

Insights on the Finnish Field of Learning Analytics – Applications and Ethics in Adaptive Education Models

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Abstract

Learning Analytics provide better means of interaction and guidance between educators and students. Through data, we can elaborate on our understanding of the way a student learns and progresses in the education environment or learning management system. Adaptive and blended learning as modern education models can further emphasize the role of learning analytics: since the teacher is no longer present physically in all (or any) learning scenarios or is partially available, the significance of data collection, analysis and reaction models have become crucial. Moreover, we can also administer pre-emptive measures to ensure continued progression by using the data in prediction models. In this presentation, we describe a learning analytics project between several Finnish universities of applied sciences named APOA. The focus is on several empirical experiments conducted in one of the participating universities. We discuss the design and the setup of the cases along with our findings on the effectiveness to student performance and motivation, and teachers and students' perceptions of the experiments. Moreover, the ethical aspect of the experiment is observed along with limitations of the cases. We conclude by providing our lessons learned and by offering some hints and tips for other researchers, who might be conducting similar experiments later.

Keywords: Learning analytics, standardization, adaptive education models, distance learning, online learning, privacy, education ethics

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Introduction

Although the concept is quite new, learning analytics itself is not a novelty. Teachers have evaluated their students and their performance with whatever means they have come up with, such as traditional exams, notes and attendance sheets. The summaries of student's performance have just taken a lot longer to produce. Today the same data (and more) is collected through different educational systems. The ECAR study (2019) concluded that at Satakunta University of Applied Sciences, 69% of the students had used a learning management system (LMS) in all their courses during the past year with 91% using it on most of their courses. (ECAR 2019) Considering that the university is polytechnic in nature, this makes for an interesting premise.

Various countries and their educational institutes through the last decade have begun to take an interest in learning analytics as a possible way to monitor, study and improve the quality of education. The term learning analytics has been defined by Siemens (2013) as the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning the environments in which it occurs. The data collected from systems used in education is used to expand our understanding of our students, faculty, education methods and effectiveness of the education in general. For example, through data we can study the students behavior, habits and progression in studies, faculty's teaching methods and their effectiveness but also on a grander scale general information on graduation averages, learning preferences of students via different education models and university's students overall succession in studies (Clow, D. 2013).

Since digitalization has settled into our societies, the amount of data we have around us should be to some extent utilized for the betterment of our society and learning analytics should be no exception. Now the amount of data available for use in analytics is almost infinite. However, the application of all said data is still unclear since all the ways and applications for data in analytics have yet to be found. In addition, said masses of data contain trash data, which is invaluable for now, and sensitive data, which cannot be used to the fullest because of regulations, laws and ethics.

Previous Research on Learning Analytics

The concept of Learning Analytics (LA) has been confirmed to have a visible impact on the learner engagement and academic outcomes as proven by several studies including Corrin et al. (2016), Schmitz et al. (2017) and Donggil S. (2018) to name a few. The defined subject of Learning Analytics and ethics has also been studied by a few research groups such as Slade & Prinsloo (2013), Siemens G. (2013) and Pardo & Siemens (2014). The fore-mentioned studies have already concluded that learning analytics can be considered a legitimate field of research that has an increasingly vital connection to privacy, data ownership and ethics (Siemens G., 2013), and that with large data handling becoming a standard practice higher education institutions should consider forming ethical frameworks for offering appropriate ways, strategies and methods in the application of learning analytics (Slade & Prinsloo, 2014). So, at the time of this study the integration of learning analytics is seen as an essential part of the frame which around future education systems are built upon. In previous studies learning analytics has also been noted to follow the levels of complexity from

descriptive to diagnostic, predictive and finally prescriptive of which we will mostly focus on the first descriptive level of analytics in this study. (Banerjee et al. 2013)

Learning Analytics in Finland

The Finnish higher education is split with the dual model, universities of applied sciences having a focus on pragmatic education responding to working life requirements. (Ministry of Education and Culture Finland, 2019) The degree programmes in Finland generally are diverse and some of them are heavily legislated by educational laws and requirements. Also, with an open university model, the studies are usually offered to anyone regardless of their educational background. The open university gateway to a higher education degree means that the studies are also offered with an adaptive teaching model where the students can for example maintain their full-time employment while studying. This creates a fundamental need for an adaptive education model, since the background of everyone requires a different approach. In turn, this also necessitates the use of learning analytics.

