Students' Perceptions about Data Safety and Ethics in Learning Analytics

Long paper

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Abstract. Analytics and its various subfields such as data analytics and learning analytics enjoy varying popularity as measured by public attention. Commonly, applications of learning analytics in the European area have been talked about lately partly because of the still fresh European General Data Protection Regulation (GDPR). Higher education institutions in Finland have all become active in standardizing learning analytics in recent years, with multiple nation-wide multi-institutional projects conducted around the topic. In this article, we present a study where we surveyed the students about the ethical issues of data collection and usage in learning analytics. The survey was conducted in two universities in Finland: University of Helsinki and Satakunta University of Applied Sciences. In addition to finding out students' general perceptions of the topic, we wanted to find out if there are differences in the attitudes and opinions between different types of higher education institutes. Based on the results, students seem to be quite positive about the possibilities of learning analytics but are also concerned about the safety and usage of their personal data. The university students seem to be even more cautious, but also less informed about the data handling procedures.

Keywords: Learning analytics, ethics, data ethics, education

1 Introduction

The need for constant improvement is not a strange thing in today's economy. We look for new and innovative ways to improve what we do in our everyday life and education is no different. Analytics is part of this improvement process where we are slowly progressing towards the efficient use of big data and as of the last decade or so, we have slowly been seeing subfields of analytics merge that factor in this trend. Learning analytics is the equivalent of using analytics to improve education and the learning process. As stated by numerous sources and studies, learning analytics is the

measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning in the environments in which it occurs. (Siemens, 2013)

Many countries have been involved in the study of learning analytics as of late and so has the Finnish higher education community as well. The usual scope of such studies has been the shaping of and application of learning analytics. (eAMK, 2019) To this extent, the national education ministry has approved and now funds two back-to-back learning analytics standardization projects with the goal of creating a tomorrow's framework for the application of learning analytics in higher education. (APOA, 2020) (AnalytiikkaÄly, 2020) These two national projects are divided by the Finnish higher education institute dual model into one with universities and the other with universities of applied sciences. As a part of these national projects, we have also become active in research of learning analytics. In this paper, we report the conduction of a study that focuses more specifically on the differences of expectations, attitudes and ethics in learning analytics of students in the higher education. The two universities were selected to illustrate the diverse nature of higher education institutes in Finland, one being an example of more theoretical hard sciences universities and the other of the more practical universities of applied sciences. As a distinction, universities of applied sciences offer professionally oriented higher education and have strong ties with working life and regional development while universities focus on scientific research and the education they provide is based on it. Doctoral programmes are offered by universities. (Ministry of Education and Culture Finland, 2020)

The focus of the study is to find out students' attitudes and opinions about learning analytics and the ethical dilemmas often associated with it. We also wanted to find out if there are any defining deviations between students' attitudes and opinions in these two differing higher education models. It should be noted that the study was concluded during the beginning of spring 2020 and was not affected by the 2020 COVID19-pandemic since the survey for the study was done prior to the virus reaching pandemic status. (Finnish Institute for Health and Welfare, 2020)

This paper is structured as follows. First, we present related studies with focus on articles related to learning analytics and ethics. Next, we discuss the topic of ethics in learning analytics in more detail. After this, we present the setup of our study, including participants**,** the design and the conduction of the survey. Next, the results are presented and discussed. Finally, we present our conclusion and some ideas for future research.

2   Related Work

As previously stated there has been a substantial amount of studies in the subfield of learning analytics in the last decade or so some of which will be used as original study sources for our study. Learning analytics applications studies compared to many dominant new fields like big data and AI have thus far been limited to a few but fruitful studies and ever since the beginning of 2010's several research communities have been formed around the role of data analytics in education. (Siemens, 2013) The field of learning analytics (LA) has developed ever since and since the first Learning Analytics

and Knowledge (LAK) conference in 2012 there has been ever increasing amounts of studies in the field. (LAK'11, 2011) Since then several studies have applied different methods to research learning analytics and its applications. Most of the studies thus far have been focusing on data mining techniques and statistics, these being the most prominent methods of analysis.

What do we actually mean when we talk about learning analytics? Early definitions (see e.g. Siemens & Fog 2011) often associated learning analytics with big data, but as we have recently seen, learning analytics setups can vary from a handful of students to whole countries. Ferguson (2012) was probably one of the first authors to combine learning analytics with educational technology, and this has been indeed quite typical way to use analytics (although learning analytics can perfectly well be used in settings where no technology enhanced learning is involved). The definition of Gašević et al. (2015), which states LA as "The analysis of data collected from the interaction of users with educational and information technology" is quite close to a general description. However, the "official" definition announced in the first International Conference on Learning Analytics (see eg. Siemens & Baker 2012) is probably the most conclusive so far: "Learning analytics is 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."

