Changes in Student Perceptions of Ethics of Learning Analytics due to the Pandemic

Long paper

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Abstract. The pandemic has affected all areas of life with education being no different. Distance learning has become the new normal in all levels of education. Learning analytics as a tool best utilized by the abundance of data should now be more lucrative and needed than ever. Prior to the change, we surveyed the students of two Finnish higher education institutes, Helsinki university and Satakunta university of applied sciences, about their opinions, attitudes and expectations of learning analytics and ethics associated with it. This study is a follow-up surveying only the students of university of applied sciences and aims to find changes that might have been brought forth by the sudden and drastic switch to distance learning only. In addition, this was a chance to gather information on the students' experiences on distance learning, and how they feel about the so called new normal. The results seem to indicate that while students' expectations towards learning analytics haven't changed, their attitudes to security of their data and ethical conduct of analytics have become significantly stricter. We also found out that students have diverse feelings about distance learning in general, indicating changes required to post-pandemic education.

Keywords: Learning analytics, ethics, distance learning, education

1   Introduction

The drastic change brought upon by the global pandemic has affected everyone. Education has had to undergo a transformation to cope with the change, higher education not being an exception (Saqr & Wasson, 2020). The change in practice meant

extreme limitations to travelling, contact, all forms of physical interaction between societies. In education, this commonly meant change from physical contact lessons to full-on online education. What higher education institutes had already been offering to the world in smaller proportions became the new standard across all levels of education. (Pappas & Giannakos, 2021) What has been brought upon by the change in higher education is what we are looking into. Already there have been several reports and studies on both the positive and negative effects of distance learning and now that we are even more dependent on educational systems and data it should also propose an interesting question to us about the position that learning analytics now hold. Whatever means we have used and experimented on with learning analytics and data before the pandemic had to be deployed to make the most out of the situation all education institutes face. (Heath, 2020) The hypothesis remains similar to our previous study on students' perceptions about learning analytics but now the question has shifted towards has learning analytics gained favor due to the increased need for digital tools, platforms and systems that learning analytics by nature should elevate to greater heights?

The focus of this follow-up study was to find out if students' attitudes, expectations and opinions about learning analytics and ethics associated with it have been changed by the pandemic. The original study was completed in the beginning of spring 2020 and was therefore done prior to the COVID-19 virus reaching pandemic status. (Finnish Institute for Health and Welfare, 2021) In addition, the study measured how distance learning has affected the study behaviors of students to provide more insight on the possible changes in their perceptions about learning analytics and ethics associated.

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. Then we disclose the results of the original study and present the setup of this follow-up study, including the design changes and conduction of the survey. Finally, the results are presented, discussed and a conclusion is drawn.

2   Related Work

As stated in the introduction the basis for this study heavily references similar studies done that measured the effects of the pandemic in education and the previous studies done by our research group on the use and application of learning analytics in higher education. The aforementioned Pappas & Giannakos (2021) did a study in April on the learning design during the pandemic where they touched both topics of data and learning analytics and Heath (2020) did similarly a study on the idea and application of learning analytics in online instruction. More notably Viberg (et al. 2018) did an exploratory study on the current state of learning analytics in higher education with extensive literature review.

