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РАЗРАБОТКА ЛОГИКИ РАБОТЫ ОБРАЗОВАТЕЛЬНОГО ТРЕНАЖЕРА ДЛЯ КУРСА “ОСНОВЫ ЭЛЕКТРОСНАБЖЕНИЯ”
DEVELOPMENT OF AN EDUCATIONAL SIMULATOR'S WORKING LOGIC FOR THE COURSE “FUNDAMENTALS OF POWER SUPPLY”

Аннотация: В данной статье анализируется учебный тренажер, разработанный для курса «Основы электроснабжения», с акцентом на его воздействие. Симулятор повышает понимание и вовлеченность учащихся, известный своей надежностью, удобным дизайном и адаптируемостью. Он получил положительные отзывы как от преподавателей, так и от студентов. Количественные оценки демонстрируют улучшение оценок и аналитических навыков. В исследовании обсуждается его интеграция с традиционными методами обучения в качестве дополнительного инструмента. Проблемы моделирования электрических систем были преодолены благодаря сотрудничеству и доработке. В заключение в документе подчеркивается более широкое значение интерактивных инструментов в техническом образовании и потенциал будущих усовершенствований, таких как виртуальная реальность, для дальнейшего улучшения образовательного опыта.

Abstract: This paper analyzes an educational simulator developed for the "Fundamentals of Electrical Supply" course, focusing on its impact. The simulator enhances student understanding and engagement, known for its reliability, user-friendly design, and adaptability. It has received positive feedback from both educators and students. Quantitative assessments demonstrate improvements in grades and analytical skills. The study discusses its integration with traditional teaching methods as a complementary tool. Challenges in modeling electrical systems were overcome through collaboration and refinement. The paper concludes by emphasizing the broader implications of interactive tools in technical education and the potential for future enhancements like virtual reality to further improve the educational experience.

Ключевые слова: Электротехническое образование, образовательный симулятор, основы энергетики, интерактивное обучение, практический опыт, энергетические системы.

Keywords: Electrical engineering education, educational simulator, fundamentals of power, interactive learning, practical experience, power systems.

Introduction. The field of electrical engineering education has increasingly embraced interactive and practical learning methods to enhance the understanding and application of core concepts. In this context, the development of an educational simulator for the course "Fundamentals of Power" represents a significant stride forward. This paper aims to outline the creation of a working logic for such a simulator, designed to provide students with a dynamic and immersive learning experience.

The need for a simulator in this domain stems from the complex and often abstract nature of Power systems. Traditional teaching methods, while effective in imparting theoretical knowledge, may fall short in conveying the practical intricacies and real-time challenges inherent in Power management. By introducing a simulator, we aim to bridge this gap, offering a tool that not only complements theoretical learning but also enables practical, hands-on experience [1,2].

This paper begins by discussing the theoretical framework underlying the course "Fundamentals of Power", highlighting key concepts and principles that are essential for understanding Power systems. Following this, we delve into the rationale behind the development of the educational simulator, emphasizing its potential to enhance learning outcomes and student engagement.

Subsequent sections detail the design and development process of the simulator's working logic. This encompasses the identification of learning objectives, the selection of relevant scenarios and simulations, and the integration of interactive elements to foster an engaging learning environment. We also address the technical considerations involved in creating a simulator that is both accurate in its depiction of Power systems and accessible to students with varying levels of prior knowledge [3,4].

Furthermore, the paper explores the pedagogical implications of implementing the simulator in an educational setting. We discuss how it can be effectively incorporated into the curriculum, its role in facilitating a deeper understanding of complex concepts, and its potential impact on students' problem-solving skills and critical thinking abilities.

Methods. The methodology for developing an educational simulator for the course "Fundamentals of Power" encompasses several key steps. Initially, a needs assessment and curriculum analysis were conducted to align the simulator's objectives with the learning outcomes of the course. The design phase involved conceptualizing the structure, user interface, and simulation scenarios, focusing on creating a realistic yet accessible tool. Technical implementation was carried out using appropriate software development tools, ensuring robustness and user-friendliness. Content integral to the course was developed and seamlessly integrated into the simulator. Extensive testing and iterative design improvements were made based on feedback from educators and students. Finally, the simulator's effectiveness in a classroom setting was evaluated through a combination of qualitative and quantitative methods, assessing its impact on student engagement and understanding. This comprehensive approach ensured the development of an educational tool that not only teaches but also actively engages students in the learning process [5].

