Scientific Research Publishing

Creative Education, 2022, 13, 2913-2920
https://www.scirp.org/journal/ce
ISSN Online: 2151-4771
ISSN Print: 2151-4755

Learning Analytics in Education, Advantages and Issues: A Systematic Literature Review

Yap Sze Mian, Fariza Khalid, Alex Wong Chiew Qun, Siti Sarah Ismail

Faculty of Education, The National University of Malaysia, Bangi, Malaysia
Email: andrea.ysm@hotmail.com, fariza.khalid@ukm.edu.my, alex4wong@1hpclucth.com, sarah.hj.ismail2gmail.com

How to cite this paper: Mian, Y. S., Khalid, F., Qun, A. W. C., & Ismail, S. S. (2022). Learning Analytics in Education, Advantages and Issues: A Systematic Literature Review. *Creative Education, 13,* 2913-2920.
https://doi.org/10.4236/ce.2022.139183

Received: June 26, 2022
Accepted: September 20, 2022
Published: September 23, 2022

Abstract

Learning Analytics (*LA*) is emerging rapidly in the field of education. The purpose of this paper is to provide an overview of the advantages and issues of Learning Analytics in education. This paper reports a systematic literature review on learning analytics in educational settings. A total of 26 published papers and indexed journals collected from several databases were reviewed and analysed. Articles were coded into two categories: advantages and issues by using the NVivo 12 software. This paper identified advantages of using learning analytics in education which included teaching quality, management of educational institutions and forecasting, and prediction of risky students, while issues found in Learning Analytics were ethical and privacy, data collection and analysis, and evaluation process.

Keywords

Education, Learning Analytics, Learning Analytics in Educations, Advantages, Issues

1. Introduction

The tremendous development of information and communication technology in this century has an enormous impact on the field of education. Students and educators in the 21st century were exposed to use various technology-driven equipments as aid or tools in teaching and learning (Yusof & Tahir, 2017). The rapid advances in information and communication technologies, coupled with increased access to information and the formation of global communities, have resulted in interest among researchers and academics to revise educational practice to move beyond traditional "literacy" skills towards an enhanced set of new media literacies (Dawson et al., 2014). Technology has been seen as a basic necessity and not a requirement (Omar, 2015).

The process of gathering and analysing a large set of data systematically from online sources for the purpose of improving learning processes is known as Learning Analytics (*LA*) (Nunn et al., 2016). Learning Analytics was introduced in 2011 to measure, collect, analyse and report student data, for the purpose of understanding the context and enhancing their learning (Banihashem et al., 2019). It is a new field in education (Nunn et al., 2016) and is booming at the higher education level (Hoel & Chen, 2016). Learning Analytics can be defined as research fields and applications related to academic analysis, action analytics, and forecast analysis (Baker & Inventado, 2014). However, earlier definitions discussed by the community suggested that Learning Analytics is the use of intelligent data, learner-produced data, and analysis models to discover information and social connections for predicting and advising people's learning (Siemens, 2010).

Learning analytics can be seen as the "measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs" (Siemens & Long, 2011). As this point emphasized by Wilson et al. (2017), learning analytics has been a rapid growth scope in learning research through technology Ferguson (2012). Many educators have emphasised the need to record and analyse what happens during the learning process so that factors that affect the performance of students' learning can be identified (LAK, 2011). The application of Learning Analytics in educational institutions is able to increase the quality of service and at the same time, could improve student grades and student achievement (Hwang et al., 2017). However, there has not been much work done by past researchers that explored the issues related to the use of Learning Analytics for educational purposes and the actual benefits of it. Therefore, this study aims to identify the advantages and issues of Learning Analytics in education. Within this context of the scenario, the research questions addressed in this review are:

1) What are the advantages of using learning analytics in education?

2) What are the issues of using learning analytics in education?

2. Methodology

This literature review focuses on advantages and issues of learning analytics in education by searching for empirical studies including quantitative, qualitative, literature reviews and conceptual papers published in peer-reviewed journals. Databases used for literature research were Google Scholar, Scopus, Emerald, Science Direct and Springer Link and Jstor. The keywords that were used included: learning analytics and education, learning analytics and advantages, and learning analytics and issues. Selected articles were published from the year 2010 to 2019 only.