The research and study of the field is done by several entities; most of the universities conclude their own studies. A national division is directed by the Ministry of Education and Culture with the aim of operating as a collaboration group between several education institutes in the field. Formed in 2016 by the University of Turku, the Center for Learning Analytics is dedicated to the research and development of the field in all levels of education with the vision of improvement of the Finnish educational system. The Center also acts as a mentor to the APOA project. Between universities we have APOA, AnalytiikkaÄly and eAMK projects. (eAMK 2019) Previously a project named Adaptable Learning Paths (fin. Poluttamo) was focused on developing practical means and models to help secondary school students control their educational progress specifically under transition phases between levels of education. (Poluttamo 2018) The APOA project (*Avain Parempaan Oppimiseen Ammattikorkeakouluissa*, eng. Learning Analytics in the Universities of Applied Sciences) is one of the two ongoing studies focusing on the standardization of learning analytics in higher education institutes along with its counterpart AnalytiikkaÄly (*IntelligentAI*). Universities are represented by the AnalytiikkaÄly project and universities of applied sciences by the APOA project. (APOA, 2019) Both of the projects have the same goal; standardization of learning analytics in higher education. In practice this consists of piloting and engaging users of learning analytics through a pedagogical perspective, creating new ways to support higher education studies with learning analytics applications and practices, combining existing national and university-level databases, systems and tools with the application of learning analytics in mind and supporting the continued development of individual educational paths. (APOA, 2019) (AnalytiikkaÄly, 2019) Individual education paths are also considered an essential part of the adaptive education models in the project and as such the study subject is relevant.

Ethics and Privacy in Learning Analytics

The premise in which data is used for analysis does not bode without some concern raised about data protection and personal information privacy policies. The ethical part consists of the way data is collected, handled and stored, and who has access to data in all stages. Institutes collecting data in any way should make it clear for which

purpose they are collecting it, be it for reporting, business analyses or learning analytics. The European GDPR data protection legislation has made things for learning analytics in Europe much more complicated. (European Commission, 2019) Universities in Europe must consider how to create applicable recommendations and policies for the effective and ethical use of learning analytics in the universities. GDPR made it that data protection in the EU area now has stronger rules on handling of personal data. The regulation made it so that companies in the EU cannot collect data without permissions, must be able to present all available data on individuals on their request to them (as the owners of their own data) and should limit their data collection to essentials only. Therefore, companies and business, including educational institutes, have all had to create a new data policy to accommodate the new regulations. To learning analytics this means that no data can be gathered without consent and we must limit our collection of data to as few sets as possibly to avoid profiling of individual students.

Adaptive Education Models with Learning Analytics

Some could argue that modern adaptive education models paired with learning analytics is the perfect culmination of teaching, where learning methods can adapt to everyone's needs making the learning experience more efficient. In addition, adaptive education models can accommodate to the usage of multiple models or types of teaching in the same course. The students can in a way choose their paths to course completion depending on their preferences and learning habits. In Finland it is quite common in higher education for the student to be presented options for completion at the beginning of the course which can be as follows;

1. Traditional lecture type course where the student attends classes and takes an exam
2. Blended course where the student attends some lectures and does part (or all) of the course assignments in LMS system
3. Distance course where the student *can* partake in lectures but can also participate in them via an online conferencing system and do assignments via LMS system
4. Online course where the student can participate in online lectures or recorded lectures and do the assignments remotely via LMS
5. Completion through recognition of prior learning practices where the student has already substantial knowledge and experience on the subject and wishes to prove said expertise by taking an exam