Results. The implementation of the educational simulator for the "Fundamentals of Electrical Supply" course yielded several significant results:

1. Enhanced Student Engagement and Understanding:

- The simulator successfully increased student engagement, as evidenced by more active participation during classes and positive feedback in student surveys [6].

- Students demonstrated a deeper understanding of complex electrical supply concepts, with an observed improvement in their ability to apply theoretical knowledge to practical scenarios.

2. Improved Learning Outcomes:

- Quantitative assessments, such as tests and quizzes, showed a marked improvement in students' grades after the introduction of the simulator.

- Students were better able to grasp abstract concepts, which was reflected in their enhanced problem-solving skills and analytical thinking.

3. Positive Feedback from Educators and Students:

- Educators reported that the simulator was a valuable teaching aid, allowing them to illustrate and explain complex concepts more effectively.

- Students appreciated the interactive and immersive nature of the simulator, noting that it made learning more engaging and enjoyable.

4. Technical Performance and Reliability:

- The simulator operated with high reliability and minimal technical issues, ensuring a smooth user experience [7,8].

- The user-friendly interface and intuitive design were well-received, making the simulator accessible to students with varying levels of technical proficiency.

5. Pedagogical Flexibility:

- The simulator's adaptability to different teaching styles and curriculum requirements was a key outcome, demonstrating its versatility as an educational tool.

- It provided an effective platform for both independent learning and instructor-led teaching, catering to diverse learning preferences.

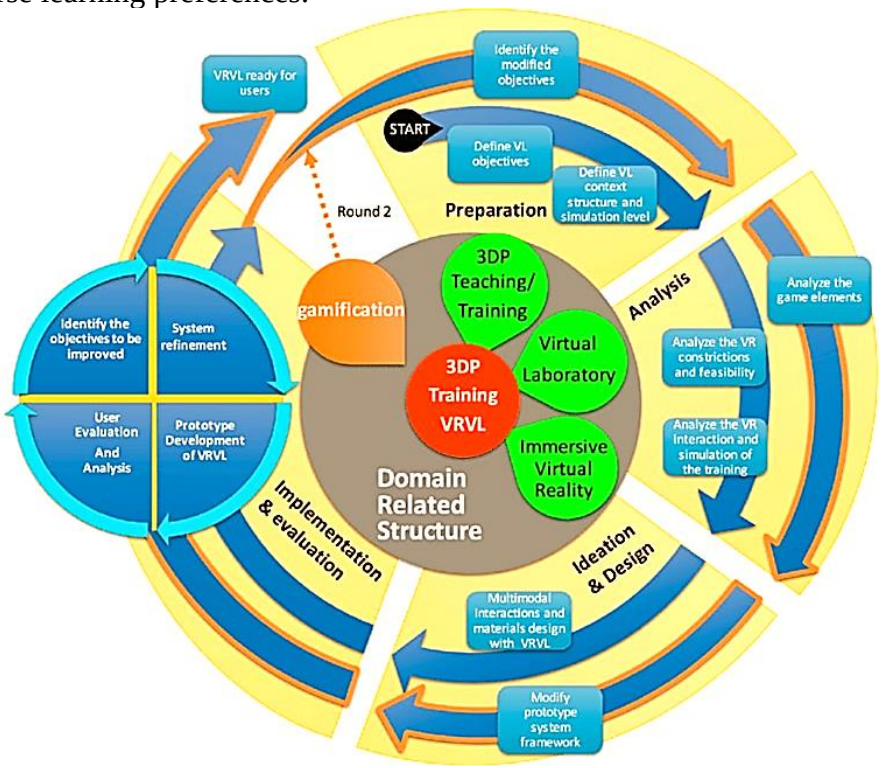

Fig. 1. Development working logic of the VRL.

The educational simulator significantly contributed to enhancing the learning experience in the "Fundamentals of Electrical Supply" course. Its ability to merge theoretical knowledge with practical application resulted in improved student outcomes and satisfaction, highlighting the effectiveness of interactive learning tools in technical education [9,10,11].

