https://doi.org/10.22364/htqe.2022.21

THE BENEFITS OF LEARNING ANALYTICS FOR EDUCATION: A STUDY OF THE EXPERIENCES OF TEACHERS IN NORWAY AND LITHUANIA

Julija Melnikova[1], Aleksandra Batuchina[2], Gita Šakytė-Statnickė[3], Gražina Šmitienė[1]

[1] Klaipeda University, Lithuania

[2] SMK University of Applied Sciences, Lithuania

[3] Klaipeda State University of Applied Sciences, Lithuania

ABSTRACT

The benefits of learning analytics for education are discussed in the article. First, at the theoretical part authors reveal the concept of learning analytics also discuss how learning analytics technologies help to improve the teaching and learning process. Second, the article emphasizes the increasing use of technology in education what goes hand in hand with the areas of learning analytics and artificial intelligence in education, also the particular focus on how data can be used to improve the teaching-learning process. When teaching/learning takes place in a digitally based learning environment, some learner interaction with the digital learning tool occurs, which leads to a specific learner's learning experience, which results in high digital data flows. These data describe the individual learning activities of learners in learning systems or the interactions of learners in groups. The analysis of such data is an area of learning analytics. The focus of the article oriented to main beneficiaries – teachers. Moreover, in the article authors discuss the benefits of learning analytics on teachers' pedagogical work.

The empirical part of the article presents the results of a qualitative study: semi-structured interviews with 7 teachers from Norwegian and 10 teachers from Lithuanian, who are applying learning analytics (digital platforms that integrate learning analytics tools) tools in teaching/learning process. The semi-structured interview method allowed to gather the research participants' insights into the use of learning analytics in schools from the perspective of teachers. Content analysis of the informants' answers revealed teachers' opinion on the benefits of learning analytics for teaching and learning, teachers' competencies to work with learning analytics tools, empowering teachers to use learning analytics tools and to make data-based pedagogical decisions. The comparative analysis allowed disclosing some differences in a way how teachers in Norway and Lithuania approach digital technologies and implement them in teaching-learning process.

Keywords: *learning analytics, general education schools, data-based pedagogical decisions, Norway, Lithuania*

Introduction

Digital technologies are changing everything: people's communication, social life, opportunities for cooperation, and are forming new life habits. These changes also affect education. Even in 2014 research predicted that in a decade about two-thirds of general education students will be learning, fully or partly, in a digital-based learning environment (Wang, Decker, 2014). Researchers have hypothesized that portable computing devices and evolving educational technologies (for example: smart classrooms, smart learning environments, etc.) will foster even more rapid digitization of education in the nearest future (Har Carmel, 2016). Therefore, the content, forms, methods, roles of educators and learners and interactions in the teaching/learning process will change over time (Hollman et al., 2019).

In recent years, the issue of digitization of education has become even more relevant. On the one hand, the COVID-19 pandemic situation has greatly accelerated the digitization of education. An unprecedented hasty experiment with school systems took place during the pandemic, with hundreds of millions of learners moving to a digital learning environment (Kalim, 2021). As a result, digital technologies have become part of the teaching/learning process and, according to researchers, their use has been proven to be crucial in ensuring better education for learners during a pandemic (Kurvinen et al., 2020). On the other hand, target groups in education – students, parents, teachers and school leaders – are increasingly using technology for a variety of educational purposes, for instance, informing students about their achievements in an e-diary environment (Howley et al., 2021). Thus, these processes encourages even more rapid digitization of education.

The increasing use of technology in education goes hand in hand with the areas of learning analytics and artificial intelligence in education, with a particular focus on how data can be used to improve the teaching/learning process. Artificial intelligence and learning analytics are becoming the most popular ways to analyze collected data in digital learning environments to support teachers and learners in their learning (Krikun, Kurilovas, 2016). It is important to note, that artificial intelligence and learning analytics aim to improve learning processes by systematically processing teaching-related data and providing guidance to teachers and learners. Researchers in artificial intelligence and learning analytics analyze cognition, motivation, influence, language, social discourse, and other issues based on data derived from digital learning environments. Therefore, the possibilities of integrating artificial intelligence and learning analytics are of particular interest in learning environments such as: adaptive learning systems, intelligent learning systems and open educational resources (Mandinach,

Gummer, 2016). These technologies aim to inform teachers and learners, as well as other stakeholders, as effectively as possible, and to encourage their interaction and collaboration, and contribute to improving of the quality of teaching/learning (Holstein et al., 2019).

