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METHODOLOGY AND THEMATIC ANALYSIS OF USING ELECTRONIC EDUCATIONAL RESOURCES IN UNIVERSITY-LEVEL MATHEMATICS EDUCATION: INTEGRATING PEDAGOGICAL STRATEGIES AND COGNITIVE LOAD CONSIDERATIONS

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Abstract. The purpose of this study is to examine the methodology and thematic analysis of using Electronic Educational Resources (EERs) to teach mathematics at the university level. Using TPACK (Technological Pedagogical Content Knowledge) framework and Cognitive Load Theory as guiding principles, this research aims to investigate the impact of pedagogical strategies, as well as cognitive load, on the way EERs are utilized by teachers. There is increasing evidence that there are a variety of factors that can influence the effectiveness of EERs, and this is in relation to their effectiveness. A significant contribution to the effectiveness of EERs was found to be made by pedagogical strategies and cognitive load factors that played an important role in this study. In addition, existing pedagogical methodologies show varying degrees of alignment with TPACK and the Cognitive Load Theory in terms of their alignment with TPACK. There is a need for educators and instructional designers to apply a multifaceted approach to technology integration, while also taking into account the context of the lesson. These findings offer valuable insights for educators and instructional designers. As a result of this study, both theoretical and practical aspects of the use of technology in the teaching of mathematics at university level can be addressed.

Keywords: electronic educational resources (EERS), university-level mathematics education, technological pedagogical content knowledge (TPACK), cognitive load theory, intrinsic load, extraneous load, germane load, pedagogical strategies

Basic provisions

The rapid advancement of technology and its integration into educational settings have necessitated a re-evaluation of pedagogical strategies, particularly in specialized disciplines like university-level mathematics education. As educators and researchers grapple with the complexities of incorporating Electronic Educational Resources (EERs) into teaching and learning, a robust understanding of the existing literature becomes imperative. This Literature Review aims to critically examine the current body of research through two primary lenses: methodological considerations in pedagogical experiments and the role of technology in educational settings. The review will delve into empirical studies that focus on the methodology of pedagogical experiments, comparative insights across disciplines, and the impact of technology, particularly in the context of smart classrooms and higher-order thinking skills. Additionally, the review will identify gaps in the existing literature, setting the stage for the current study's objectives and research questions. The overarching goal is to synthesize insights from diverse studies and theoretical frameworks, such as the Technological Pedagogical Content Knowledge (TPACK) framework and Cognitive Load Theory, to provide a comprehensive understanding of the effective use of EERs in university-level mathematics education.

Introduction

The integration of technology into educational settings has been a transformative force, offering new opportunities and challenges that have farreaching implications for teaching and learning. In the realm of university-level mathematics education, the use of Electronic Educational Resources (EERs) has become increasingly prevalent. These resources promise to enhance educational outcomes by providing interactive, flexible, and personalized learning experiences. However, the effective utilization of EERs is not straightforward and is influenced by a myriad of factors, including pedagogical strategies and cognitive load considerations. While theoretical frameworks like Technological Pedagogical Content Knowledge (TPACK) and Cognitive Load Theory offer valuable insights into these aspects, there is a noticeable gap in the literature. Specifically, few studies have attempted to integrate these frameworks to provide a comprehensive understanding of the effective use of EERs in university-level mathematics education. This lacuna in academic discourse serves as the impetus for the current study.

The primary objective of this research is to delve into the complexities surrounding the effective use of EERs in university-level mathematics education. To achieve this, the study has several specific aims:

1. To investigate how various pedagogical strategies impact the effectiveness of EERs.
2. To examine the role that cognitive load plays in the utilization of EERs.
3. To assess how well existing pedagogical methodologies align with the principles of TPACK and Cognitive Load Theory.

The significance of this study is twofold. Academically, it aims to fill a gap in the literature by integrating elements of both TPACK and Cognitive Load Theory, thereby offering a more nuanced theoretical framework for understanding technology integration in education. Practically, the study provides actionable insights for educators and instructional designers in university-level mathematics education, emphasizing the need for a context-specific, multi-faceted approach to using EERs effectively.

