

Comparison and Transition of Research Focus on Application of IT in Education: Literature Keyword Analysis

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ABSTRACT

The application of information technology (IT) in education has opened new scenarios for this ancient process. With the rapidly changing field of IT, the adoption of IT in education has been changed drastically. It is quite difficult for researchers to keep pace with changing research trends. An analysis based on the keywords could provide a synopsis on the use of IT in education. The keywords can be extracted and clustered to draw a sketch of trend changes over time. In this paper, the authors propose two empirical methods based on classic TF/IDF (i.e., overall rating [OR] and dynamic character [DC] of a keyword for in-depth keyword analysis) to examine changing trends in research. The method helps in disclosing time-based changes in research focuses by comparing TF/IDF weights of keywords in different years. A total of 8,131 scholarly articles from 12 well-recognized journals were used in this analysis. The analysis shows that proposed methods provide sufficient insight into the research trends of application of IT in education in 11 years (i.e., 2007-2017).

KEYWORDS

Application of IT in Education, Keyword Analysis, Text Mining, TF/IDF

INTRODUCTION

Despite the controversy over the relationship between technology and education (Bjarnason, 2001), the widespread use of information technology in educational practices has been widely recognized as a promising move to promote the overall development of education (Martí-Parreño, Méndez-Ibáñez, & Alonso-Arroyo, 2016). The use of technology in education is pervasive, yet its contribution to educational research output and dynamics is unclear (Raban & Gordon, 2015). There are a large number of educational research literatures focusing on the application of IT technology in different fields of education, for example:

The application of LMS (Learning Management System) in teaching and analysis of its impact on students' learning (Akram, Fu, Tang, Jiang, & Lin, 2016; Andergassen, Mödritscher, & Neumann, 2014; Jayaprakash, Moody, Lauría, Regan, & Baron, 2014; Kasim & Khalid, 2016; Whitmer, 2013); In particular, Moodle has become a specialized research topic (Sun, Liu, Luo, Wu, & Shi, 2017; Z., R., L., M., & C., 2017), while MOOC is a very hot research topic in recent years (Jordan, 2014; Littlejohn, Hood, Milligan, & Mustain, 2016; Liyanagunawardena, Adams, & Williams, 2013).

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The application and evaluation of IT in different disciplines (references in physics, chemistry and mathematics, respectively) (Bray & Tangney, 2017; Emre, Ben-Daat, Austin, & Gould, 2016; Gerlič & Ülen, 2012);

The application in activities for teachers, students, education processes or other educational scenes (Heradio et al., 2016; Manca & Ranieri, 2013; Sang, Valcke, van Braak, & Tondeur, 2010; Teo, 2009; Wang, Woo, Quek, Yang, & Liu, 2012).

Most of studies focus on application of IT on only one aspect of education. Fewer studies discuss multiple dimensions of application of IT. There has been a constantly changing trend of researching different ITs in educational practices. It is may be because in last four decades, there have been rapid changes in IT, so as its application in different field, e.g., in education. A study conducted by (Raban & Gordon, 2015), presented a detailed analysis of five decades of applications of IT in education. Their analysis was based on keyword analysis using bibliometric tool. This study provided a detail picture of evolving trends of technology usage in education in 50 years. According to this study, the technology based concepts like internet and web learning, community and E-learning, and network learning have emerged significantly with the emergence of Internet in 1990s.

In this paper, we present an analysis of research trends of 11 years, i.e., 2007 to 2017. For this purpose classic TF/IDF algorithm has been used to extract keywords from 8131 research articles published in 12 reputed journals. The TF/ IDF provides the frequency of occurrence of keywords. However, just calculating frequency of keywords is not enough to gain full insight into the changing research trends. We present a detail analysis of keywords usage using K-means clustering algorithm along with proposed empirical methods of calculating overall rating and dynamic character of keywords. Using the proposed overall rating (OR) value calculation of keywords, we also present year-wise and journal-wise most commonly used keywords. In addition to this, using our proposed empirical method of calculating dynamic character bundled with K-means, we show which keywords were most commonly used in research articles in 11 years, i.e., from 2007 to 2017.

The paper is organized as follows: section 1 describes related work, in section 2 we mention research questions for present study, section 3 introduces empirical method of calculating keyword usage, in section 4 a detail description of dataset, notations and processes used in this paper is given, in section 5 we present results of our analysis and also discuss the research question in perspective of obtained results, finally in section 6 we conclude current work.

RELATED WORK

There are numerous studies which have used keyword analysis to study the characteristics of research articles. However, there are other methods which are also used for this purpose. (Park, Kwon, & Ieee, 2013) used cosine similarity based on keywords to determine distance between articles. These measures were used to analyze research trends in the field of computer networks in 24 conferences from 2009-2010. (Raban & Gordon, 2015) used keyword analysis using bibliometric tools to study the research trends of technology use in learning in five decades. They have studied extensively the technology usage from early computers to Internet and showed what technology was prevalent at different stages in last five decades. Similarly, (Gwo-Jen & Chin-Chung, 2011) studied research trends in mobile and ubiquitous learning from 2001 to 2010 using keyword analysis. They extracted research articles from six reputable journals. In total 3995 articles were extracted and further put into rigorous classification and tagging process. After which 154 papers were selected as relevant to the study. In these studies presented above, frequency of occurrences of keywords and simple statistical measures like correlations analysis were used to analyze most frequent keywords.

There are other studies in which advanced methods methods, e.g., bibliometric analysis, text mining and clustering was used to study effectively the research trends in different fields of scholarly research. (Hung & Zhang, 2012) text mining and clustering to study categorical meta trend analysis in mobile learning trends from 2003 to 2008. The grouped articles related to mobile learning in to

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