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TECHNOLOGY FOR IMPLEMENTING ELECTRONIC EDUCATIONAL RESOURCES BASED ON PROBLEM-BASED APPROACHES INTO PRACTICE

Annotation

This study explores the technological and pedagogical strategies for implementing EERs within PBL, assessing their impact on student learning and engagement. Using a mixed-methods approach with surveys, interviews, and performance assessments, the study finds that students who engage with EERs in PBL settings show increased motivation, improved understanding, and better problem-solving skills. The study recommends solutions like faculty training, investment in adaptive digital platforms, and fostering student collaboration in virtual spaces to optimize the implementation of PBL-based EERs. It contributes valuable insights into using technology for more effective, student-centered learning in higher education.

Key words: Electronic educational resources, problem-based learning, digital pedagogy.

ТЕХНОЛОГИЯ ВНЕДРЕНИЯ ЭЛЕКТРОННЫХ ОБРАЗОВАТЕЛЬНЫХ РЕСУРСОВ НА ОСНОВЕ ПРОБЛЕМНО-ОРИЕНТИРОВАННЫХ ПОДХОДОВ В ПРАКТИКУ

Аннотация

Настоящее исследование изучает технологические и педагогические стратегии внедрения ЭОР в рамках ПОО, оценивая их влияние на обучение и вовлеченность студентов. Используя смешанный метод исследования с опросами, интервью и оценками успеваемости, исследование показывает, что студенты, взаимодействующие с ЭОР в условиях ПОО, демонстрируют повышенную мотивацию, улучшенное понимание и лучшие навыки решения проблем.

Исследование рекомендует решения, такие как программы подготовки преподавателей, инвестиции в адаптивные цифровые платформы и стимулирование сотрудничества студентов в виртуальных пространствах, чтобы оптимизировать внедрение ЭОР на основе ПОО. Оно вносит ценные идеи в использование технологий для более эффективного, ориентированного на студента обучения в высшем образовании.

Ключевые слова: Электронные образовательные ресурсы, проблемно-ориентированное обучение, цифровая педагогика.

MUAMMOLI YONDASHUVLAR ASOSIDA ELEKTRON TA’LIM RESURSLARINI AMALIYOTGA JORIY ETISH TEXNOLOGIYASI

Annotatsiya

Ushbu tadqiqot ETRlarni muammoli yondashuv doirasida joriy etish uchun texnologik va pedagogik strategiyalarni o'rganadi, ularning talabalar o'quvi va ishtirokiga ta'sirini baholaydi. So'rovlar, intervyular va ish natijalarini baholash orqali olib borilgan aralash usuldagi tadqiqot shuni ko'rsatadiki, ETRlar bilan faol ishlaydigan talabalar motivatsiyasi oshganini, tushunishlari yaxshilanganini va muammoni hal qilish qobiliyatlari yaxshilanganini ko'rsatadi.

Tadqiqot ETRlarni muammoli yondashuvlar asosida samarali joriy etish uchun o'qituvchilarni tayyorlash, moslashuvchan raqamli platformalarga sarmoya kiritish va virtual makonlarda talabalar hamkorligini rivojlantirish kabi yechimlarni tavsiya qiladi. Bu yuqori ta'limda talabaga yo'naltirilgan o'quv jarayonini yanada samarali qilish uchun texnologiyalardan foydalanish bo'yicha qimmatli tushunchalarni taqdim etadi.

Kalit so‘zlar: Elektron ta’lim resurslari, muammoli ta`lim, raqamli pedagogika.

Introduction. Due to the fast pace of digitalization across education sectors, there have been considerable changes in the way teaching and learning is delivered. One of these changes is the adoption of electronic education resources (EERs) in teaching practices. Such resources include digital books, simulations over the web, virtual labs, and adaptive learning systems, offering students engaging and diverse ways to learn. Nonetheless, their effectiveness is dependent on how the incorporation of these resources into the learning process is handled.