3   About Learning Analytics and Ethics

Learning analytics as a subfield of 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). In other words, learning analytics is a tool with which we can harness the abundant data about learners in their learning environments to better and more effectively guide them towards their academic goals. In higher education the use of lower level analytics tools in learning and study management systems has become common in the last decade or so and the need for more individualized and optimized learning paths for the learners has also elevated the position of learning analytics in education (Schumacher & Ifenthaler, 2018). In Finnish universities, depending on the learning management system (LMS) and study management system used, there are several lower level analytics tools that can be used by both teachers and students to progress the students' studies more effectively. For example, there are visual progress completion tools that visualize the students overall and course progression and graphs that display the students' semester progression in relation to their own and the institute's goals and expectations (fig 1).
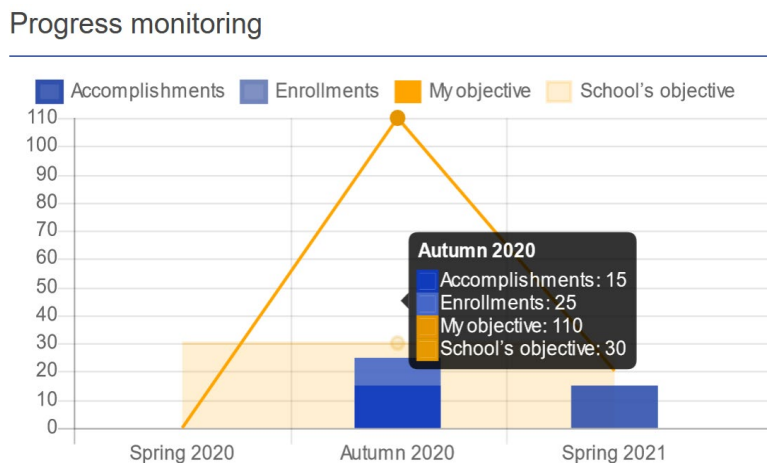
Fig 1. Students study progression monitoring graph in a study management system.
Depicts the completed, ongoing, and planned studies, f. ex. in Autumn 2020 the student has completed 15 credits, enrolled into 25 credits (including the completed) and is therefore 5 credits short of the school's semester objective of 30 credits for Autumn 2020.

Data ethics always follow analytics since use of data comes with its own questions and worries about safety, rights, and privacy. These questions and worries consider data ownership, consent and handling of the students' data. What are the rights of the data owner, do the students really understand what they are enabling, where are the boundaries of privacy set? While ethics can be seen as a concept of conduct that affects

the safety of learning analytics and rights of the data handler and owner, privacy can also be separated from the three as a continuous negotiable boundary that is guided by the ethics surrounding. (Ferguson et al. 2016) As reviewed by Viberg (et al. 2018) in her extensive higher education learning analytics literature review there have been several studies done either addressing the concerns of learning analytics ethics or directly emphasizing the issues of ethics (including data ethics) and privacy there within. The general consensus here seems to be that we are not in fact even remotely close to a level where we are using learning analytics in an ethical way, be it either due to the lack of privacy and safety, moral qualms, juridical issues or even technical challenges. Ethical concerns are present but there are no clear indications on how they should be addressed or overseen, as this not only is a difficult topic but varies greatly depending on the level of analytics, country of the educational institute and its own laws, data regulations etc. (Willis et al. 2016) Out of the four levels of learning analytics that Gartner (2013) has outlined for us lower level descriptive and interpretive (diagnostic) data analysis methods seem to be more easily justifiably as they do not involve automated decision-making. One of the most cited studies on the ethical issues regarding learning analytics was done eight years ago by Slade and Prinsloo (2013) who proposed a six principles framework to guide educational institutes through these issues. The ethical principles were benefits, consent, vulnerability and harm, data and administration and resources that are context and strategy driven. The study reasoned that the six principles could be used by higher education institutes to offer appropriate solutions that use learning analytics to further increase the quality and effectiveness of the collective learning experience. These principles could act as a checklist against any level learning analytics tool and form the base structure for the dos and don'ts of learning analytics ethics. In our study all these principles are visible in the statements, but they are limited to only from one group's perspective (the students).

4   Previous Study

The previous study on the students' perception about learning analytics and ethics served as comparison to this study. In the previous study both students from a university and a university of applied sciences were surveyed. The students of the previous study found learning analytics to be a potential and welcome tool to aid them create their personalized learning paths but did also convey their worries about data safety and data transparency. Learning analytics was generally seen as a good addition but the data it needs to be useful must be collected and handled by ethically justifiable methods. This was made even more evident by the university students, who were stricter about the usage of their data, its collection and handling. (Nevaranta et al. 2020) Ultimately the population's views about learning analytics and data ethics sway the way our education evolves so it is crucial to make data ethics more common ground today.

The basis for this and the previous study are the ongoing and shortly concluding learning analytics standardization projects in the Finnish higher education scene funded by the national ministry of education (Hartikainen et al. 2019). In universities of applied sciences there is the APOA project and in universities there is the AnalytiikkaÄly

project (APOA, 2021; AnalytiikkaÄly, 2021). In the previous study the focus was in measuring the changes between two university models that are in Finnish higher education. The more theoretical hard sciences universities and the more practical universities of applied sciences. (Ministry of Education and Culture, 2021) The previous study was concluded before the pandemic and it was already known at the time that there was a possibility to do a follow-up since the pandemic set in shortly after the study was completed. From the previous study we already had good data that with a few additions could be extended into a follow-up study on the students' changed perspectives about learning analytics and ethics that was brought upon by the change in learning due to the pandemic.