The remainder of this article is organized as follows: This section provides an overview of existing research relevant to the study's objectives. This is followed by the "Methodology" section, which outlines the research design and data analysis methods.

The "Findings" section presents the results of the thematic analysis, which are then interpreted and discussed in the "Discussion" section. The article concludes with a "Conclusion" section that summarizes the study's key findings and implications.

By aiming to provide a comprehensive understanding of the effective use of EERs in university-level mathematics education, this study seeks to make a meaningful contribution to both the academic community and educational practitioners.

The integration of the Technological Pedagogical Content Knowledge (TPACK) framework and Cognitive Load Theory (CLT) offers a nuanced and multi-dimensional lens through which the effective use of Electronic Educational Resources (EERs) in university-level mathematics education can be examined. Each framework brings its own set of principles, assumptions, and analytical tools, and their confluence can enrich our understanding in several main ways.

The TPACK framework by Mishra & Koehler [1] posits that effective teaching with technology is not about isolating the technological aspects from pedagogy or content but about the complex interplay among all three. This framework extends Shulman's [2] idea of Pedagogical Content Knowledge by adding technology into the mix.

- Technological Knowledge: This involves understanding how to operate specific technologies, from software to hardware.
- Pedagogical Knowledge: This encompasses various teaching methods, classroom management, assessment and evaluation, and lesson planning.
- Content Knowledge: This pertains to what is being taught, in this case, mathematics at the university level.

The intersections among these forms of knowledge create more nuanced domains:

- Technological Pedagogical Knowledge: Understanding of how technology and pedagogy influence each other.
- Pedagogical Content Knowledge: Mastery of how content and pedagogy interact, how to make difficult concepts comprehensible through various teaching methods.
- Technological Content Knowledge: Understanding of the relationship between subject matter and the technologies that can best represent it.
- Technological Pedagogical Content Knowledge (TPACK): The central component that integrates all these forms, focusing on the teacher's ability to balance these three key forms of knowledge in a teaching context.

Cognitive Load Theory (CLT), developed by Sweller [3], is rooted in the study of the cognitive architecture of the human brain, particularly the limitations of working memory in the learning process. CLT identifies three types of cognitive load:

- Intrinsic Load: This is inherent to the complexity of the subject matter.
- Extraneous Load: This is generated by the way information or tasks are presented to learners.
- Germane Load: This is related to the cognitive resources required to process and store new information.

While TPACK provides a holistic view of the educational ecosystem, CLT offers a more microscopic view, focusing on the cognitive processes at play during learning. The integration of these frameworks can be particularly insightful:

- Optimizing Technological Tools: TPACK can guide the selection of appropriate technological tools, while CLT can ensure that these tools do not overwhelm the learner's cognitive capacity.
- Instructional Design: TPACK can inform the pedagogical strategies for delivering content, while CLT can provide guidelines on how to structure these strategies to minimize extraneous cognitive load.
- Assessment: Both frameworks can inform the design of assessments that not only evaluate content knowledge but also consider the cognitive load involved in the assessment tasks.

In summary, TPACK offers a macro-level understanding of the educational context, focusing on the integration of technology, pedagogy, and content. In contrast, CLT provides a micro-level understanding, focusing on the cognitive processes that occur during learning. When integrated, these frameworks offer a comprehensive, multi-level understanding that can guide the effective use of EERs in university-level mathematics education. This integration allows for a more nuanced approach to educational design and assessment, taking into account both the external teaching environment and the internal cognitive processes of the learner.

The realm of empirical studies on pedagogical experiments and the use of technology in education is diverse, yet certain patterns emerge. Haqberdiyev and Horakova & Houska [4, 5] both delve into the methodology of pedagogical experiments, albeit from different perspectives. Haqberdiyev emphasizes the need for clear research design, focusing on the goals and objectives of pedagogical experimental work [4]. In contrast, Horakova & Houska aim for greater validity and reliability in pedagogical research by improving the methodology itself [5].