More recently Teasley (2019) stated that learning analytics has ever since become increasingly broad as a subfield of analytics including now but not limited to the aforementioned methods like data mining and statistics, but also semantics, learning theories and more precisely focused studies. Since this would suggest that learning analytics is getting more precision-based as more varying methods are used to do more narrowed and focused studies, the methods to improve the learning experience for individual students further would tempt to do more in-depth research about the primary benefactors of said analytics. (Teasley, 2019) (Khalil & Ebner, 2016) However there are only a few researches about students' beliefs and expectations towards learning analytics services. (Whitelock-Wainwright et al 2019, 633) In Finland and in Europe the study and application of learning and any form of analytics has also been dealt a significant blow due to the inception of the European general data protection regulation that dictates the application of data that can be identified as personal or profitable data. The regulation affects every industry with education also being affected as most of the analytics data in educational institutes is closely tied to students in said institutes. (European Commission, 2019) This is something that should always be kept in mind when doing studies like this, which heavily rely on the data of students, how it is handled and processed during the study.

3   About Learning Analytics and Ethics

The application of all and any analytics does come with its own questions about data ethics. Generally, ethics in technology question the problems that technological advancements, digital tools and methods produce. This can range from privacy to

autonomy to discrimination by data. (Johnson, 2017) The overall idea of data is to make the world more transparent and efficient towards individuals of which data is collected from but at the same time, these individuals know little about the data collected from them, referred to as the transparency paradox. (Richards & King, 2013) So ethics in the context of learning analytics questions for example whether it is ethically permissible to pursue learning analytics, and whether the benefits outweigh the costs. (Rubel et al. 2016) As such, it was considered a worthwhile effort to analyze the ethicality of learning analytics through the different students' viewpoints as students represent the individuals of whom the data mostly is gathered from in this context. At present time, most of the population in European Union should have been activated into thinking about data regulation and protection due to the GDPR through studies, work or other sources over the last two years. The abundance of data and information everywhere affects everyone on a daily basis and is closely tied to their personal life. (Marr, 2019) We would dare say that whether or not the general population regard data ethics important is not about the lack of interest but lack of awareness at this point in 21st century.

To draw a line from data ethics to LA, we have to consider the owners and producers of data in question. In a learning environment, this would mean institutes and students. These educational institutes can gather data about their students to facilitate the education requirements dictated by law which can be used for LA but also collect data for other varying purposes if they have been given permission to do so which also could benefit LA among other things. (Data protection law 1050/2018, 2 chapter 6 §) To satisfy the framework requirements for education qualifications and be able to offer studies institutes need to possess certain information about its students. This contains but is not limited to personal information (previous education record, social security details etc.) and depending on the extent of digitalization, the amount of student data on each individual student can rightfully cause concern among students.

Now to elaborate on the reasoning for the study, the ethics point of view; it is a common conception that the dual model presents a divide in the train of thought in the general population which stems all the way from second degree education level, called the upper secondary level, where the dual model is first proposed. (Ministry of Education and Culture Finland, 2020) You typically choose between getting a profession fast through vocational school or entering high school (also known as general upper secondary education, fin. lukio) to get more literate before moving onwards to third educational level (which is the university level in Finland, National Qualification Framework (NQF) 6 and up). (Finnish National Agency for Education, 2020) This creates the basis for the dual model divide in which two sides represent different emphasis in their studies, commonly depicted as practice and theory. Therefore, it seems that different educational environments could nurture different ideas and thoughts that could be more distinct at a higher education level. Our study introduced these students to the concept of LA and data ethics, which we could now measure differences in. Data privacy and the ethicality of using individuals' data in analytics is something that does not easily unfold without delving into the subjects and/or having prior knowledge about. We also previously conducted a study about the students' and teachers' initial thoughts on LA. Through that study, we concocted the

research interrogative about the dual model divide. (Nevaranta, Lempinen & Kaila, 2019) The question we try to ask and answer in this study is effectively; is there a distinguishable deviation in the perception of LA and data ethics between students representing each side of the common dual model and how does it manifest? Of course, to answer these questions we must first humor the idea that the dual model divide exists.

