achieve this, factors such as task design, learner autonomy, and scaffolding techniques must be considered. Following the finalization of the ESP curriculum, policymakers can evaluate the integrated VAR curriculum based on students' needs and context. In addition, it is a recommendation for institutional decision-makers as well to focus on innovative pedagogical ESP.

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Institutional Review Board Statement

The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board of the Universitas Musamus Merauke, Papua, Indonesia (0680/UN52.6.TU/2023, 05 June 2023).

Informed Consent Statement

Not applicable.

Data Availability Statement

Not available.

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Conflicts of Interest

The author declares no conflict of interest.

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