More than 300 research studies have been found. However, only 26 articles were selected as the reference for this paper based on the focus of the research on Learning Analytics in the education field. The studies were selected based on the method of research, the context of the study, the scope of respondents involved from various countries. The selection of previous studies was also summarized

based on the requirement to answer the research questions that have been developed. In addition, analysis has been conducted to ensure that the selected articles were in line with the main focus of this concept paper. Selected articles were then coded based on two categories: advantages and issues using the NVivo 12 software. Each of these categories was then separated into sub-categories which will be discussed in the findings and discussion below. Table 1 summarized the past studies in terms of study design, location, focus and research area.

3. Findings and Discussions

The findings of this study are based on the research questions.

3.1. Advantages of the Implementation of Learning Analytics in Education

This section is to answer the first research question: What are the advantages of using Learning Analytics in education? Analytics in education can exist and appear in all stages, and it ranges from classroom, department and university until the level and stage of international (Siemens, 2013).

1) Assessment of Teaching Quality

Based on the literature research, one of the advantages of the implementation of Learning Analytics in education is that is able to assess teaching quality and identify as well as excavate the endorsement, support and association that are needed in order to help students in their learning (Viberg et al., 2018). Through the implementation of Learning Analytics, all information that is related to students and their environments can be assessed, uncovered and analysed as the forecasting and modelling of the learning process (Mah, 2016). Besides that, Learning Analytics also functions in preparing and providing educational opportunities based on the students' needs and skills (Nunn et al., 2016). Learning Analytics helps and assists the understanding of the behaviour and learning process of students through the data being collected (Blikstein, 2011). The amount of data being collected can help the students in becoming successful through the implementation of Learning Analytics (Dietz-Uhler & Hurn, 2013).

Table 1. Summary of previous studies.

Research design	Location	Focus of study
Quantitative (5)	US (2)	Instructor (1)
Qualitative (1)	Spain (1)	Instructor & student (1)
Literature review (7)	New Zealand (1)	Management (1)
Conceptual paper (3)	Turkey (1)	Student (2)
	German (1)	Higher institution student (1)
	Iran (1)	LA expert (1)
	Sweden (1)	Higher institution student (3)
	US (1)	LA expert (1)
	Others (5)	Others (3)
	Others (3)	

2) Management of Educational Institution

The approach of Learning Analytics in education enables the management department of an institution or teaching staff to collect information and data from students that are going to be analysed and, they can carry out and organize follow-up actions in order to improve teaching and learning quality. This has been further supported by Mahroeian et al. (2017) and Siemens (2013) in which they report that the approach of Learning Analytics is useful and functional in helping the learning areas of students, the optimizing, enhancement and resource allocation, monitoring, increasing of achievement and overcoming critical issues, management and arrangement of staff as well as increasing efficiency in an educational institution.

3) Forecasting of Risky Students

The approach of Learning Analytics is also capable of helping educators in forecasting and predicting or identifying risky students in academic achievement. The system of early warning can be interpreted as follow-up actions in the forecasting of academic achievement (Akçapınar et al., 2019). With the implementation of Learning Analytics in the classroom, teachers or educators can detect and track risky students from the perspective of academic failure and then plan, structure and provide actions and initiatives to help and assist the students in practising improvement.

This has also been supported by some examples of research in the past that were being analysed by Akçapınar et al. (2019) and Mah (2016). A statement was being made by Siemens (2013) that Learning Analytics can help educators in making early forecasting and prediction towards the academic achievement and performance of students who are facing and encountering risks in education through statistical analysis from the data being collected.

3.2. Issues of the Implementation of Learning Analytics in Education

This section is to answer the second research question: What are the issues of using learning analytics in education? More issues are arising regarding this matter. However, identified issues in this literature review are ethical, and privacy, data collection and analysis, and evaluation process will be discussed.

1) Ethical and Privacy Issues

Definitions of ethics and privacy according to Ifenthaler & Schumacher (2016) are, "Ethics refers to a system of fundamental principles and universal values of right." "The most general definition of privacy is freedom from interference or intrusion. A legal definition of the concept of privacy is a person's right to control access to his or her personal information. More precisely, privacy is a combination of control and limitations, which implies that individuals can influence the flow of their personal information and prevent others from accessing it."

Data collection for information analysis on the learning process has raised concerns about privacy issues, as not every individual agrees to disclose their data. According to Ifenthaler & Schumacher (2016), learners would like to keep

their information private for competitive reasons and personal reasons. However, when more comprehensive learning processes need to be identified, the more data are needed. Therefore, ethical and privacy issues have been identified as the main concerns (Ifenthaler & Schumacher, 2016). Dyckhoff et al. (2013) in their study found out that primary schools often do not have their own server and platform have to rely on the cloud and Web 2.0 tools raise legal and ethical issues.