4   Research Setup

In this section, the research setup is presented. The data gathering was spread between two universities in Finland: University of Helsinki (which is the largest university in the country) and the Satakunta University of Applied Sciences. The reasoning behind this was to find out if the students in different universities have different perceptions about use of learning analytics and the ethical perspectives associated with it. To further diversify the student population, the study in University of Helsinki was conducted in a programming Massive Open Online Course (MOOC), where many students come from outside university. However, in this article we have filtered out the answers from students who did not have a status as a student in either of the selected universities when the survey was conducted.

4.1   Procedure

The study was conducted as an online survey. In the university, the survey was attached to a programming MOOC. The MOOC in question is a popular programming MOOC aimed for students with multidisciplinary backgrounds and can be completed by students outside universities as well. In addition, the MOOC works as an entrance exam: the students who pass the MOOC with a high enough grade can apply to be students in the Department of Computer Science. Because of this, the MOOC has been quite popular. More than 5,000 students in total have started the current implementation. The survey was included in one of the weekly exercise rounds in the MOOC. To motivate the students in answering, one point was awarded for it.

In the university of applied sciences, the survey was conducted through basic face to face (F2F) methods. The same survey was used but the students were actively encouraged to participate in it by engaging them. Students of two separate campuses in the university of applied sciences were surveyed in their respective locations (Pori and Rauma), and motivated to participate by awarding traditional Finnish overall badges (a Finnish student custom in which students collect badges to overalls that represent your faculty) upon survey completion.

The survey was constructed with Google Forms and Microsoft Forms. Forms were selected to conduct the survey in the educational institutes as they offered adequate form functionalities and were deemed viable solutions for surveying. The survey questions were composed mostly of multichoice questions and statements based on the 5-step Likert scale and open form questions.

4.2   Participants

The participants for the survey were a group of students from both of the higher education institutes. The total number of replies received in the survey was 201 of which 56 were from the university and 145 from the university of applied sciences. 652 students answered the survey in the university programming MOOC, but only 56 of these had an official status as university students. Hence, the other answers were excluded from this study. Student numbers are displayed in Table 1.

Table 1. Number of participating students in both universities. The largest age group was 20 to 25 year olds in both universities. The final column depicts the number of students who answered to open questions as well.

Educational institute	Participants	Largest age group (%)	Open answer %
University	56	20 to 25 (58%)	73%
University of Applied Sciences	145	20 to 25 (46%)	43%

Biggest age group was 20 to 25 year olds (58% and 46%, respectively). Second largest age group was 26 to 30 (21% and 25% respectively). Hence, a total of 79% and 71% of the students in the survey were between the ages 20 and 30. 73% of university students and 43% of university of applied sciences students answered to at least one of the open questions at the end of the survey, which can be considered as a good total percentage.

The division of students between different majors is displayed in Figures 1 and 2.
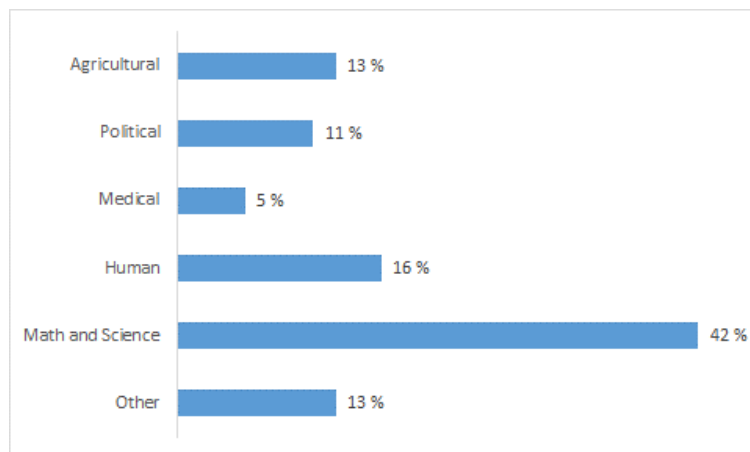
Figure 1. The students' majors in university.
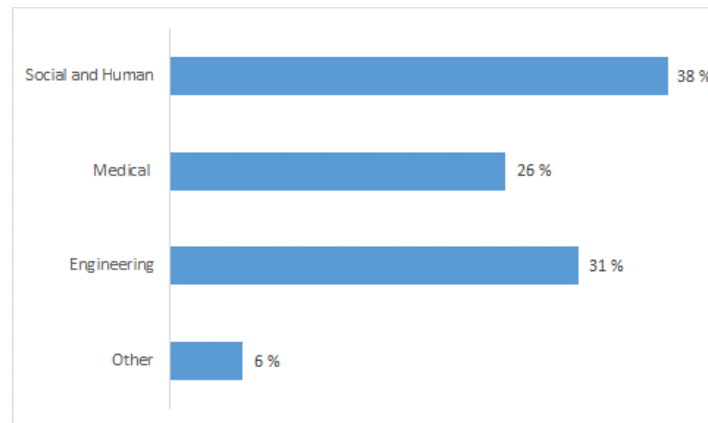
Figure 2. The students' majors in university of applied sciences.