The scientific literature (Hollman et al., 2019) increasingly raises questions about how digital technologies change education, how they affect participants in education, how to use the advantages of technology to improve the quality of education, how to overcome technology-related challenges in education, and so on. One of the main factors driving their application in general education is the findings of research showing that teachers and students show a high level of support for intelligent learning systems (the study involved the following learning experience platforms: ALEKS, Cognitive Tutor, Khan Academy, edX and Coursera) (McHugh, 2015). In addition, these systems contribute to the development of the concept of evidence-based education (Khine, 2018) by providing data-based feedback and the opportunity to analyze and improve the teaching/ learning process.

In recent years, artificial intelligence and learning analytics have been integrated by an increasing number of digital tools, both commercial, such as MS Teams, Google Classroom, iSpring Learning, and open source, such as Moodle, and other platforms, which have been designed for various educational sectors. Today learning experience platforms based on artificial intelligence and integrative learning analytics tools are seen as one of the most effective tools to make it easier for learners to learn and easier for teachers to teach (Rienties et al., 2018).

The article is focused on the micro level (i. e. the teaching/learning process and the digital learning tools used in it, these tools provide the learning content and are equipped with analytical tools and are able to provide guidance to the participants in the educational process by means of artificial intelligence). Within the framework of the research, such tools have been referred to as Learning Experience Platforms (Vincent-Lancrin, 2021). In global practice, learning experience platforms such as *Eduten Playground, Matific, FastForWord, EduAi, LearnLab, etc.* allow learners to personalize what they are learning, how they are learning and when/ where they choose to learn. Through such platforms, participants in the learning process can identify specific skills or knowledge gaps by accessing an analysis of their teaching- learning activities and suggestions for action to improve their achievement.

Taking everything into consideration, current article aims to discuss the possibilities of integrating learning analytics into general education from the perspective of teachers theoretically emphasizing the benefits of learning analytics tools and the data analysis they provide for teachers' pedagogical

work; empirically revealing the experience of Lithuanian general education teachers using learning analytics, their insights on benefits of learning analytics for education and the teaching/ learning process, and about the changes in pedagogical practice caused by learning analytics. Two countries were selected for the study – Norway and Lithuania. Current countries were chosen, since in Lithuania the project "Artificial Intelligence in Schools: Scenarios for the Development of Learning Analytics in Modernizing General Education in Lithuania" (DIMA_LT) was implemented, and Norway was taken as a model country in this project.

Methodology

During the implementation of the mentioned above project an exploratory empirical study was performed. The problematic question of the study was: what benefits of learning analytics for education in Norwegian and Lithuanian school teachers see while using learning analytics tools? This article aims to reveal the experiences of teachers in Norway and Lithuania using learning analytics, their insights into changes in pedagogical practice.

The study sample was formed using convenient target selection (Rupšienė, 2007). Teachers from Norwegian and Lithuanian schools took part in the project. A total of 17 semi-structured interviews were conducted. Participants were the teachers who are using in learning analytics programs (*Eduten Playground, LearnLab, Matific* and *EduAi*) at their classes.

Semi-structured interviews are flexible and versatile, making them a popular choice for collecting qualitative data (Kallio et al. 2016). Semi-structured interviews provide a platform for a collaborative exchange in which information can be elicited quickly and effectively. It serves equally well either as a means of gathering data for research (Magaldi, Berler, 2020).