In the scenarios 3-5 the student can essentially complete the course without being physically present. The scenario 5 also contains on-the-job learning. In the scenarios 3 and 4 the student will be accumulating the greatest amount of data since most of the activities regarding course progression will be done through some system and as such accumulates logs. While in the scenarios 1 and 2 some data will be generated these will not offer substantial certainty about the student's performance nor behavior. As such it should be discernible that learning analytics is best paired with course types 3, 4 and 2 in some extent for the greatest effectiveness. As such in courses that follow the adaptive education model where students can progress in different paths towards course completion the amount of data on each student varies greatly and the potential benefit of learning analytics accordingly.

It should be noted that that while the most amount of data will be gathered through the fore-mentioned scenarios it does not inherently mean that enough data is gathered since the student can display minimal presence in the systems used to gather data for learning analytics. This is highly dependent on the amount of accessible materials, assignments and other points of interest in the course that could potentially log data. Course design also plays a key role in generating relevant data that can be used for learning analytics. Course can be implemented with analytics tools without considering course design, but in doing so a lot of unnecessary and irrelevant data can be gathered.

Methods

Prior to the use of so-called lower level analytics tools in our educational systems, surveys were conducted about the expectations of the faculty (teachers) regarding analytics and their application in fore-mentioned adaptive education courses. One key factor that was measured was the increase in the instances of lower level analytics tools in our LMS prior, during and after we had given training to the faculty about the applications. After the conclusion of the courses, the surveys were replicated with the teachers to measure their change in opinion, understanding and application. In addition, the participating students were surveyed after the conclusion of the courses about their opinion about the experiment regarding the visibility and aid of the learning analytics and whether they thought the impact of such tools is crucial for more personal and in-depth learning experience. As the focus of the study was not only on the application of learning analytics in different education models and situations, but also in the ethics of data gathering and personal privacy, the data gathered from the study could be effectively processed to provide results for the subject as well. We also surveyed the opinions of the students about the ethical side of the study which consisted of their perceived possibilities and threats about learning analytics.

Participants

The participants for this study were four teachers each from different degree programs and fields of expertise with very differing teaching methods. One of the previous used adaptive teaching models consisting of contact lessons, distance lessons and independent study as a part of the course. Two teachers opted to use distance learning only since the courses in question has only been done via the said method during previous terms and one also held the course via traditional contact lessons only. Three of the courses were for students studying for their bachelor's degree, one for master's degree. The third bachelor course begins later in January 2020 so we can only use the expectations of the completed at this point. Out of the 138 in the remaining three courses 46% (62) answered our survey:-

Table 1: Pilot courses

Course #	Course A	Course B	Course C	Course D
Level	Bachelor	Bachelor	Master	Bachelor
Course type	Blended	Online/Distance	Distance	Online
Student #	77	35	26	TBA 2020/01

Measures

Surveys formed a part of the results in the study but also measured will be the actual data around the courses grade averages and activity. These could be reflected to some extent on the consecutive runs of the same courses by the same teachers during terms prior. Additional information for the results were provided by an additional study about the opinions of new students on learning analytics as well as the ethics of data privacy. The results were then mirrored on the assumptions, expectations and actual data surrounding the topic of the study. This included the teacher interviews prior to introducing learning analytics, student's assumptions on learning analytics without prior knowledge and the data provided by the LMS, examination and student management systems.

For the ethics portion of the study the goal was made simple; produce recommendations for the ethical framework for the use of learning analytics in higher education, to be further used in the ongoing project. As the project consists of numerous Finnish universities of applied sciences also participating in the creation of the recommendation, the recommendation on our part as of now would consider how learning analytics should be used in higher education and what we should generally take into account regarding privacy, training and application in learning analytics. This meant also taking into consideration the GDPR legislation of the European Union.