2) Data Collection and Analysis

The collection of data in learning analytics can be a challenge (Nunn et al., 2016). Underage or minor students who use their family's identity to access services such as Gmail lead to some issues such as data analysis complexity and validity of the collected data (Triana et al., 2016). Every each key-in data usually will leave a trace in the database and information system. The collected data will be used in the model and statistical method of learning analytics to benefit the expected learning. Hence, students need to keep their data up-to-date. This is to ensure that the best data will be obtained when needed (Leitner et al., 2019). Lack of understanding of what exactly needs to be measured to understand learning is an issue of learning analytics (Dringus, 2012). Incorrect data can be able to ruin the findings that lead to misinterpretation of the overall population (Nunn et al., 2016).

3) Data Evaluation Process

Evaluating the effectiveness of Learning Analytics is a challenging task (Dyckhoff et al., 2013). They also mentioned in their study that until now, there had been little evidence of the current learning analytics system able to bring a positive effect to teachers or students or both. This is due to the fact that even though higher education institutions have taken their own initiative to practice learning analytics, it is still in the preparation or early stage (Tsai & Gasevic, 2017). Dyckhoff et al. (2013) again mentioned that learning analytics is not possible to calculate indicators of students' appreciation or level of satisfaction with particular learning design.

4. Conclusions

Various factors needed to be given attention and examined more extensively so that the objectives of Learning Analytics in teaching and learning would be achieved. A considerable amount of literature has been published in Learning Analytics in educational contexts for a wide variety of learning domains. However, there is a lack of review studies so far with a focus on investigating factors such as the purposes, uses, abilities, benefits, disadvantages, limitations, effectiveness, challenges, affordances when applied in different domains, and features of Learning Analytics in educational and non-educational settings. Further studies on Learning Analytics should be conducted massively by focusing on the area of studies in educational institutions, especially in Southeast Asia since Learning Analytics has been practiced in the learning environment in developed

countries for the last few decades. These related studies may be detailed in the context of organizational management, entrepreneurship, institutional services, and individual learning, etc.

The number of published studies about learning analytics in education has increased progressively year by year. The implementation of Learning Analytics in education is crucial in line with the rapid changes in technology development. Learning Analytics is very beneficial for improving educational systems, especially in the quality of teaching and management of educational institutions. These elements will not only provide an improvement in the quality of education services but also can be practiced in order to face the challenges in the educational institutions. This is important in comparing the education systems with international benchmarks to ensure that they are moving in line with the development of international education.

Acknowledgements

This research is funded by GG-2021-030 research grant.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

Akçapınar, G., Altun, A., & Aşkar, P. (2019). Using Learning Analytics to Develop Early Warning Systems for At-Risk Students. *International Journal of Educational Technology in Higher Education, 16,* Article No. 40. https://doi.org/10.1186/s41239-019-0172-z

Baker, R. S., & Inventado, P. S. (2014). Educational Data Mining and Learning Analytics. In *Learning Analytics* (pp. 61-75). Springer. https://doi.org/10.1007/978-1-4614-3305-7_4

Banihashem, S., Aliabadi, K., Pourroostaei Ardakani, S., Nili AhmadAbadi, M., & Delavar, A. (2019). Investigation on the Role of Learning Theory in Learning Analytics. *Interdisciplinary Journal of Virtual Learning in Medical Sciences, 10,* 14-27.

Blikstein, P. (2011). Using Learning Analytics to Assess Students' Behavior in Open-Ended Programming Tasks. In *Proceedings of the 1st International Conference on Learning Analytics and Knowledge* (pp. 110-116). The Association for Computing Machinery. https://doi.org/10.1145/2090116.2090132

Dawson, S., Gašević, D., Siemens, G., & Joksimovic, S. (2014). Current State and Future Trends: A Citation Network Analysis of the Learning Analytics Field. In *Proceedings of the Fourth International Conference on Learning Analytics and Knowledge* (pp. 231-240). ACM. https://doi.org/10.1145/2567574.2567585

Dietz-Uhler, B., & Hurn, J. (2013). Using Learning Analytics to Predict (and Improve) Student Success: A Faculty Perspective. *Journal of Interactive Online Learning, 12,* 17-26.