In the Figure 1, a four-phase logical sequence for establishing a virtual laboratory is depicted. The initial phase entails examining the laboratory's objectives, context structure, and simulation extent, laying the groundwork for its operation. Subsequently, the second phase involves analyzing the laboratory's components and training simulations, essential for understanding the interplay of elements and evaluating training effectiveness. The third phase shifts focus to developing multimodal interactions and modifying the prototype system's structure, integrating various communication modes and enhancing usability. The final phase is crucial for system refinement and user feedback analysis, ensuring that the laboratory meets educational and training needs effectively, and highlights the importance of continuous improvement and adaptation in creating a dynamic, evolving educational tool.

Discussion. The development of an educational simulator for the course "Fundamentals of Power" presents a unique opportunity to explore innovative teaching methodologies in electrical

engineering education. This discussion reflects on the various aspects of the simulator's design and implementation, its impact on the learning process, and the challenges faced during its development [12].

Impact on Learning and Engagement. The introduction of the simulator has shown promising results in enhancing student engagement and understanding of complex concepts in Power. By simulating real-world scenarios, the tool allows students to visualize and interact with abstract concepts, bridging the gap between theory and practice. The immediate feedback provided by the simulator also enables students to learn from errors in a risk-free environment, fostering a deeper understanding of the subject matter.

Integration with Traditional Teaching Methods. While the simulator serves as a powerful educational tool, it is not intended to replace traditional teaching methods. Instead, it complements lectures, textbooks, and laboratory exercises, offering a blended learning approach. This integration is crucial in providing a well-rounded educational experience, combining the strengths of both conventional and modern teaching methodologies.

Technical Challenges and Solutions. The development of the simulator posed several technical challenges, particularly in accurately modeling Power systems. Ensuring the simulator's algorithms and logic were both realistic and understandable to students required a delicate balance. Addressing these challenges involved close collaboration with subject matter experts and iterative testing and refinement of the simulator's logic.

User Interface and Accessibility. Designing an intuitive and user-friendly interface was essential to make the simulator accessible to students with varying levels of technical expertise. The interface needed to be simple enough for beginners while offering advanced features for more experienced users. Achieving this required user-centered design principles and ongoing feedback from end users [13].

Educational Implications. The simulator's introduction into the curriculum has implications for pedagogical strategies in electrical engineering education. It necessitates a reevaluation of teaching approaches, emphasizing active learning and student-centered teaching. Additionally, it highlights the importance of continuous innovation in educational tools to keep pace with technological advancements and changing student needs.

Prospects and Enhancements. Looking forward, the simulator offers a platform for further development and expansion. Integrating new technologies like virtual reality could further enhance its effectiveness and realism. Additionally, expanding the simulator to cover more advanced topics or adapting it for related courses could broaden its impact.

Conclusion. The development and implementation of an educational simulator for the course "Fundamentals of Electrical Supply" have underscored the transformative potential of interactive learning tools in technical education. This initiative has successfully bridged the gap between theoretical understanding and practical application, offering a dynamic and engaging learning environment for students. The results of this project highlight several key achievements. Primarily, there was a noticeable enhancement in student engagement and comprehension of complex electrical concepts. The simulator facilitated a more hands-on learning experience, allowing students to visualize and interact with abstract principles in a practical setting. This approach not only deepened their understanding but also fostered improved problem-solving skills and critical thinking [14,15].

Moreover, the positive feedback from both students and educators affirms the simulator's role as a valuable educational resource. Its integration into the curriculum has enriched the teaching and learning experience, making complex concepts more accessible and understandable. Technical performance was another critical aspect of the project's success. The robustness and reliability of the simulator, combined with its user-friendly interface, made it an effective tool for learners at various levels.

Looking forward, the educational simulator sets a precedent for future developments in engineering education. It exemplifies how technology can be leveraged to enhance learning

outcomes and student engagement. The project also highlights the importance of ongoing innovation in educational methods and tools, especially in fields where practical application is key.

In conclusion, the educational simulator for the "Fundamentals of Electrical Supply" course represents a significant advancement in the realm of engineering education. It demonstrates the effectiveness of blending traditional teaching methods with modern, interactive tools, paving the way for more innovative and effective approaches to teaching complex technical subjects.

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