The interviews were conducted in April-May, 2021. In preparation for the interview, interview questions were prepared, information was provided to the informants about the peculiarities of conducting remote interviews, the objectives of the research, publicity of the obtained research results, guarantees of their anonymity, etc. The Zoom platform was chosen as the most acceptable remote communication platform for all informants. The advantages of this platform are recognized in qualitative research as a high-quality data collection tool: video and audio recording capability, cost-effective, etc. (Archibald et al., 2019). The possible limitations of this platform, the occasional problems of communication interference and the limited ability to capture non-verbal information, have been addressed with informants in the context of video interviews and solutions to the communication problem (Weller, 2017). Up to an hour and a half for each interview. All appointments are recorded. Each study participant consented

to participate in the study and allowed the researchers to make interview recordings that were used only for data analysis purposes and stored on the investigators' media.

Qualitative content analysis was chosen as a method to analyze written, oral, and visual communication messages for the analysis of interview data and presentation of research results (Cole, 1988). Classical content analysis involves the technique of grouping text into groups according to codes generated by variables (presence, intensity, or quantity of significant characteristics) (Creswell, 2009). Data analysis was performed in several stages: 1. reading the text of the interview; 2. separation of categories based on key words; 3. the division of the content of the categories into subcategories; 4. description of categories and subcategories and substantiation with evidence extracted from the text (Žydžiūnaitė, Merkys, Jonušaitė, 2005). To ensure the internal validity of the study, the informants were provided with a study report with feedback. Informants rated the study report positively. The external validity of the study was ensured by providing a detailed description (Rupšienė, 2007).

Results

The results below will be presented separately by country. When analyzing Norwegian teachers the study participants' answers to the open question "What do you think are the benefits of learning analytics for education and training?" the following subcategories were distinguished from their answers (see Table 1).

Norwegian teachers who participated in the study, when speaking about the benefits of learning analytics for education, emphasized that this is primarily an opportunity to obtain more data related to teaching and learning processes. According to informants, it is common practice in schools to collect a variety of data using traditional methods, but this data is fragmented, there is a lack of data collection and consistent and continuous analysis practices in schools, and it is not clear who is the "host" of data, how the data could serve to improve education, and so on. Learning analytics, in the opinion of informants, provides an opportunity to collect more useful data on students' learning and use them more effectively to improve education, curriculum, curricula, and so on. Regarding their experience, participants emphasized that "teachers need to develop curricula, review curricula, and the data collected by learning analytics for these purposes are very helpful". In respondents' words, learning analytics and the data collected through it enable data-based pedagogical decisions. Based on the experience of the study participants, it can be stated that such visual, automatically systematized presentation of data facilitates the work of teachers.

Table 1. Norwegian teachers' views on learning analytics, its benefits and relevance to education and the teaching/learning process

Category	Subcategories
The benefits and importance of learning analytics	• "provides" teachers with relevant data on teaching/learning • the opportunity to monitor student achievement • promotes data-based pedagogical decisions • enables to see shortcomings of teaching process • enables to provide timely feedback
Involvement and empowerment of teachers	• teachers-leaders • the "chain" principle • learning communities • teachers' enthusiasm and leadership • leadership • bottom-up principle
Technology management	• teachers who use technology effectively • teachers who foster technological solutions
Providing schools with technological resources	• the importance of infrastructure • insufficient technological base of schools
Teachers' competence to work with data and make data-based pedagogical decisions	• access to data • optimal data delivery solutions • visualization of data • data-based pedagogical decisions
Opportunity for teachers to reflect on their pedagogical activities	• improvement of teaching/learning process • possibility to design personalized learning pathway • useful data for improvement of pedagogical practice
Decision making and personalization of learning	• formative assessment • the role of the teacher in the assessment process

Visual presentation of the data, in the words of the informants, is useful for both the teacher and the students. The informants also mentioned that the obtained data can be easily exported, thus saving time for reports and other activities. In addition, informants stressed that learning analytics tools need to be very thoughtful, have a scientific basis. In their words, data should be collected in a targeted and targeted manner. Useful and relevant data for pedagogical practice should also be collected so that the teacher "only has to interpret them correctly and make a decision".

All in all, it can be concluded that the learning analytics initiatives were supported and encouraged in the school communities by teacher leaders, for instance, those teachers who were interested and motivated to implement certain innovations in their pedagogical work. According to the informants from Norway, such teachers, through their example and good practice, encouraged colleagues to take an interest in innovation and apply it in their pedagogical work.