As seen from the figures, the largest groups were Math and Science and Engineering, respectively. The students in the university had more diverse backgrounds than students in the university of applied sciences. It should be noted that the major of Social and Human in university of applied sciences consists mostly of business majors.

5   Materials

As the idea was to collect data on students' ethical perceptions about learning analytics, the majority of the questions were constructed around this theme. The form of data collection was an online survey that was made to reflect the themes of the study in learning analytics and its ethics. A total of twenty multichoice questions and statements and three open questions divided into three categories were included in the final survey. The themed categories were:

1.   **Attitudes**: Students' attitudes towards the application of learning analytics. The first section also measures students' current knowledge about analytics.
2.   **Expectations**: What students expected learning analytics to be, and for whom are they collected.
3.   **Ethical issues**: How students viewed the possibilities and problems posed by learning analytics and associated individual data in learning environments.

This survey was then replicated into two exact copies, which were then shared with students in both institutes early 2020. The questions and/or statements in these categories were based on the themes found in the student-teacher workshops made in APOA-project (Avain Parempaan Oppimiseen Ammattikorkeakouluissa) and published by the Jyväskylä University of Applied Sciences late 2019 (Hartikainen, S. et al, 2019) and Whitelock-Wainwrights (2019) pilot studies article about LA

questionnaire in students' expectations. The form of the questions and statements in the survey were chosen with unequivocality in mind; each student should be made to understand the questions and statements in the same way.

6   Results

In this section, we present the results from the surveys conducted in both universities. First, the means and differences between the two universities for all three themes are displayed. After that, we discuss the answers to open questions.

In Table 2, the average answers for questions in Theme 1, attitudes are displayed.

Table 2. The mean values for statements in Theme 1, measuring students' attitudes towards learning analytics (LA). The difference is calculated by subtracting the university of applied sciences mean value from the university mean value. The differences with statistical significance are **bolded**.

Statement	University	University of A.S.	Difference
1. I know what analytics means	3.518	3.552	-0.034
2. IT systems help organizing and scheduling my studies	4.196	4.517	**-0.321**
3. LA helps following my own progress	3.821	4.138	**-0.317**
4. It is a positive thing, that a teacher can follow my progress via LA	4.125	4.283	-0.158
5. It is a positive thing, that I'm assisted with my studies without my own request, if a need is indicated by data	4.179	4.331	-0.152
6. Institution can freely utilize all data about me to progress my studies	2.804	3.621	**-0.817**

As seen in the Table, there seems to be no major differences between the two universities. However, the students in the university of applied sciences seem to value learning analytics and IT systems in general higher than the university students. The university students also seem to have a tighter attitude towards institutions utilizing data in analytics. The differences in questions 2, 3 and 6 are statistically significant (two-tailed T-test, $p < 0.05$).

The mean values and differences for questions under Theme 2, expectations are displayed in Table 3.

Table 3. The mean values for statements in Theme 2, measuring students' wishes and expectations towards learning analytics. The difference is calculated similarly to previous table.

Statement	University	University of A.S.	Difference
7. I wish that LA would help me follow my progress in studies	4.055	4.110	-0.056
8. I wish LA would help me design my studies better	3.911	4.200	-0.289
9. I wish LA would help visualize my progress in studies	4.232	4.145	0.087
10. I wish teachers would use LA to follow my progress	3.745	3.972	-0.227
11. I wish that the institution would use LA to progress my studies	3.709	3.966	-0.256

According to results, the students' wishes towards learning analytics were quite similar in both universities. Most students hope that utilization of analytics would help them to design and visualize their studies better. Notably, the students also wish that learning analytics would provide better chances for teachers to follow their progress in studies. There are no statistically significant differences between statements under Theme 2.