Prior to the previous study our research group also did a study on the application of learning analytics in different learning models where both students and teachers' perspectives were considered. In the study it was found that teachers involved were positively taken by especially lower level analytics tools that would allow them to better facilitate course design on their terms and level of skill. The students of this study outlined similarly to the students of the previous and current study that while learning analytics is a welcomed addition to help them advance their studies there are ethical considerations considering the pros and cons of using their data to produce learning analytics results. It was also found during this study that the students want to know how their data is used to produce these results and that generally they would like to know more about how learning analytics work. (Nevaranta et al. 2019)

During the pandemic several studies and publications with similar scopes and objectives were completed which were referenced on this article. As the online learning became the new normal across education levels the allure of learning analytics seemed to increase (Qiyuan 2021). As stated by Pastor (2020) in his article there will be a continuing linear development in the use of digital learning tools and learning analytics accelerated by the pandemic. Where in our studies the students did find learning analytics a welcome addition to the students' studies, we could find some complementary remarks in the recent international studies. Learning analytics require active involvement from both teachers and student equally and the input of these two parties in the development of said tools seems to be often neglected in favor of other stakeholders (f. ex. support services), which in turn does enforce the idea of more active learner involvement in these studies (Guzman-Valenzuela et al. 2021). The consensus all in all seems to hold; learning analytics is what everyone would like to implement but are not convergent on the details of how the implementation would be done.

5   Research Setup

The study was conducted in early 2021 with an electronic survey. The participants were the students of Satakunta University of Applied Sciences. The survey was based on the previously given survey (Nevaranta et al. 2020) one year prior and contained the same basic statements. Additional questions about students' perceptions of the Covid lockdown were added to further analyze the effects on students.

The study was conducted via Microsoft Forms, distributed by the university's student mail listing and the students had eight days to answer the survey. The results were then downloaded, combined, and analyzed. The survey comprised mostly of multichoice questions and statements on a 5-step Likert scale with a few supplemental open questions.

5.1 Participants

A total of 133 students (N=133) answered the survey. Most students were between 20 to 25 years or 31 to 40 years old. The age distribution of all respondents is displayed in Figure 2.
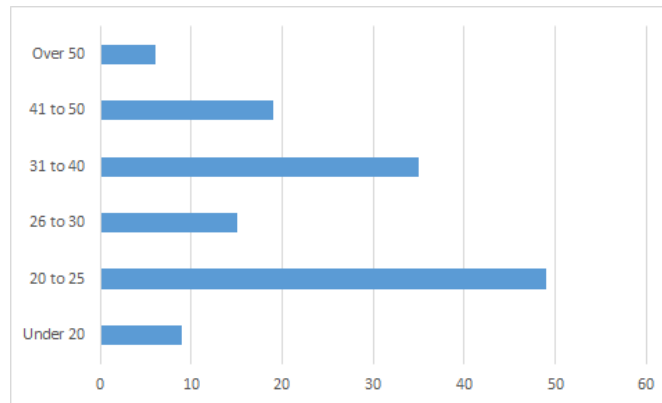

Fig 2. The age distribution of all respondents in the survey.

The student distribution between different majors is displayed in Figure 3.
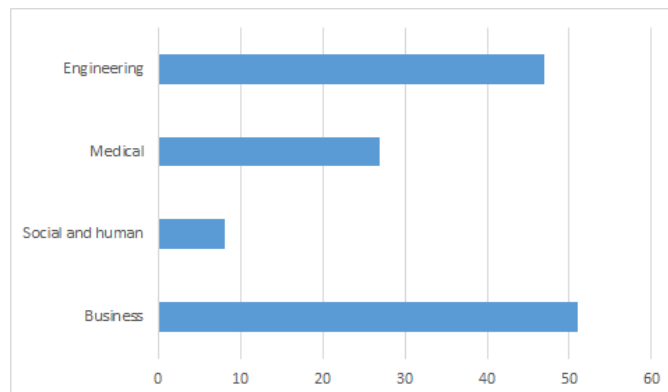

Fig 3. The major subjects of all respondents.

