Learning analytics in Vocational Education: A Systematic Literature Review

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Abstract：The purpose of learning analysis is to analyze the data collected from the educational environment, so as to promote the sustainable development of education. Learning analysis is a new field, which is also widely used in various levels of teaching environment. This paper is a systematic review of the application of learning analysis in vocational education. Such a comprehensive and systematic review can provide policy makers, teaching and research personnel and schools with the objectives, aspects and use of learning analysis in vocational education, so as to improve the current teaching environment through learning analysis.

Introduction

Learning analysis is a hot and emerging field of education. Analyze the data collected from the educational environment to understand students' learning, so as to optimize teaching or provide corresponding intervention measures.

In addition, the development and progress of the country are inseparable from high-quality workers and professionals. Education is the fundamental guarantee to improve the overall quality of workers, and vocational education provides educational guarantee for most groups. At the same time, vocational education also contributes to a country's economic development. In the past two years, as the country began to attach great importance to the development of vocational education, policies on vocational education have been issued one after another. Under the policy background of the "double high" plan, more and more people begin to pay attention to the development of vocational education.

The application of learning analysis in vocational education is bound to become a trend. At present, we can collect less information about the combination of learning analysis in vocational education. Therefore, there is a literature review vacancy. The purpose of this paper is to provide a reference for the application of learning analysis in vocational education.

At present, there is little systematic research on the application of learning analysis in vocational education (figure 1). In order to fill the gap in the application of learning analysis in vocational education, this paper completes a systematic literature review on this topic.
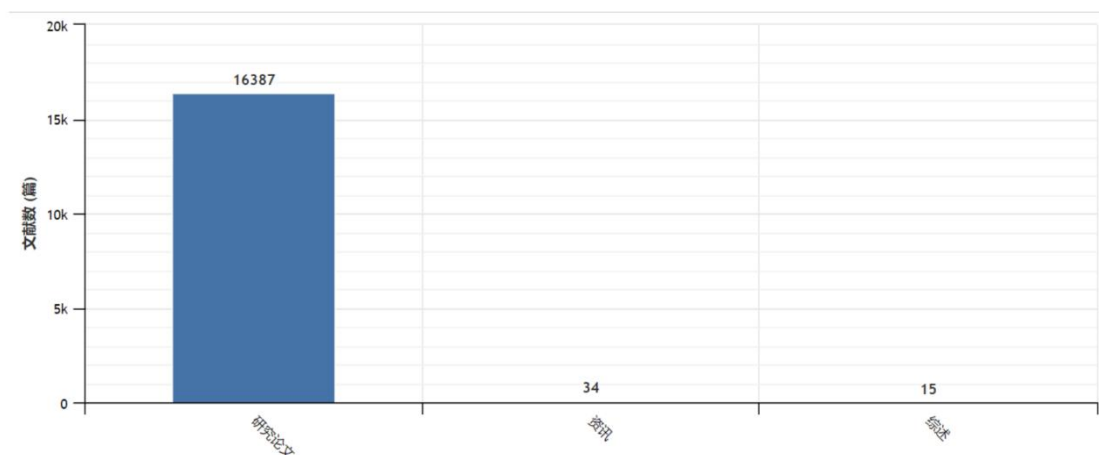

Figure 1 Article types of CNKI in learning analysis and Vocational Education

1 Learning Analytics

Learning analysis is to measure, collect, analyze and report data about learners and their background, in order to understand and optimize learning and its environment.

Learners will leave some columns of data after learning. We can use learning analysis to collect these data from different places, so as to use these data for analysis and provide meaningful insights for managers, teachers and learners (Gedrimiene, Silvola, Pursiainen, Rusanen, & Muukkonen, 2020). The field of LA has emerged from and is closely connected to multiple and different research fields and areas related to analysis,such as business intelligence, statistics, web analytics, academic analytics, data mining, Social Network Analysis (SNA), as well as research interest in the field of learning sciences such as pedagogies, Technology Enhanced Learning, cognitive sciences etc.

LA is strongly related to learning technologies ranging from cognitive tools to more sophisticated and complex environments, such as Learning Management Systems (LMSs), Virtual Learning Environments and the recent Massive Open Online Courses (MOOC), that generate large amounts of educational data (Zotou, Tambouris, & Tarabanis, 2020).

Therefore, the La field can provide feedback based on the generated data and allow in-depth understanding of the learning experience, so as to strengthen education and training. This can be achieved by accumulating as much educational data as possible, so that students and educators / trainers can understand the information provided, make decisions on the learning process, learners' knowledge and skills, and make it easier to identify students' weaknesses and misunderstandings, evaluate the efficiency, etc. All these insights can support successful personalized and adaptive learning, thereby improving all aspects of education and training.