The mean values and differences for questions under Theme 3 are displayed in Table 4.

Table 4. The mean values for statements in Theme 3, measuring students' perceptions towards ethical considerations of LA. 'Institution' in statements refers to the university where the data was collected. The difference is calculated similarly to previous tables. The differences with statistical significance are **bolded**.

Statement	University	University of A.S.	Difference
12. I get enough information about my data collected by institution	2.582	3.131	**-0.549**
13. I can affect how my data is collected and handed in institution	2.722	3.179	**-0.457**
14. I know what data is collected by institution	2.091	2.876	**-0.785**
15. I accept the collection of my data by institution	3.782	3.938	**-0.156**
16. I accept the utilization of my data by institution	3.855	3.903	-0.049

17. Institution should follow laws and regulations to keep my data safe	4.891	4.338	**0.553**
18. My data collected by institution can be used for my own benefit	3.855	4.117	**-0.263**
19. My data collected by institution can be used for institutions benefit	2.855	3.821	**-0.966**
20. I know that my data is removed by institution after my graduation	2.182	3.345	**-1.163**

Notably, the answers to the third category were somewhat different between the two universities. In fact, the difference is statistically significant in all questions under Theme 3 except for question number 16. The biggest absolute differences were in statements 19 and 20. The first one was about attitudes towards institutions using data for their own benefit (such as marketing), which the students from the university of applied sciences found more acceptable than the students from university. The university students also seemed to lack knowledge about their personal data being erased after their graduation, which may indicate that the university of applied sciences had informed the students better about the topic.

In addition to questions answered in the Likert scale of 1 to 5, the survey contained three open questions. In general, the students in the university were more verbose in their answers, but there were no huge differences in the tone or content. The first question asked the students about their opinions in using their own data to progress their studies. The students were also asked to consider both positive and negative aspects of the topic.

In general, the students found the possibilities of data utilization positive (all comments are translated from Finnish and in some cases re-worded and/or shortened by authors).

- "Data collection is a good thing for course design and implementation"
- "I found the data collection as positive thing, since my data benefits me"
- "I think the data can help me study more effectively"

In a modern society where data usage is common especially younger generation seems to be more accepting of it. On the other hand, most students expressed their concerns about the safety and ethicality of data storage and handling by third parties:

- "I found it risky if third parties are used to handle the data"
- "I'm wondering if my data is used to something I don't know about"
- "I am very suspicious about any data collection or utilization where the participants are not clearly informed about the procedure"
- "The students should be able to restrict the utilization of their data"

Now that GDPR is in effect the results could be affected in one way or the other about data safety; GDPR made the public more aware about data protection but at the same time it stipulated it. In the second open question, the students were asked about the additional value learning analytics could produce for them. Again, most of the students considered analytics as potentially quite useful:

- "I expect analytics to improve the development of study materials and the better teaching of difficult topics"
- "Recommendations on what courses to take"
- "More personal guidance"
- "Personally tailored courses"

Personal guidance and adaptive learning materials and courses were repeated in most of the answers. It seems that the students find this as one of the most important thing learning analytics can offer them. Analytics generally is seen as added value to an existing system and in LA the benefits are easily perceived.

As the final open question, the students were asked to consider if they find learning analytics as ethically justifiable part of future studies, where student instruction is based on data collection and analysis. While previously students gave positive feedback about LA, in the utilization of analytics, they found both positive and negative chances:

- "In principle, it's in everyone's interest to make learning more effective. Practical procedures may prove to be problematic"
- "If the learning results are improved, the development is ethically provable. The ethical problems may arise from data collection and storage."
- "In the future lot of the studies are likely implemented over internet. Hence, LA will be needed more."
- "I find LA ethically sustainable as the results will benefit students. Students should have a chance to limit the data collection and usage."

Some students mentioned that even though learning analytics has potential ethical issues, it is still ethically more acceptable than most of the data collection happening already in different systems, such as social media platforms.

7   Discussion

As seen on the results, the students in general seemed to find the possibilities learning analytics offers quite positive, but were worried about whether their data is stored and utilized safely and ethically sustainable. The biggest things that students value in analytics are visualizing their progress and the possibility to get assistance when required, even without requesting for it. From the future analytics, the students seem to wait for personalized and adaptable learning environments and materials. This is perfectly understandable, as in online education (especially in the form of massive open

online courses), there is often a lack of communication and personal guidance. Hence, the idea of learning environments that fit to everyone's skill levels and learning preference must sound tempting.