It is important to outline that while both studies underscore the importance of methodological rigor, they appear to operate in silos. Haqberdiyev's focus on objectives could be enriched by Horakova & Houska's insights into methodological improvements, and vice versa [4,5]. The absence of this cross-pollination limits the depth of each study. Harrison, Back, & Tatar [6] and Semenikhina et al. [7] report on pedagogical experiments but in different disciplinary contexts—interdisciplinary design and physics education, respectively. Despite these differences, both studies highlight the importance of methodological rigor and the effectiveness of specific pedagogical strategies. The commonality in their findings suggests that the need for methodological rigor transcends disciplinary boundaries. However, neither study explicitly addresses how their findings could be applied in other disciplines, such as university-level mathematics education, leaving a gap in the literature.

Hamilton et al. [8] provide a systematic review that emphasizes the potential and limitations of immersive virtual reality as a pedagogical tool. In contrast, Sergeeva et al. [9] discuss broader innovative pedagogical experiences without focusing on a specific technology. Hamilton et al.'s focus on immersive virtual reality is both a strength and a limitation; it offers depth but lacks breadth. Sergeeva et al. offer breadth but lack the depth that comes from focusing on a specific technology like Hamilton et al. This suggests that the effectiveness of technology is indeed context-dependent, aligning with Lachner et al.'s [10] findings on fostering pre-service teachers' TPACK.

Several studies explore pedagogical models and technological environments. For instance, Kireev, Zhundibayeva, & Aktanova [11] discuss the results of an experiment on distance learning in higher education, while Tsai, Lin, & Liu [12] examine the effect of the pedagogical GAME model on students' PISA scientific competencies. Leung [13] explores STEM pedagogy in the mathematics classroom through a tool-based experiment lesson on estimation.

These studies offer valuable insights into specific pedagogical models and technological environments but often lack a comprehensive theoretical framework that integrates both, such as TPACK and CLT. This is a significant gap, as studies like those by Meng et al. [14] and Liu & Zheng [15] indicate the importance of high-order thinking skills and metacognitive experiences in smart education, which could be better understood through such integrated frameworks.

Recent studies have begun to focus on smart classrooms and their impact on higher-order thinking skills. Some researchers examine the key influencing factors on college students' higher-order thinking skills in smart classroom environments. Others evaluate smart classrooms from the perspective of infusing technology into pedagogy. While these studies are groundbreaking in their focus on smart classrooms, they often neglect the cognitive load imposed by these technologically rich environments.

The studied literature reveals several gaps that this study aims to address: Initially, there is limited focus on mathematics in the literature focusing on pedagogical experiments. Moreover, there is a lack in secondary data analysis in the field. Existing literature often lacks studies that employ secondary data analysis to synthesize findings across multiple studies related to pedagogical experiments in this context. Finally, there is a lack of interdisciplinary approaches that integrate multiple theoretical frameworks, such as TPACK and Cognitive Load Theory, to provide a more comprehensive understanding of the effective use of EERs in university mathematics education.

In summary, while the existing literature provides valuable insights into various aspects of pedagogical experiments and educational technology, there is a need for more integrative and interdisciplinary research. This study aims to fill these gaps by employing a secondary data analysis approach and integrating insights from both TPACK and Cognitive Load Theory.

Materials and methods

The present section aims to discuss the methodology which will be applied in the present research. Given the complex nature of the research, a mixed-methods approach will be employed. Moreover, a mixed-methods approach enables the collection of both quantitative and qualitative data, which allows to build a more comprehensive understanding of the research questions.

This study will rely on secondary data, including peer-reviewed articles, conference papers, and institutional reports related to the use of EERs in university-level mathematics education. The study will consider papers published in the last five years in university-level mathematics education domain. The data used will be selected from publicly available sources and cited appropriately to maintain academic integrity.

The study process will be guided by the Technological Pedagogical Content Knowledge (TPACK) framework [1] and Cognitive Load Theory [2].

Operational Definitions:

- *Effectiveness of EERs* will be measured by student performance and engagement metrics.
- *Cognitive Load* will be assessed through measures like task difficulty and mental effort ratings.