Another recent field overview focused on the analysis of the current research trends of LA, limitations, methods and the key stakeholders. The results show that the use of large-scale online open courses (MOOC), the improvement of academic performance, the bench marking of student behavior and learning environment are the key areas of La research focus; these limitations include the time required to prepare data or obtain results, the size of available data sets and inspection groups, and ethical reasons.

Finally, Peña-Ayala (Peña-Ayala, 2018) conducted a detailed review of LA with the aim of providing an idea of the LA toil, its research lines, and trends to inspire the development of novel approaches for improving teaching and learning practices. This study shows that a small number of studies proposed to confirm progress in this field provide representative concepts and identify the roles of different stakeholders. In addition, it also points out that a perfect theoretical framework is needed to guide La progress. In this study, we are especially interested in how LA can be applied in vocational education.

2 Research Questions

In order to better discover the application of learning analysis in vocational education, three questions are set to help us better understand the current development:

Q1: What is the educational goal of using learning analysis in vocational education?

Q2: What methods of learning analysis are used in vocational education?

Q3: What are the applications of learning analysis in vocational education?

3 Methodology

The systematic literature review was used in this study. The review mainly focused on the literature of the last 5 years, papers published between 2017 and 2021. In the method, Prisma checklist is used to assist in literature retrieval.

4 Search Strategies Selection Criteria

The first step in the systematic review was a keyword search. EBSCO, Scopus and CNKI database were used for the searches.

In the preliminary screening, the following combined keywords are selected for the preliminary screening of literature: Learning analytics AND vocational education OR vocational OR technical education (as a synonym for vocational education)

OR work training. Table 1 presents the number of papers retrieved per database.

Table 1 Counts of studies found in each database

Datebase	Studies initially retrieved	Studies selected
CNKI	160200	8
SCOPUSEBSCO	32	3
EBSCO	41	4
Total	160273	15

In addition to the selection process described in section 4.2, Kitchenham (2004)

recommend that an SLR should also evaluate the quality of the selected papers in order to validate the results found. Import the filtered articles into endnote for de duplication.

Then screen again according to the following criteria:

The articles targeted on LA .

LA was used in vocational educational or work-training context.

The articles were published between 2017 and 2021.

The articles were peer-reviewed.

5 Data analysis: Selection Process

The second step was to exclude articles with little relevance. Firstly, the preliminary screening is carried out by inputting keywords, and then the limited screening is carried out by limiting the research discipline, keywords, language, time range and literature type. In this process, we choose the research discipline in the fields of vocational education or learning analysis. Exclusion screening shall be conducted for the keyword part to exclude the keywords that do not meet the research field, such as health, medicine, etc. Select the last five years, i.e. 2017-2021. Document types exclude conference paper, conference review and book. Simple filtering is carried out through the above methods, and the final filtering results are imported into endnote for de duplication.
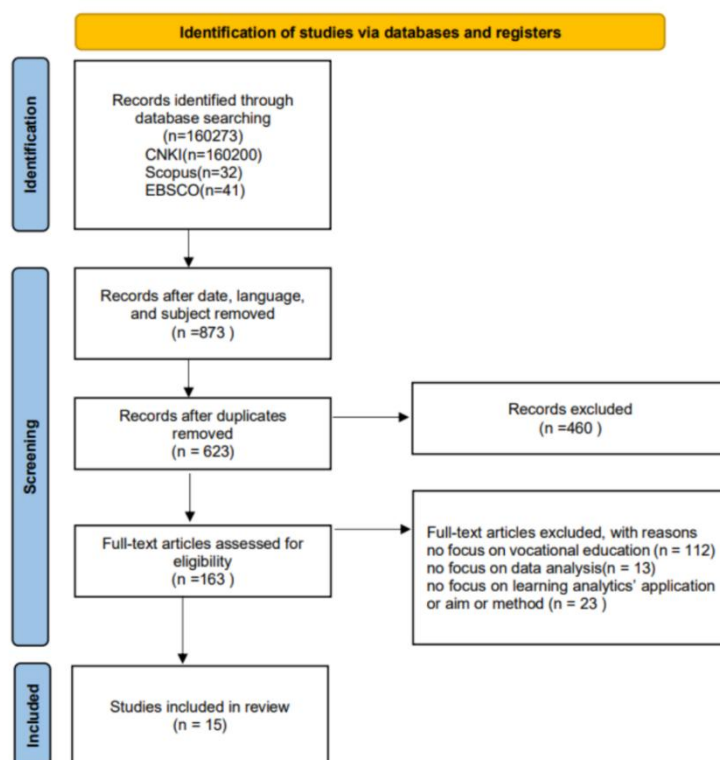

Figure 2 PRISMA Flowchart.

The PRISMA flow diagram for the systematic review detailing the database searches, the number of abstracts

screened, and the full texts retrieved.

6 Extraction of Relevant Fields

Finally, the last step of SLR is to extract relevant information from the full text of the selected article. We simply read the literature in endnote and select the articles closest to this paper. Finally, 15 articles closely related to the research content of this paper are obtained.

