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Scientometric and SWOT Analysis of Webcams in Online Education: Trends and Applications

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ABSTRACT

While online education has been widely studied, the impact of webcams on online learning remains underexplored. Combining a scientometric study with strengths, weaknesses, opportunities, and threats analysis, this study examines the application of webcams in online education. It identifies research trends; the top 10 cited authors, organizations, countries, and sources; as well as hot research topics in this field. These hotspots include the effectiveness of webcam-based instruction, student engagement, and the integration of webcams into online learning platforms. The strengths of webcams in online education lie in their ability to enhance interaction and promote a more authentic learning experience. The weaknesses include technical challenges, privacy concerns, and the potential for distractions. Opportunities for the use of webcams in online education include their increasing availability and affordability, as well as the potential for remote tutoring and language translation services. Threats include security issues and challenges related to asynchronous communication.

KEYWORDS

Webcams, Online Education, Scientometric Study, SWOT Analysis

INTRODUCTION

The rise in popularity of online education is often attributed to its convenience. However, its effectiveness has been questioned. Controversies regarding online learning persist despite its recognized convenience and efficiency, particularly concerning improvements in teacher–student interaction, a long-debated issue. Compared with traditional face-to-face classes, online courses lack direct, timely, and effective communication and feedback between teachers and students. Empirical studies also highlight the combined impact of limited online coverage and insufficient webcam use. For example, although online education expanded by more than 300% worldwide during the COVID-19 pandemic (Jayasundara et al., 2023), average webcam usage in key regions remained below 40%,

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which has been associated with a 25% drop in active class participation and a 15% decline in learners' satisfaction (Marlow et al., 2017).

Video conferencing is a common tool used in remote education and research. It offers features such as virtual backgrounds, slide sharing, and nonverbal feedback. However, some computers may not be capable of supporting these features because they require high-performance processors and up-to-date software (Odan et al., 2021). During the pandemic, the shift to online education left many students feeling socially and academically isolated. Many were reluctant to turn on their video cameras during online meetings, making it difficult to feel present with one another (Jayasundara et al., 2023). This reluctance highlights gaps in research on online learning effectiveness and points to potential issues such as privacy concerns, technical barriers, and unequal access to devices. These issues remain underexplored and are the focus of the current study.

To address the problems described above, it is first necessary to clarify why existing research has been limited by integrating scientometric analysis with strengths, weaknesses, opportunities, and threats (SWOT), an approach expected to rigorously examine the issues using both qualitative and quantitative methods. The combination of scientometric analysis and SWOT is effective for three main reasons. First, scientometric techniques can quantitatively analyze Western dominance and reveal cross-regional differences through citation analysis and keyword co-occurrence mapping (Fauzan & Soegoto, 2023). Second, integrating quantitative scientometric findings into SWOT can highlight strengths and weaknesses. Third, this combined approach connects global research trends (from scientometrics) to practical policy implications (from SWOT), bridging the gap between theoretical insights and educational practice.

The research gap in the use of webcams in online education is substantial. Although the popularity and convenience of online education have been widely studied, the impact of webcams on student engagement and learning outcomes remains underexplored (Marlow et al., 2017). More rigorous scientometric studies are needed to quantitatively examine webcam use in online education and its effects on student learning. Additionally, a SWOT analysis could help identify the benefits and challenges associated with webcam use in this context (Weng et al., 2025). This study aims to bridge the research gap by integrating a SWOT analysis with scientometric analysis. Such an approach can inform educators and policymakers about the potential advantages and limitations of incorporating webcams into online education, supporting more effective teaching and learning experiences.

To conduct a scientometric study and SWOT analysis of webcam use in online education, we first conducted a comprehensive literature review to understand the current state of research in this area. To enhance representativeness and diversity, we then collected relevant data, including published articles, research reports, and available datasets. The data were selected to capture a range of perspectives and experiences and to help identify existing gaps and areas for further exploration. The collected data were analyzed using scientometric techniques to identify trends, top-cited authors, sources, organizations, and countries in the field (Fauzan & Soegoto, 2023). This step employed quantitative methods to assess research output and impact. A SWOT analysis was then implemented to identify the strengths, weaknesses, opportunities, and threats associated with webcam use in online education, providing a thorough assessment of internal and external factors that could influence effectiveness in educational settings. Combining these two methods ensures both quantitative rigor (through scientometrics) and strategic relevance (through SWOT), bridging the research gap by linking empirical data to practical policy and pedagogical solutions.

LITERATURE REVIEW

The integration of technology into education has been rapidly evolving, with webcams playing a pivotal role in the shift to online learning. This literature review aims to provide a comprehensive overview of research on webcam use in online education, incorporating insights from both scientometric studies and SWOT analyses.