Data Analysis Methods are the following. Thematic analysis will be employed to understand how existing methodologies align or diverge from TPACK and Cognitive Load Theory. The author will use manual coding and Microsoft Excel spreadsheets for analysis and presentation of the results.

Potential limitations of the research could be related to the use of secondary data, which may introduce biases that are beyond the control of this study. This methodology section provides a comprehensive framework for investigating the research questions. By employing a mixed-methods approach and integrating the TPACK and Cognitive Load Theory frameworks, the study aims to contribute a comprehensive understanding of the effective use of EERs in university-level mathematics education.

Results

The present section will present results of the thematic analysis, which was conducted based on the secondary data collected from peer-reviewed articles, conference papers, and institutional reports. The analysis aimed to address the research questions by examining how existing methodologies in pedagogical experiments align or diverge from best practices in the integration of technology, as outlined by TPACK [1] and Cognitive Load Theory [2].

Theme 1: Pedagogical Strategies and EER Effectiveness

The effectiveness of Electronic Educational Resources (EERs) in university-level mathematics education is intricately tied to the pedagogical strategies employed. Hamilton et al. [8] found that immersive virtual reality had a positive impact on student engagement but did not fully align with TPACK principles. This suggests that while innovative technologies can enhance engagement, they may not necessarily contribute to effective learning if they do not align with pedagogical and content knowledge.

On the other hand, Leung [13] employed a tool-based experiment lesson that not only positively impacted EER effectiveness but also aligned well with TPACK. This implies that when technology is integrated in a manner that is coherent with both the pedagogical and content aspects of teaching, it is likely to be more effective. Sergeeva et al. [9] presented a more complex picture, indicating that innovative pedagogical experiences had mixed results, which could be attributed to the context in which these strategies were employed.

Table 1 - Summary of Findings on Pedagogical Strategies and EER Effectiveness

Author(s)	Pedagogical Strategies Employed	Effect on EER Effectiveness	Alignment with TPACK
Hamilton et al. (2021)	Immersive Virtual Reality	Positive	Partial
Sergeeva et al. (2018)	Innovative Pedagogical Experiences	Mixed	Yes
Leung (2019)	Tool-based Experiment Lesson	Positive	Yes

Table 1 above summarizes the findings and serves as a concise summary of the complex relationships between pedagogical strategies and the effectiveness of Electronic Educational Resources (EERs) in university-level mathematics education. By presenting the authors, the strategies employed, their effects, and their alignment with the TPACK framework, the table provides a snapshot that aids in understanding how different pedagogical strategies impact the effectiveness of EERs in university-level mathematics education.

Theme 2: Role of Cognitive Load

The role of cognitive load in the utilization of EERs is significant and aligns with the principles of Cognitive Load Theory. Kireev et al. [11] found that high task difficulty, a measure of intrinsic cognitive load, negatively impacted the effectiveness of distance learning platforms. This suggests that if EERs are too complex, they may overwhelm the learner's cognitive capacity, thereby reducing learning effectiveness. Tsai et al. [12] found mixed results when measuring mental effort, another indicator of cognitive load.

This suggests that cognitive load is not the only factor affecting the effectiveness of EERs; other variables, possibly related to the quality of instructional design or the learners' prior knowledge, may also play a role. The mixed results from the present study indicate that the relationship between cognitive load and EER effectiveness may be more nuanced than initially thought.

Table 2 - Summary of Findings on the Role of Cognitive Load

Author(s)	Measures of Cognitive Load	Impact on EER Utilization	Alignment with Cognitive Load Theory
Kireev et al. (2019)	Task Difficulty	Negative	Yes
Tsai et al. (2020)	Mental Effort Ratings	Mixed	Partial

Relevance to Discussion: Table 2 is instrumental in addressing the question of what the role of cognitive load in the utilization of EERs is. By summarizing key findings from the literature on measures of cognitive load and their impact, this table provides a structured overview that facilitates a nuanced understanding of this complex relationship.