7 Result

Q1: What is the educational goal of using learning analysis in vocational education?

The first goal is for policy. At present, the national attention to vocational education is gradually increasing, but how to carry out effective vocational education needs to be further improved. By using LA to analyze the current enrollment, employment, teaching and school facilities of secondary school students in vocational education, it can help policy makers to improve the current vocational education policies. In recent years, student guidance counseling, special support, welfare services in Finnish VET have started cultivating the idea that all teachers should be involved in supporting students' studies and career choices.

The second goal is for teachers and students. Teachers can timely provide learning intervention through the results of La, which will help students make progress in learning. One of the most influential advantages of La in vocational education is to provide each student's learning situation. By analyzing students' learning behavior or performance in the environment of vocational education, we can know the extent of students' knowledge reserve. In recent years, it has been suggested to personalize students' learning path, for example, by participating in additional language or learning skills courses or increasing on-the-job training time, to provide vocational students with the opportunity to choose their personal learning rhythm and trajectory.

Q2: What methods of learning analysis are used in vocational education?

when actually using big data technology to carry out vocational education, it is necessary to conduct statistical analysis and processing on the original data records through the comprehensive operation of statistical analysis technologies and methods such as mathematical statistics, artificial intelligence, computer learning and data mining ,mathematical modeling, build various data models, and analyze and describe the comprehensive data of vocational education such as students' learning process, content, resources, results and teaching behavior methods, so as to effectively predict the learning trend of students and the teaching demand trend of vocational education, and provide strong data support for teachers and students' parents.

The goal of cultivating students in vocational colleges is clear and the direction is relatively single, which also provides a clear content demand orientation for classroom teaching. Therefore, when using big data technology to carry out classroom teaching, learning analysis is a new information technology. Its research object is the students themselves and their learning environment. Learning analysis is to discover the existing problems, optimize and improve learning methods, and predict the progress and comprehensive performance in stage learning through the collection, analysis and mathematical modeling of massive data generated by students' learning.

Using the existing information technology, the ideal of providing personalized micro classroom teaching and student guest teaching is no longer on paper(Rahimi- Ardabili et al., 2021). In the future, supported by big data, vocational education can more accurately analyze the needs and development trends of various students. Its teaching methods will inevitably become increasingly personalized, and educational approaches such as micro-classes and guest lectures will be more easily realized.

Vocational education needs to quickly cultivate resources with socio-economic value and individualization, which requires that from schools to teachers, we must change the thinking mode of traditional education, explore and innovate teaching modes, make full use of the benefits brought by big data, develop a variety of teaching information platforms, and realize novel teaching prevention such as micro classroom and guest teaching.

Multimedia teaching in the era of big data is particularly common. It is also a

new teaching method produced by the full combination of the application of big data and the reality of vocational

education. Information interconnection technology realizes massive information sharing, and the operation demonstration of audio, video, pictures, PPT, office and other software of learning content, creating a very rich and vivid classroom teaching environment.

Q3: What are the applications of learning analysis in vocational education?

While we are still discussing what problems arise in vocational education, the era of mobile Internet is affecting our classroom. Collected massive data—including learners' basic, learning, and behavioral information (reflecting attitudes and outcomes) as well as learning resource data like courses and teaching guidance—are key educational resources. Vocational education can use learning analysis to automatically and comprehensively gather such data. Serving teachers, students, and managers, the technology analyzes data and feeds back results promptly: aiding managers in improving management, assessment, and spaces; enabling teachers to deliver tailored instruction; and helping students correct poor behaviors. Its goal is to optimize learning environments, support personalized learning, and assist vocational education decision-making via real-time services to boost learning.

8 Discussion

Big data is a values system, methodology, and profound shift in thinking that has permeated all industries, sparking transformative waves. As informatization advances, educational information abounds, management tools innovate continuously, and massive structured/unstructured educational data emerges—ushering in the era of educational big data. In this context, schools are no longer sole knowledge providers; educational data is more accessible and integrable, enabling students to acquire knowledge through diverse channels and enrich their reserves. How to utilize and analyze this vast data not only impacts information exchange, knowledge transmission, and learning outcomes but also influences teaching decision-making and learning mode optimization to a certain extent.

9 Conclusion

At present, the application of learning analysis in the field of vocational education is relatively small, and most of them are some mobile devices or web teaching applied to vocational education. The application of the complete concept of learning analysis to vocational education needs to be further strengthened. In the future, we need to pay more attention to the combination of teaching and practice, and distinguish the differences between vocational education and general education. The ultimate goal of improving vocational education is to diversify teaching forms, such as strengthening school enterprise cooperation and truly improving the skill level of vocational education students. Combine learning with practice, and use learning analysis to better help the field of vocational education do a good job in the future teaching transformation.

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