論文題目	Classroom Analytics with Educational Big Data （教育ビッグデータを活用した授業分析）

（論文内容）

Traditional classroom analytics has relied heavily on the observations of teachers and researchers. However, such methods face challenges, including the lack of objectivity in data and the difficulty of sustaining data collection efforts. To address these issues, recent advancements have enabled data collection using video cameras and wearable devices, which have eliminated observer subjectivity. Nevertheless, these technologies have limitations, such as high cost and installation complexity. Against this backdrop, this study proposes a novel approach to classroom analytics that leverages digital trace data as educational big data. Digital trace data collected through digital tool interfaces form a core component of educational big data. However, its fragmented nature necessitates specialized analytical approaches tailored to its characteristics to extract meaningful insights for classroom analytics. To address this challenge, this study introduced the ICCC Classroom Analytics Framework. This framework is based on three key findings derived from exploratory analyses of digital trace data that are central to this dissertation.

The first study proposed a method for automatically extracting teaching processes. By analyzing digital trace data as a point process, the method visualizes teaching processes and offers a clear understanding of lesson structures. The second study focused on detecting changes in overall student engagement during class. Using the Pruned Exact Linear Time (PELT) algorithm, this study demonstrated the ability to analyze dynamic changes in student behavior throughout a classroom. The first two studies make significant contributions by visualizing and analyzing instructional processes and student engagement using digital trace data, overcoming the challenges associated with video analytics and observer-dependent studies. However, both studies were limited to analyzing individual classrooms, highlighting the need for broader analytical scopes. To address this limitation, this third study extended its analytics to multiple classrooms by leveraging the unique characteristics of educational big data. An algorithm was developed to automatically identify comparable classrooms, thereby enabling teachers to compare and understand the distinguishing features of various classrooms. This comparison supports the identification of areas for improving instructional methods and lesson design.

By integrating these three findings, this study proposes the ICCC Framework that encompasses three perspectives: visualizing teaching processes, detecting dynamic changes in student engagement, and comparing multiple classrooms. This framework demonstrates a novel approach to classroom analytics using educational big data. Finally, this dissertation discusses the contribution of utilizing digital trace data as educational big data to support the comparison and improvement of instructional practices, thus paving the way for new advancements in classroom analytics.