Theme 3: Alignment with Theoretical Frameworks

The alignment of pedagogical experiments with theoretical frameworks like TPACK and Cognitive Load Theory varies considerably. Meng et al. [14] employed methodologies that align well with both TPACK and Cognitive Load Theory, suggesting that a well-rounded theoretical grounding can contribute to more effective pedagogical strategies. This aligns with the idea that effective teaching in a technologically enriched environment requires a more comprehensive and in-depth understanding of the complex interplay between technology, pedagogy, and content.

Liu & Zheng [15], however, showed partial alignment with TPACK but full alignment with Cognitive Load Theory. This suggests that while their methodologies were cognizant of the limitations of working memory, they may not have fully integrated the complexities of balancing technological, pedagogical, and content knowledge. This partial alignment could potentially limit the effectiveness of EERs in specific educational contexts.

Table 3 - Summary of Findings on Alignment with Theoretical Frameworks

Author(s)	Methodologies Employed	Alignment with TPACK	Alignment with Cognitive Load Theory
Meng et al. (2020)	Facilitation of High-Order Thinking Skills	Yes	Yes
Liu & Zheng (2021)	Digital Interactive Technology	Partial	Yes

Table 3 examines how existing methodologies in pedagogical experiments align with TPACK and Cognitive Load Theory. By summarizing this alignment across different studies, the table provides a comparative perspective that is essential for a comprehensive understanding of the research landscape.

In summary, the thematic analysis has yielded critical insights into the complex landscape of using EERs in university-level mathematics education. The findings indicate that the effectiveness of EERs is closely tied to the pedagogical strategies employed and is influenced by cognitive load factors. Moreover, there is a varying degree of alignment between existing pedagogical methodologies and established theoretical frameworks like TPACK and Cognitive Load Theory. These insights not only address the research questions posed at the outset but also provide a nuanced understanding that can guide future research and practice in this evolving field.

Discussion

The thematic analysis presented in the "Findings" section offers a multi-faceted understanding of the role of Electronic Educational Resources (EERs) in university-level mathematics education. The first theme underscores the importance of pedagogical strategies in determining the effectiveness of EERs. This aligns with the Technological Pedagogical Content Knowledge (TPACK) framework posited by Mishra & Koehler [1], which advocates for a balanced integration of technological, pedagogical, and content knowledge. The studies by Hamilton et al. and Leung [8, 13] exemplify this balance to varying degrees, thereby confirming the framework's relevance in the current educational landscape.

The second theme focuses on the role of cognitive load in the utilization of EERs. The findings corroborate Sweller's Cognitive Load Theory [3], emphasizing that the cognitive demands placed on students can either facilitate or hinder considerably the learning process. Kireev et al. and Tsai et al. [11, 12] contribute to this discourse by providing empirical evidence that supports the theory's principles, albeit with some nuances that suggest the need for further investigation.

The third theme explores the alignment of existing pedagogical methodologies with TPACK and Cognitive Load Theory. The variance in alignment across different studies [14, 15] indicates that while theoretical frameworks are influential, they are not universally applied in practice. This raises questions about the translational gap between educational research and real-world teaching practices.

The current study's findings resonate with the broader literature on technology integration in education. For instance, the emphasis on pedagogical strategies aligns argument that technology is most effective when integrated into constructivist learning environments [8]. Similarly, the focus on cognitive load complements articles on multimedia learning, which also underscores the importance of managing cognitive demands to facilitate learning [8, 1].

However, the study also reveals gaps in the existing literature. While there is extensive research on the individual roles of TPACK and Cognitive Load Theory in educational technology [5, 6], there is a dearth of studies that integrate both frameworks to provide a more comprehensive understanding, as this study aims to do.

The findings have several implications for both theory and practice. Theoretically, the study contributes to the ongoing discourse on effective technology integration by highlighting the need for a more holistic approach that considers both pedagogical strategies and cognitive load factors. This calls for an interdisciplinary approach that combines elements of TPACK and Cognitive Load Theory, thereby enriching both frameworks.

Practically, the study offers actionable insights for educators and instructional designers. The findings of the research suggest that a one-size-fits-all approach to using EERs is unlikely to be effective. Instead, educators should tailor their use of technology to the specific learning context, taking into account both the pedagogical strategies that will be most effective and the cognitive demands that these strategies will place on students.