As seen in the figure, most of the students were either business or technical majors. There are some minor differences in distributions compared to the earlier survey, (Nevaranta et al. 2020), but not enough to likely have an effect in the results.

5.2   Materials

The survey contained all the questions from the similar survey conducted a year earlier (Nevaranta et al. 2020). In addition, there was a new category with statements related to distance education and its effects. Hence, a total of 26 questions were included in the final survey, divided into four categories. All questions were answered in a Likert scale of 1 to 5. The categories were

1. Questions about students' knowledge of analytics and about their attitudes and perceptions towards learning analytics and the access to their study information.
2. Questions about students' expectations towards learning analytics, i.e. what they wish they could gain from it and how it could (and should) help them in their studies.
3. Questions about ethical and security issues associated with learning analytics.
4. Questions about students' attitudes and experiences towards distance education during the Covid-19 pandemic.

The questions were provided with an electronic form using Microsoft Forms. Some additional descriptions of some of the concepts were provided alongside questions to ensure that the students understood all the questions correctly. These included the description of analytics, learning analytics and the project under which the study was done. The new statements about distance education and its effects included statements about how the students' learning has been affected, has the studying become harder or easier and do they find themselves receiving enough study counseling. The statements can be found in Table 4.

5.3   Analysis

The results were first analyzed with Microsoft Excel. For additional analysis, the data was converted into quantitative form (where applicable) and analyzed with custom-made Python scripts. The two central forms of analysis were hence

1. Quantitative analysis of students' answers to questions 1 to 21 and differences to last year's results
2. Qualitative analysis of open answers and the differences to last year's study results

We also constructed correlation matrices between all questions in 2020 and 2021 surveys, respectively. This was done to ensure the validity of answers and to see whether there were any unforeseen connections between individual questions.

6   Results

In this section, the results of the study are presented. When applicable, the corresponding results of the 2020 instance of the survey are also included. It should be noted that in 2020 the survey was conducted in both, University and University of Applied Sciences. To keep the results comparable, only the results of the latter are included in the comparison.

6.1   Means and Comparison to 2020 Survey

Table 1 contains the results related to the questions in the first category, i.e. questions about students' attitudes towards analytics.

Table 1. The students' answers to questions under category 1 in 2020 and 2021, change from 2020 to 2021 and the significance of difference.

Statement	2020	2021	Change 2020 → 2021	p
1. I know what analytics means	3.552	3,586	-0,035	0,789
2. I know what learning analytics means	3,345	3,045	0,300	**0,015***
3. IT systems help organizing and scheduling my studies	4,517	4,316	0,201	**0,013***
4. LA helps following my own progress	4,138	3,805	0,333	**0,001****
5. It is a positive thing, that a teacher can follow my progress via LA	4,283	4,180	0,102	0,323
6. It is a positive thing, that I'm assisted with my studies without my own request, if a need is indicated by data	4,331	4,331	0,000	0,998
7. Institution can freely utilize all data about me to progress my studies	3,621	3,383	0,237	0,125

The significance of difference between distribution of answers was calculated with a two-tailed t-test. The difference was statistically significant ($p < 0.05$) in questions 2, 3 and very significant ($p < 0.01$) in question 4. Hence, it seems that in 2021 the students were less confident about what learning analytics means, whether IT systems help organizing their studies and whether learning analytics help them to follow their own progress. This could be due to different forms of data collection last year. Students were asked to take the survey and at the same time they were also informed about the goals of the APOA-project and shortly about learning analytics. This year in the pandemic situation the same forms of data collection was not possible. In the student union's national survey, answers of the students in SAMK indicated that students in their own opinion are good or at least adequate in study preparedness, which also includes timetabling (SAMMAKKO, 2021). Possible reasons for that can be found in the open questions section. However, the absolute difference in mean values was still rather small.

The answers to questions in category 2, students' expectations towards learning analytics, are displayed in Table 2.

Table 2. The students' answers to questions under category 2 in 2020 and 2021, change from 2020 to 2021 and the significance of difference.

