

BUCHAREST UNIVERSITY OF ECONOMIC STUDIES



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PhD THESIS

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Components for Computer-Assisted Learning

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SUMMARY

In the context of rapid transformations in the educational field and the integration of technology into the learning process, computer-assisted learning has become an essential component in modernizing educational systems. This paper addresses the topic of reusable components in the development of educational software, a highly relevant subject given the increasing demands for flexibility, adaptability, and personalization in educational processes.

The COVID-19 pandemic crisis has accelerated the transition to digitalization and exposed the current limitations of traditional educational systems, highlighting the need for reliable, scalable solutions that can be easily adapted to diverse contexts. Although there has been significant research on Component-Based Software Development (CBSD) in software engineering, its application in educational software remains limited. The paper emphasizes the importance of using reusable components to facilitate the personalization and adaptation of educational content, focusing on the development and validation of a specific guide adapted to the technical and pedagogical requirements of educational components.

The purpose of the paper is to analyze and evaluate how CBSD principles can be applied to educational software, with an emphasis on developing reusable components that enhance adaptability, scalability, and efficiency in computer-assisted learning. To this end, a framework is developed for creating such components, which combines technical and pedagogical criteria, such as modularity, interoperability, multi-platform compatibility, and alignment with educational objectives.

The paper has the following objectives: to analyze the current context of digital education, identify the fundamental principles of CBSD, develop a methodological guide, and validate it by transforming a traditional component into a technological one. The experiment demonstrated that the proposed guide provides development efficiency, adaptability to various contexts, and resource savings.

The results highlight the benefits of component-based development, including increased accessibility and reduced development time. The proposed guide was validated through feedback from developers and educators, emphasizing its practical utility and the clarity of its stages.

Moreover, the paper underscores the necessity of collaboration between software developers and pedagogical experts to ensure the creation of coherent and effective educational solutions.

An innovative aspect of the research is the integration of artificial intelligence (AI) into the development process of educational components, offering automation in code generation and the personalization of the learning experience. The thesis also develops a model for automatic shape recognition applicable in the field of identifying learning components, based on usage requirements. This approach has demonstrated the potential of AI in reducing costs and improving accessibility.

In conclusion, the research highlights the importance of applying CBSD principles to educational development, contributing to the modernization of the learning process and the creation of scalable and accessible educational solutions tailored to the current demands of digital education.

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e-learning, CBSD, component-based software development, CAL, computer-assisted learning, code reuse, COVID-19