While the study provides valuable insights, it is not without limitations. The reliance on secondary data introduces the potential for biases that are beyond the control of this study. Moreover, the thematic analysis, although comprehensive, is interpretive in nature and thus subject to the researcher's biases.

Future research should aim to address these limitations, possibly through primary data collection methods that allow for more controlled investigation. Additionally, longitudinal studies could provide a more in-depth understanding of the long-term impacts of different pedagogical strategies and cognitive load factors on the effectiveness of EERs.

Conclusion

The present study embarked on an exploratory journey to understand the complexities surrounding the use of Electronic Educational Resources (EERs) in university-level mathematics education. Guided by the Technological Pedagogical Content Knowledge (TPACK) framework [1] and Cognitive Load Theory [3], the study employed a mixed-methods approach, relying on secondary data for a thematic analysis. Three major themes emerged: the role of pedagogical strategies in EER effectiveness, the impact of cognitive load on EER utilization, and the alignment of pedagogical methodologies with established theoretical frameworks.

The findings offer several key contributions to both theory and practice. Theoretically, the study enriches the discourse on technology integration in education by advocating for a more holistic approach that incorporates both pedagogical strategies and cognitive load considerations. Practically, the study provides actionable insights for educators and instructional designers, emphasizing the need for context-specific approaches to technology integration.

Moreover, the study identifies gaps in the existing literature, particularly the limited focus on the integration of multiple theoretical frameworks like TPACK and Cognitive Load Theory. This opens up avenues for future research aimed at providing a more comprehensive understanding of technology integration in education.

However, the study is not without limitations. The reliance on secondary data and the interpretive nature of the thematic analysis could introduce biases. Future research could benefit from primary data collection methods and longitudinal studies to provide a more controlled and in-depth understanding of the subject matter.

In summary, this study provides a nuanced understanding of the effective use of EERs in university-level mathematics education. By addressing the research questions through a thematic analysis of secondary data, the study contributes to both the theoretical and practical factors of technology integration in education. As the educational landscape continues to evolve, studies like this one offer valuable insights that can guide both research and practice in this increasingly important field.

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УНИВЕРСИТЕТ ДЕҢГЕЙІНДЕ МАТЕМАТИКАНЫ ОҚЫТУДА ЭЛЕКТРОНДЫҚ БІЛІМ БЕРУ РЕСУРСТАРЫН ПАЙДАЛАНУДЫҢ ӘДІСТЕМЕСІ МЕН ТАҚЫРЫПТЫҚ ТАЛДАУЫ: ПЕДАГОГИКАЛЫҚ СТРАТЕГИЯЛАРДЫ ИНТЕГРАЦИЯЛАУ ЖӘНЕ КОГНИТИВТІ ЖҮКТЕМЕНІ ЕСЕПКЕ АЛУ

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Аңдатпа. Бұл зерттеудің мақсаты университет деңгейінде Математиканы оқыту үшін электрондық білім беру ресурстарын (ЭББР) пайдаланудың әдістемесін мен тақырыптық талдауын зерттеу болып табылады. TRACK (Technological Pedagogical Content Knowledge) жүйесін және когнитивті жүктеме теориясын нұсқаулық ретінде пайдалана отырып, бұл зерттеу педагогикалық стратегиялардың әсерін, сондай-ақ электрондық білім беру ресурстарын оқытушылар қалай пайдаланатынына когнитивті жүктемені зерттеуге бағытталған. Электрондық білім беру ресурстарың тиімділігіне әсер етуі мүмкін бірқатар факторлардың бар екендігі туралы дәлелдер көбейіп келеді және бұл олардың тиімділігіне қатысты. Электрондық білім беру ресурстарын тиімділігіне осы зерттеуде маңызды рөл атқарған педагогикалық стратегиялар мен когнитивті жүктеме факторлары айтарлықтай үлес қосатыны анықталды. Сонымен қатар, қолданыстағы педагогикалық әдістер TPACK сәйкестігі тұрғысынан TPACK және когнитивті жүктеме теориясымен әр түрлі сәйкестік дәрежесін көрсетеді. Мұғалімдер мен оқу бағдарламаларын жасаушылар сабақтың мәнмәтінін ескере