Procedures

At the first part of APOA project was found out teachers' expectations about learning analytics; what were the most important things they should know about students and their studying? In a previous survey made by the project regarding the subject it was established that students and teachers views on what analytics should do for them aligned quite well. (Teräs, H. & Teräs, M. 2019) The views were highly focused on the pedagogical quality and its improvement. These seven most important themes were found:

- 1) Student group data about their previous studies and background already before course starts. This information is needed for course design.
- 2) Learning and analytics design: how to plan the course so, that analytics data would be useful.
- 3) How to plan learning path and make it visual to students and teachers
- 4) Supporting communication between students, student group and teacher.
- 5) Feedback systems (automatic feedback to student who (f. ex.) has not yet started the course, feedback to support student's reflection during the course and for teacher to find students who need help)
- 6) Visualization of students learning – the way to see what students have learned
- 7) Usage of materials (were they useful, when were they read and how long students read them).

Our projects previous student workshop showed students had ten themes as opposed to the teachers seven. Identical themes from the student workshops were learning paths, feedback, materials, and visualization of learning. (Teräs, H. & Teräs, M. 2019) It is these themes that we intend to measure from the teachers in the pilot courses

through the surveys, proposed hypotheses and application of lower level descriptive learning analytics tools.

Prior to the courses

We surveyed the teachers involved in the project about the assumptions and expectations regarding learning analytics. What they think it is? How does it work? How can they improve their courses? All based on their idea of what learning analytics is and how to implement it. We used the previously mentioned seven themes as a starting point for the surveys.

One relevant point the teachers brought up in the surveys was the desire to develop learning. By developing learning through the use of learning analytics the teachers expressed their desire to help students develop their own ways of assessing themselves in their study through the use of learning analytics and that the teachers role would become something more of a supporting figure in the endeavor. This would support the themes of learning and course design, but also contain the entirety of expectations surveyed previously in the project. The pilot teachers clearly expressed the need for learning analytics as a means for teachers and students to better their performance. On the other hand, they also expressed their worry regarding the amount of contribution it would need to create a so-called perfect environment for the use of learning analytics. Considering that the course would need to be fully structured around the most efficient use of the learning analytics tools it would require a considerable amount of time designing. Time required for designing is also considerably extended when the teacher in question has a multitude of different courses to hold, each of which would essentially require a new course design based on the effective use of the analytics tools which in turn would of course vary by the course requirements, details, assignment types etc. The courses created and used in the project would be based only on the extent of knowledge regarding course and learning design and learning analytics of each teacher.

Several hypotheses were proposed to the teachers as means measure their assumptions and expectations. The hypotheses were based on learning analytics and ethics. The last four were proposed by the teachers themselves. These would be reflected upon after the pilot courses had been completed. The hypotheses were as follows:

- 1. Visually seeing the course progression will motivate the student towards course completion.*
- 2. The student is solely responsible for his progression towards course completion.*
- 3. Personal feedback is essential for good performance in a course.*
- 4. Students performance in general is better in courses applying learning analytics.*
- 5. Learning analytics benefit students especially during self-study periods.*
- 6. Learning analytics initial time investment does not surmount the benefits of use.*
- 7. The student does not know how to benefit from learning analytics.*
- 8. Learning analytics encourages students to evaluate their own performance realistically.*

Students were not surveyed in the similar manner prior to the courses but for the ethics proportion of the study we did include a survey after the courses regarding the student's extent of knowledge on the topic of learning analytics, data protection and ethics.

After the courses

After the courses were completed the teachers were interviewed in a similar manner about learning analytics and what had changed between the duration of the courses using lower level analytics tools. Students were surveyed in this part of the study to see mostly did the teacher follow through the course using the tools and how they manifested in the student's point of view.