Problem-based learning (PBL) is a student-centered methodology that enhances critical thinking, collaboration, and problem-solving skills by engaging learners in real-world challenges. Unlike traditional lecture-based instruction, PBL encourages students to actively explore concepts, formulate hypotheses, and develop solutions through inquiry-driven processes. Integrating EERs within a PBL framework presents an opportunity to optimize digital learning environments, making education more engaging, personalized, and effective.

Despite the potential benefits, implementing EERs based on PBL methodologies poses several challenges. These include the need for robust technological infrastructure, faculty training, and strategies to ensure meaningful student interaction with digital content. This study aims to explore the technological and pedagogical frameworks required for the successful implementation of PBL-based EERs, assess their impact on student learning outcomes, and provide recommendations for educators and policymakers. Research Objectives:

1. To analyze the technological requirements for integrating EERs into PBL-based instruction.
2. To evaluate the impact of PBL-based EERs on student engagement and learning outcomes.
3. To investigate challenges and propose strategies for beneficial implementation.

By addressing these objectives, this study contributes to the ongoing discourse on digital pedagogy and provides insights into optimizing the use of technology to enhance active learning experiences.

Literature review. EERs include digital textbooks, interactive simulations, online courses, and virtual labs that support flexible learning environments. Studies suggest that well-designed EERs enhance student engagement and personalized learning (Anderson & Johnson, 2020).

PBL encourages students to analyze real-world problems, fostering self-directed learning (Barrows, 1986). Research

indicates that students engaged in PBL exhibit better retention rates and problem-solving capabilities than those in traditional learning environments (Hmelo-Silver, 2004).

The integration of EERs in PBL settings enhances student collaboration and interaction. Digital tools such as learning management systems (LMS), artificial intelligence (AI)-driven feedback systems, and virtual reality (VR) environments support active learning (Schmidt et al., 2021).

Despite the benefits, challenges such as technical limitations, digital literacy gaps, and resistance to change among educators hinder adoption (Kirkwood & Price, 2014). Effective training programs and policy support are crucial for successful implementation.

Research methodology. This study utilized a mixed-methods approach to gain a comprehensive understanding of how electronic educational resources (EERs) based on problem-based learning (PBL) can be effectively implemented in educational settings. Mixed-methods research is increasingly valued for its ability to offer both numerical data and rich, contextual insights (Creswell & Plano Clark, 2017). This approach facilitated a robust analysis of the impact of EERs on student learning outcomes and engagement.

The study aimed to address three key research questions:

1. How can EERs be effectively integrated into PBL-based instruction?

2. What technological infrastructure is required for successful implementation?

3. What are the impacts of PBL-based EERs on student learning outcomes?

To answer these questions, a combination of qualitative data from semi-structured interviews and focus groups, along with quantitative data from pre- and post-test assessments and engagement metrics, was used. This mixed-methods design allowed the researchers to examine the complexities of EER implementation in PBL settings and triangulate findings from various data sources.

Participants. The study involved 200 students and 25 educators from three universities that adopted PBL and utilized EERs in their teaching. Participants were selected using purposive sampling to ensure that they had relevant experience with PBL and EERs. The inclusion of both students and educators provided a comprehensive view of the implementation process. The students, from disciplines such as engineering, business, and medicine, offered diverse insights into the intersection of PBL and EERs across various fields. Educators were chosen based on their experience with PBL and their willingness to integrate technology into their teaching.

Data Collection Methods. Both qualitative and quantitative methods were used to gather data. Qualitative data were collected through semi-structured interviews and focus group discussions with educators and students. These interviews provided detailed insights into participants' experiences with EER integration, the challenges faced, and the perceived benefits of the approach (Merriam & Tisdell, 2016). Focus groups with students enabled a more collaborative exploration of their experiences with PBL and EERs.

Quantitative data were gathered through pre-test and post-test assessments to measure changes in student performance. The pre-test was administered at the start of the semester to assess baseline knowledge, while the post-test, identical in content and structure, was administered at the end of the semester. This pre-post testing method is commonly used to evaluate the effectiveness of instructional interventions (Leedy & Ormrod, 2013). Additionally, student engagement data were collected from Learning Management Systems (LMS), providing metrics on time spent on tasks, participation in online discussions, and completion rates for digital assignments. These metrics offered valuable quantitative measures of student involvement.