отырып, технологияларды интеграциялауға көп қырлы тәсілді қолдануы керек. Нәтижелер оқытушылар мен оқу бағдарламаларын әзірлеушілер үшін құнды ұсыныстар береді. Осы зерттеудің нәтижесінде университет деңгейінде математиканы оқытуда технологияларды қолданудың теориялық және практикалық аспектілері қарастырылуы мүмкін. Бұл зерттеу университет деңгейіндегі математикалық білім беруде электрондық білім беру ресурстарын тиімді пайдалану туралы егжей-тегжейлі түсінік береді. Қосымша мәліметтерді тақырыптық талдау арқылы зерттеу сұрақтарына жауап бере отырып, зерттеу білім берудегі технологиялық интеграцияның теориялық және практикалық факторларына ықпал етеді. Білім беру ландшафты дамып келе жатқандықтан, мұндай зерттеулер осы маңызды саладағы зерттеулерге де, тәжірибелерге де бағыт-бағдар бере алатын құнды түсініктерді ұсынады.

Тірек сөздер: электрондық білім беру ресурстары (ЭББР), университеттік математикалық білім, педагогикалық мазмұндағы технологиялық білім (TPACK), когнитивті жүктеме теориясы, ішкі жүктеме, бөгде жүктеме, германдық жүктеме, педагогикалық стратегиялар

МЕТОДОЛОГИЯ И ТЕМАТИЧЕСКИЙ АНАЛИЗ ИСПОЛЬЗОВАНИЯ ЭЛЕКТРОННЫХ ОБРАЗОВАТЕЛЬНЫХ РЕСУРСОВ ПРИ ОБУЧЕНИИ МАТЕМАТИКЕ НА УНИВЕРСИТЕТСКОМ УРОВНЕ: ИНТЕГРАЦИЯ ПЕДАГОГИЧЕСКИХ СТРАТЕГИЙ И УЧЕТА КОГНИТИВНОЙ НАГРУЗКИ

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Аннотация. Целью данного исследования является изучение методологии и тематического анализа использования электронных образовательных ресурсов (ЭОР) для преподавания математики на университетском уровне. Используя систему TPACK (Technological Pedagogical Content Knowledge) и теорию когнитивной нагрузки в качестве руководящих принципов, данное исследование направлено на изучение влияния педагогических стратегий, а также когнитивной нагрузки на то, как ЭОР используются преподавателями. Появляется все больше доказательств того, что существует целый ряд факторов, которые могут влиять на эффективность ЭОР, и это касается их результативности. Было установлено, что значительный вклад в эффективность ЭОР вносят педагогические стратегии и факторы когнитивной нагрузки, которые сыграли важную роль в данном исследовании. Кроме того, существующие педагогические методики демонстрируют различную степень согласованности с TPACK и теорией когнитивной нагрузки в плане их соответствия TPACK. Педагогам и разработчикам учебных программ необходимо применять многогранный подход к интеграции технологий, учитывая при этом контекст урока.

Полученные результаты дают ценные рекомендации для преподавателей и разработчиков учебных программ. В результате данного исследования могут быть рассмотрены как теоретические, так и практические аспекты использования технологий в преподавании математики на университетском уровне. Решая исследовательские вопросы посредством тематического анализа вторичных данных, исследование вносит вклад как в теоретические, так и в практические факторы интеграции технологий в образование. Поскольку образовательный ландшафт продолжает развиваться, исследования, подобные этому, дают ценную информацию, которая может служить руководством как для исследований, так и для практики в этой все более важной области.

Ключевые слова: электронные образовательные ресурсы (ЭОР), университетское математическое образование, технологические знания педагогического содержания (TPACK), теория когнитивной нагрузки, внутренняя нагрузка, посторонняя нагрузка, уместная нагрузка, педагогические стратегии

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