Going back to the teachers seven themes, assumptions and expectations of teachers stated previously prior to the courses as the benchmark for this analysis, we can at this point already see the pedagogical benefit the teachers attained. Six of the seven themes were seen actualized after the courses; the only one absent was the first theme of student awareness from teacher's point of view as the teachers did not have access to prior data about the students before the courses. Learning design and study process were fulfilled early on during the creation of the courses, feedbacks were used throughout the courses as a way to support the student's progression, course completion analytics tool gave the students a way to evaluate and monitor their own progress, interaction was guided by the analytics tools and material usage was visualized for teachers via activity heat-mapping.

Out of the eight proposed hypotheses three (1,3 and 5) were considered fulfilled by the teachers after the courses;

- *Visually seeing the course progression will motivate the student towards course completion.*
- *Personal feedback is essential for good performance in a course.*
- *Learning analytics benefit students especially during self-study weeks.*

Furthermore, during the interviews with the teachers after the courses it was agreed that learning analytics give substantial benefit when handling larger groups which have students in need of tutoring and guidance. With the learning analytics tools the students requiring assistance were more easily identified and could also be to some extent, guided in quantities rather than one at a time reducing the total amount of time teacher spends guiding students in one course. All teachers also expressed their interest on using the analytics tools in the future and further developing their courses to support them.

The student's opinions on the use of learning analytics are almost unanimous. The students who partook in the courses with lower level analytics tools agreed that the learning path towards course completion was constantly visible which was generally favorable.

New students survey

Prior to this study we did a workshop regarding the ethicalities of learning analytics and this was reflected on the general survey we did. While the pilot course students were surveyed on the effect of learning analytics, data protection and ethics in general the survey made for the new students that began their studies this Fall semester was heavily focused on the ethics of learning and data analytics. The amount of answers we got this survey was 398.

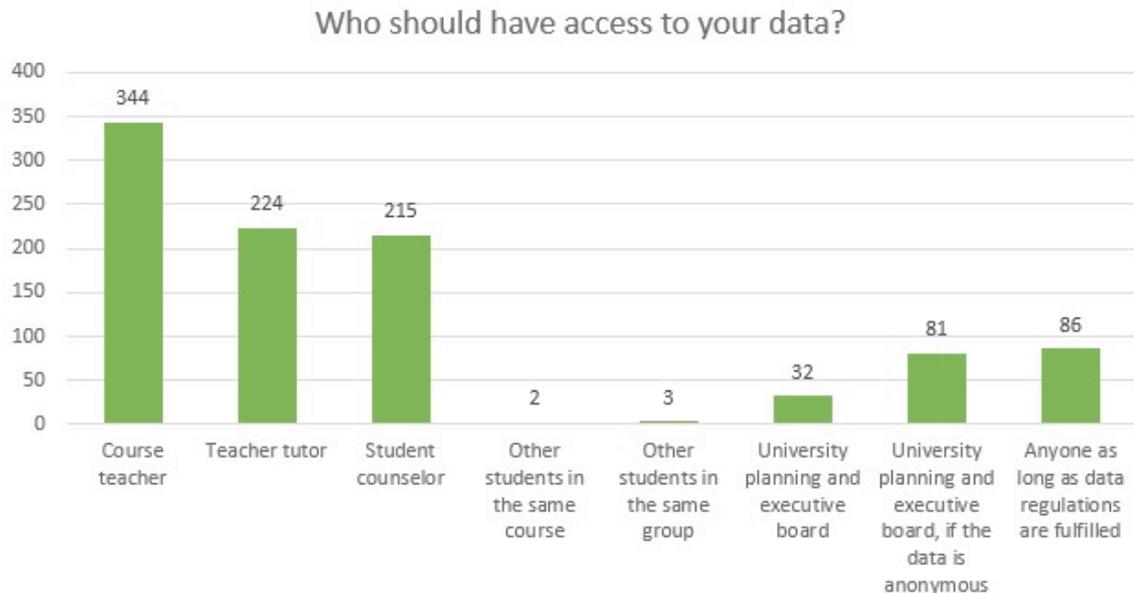


Figure 1: Who should have access to your data?