Dringus, L. (2012). Learning Analytics Considered Harmful. *Journal of Asynchronous Learning Networks, 16,* 87-100. https://doi.org/10.24059/olj.v16i3.272

Dyckhoff, A. L., Lukarov, V., Muslim, A., Chatti, M. A., & Schroeder, U. (2013). Supporting Action Research with Learning Analytics. In *Proceedings of the Third Interna-*

tional Conference on Learning Analytics and Knowledge (pp. 220-229). Association for Computing Machinery. https://doi.org/10.1145/2460296.2460340

Ferguson, R. (2012). Learning Analytics: Drivers, Developments and Challenges. *International Journal of Technology Enhanced Learning, 4,* 304-317. https://doi.org/10.1504/IJTEL.2012.051816

Hoel, T., & Chen, W. (2016). Privacy-Driven Design of Learning Analytics Applications: Exploring the Design Space of Solutions for Data Sharing and Interoperability. *Journal of Learning Analytics, 3,* 139-158. https://doi.org/10.18608/jla.2016.31.9

Hwang, G. J., Chu, H. C., & Yin, C. (2017). Objectives, Methodologies and Research Issues of Learning Analytics. *Interactive Learning Environments, 25,* 143-146. https://doi.org/10.1080/10494820.2017.1287338

Ifenthaler, D., & Schumacher, C. (2016). Student Perceptions of Privacy Principles for Learning Analytics. *Educational Technology Research and Development, 64,* 923-938. https://www.jstor.org/stable/45018697 https://doi.org/10.1007/s11423-016-9477-y

LAK (2011). *Proceedings of the 1st International Conference on Learning Analytics and Knowledge*.

Leitner, P., Ebner, M., & Ebner, M. (2019). Learning Analytics Challenges to Overcome in Higher Education Institutions. In D. Ifenthaler, D.-K. Mah, & J. Y.-K. Yau (Eds.), *Utilizing Learning Analytics to Support Study Success* (pp. 91-104). Springer. https://doi.org/10.1007/978-3-319-64792-0_6

Mah, D.-K. (2016). Learning Analytics and Digital Badges: Potential Impact on Student Retention in Higher Education. *Technology, Knowledge and Learning, 21,* 285-305. https://doi.org/10.1007/s10758-016-9286-8

Mahroeian, H., Daniel, B., & Butson, R. (2017). The Perceptions of the Meaning and Value of Analytics in New Zealand Higher Education Institutions. *International Journal of Educational Technology in Higher Education, 14,* Article No. 35. https://doi.org/10.1186/s41239-017-0073-y

Nunn, S., Avella, J., Kanai, T., & Kebritchi, M. (2016). Learning Analytics Methods, Benefits, and Challenges in Higher Education: A Systematic Literature Review. *Online Learning, 20,* 13-29.

Omar, S. (2015). Pengaruh Peranti Teknologi Kepada Perkembangan Sosial dan Permasalahan Kesihatan Kanak-kanak. *Jurnal Kebajikan Masyarakat, 1,* 1-11.

Siemens, G. (2010). *What Are Learning Analytics*? Elearnspace Archived at the Wayback Machine.

Siemens, G. (2013). Learning Analytics. *American Behavioral Scientist, 57,* 1380-1400. https://doi.org/10.1177/0002764213498851

Siemens, G., & Long, P. (2011). Penetrating the Fog: Analytics in Learning and Education. *EDUCAUSE Review, 46,* 31-40.

Triana, M. J. R., Monés, A. M., & Sobrino, S. V. (2016). Learning Analytics in Small-Scale Teacher-Led Innovations: Ethical and Data Privacy Issues. *Journal of Learning Analytics, 3,* 43-65. https://doi.org/10.18608/jla.2016.31.4

Tsai, Y.-S., & Gasevic, D. (2017). Learning Analytics in Higher Education—Challenges and Policies. In *Proceedings of the Seventh International Learning Analytics & Knowledge* (pp. 233-242). The Association for Computing Machinery. https://doi.org/10.1145/3027385.3027400

Viberg, O., Hatakka, M., Bälter, O., & Mavroudi, A. (2018). The Current Landscape of Learning Analytics in Higher Education. *Computers in Human Behavior, 89,* 98-110.

https://doi.org/10.1016/j.chb.2018.07.027

Wilson, A., Watson, C., Thompson, T., Drew, V., & Doyle, S. (2017). Learning Analytics: Challenges and Limitations. *Teaching in Higher Education, 22,* 991-1007. https://doi.org/10.1080/13562517.2017.1332026

Yusof, M. N. M., & Tahir, Z. (2017). Importance of Information Technology-Driven Social Media in Public Institutes of Higher Education. *Journal of Social Sciences and Humanities, 12,* 23. https://doi.org/10.24059/olj.v20i2.790