Table 2. Lithuanian teachers' views on learning analytics, its benefits and relevance to education and the teaching/learning process

Category	Subcategories
Access to data	• access to useful and important data in one place • allows to collect data on students' and classroom learning • allows to visualize data, make decisions using artificial intelligence
Differentiation and inclusion	• artificial intelligence provides possibility to differentiate education according to different needs of children • makes it easier to differentiate and individualize tasks according to the student's achievements • helps improving improve the processes of assessment
Teachers are researchers	• teachers analyze the teaching/learning process with the help of data • predict which learners are at risk of failing
Analytical assistance	• working with parents and reports • reports to the school administration
The need for training	• need for relevant and continuous trainings • help of a supervisor, mentor, assistant
Teachers-leaders	• more individual teacher initiatives
Teacher skepticism	• lack of motivation • burnt out due to pandemic restrictions and limitations • low energy
School resources and infrastructure	• insufficient technological resources • lack of computers / computerized
Technology management	• fear of technology • opponents of blended learning

Talking about the Lithuanian teachers replays, the analysis of the answers the same question, some different categories were extracted and the subcategories detailing them (see Table 2).

According to the Lithuanian teachers, who were research participants, the most important advantage of learning analytics in relation to the teaching/learning process is the possibility to individualize it and differentiate it according to the needs of the students. Learning analytics tools and reports make it possible to monitor the progress of each student and their groups (classes), individualizing the learning according to the identified progress and differentiating the learning according to the needs of the children. In addition, according to the informants, learning analytics tools based on artificial intelligence help teachers to see the difficulties of teaching and provide students with the necessary support in the learning process. In addition to the above benefits, the informants emphasized the benefits

of learning analytics for students and their parents. Learning analytics, according to informants, enables greater involvement of parents in their children's learning process, with the help of learning analytics reports that the teacher has the opportunity to share with parents. According to teachers, participated in the research, learning analytics is also important for the learners themselves – it allows students to monitor their progress and thus contributes to increasing learning motivation. Study participants mentioned that teachers must first and foremost be 'technology-friendly' – they must be willing to apply technology in the teaching/learning process and manage it effectively. Informants acknowledged that there are doubts among teachers about the benefits of integrating technology into education. Participants in the study also stressed that to successfully use learning analytics, they need to have the ability to interpret data summaries and statistics. It is important to be able to understand the "outcome" of learning analytics – what are the cross-sections of the data analysis that can help in answering various questions related to the teaching/learning process. In addition, according to the informants, it is important to be able to interpret the data and relate it to the possibilities of improving the teaching/ learning process. Such skills of teachers would encourage evidence-based pedagogical decisions.

Discussion

Researchers highlight the benefits of learning analytics for the teachers' pedagogical work (Mouri et al., 2018; Pardo et al., 2016). Our study participants also emphasized that it is an opportunity to apply various pedagogical scenarios and methods, to see the shortcomings of the teaching process, and to help the teacher assess students' achievements and personal progress, quickly identify, and respond to teaching gaps and provide timely feedback. According to the current study artificial intelligence that is integrated into learning platforms makes it easier to differentiate and individualize tasks according to the student's achievements, to improve the processes of assessment of learners' knowledge, improving the organization of curricula and their content, to notice possible erroneous thoughts (e. g. guess the correct answers); or reflect on different ways and to encourage students to learn ahead; allows to collect data on students' and classroom learning, visualize them, make decisions using artificial intelligence, thus significantly saving time and planning learning goals. A very important aspect of using mentioned programs is an opportunity to use personalized learning pathway and that assessment materials are selected for the learner through artificial intelligence and learning analytics; interventions where the teacher is provided with information and the teacher can provide

targeted assistance to the learner; improving the schedules of learning activities according to learners' learning styles.

Other research stresses that with the help of programs with artificial intelligence and learning analytics, it is possible to predict which learners are at risk of failing to complete a course also to have the visualization of information by providing an overview of learning data (using various diagrams, graphs, and tables) in the learning dashboard (Ifenthaler et al., 2020). For example, there are various tools that can notify a teacher if many students have chosen incorrect answers to a particular question. As a result, the teacher has the opportunity to point out a less learned topic.