Students' worries about data safety and misconduct with their data are also perfectly understandable. In general, most of the students seem to agree that data collected about their learning can be used in analytics as long as the results benefit themselves. However, the students find it problematic if data is used for anything else (even inside the institutions) or delivered outside institutions. From a perspective of learning analytics researchers, we find this attitude quite reasonable: as long as learning analytics is conducted openly and in collaboration with students, they seem to have no problems with it.

Although students in both participating universities seemed to mostly agree on the ethical issues of learning analytics, there were some significant differences. The students in university seemed to be more cautious about the usage of their data. For example, while students in university of applied sciences seem to find the usage of their data to benefit the institution within acceptable boundaries, the students in university find it significantly less acceptable. Similar differences can be found with other statements and in open comments as well: the comments from university students were more verbose, and the same basic message was repeated in them: using data is perfectly fine as long as it is used to benefit students and not shared with anyone outside the institution.

There are some likely explanations for the differences between the two universities. First, the students in university of applied sciences are likely more familiar with the concept of learning analytics and with the procedures associated with it (such as data safety for example), due to the ongoing APOA project (APOA, 2020) which has familiarized the students and teachers with analytics. Second, the university students came from a more diverse selection of majors, and up to this date, the university probably has not informed students well enough on ethical procedures of data handling. For example, on average university students seem to have no idea whether their data is erased from the institution after their graduation. In addition, since the survey in the university was done within a programming MOOC the more verbose answers could be speculated with the participants interest in computer sciences and therefore with data ethics.

It should also be noted that in the survey, we first introduced the concept of LA to the students in order to give them an idea about it, so they would not rush into the survey with a false understanding. Even though we created the survey with unequivocality in mind, while presenting the survey in university of applied sciences we also encouraged people to use the neutral answer "I don't know" when they did not feel like they fully understood the question as to prevent falsifying the data. No similar procedure was used in university, which may have skewed the results in some degree against or in our favor. These details and their effects could be ruled out by replicating the research setup in future on different groups in different educational institutes.

Overall, it seems that the students have strong opinions about the subject. For example, it is quite typical that openly answered questions, particularly at the end of a survey do not collect that many replies. In the survey, we had many very interesting

and well thought out answers on all three categories. The fact that university students' answers were much longer could indicate more interest on the topic, but likely explanation may also be that the topic was already familiar to students in university of applied sciences. Moreover, it is possible (although cannot be confirmed) that students in the latter case answered the survey mostly with mobile devices while the students in university used laptops, which enables easier text input. From the students point of view the survey did seem to be a tad too long, which we found out when interviewing some students about it after completion. The amount of unreplied open answers supports this.

By now, with the accelerated digital leap forced on us by the 2020 pandemic, the collection of student data should have become more obvious in a modern educational environment. More and more of the lessons are held via digital tools, conferencing systems, learning management systems etc. supplemented by digital registers that keep track of the students' studies and progress. As it is at least somewhat likely that some of the newly widely adapted digital tools will become part of the permanent workflow after the pandemic as well, the need for extensive use of learning analytics has become imminent. For this reason, we should listen to students' perceptions carefully to come up with ethically sustainable analytics. LA is seen as a necessary form of analytics somewhat comparable to healthcare analytics, where the data primarily serves the individual, but also the public and common welfare.

8   Conclusion and Future Work

In this study, we found out that students find learning analytics as a potentially promising tool for tracking and visualizing their own progress. They also see the potential of analytics to create adaptive and personalized learning paths for students with different skills, mindsets and learning preferences. However, the students are also worried about the safety of their data and the transparency of the data collection and utilization. In short, the students feel that learning analytics can and should be used, but only if the data collection and handling is done in ethically justifiable methods. Curiously, university students were stricter about this than their counterparts in the university of applied sciences were.

In future, we are planning to expand the study to contain more universities and other institutions, and to collect even more data about students' backgrounds to find out if there are factors that may explain the attitudes and expectations towards analytics. It would also be useful to find out how much the universities have formally informed the students about the data safety procedures used in the institutes, f.ex. how GDPR has been implemented and voiced in a institute. Finally, it would be interesting to combine the survey data with performance data from courses to find out if the students' success or failures in courses affect their attitudes towards analytics. Data ethics should be given more consideration in future studies since it ultimately affects in which way the public opinion, attitudes and expectations, sway and as the world of IT it will evolving and changing constantly.

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