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Learning analytics and educational data mining in the context of learning management systems : summary

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SUMMARY

Learning analytics and educational data mining in the context of learning management systems

The publication provides a broad introduction to the fields of learning analytics and educational data mining, which are still relatively new and unexplored areas of Czech pedagogical research. Three examples of analyses employing methods of learning analytics and educational data mining are presented in order to explore and describe different ways of learning and teaching within learning management systems.

Learning analytics and educational data mining are emerging research areas focused on the analysis of data from various online educational systems and virtual learning environments. This publication provides a detailed overview of these research areas by exploring their origins and by explaining the main similarities and differences between them, outlining the process of applying learning analytics and educational data mining, describing the methods and techniques of data analysis used in these areas, and presenting the most prominent research trends within the fields.

The publication thus provides an introduction to the fields of learning analytics and educational data mining in general and offers a relatively detailed insight into current educational research dealing with the visualization of student data and learning analytics dashboards, student performance prediction and identification of at-risk students, modeling of student knowledge, affective states and behavior, adaptive and recommender systems, social learning analytics, multimodal learning analytics, and ethical aspects of using analytics and data mining in an educational context.

Summary

The publication contains three examples of analyses concentrating on selected aspects of learning and teaching in learning management systems and using various methodological approaches of learning analytics and educational data mining. The first analysis deals with the prediction of student achievement in blended learning courses using different machine learning algorithms. The second analysis focuses on the interaction of students and teachers in online discussion forums using methods of social network analysis. The third analysis pays attention to student quiz-taking behavior, which is analyzed using process mining methods.

As part of the first analysis, data from 2,321 students in 35 different blended learning courses were used to predict student achievement based on various temporal characteristics of attendance and behavior in a learning management system (such as the number of visits, regularity of the visits, and total time spent in the course). The first analysis also paid attention to the issues of generalizability and the transferability of predictive models in the context of blended learning. However, the results of the analysis showed that predicting student achievement in the context of blended learning courses is challenging since general models have very limited predictive ability across different courses. The results of the first analysis thus offer important insights into the current limits of predictive models in blended learning and suggest several possible approaches to moving forward.

The second analysis moves from prediction to description; its goal is to map and describe how students and teachers interact in online discussion forums in different courses in a learning management system. Interaction among students and teachers was analyzed in a total of 453 courses, primarily using a social network analysis method. The results of the analysis showed that social network analysis can be used to identify four basic patterns of interaction among students and teachers in online discussion forums. Specifically, these are 1) discussion forums with no interaction, 2) discussion forums with a low level of interaction, 3) discussion forums with star-shaped interaction, and 4) discussion forums with very intense interaction. The second analysis thus helped reveal important information about how and to what extent the interaction among students and teachers takes place in discussion forums in learning management systems.

The last of the presented analyses focused on the behavior of students while attempting online quizzes in a learning management system, using a process mining method to analyze student quiz-taking behavior. The primary goal of the third analysis was to evaluate whether and to what extent the process mining method is applicable for analyzing student quiz-taking behavior in learning management systems. The secondary goal was to identify what types of student quiz-taking behavior can be detected using the process mining method and to what extent individual types of quiz-taking behavior occur. The results of the analysis revealed that the process mining method enables the identification of four different types of student quiz-taking behavior. There is standard quiz-taking behavior and three

different types of non-standard quiz-taking behavior. Among non-standard behavior, it is then possible to distinguish study materials misuse (the most common), feedback misuse, and multitasking behavior.

The publication discusses the main benefits of educational data mining and learning analytics for the study of learning and teaching within learning management systems and educational research in general.