Our study also proved that artificial intelligence and learning analytics help teachers to involve students in the educational process, making it more interactive.

However, research highlights the need to help teachers master data-driven technologies and develop their competencies to use data effectively for pedagogical decisions (Gummer, Mandinach, 2015). Our study found that study participants lacked competence to interpret data correctly. The study has shown that it was difficult for teachers to plan appropriate pedagogical interventions based on the data. The conducted study highlighted the need to develop teachers' competencies in the use of learning analytics. We emphasized the importance of the role of mentor or a supervisor in helping teachers to work successfully with data and to make evidence-based decisions based on learning analytics.

In addition, researchers single out the following factors that may have a negative impact on the integration of learning analytics technologies in schools: the inability of teacher education and training programs to impart the necessary technical knowledge and skills; lack of funding and resources; lack of a strategy for data collection and analysis; limited motivational incentives (Zhu et al., 2018). Our study emphasizes that the COVID-19 pandemic period has highlighted other problems for teachers, such as fear of technology management, skepticism, apathy and lack of motivation etc., which may also have a negative impact on the integration of learning analytics technologies in schools.

Conclusions

Learning analytics and artificial intelligence programs (or platforms) have a great number of benefits for teachers, as a result, such programs might solve many educational problems, improve teaching/learning process, save time and energy. Pandemic years where one of the hardest for education process, however learning analytics and artificial intelligence programs helped to go trough it and ensured it's use in the future.

Countries, which are just starting to use learning analytics and artificial intelligence programs still lacking some digital skills, also analytical competences in order to interpretated and to use programs fully. However, the example of the experienced countries show that such challenges are beatable.

Author Note

The article was prepared within the framework of the project "Artificial Intelligence in Schools: Scenarios for the Development of Learning Analytics in Modernizing General Education in Lithuania" (DIMA_LT). Implementing institution: Klaipeda University. Project partner: School Improvement Center. The project was funded by the European Union (project No. S-DNR-20-4) under a grant agreement with the Lithuanian Science Council (LMTLT).

References

Archibald, M. M., Ambagtsheer, R. C., Casey, M. G., & Lawless, M. (2019). Using Zoom videoconferencing for qualitative data collection: perceptions and experiences of researchers and participants. *International Journal of Qualitative Methods, 18*, 1–8. https://doi.org/10.1177%2F1609406919874596

Cole, F. L. (1988) Content Analysis: Process and Application. *Clinical Nurse Specialist, 2*, 53–57. https://doi.org/10.1097/00002800-198800210-00025

Creswell, J. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches* (3rd ed.). Thousand Oaks, CA: Sage.

Gummer, E., Mandinach, E. (2015). Building a conceptual framework for data literacy. *Teachers College Record, 117*(4), 1–22.

Har Carmel, Y. (2016). Regulating "Big Data education" in Europe: lessons learned from the US. *Internet Policy Review, 5*(1). DOI: 10.14763/2016.1.402

Hollman, A. K., Hollman, T. J., Shimerdla, F., Bice, M. R., Adkins, M. (2019). Information technology pathways in education: Interventions with middle school students. *Computers & Education*, 135, 49–60.

Holstein, K., Wortman, J., Hal Daumé, V., Dudik,M., Wallach, H. (2019). Improving Fairness in Machine Learning Systems: What Do Industry Practitioners Need? P*roceedings of the 2019 CHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery, New York, NY, USA, Paper 600, 1–16. DOI:https://doi.org/10.1145/3290605.3300830

Howley, P., Wang, K., Bilgin, A.A. (2021). Big Data for Early Learners. In Prodromou, T. (Eds.), Big Data in Education: Pedagogy and Research. *Policy Implications of Research in Education, 13*. Springer, Cham. https://doi.org/10.1007/978-3-030-76841-6_2

Ifenthaler, D., Gibson, D., Prasse, D., Shimada, A., Yamada, M. (2020) Putting learning back into learning analytics: actions for policy makers, researchers, and practitioners. *Education Tech Research Dev*. https://doi.org/10.1007/s11423-020-09909-8

Kalim, U (2021). The Growing Role of Big Data in Education and its Implications for Educational Leadership. *International Journal of Research and Innovation in Social Science* (IJRISS)Vol.V(I)

Kallio, H., Pietilä, A., Johnson, M., & Kangasniemi, M. (2016). Systematic methodological review: Developing a framework for a qualitative semi-structured interview guide. *Journal of Advanced Nursing, 72*(12), 2954–2965. https://doi.org/10.1111/jan.13031.