Ethical considerations from the students were very broad in nature. We could clearly see a divide in the knowledge between students who are studying in a technologically inclined degree program compared to other sciences. Still the students of today seems to be quite aware of data abuse, the need for data protection and regulation as well as consider the ethicality of analytics and the extent of it. Everyone mostly agreed to the idea of giving their educational data for learning analytics seeing the benefit in it. 83% (330) of the new students knew that the digital study environments (LMS, examination system, conferencing software) collect data as activity logs but only 23% (93) knew about learning analytics as means to harness said data.

The ethics discussion in the survey also covered the threats and possibilities offered by use of analytics in general. As learning analytics is a sub-field of data analytics one can say it has the potential for something great in the form of predictive and prescriptive application but also quite the opposite possibilities such as data theft, abuse and misuse. The new students were asked about the following regarding data and learning analytics:

“My consent on the use of my data is highly dependent on the application.”
Agreed by **91%**, 9% did not know.

“I believe I can be profiled through data combination from several data sources.”

Agreed by **52%**, 34% did not know and 14% disagreed.

“I need to know what data others have about me (data-symmetry).”
Agreed by **85%**, 13% did not know and 2% disagreed.

“The amount of data on one individual affects the performance of analytics.”
Agreed by **72%**, 29% did not know and 1% disagreed.

Threats students saw learning analytics can pose were the fore-mentioned data theft, abuse and misuse, but also data leaks, breach of personal privacy and excessive guidance were present. The need for additional computing capacity and servers which could potentially fail and result in loss of data were mentioned. Possibilities included better and more personal guidance, student motivation through visible progression and more efficient studies through digitalization. Out of the 131 (33% of 398) students that replied to this topic 50 (38% of 131) did not see neither threats or possibilities, threats only 30 (22%), possibilities only 28 (21%) and both threats and possibilities 26 (19%). As such more threats than possibilities were presented by this sample. To end on a positive note, out of the 398 students in the survey 348 (87%) wished for the teacher to follow their course progression.

Conclusions

In conclusion we achieved results for all our outlined goals in the study; the goal which was to outline from an ethical point of view how we should handle learning analytics in an educational environment that consists of multiple and adaptive education and teaching models. The results of the study should benefit all projects, research and study into the field of learning analytics. Considering the ongoing nature of our project we must also highlight some questions we intend to answer in the future while continuing the project.

Learning analytics is something teachers and students alike expect to benefit from. Teachers focus on the subject is more towards the development of learning and course design while the students are more on personal betterment. Learning analytics may be implemented on any institute easily given the abundance of available tools and software, but another matter altogether is the amount invested in learning the most efficient way to apply said analytics tools. The learning path had to be reformed to supplement the analytics tools. Teachers in this study had previously been accustomed to using modern LMS, examination and conferencing software to deliver the courses but regardless training was required. Since the beginning of the project we have offered various lower level analytics tools and training for teachers and have since seen a steady growth in both interest and application of said learning analytics tools.

Teachers in this study were all positively taken by the lower level learning analytics tools and will be further developing their own ways of using learning analytics as a part of their courses. The students generally were favorable towards the use of learning analytics with minor observations; the data should only be processed on a need basis and they should be informed about the use of learning analytics and its nature, extent, prior.

Recommendations for anyone partaking in the application of learning analytics would be as follows; generally learning analytics pave the way for more effective courses but at the expense of requiring a new course and learning design for it to make any sense. The amount of time educators must invest initially into learning analytics tools in different systems will eventually pay off and will benefit teachers and students alike. Teachers in this study were fortunate enough to have gotten project hours to spend on their course design and training which lowered the bar for the initial stages of the application.

For the future the study has proposed these questions about learning analytics that we will be addressing; Should learning analytics be made a permanent part of the learning design given how data-oriented our society is or should we still be able to choose to study without overly exact analytics tools? And at which point can we progress from just using lower level descriptive analytics tools to diagnostic, predictive and further to prescriptive models? When do we have a definite amount of data from a student's learning path?

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