Data Analysis. Data analysis was conducted in two stages: qualitative and quantitative. For the qualitative data, thematic analysis was used to identify patterns and themes across interview and focus group transcripts (Braun & Clarke, 2006). This analysis highlighted key insights related to the research questions, including common challenges and successes regarding the use of EERs in PBL environments.

Quantitative data were analyzed using SPSS software. Paired t-tests compared pre-test and post-test scores to assess whether EERs in PBL settings led to significant improvements in students' problem-solving skills and knowledge retention. Engagement data from the LMS were also analyzed using descriptive statistics (mean, median, and standard deviation) to assess the level of student interaction with EERs and its correlation with learning outcomes. By combining both qualitative and quantitative methods, this research provides a comprehensive understanding of the impact of EERs on student learning, engagement, and skill development in PBL environments. The integration of both data types allowed for a nuanced interpretation, where qualitative insights contextualized and helped explain the quantitative findings (Tashakkori & Teddlie, 2010). This approach contributes to the growing literature on digital education, offering practical recommendations for implementing EERs and PBL in higher education.

Analysis and results. Adoption of EERs in PBL Settings. The study found that 85% of educators reported a positive impact of integrating electronic educational resources (EERs) into problem-based learning (PBL), with improved student participation and collaboration. Educators noted that tools such as online course materials, simulations, and multimedia resources made learning more dynamic and personalized, allowing students to learn at their own pace. However, some educators highlighted the need for more effective training to maximize the potential of these tools. Learning Management Systems (LMS) were also integral, with 78% of educators finding them essential for organizing and delivering materials. AI-driven feedback systems further enhanced the learning experience by providing timely, personalized responses.

Impact on Student Learning Outcomes. The analysis of pre- and post-test assessments revealed a 23% improvement in problem-solving skills among students using EERs in PBL. This improvement was particularly significant in tasks requiring critical thinking and real-world application of knowledge. EERs, such as virtual labs and interactive simulations, helped students engage more deeply with content, leading to better retention and application of knowledge.

Student Engagement and Collaboration. Data from the LMS showed that students who actively engaged with online discussions and resources performed better in assignments and tests. Students who spent more time interacting with EERs demonstrated improved critical thinking and problem-solving abilities, particularly in collaborative projects. The use of digital tools such as discussion forums, video conferencing, and shared workspaces also facilitated more effective teamwork and communication, enhancing the collaborative nature of PBL.

Best Practices for Implementation. Several best practices for the successful implementation of EERs in PBL were identified. First, providing comprehensive training for educators is crucial, focusing not only on technical skills but also on designing and delivering PBL-based courses that leverage digital tools. Developing adaptive EERs that cater to diverse learning needs and allow for personalized learning pathways can further enhance engagement. Additionally, AI-driven feedback systems can support real-time, personalized assessments of student progress. Finally, fostering a collaborative learning environment, both online and in-person, is essential.

Conclusion. This study highlights the significant potential of electronic educational resources (EERs) integrated with problem-based learning (PBL) approaches in enhancing student engagement, critical thinking, and problem-solving skills. The findings demonstrate that EERs can foster deeper learning experiences by providing interactive and personalized learning environments, which in turn promote student autonomy and collaboration. Through the use of digital tools such as learning management systems (LMS), artificial intelligence-driven feedback, and virtual labs, students exhibited marked improvements in their ability to apply knowledge to real-world problems and demonstrated higher levels of motivation and active participation.

However, the study also identified several challenges that must be addressed for the successful integration of EERs in PBL settings. Future research should explore further the use of AI to personalize EERs and how such technologies can be leveraged to better support diverse learning needs. Additionally, exploring the long-term effects of EER-based PBL on student outcomes and broader institutional practices could provide valuable insights for enhancing digital pedagogy. Ultimately, for EERs to be fully effective, continuous professional development and investment in technological infrastructure are necessary to maximize their potential and improve educational practices.

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