Khine, M. (2018). Learning Analytics for Student Success: Future of Education in Digital Era, *The European Conference on Education*.

Krikun, I. ir Kurilovas, E. (2016). Pagrindinės tendencijos taikant edukacinių duomenų gavybą mokymuisi personalizuoti. *Lietuvos matematikos rinkinys* [Key trends in educational data mining to personalize learning. *Lithuanian mathematics collection*], *57*(B), p. 25–30. doi: 10.15388/LMR.B.2016.05.

Kurvinen, E., Kaila, E. Laakso, M.-J. Salakoski, T. (2020). Long Term Effects on Technology Enhanced Learning: The Use of Weekly Digital Lessons in Mathematics. *Informatics in Education, 19*. 51–75. Vilnius, Vilniaus universitetas. https://www.researchgate.net/publication/339894641_Long_Term_Effects_on_Technology_Enhanced_Learning_The_Use_of_Weekly_Digital_Lessons_in_Mathematics; https://infedu.vu.lt/journal/INFEDU/article/25/info 10.15388/infedu.2020.04.

Magaldi, D., & Berler, M. (2020). Semi-structured interviews. *Encyclopedia of personality and individual differences*, 4825–4830. https://link.springer.com/content/pdf/10.1007/978-3-319-24612-3_857.pdf

Mandinach, E., Gummer, E. (2016). *Data literacy for educators: Making it count in teacher preparation and practice*. New York, NY: Teacher College Press

McHugh, D. (2015). Traffic prediction and analysis using a big data and visualisation approach. Retrieved from http://leeds.gisruk.org/abstracts/GISRUK2015_submission_20.pdf.

Mouri, K., Yin, C., Uosaki, N. (2018). Learning analytics for improving learning materials using digital textbook logs. *Information Engineering Express International Institute of Applied Informatics, 4*(1), 23–32.

Pardo, A., Dawson, S., Gašević, D., Steigler-Peters, S. (2016). The role of learning analytics in future education models. https://www.telstra.com.au/content/dam/tcom/business-enterprise/industries/pdf/tele0126_whitepaper_5_spreads_lr_notrims.pdf

Rienties, B., Herodotou, C., Olney, T., Schencks, M., Boroowa, A. (2018). Making sense of learning analytics dashboards: A technology acceptance perspective of 95 teachers. *International Review of Research in Open and Distributed Learning, 19*(5), 1. https://doi.org/10.19173/irrodl.v19i5.3493.

Rupšienė, L. (2007). *Kokybinio tyrimo duomenų rinkimo metodologija: metodinė knyga [Data collection methodology for qualitative research: a methodical book]*. Klaipėda: Klaipėdos universiteto leidykla.

Vincent-Lancrin, S. (2021). OECD Digital Education Outlook: Pushing the frontiers with AI, blockchain, and robots, OECD.

Wang, Y., Decker, J. R. (2014). Can virtual schools thrive in the real world? *TechTrends*, *58*(6), 57–62.

Weller, S. (2017). Using internet video calls in qualitative (longitudinal) interviews: Some implications for rapport. *International Journal of Social Research Methodology, 20*, 613–625. https://doi.org/10.1080/13645579.2016.1269505

Zhu, M., Urhahne, D., Rubie-Davies, C. M. (2018). The longitudinal effects of teacher judgement and different teacher treatment on students' academic outcomes. *Educational Psychology*, 38(5), 648–668. https://doi.org/10.1080/01443410.2017.1412399

Žydžiūnaitė, V., Merkys, G., Jonušaitė, S. (2005). Socialinio pedagogo profesinės adaptacijos kokybinė diagnostika [Qualitative diagnosis of social pedagogue's professional adaptation]. *Pedagogika, 76*, p. 23–32.