Statement	2020	2021	Change 2020 → 2021	p
8. I wish that LA would help me follow my progress in studies	4,110	4,211	-0,100	0,350
9. I wish LA would help me design my studies better	4,200	4,195	0,005	0,966
10. I wish LA would help visualize my progress in studies	4,145	4,263	-0,118	0,259
11. I wish teachers would use LA to follow my progress	3,972	3,872	0,100	0,385
12. I wish that the institution would use LA to progress my studies	3,966	3,835	0,131	0,259

As seen in the table, the students' expectations towards learning analytics have not changed between the two observed years. The students still wish that analytics would help them to follow, visualize and design their studies better. Moreover, the students

still hope that teachers and institutions would utilize learning analytics to follow their progress in their studies.

The answers to questions in category 3, measuring students' attitudes towards ethics and security of learning analytics are displayed in Table 3.

Table 3. The students' answers to questions under category 3 in 2020 and 2021, change from 2020 to 2021 and the significance of difference.

Statement	2020	2021	Change 2020 → 2021	p
13. I get enough information about my data collected by institution	3,131	2,248	0,883	**0,000****
14. I can affect how my data is collected and handed in institution	3,179	2,571	0,608	**0,000****
15. I know what data is collected by institution	2,876	2,030	0,846	**0,000****
16. I accept the collection of my data by institution	3,938	4,000	-0,062	0,571
17. I accept the utilization of my data by institution	3,903	3,947	-0,044	0,694
18. Institution should follow laws and regulations to keep my data safe	4,338	4,752	-0,414	**0,000****
19. My data collected by institution can be used for my own benefit	4,117	3,541	0,576	**0,000****
20. My data collected by institution can be used for institutions benefit	3,821	3,541	-0,315	**0,005****
21. I know that my data is removed by institution after my graduation	3,345	2,474	0,871	**0,000****

As seen in the table, the students' attitudes towards the ownership and safe handling of their own data have changed in a year. The students still accept the utilization and collection of their data similarly to 2020 (questions 16 and 17), but in all other questions there is a significant change. Notably, the students feel that they don't receive as much information about data collection and usage (questions 13, 14 and 15) and they also have stronger opinions about secure storage and ethical usage of their own data (questions 18 to 21).

In the 2021 survey there was also a fourth category to measure students' perceptions about distance and online education during the Covid-19 pandemic. The answers to the fourth category are displayed in Table 4.

Table 4. The students' answers to questions under category 4 in 2021. Questions were not included in the 2020 survey.

Statement	2021
Studying remotely has been more difficult than regular learning	3,152
My digital and IT skills are sufficient for studying	4,439
I have received enough instruction for studying	3,553
Visualizations in Moodle help in tracking my study progress	3,833
Visualization in Loki helps in tracking my study progress	3,909

As seen in the table, the students haven't found distance learning as more difficult and feel that they have sufficient IT skills for learning remotely. Most of the students seem to find visualizations useful in tracking their study progress as well. As a side note, Moodle is the common open-source LMS used by many institutes globally (Moodle.org, 2021). Loki, commonly known as Peppi, is the study management system used commonly in Finnish higher education institutes (Peppi-consortium, 2021).

6.2 Open Answers

The survey included some open questions as well. The first three were the same as the questions asked in 2020 (Nevaranta et al. 2020). In addition, there was an open question about distance learning during the Covid-19 pandemic.

The first question was about students' perception on using their data to progress or track their studies. Most of the answers were positive about this, such as (translations from Finnish by authors):

> "I find it positive that progress is tracked, and actions are taken
> if anomalies are detected. This way nobody gets left behind."

> *"I think it's a good thing that teachers and tutors can follow my progress. This improves the discussion."*

> *"Anything that's helpful can be used."*

However, several students that were positive about utilization of their data also raised a concern about the privacy and security of this:

> *"A good thing as long as data security in ensured."*

> *"As long as my study data is used to promote or guide my studies, this is ok. I don't want my data exposed to any outsiders."*

> *"The fact that my data is collected and can be observed by anyone else makes me a little uncomfortable. But for promoting my studies it is ok as long as the data is not shared with anyone else."*

There were also students who did not think that the data was utilized to full extent:

> *"Students and teachers need a lot of training for this."*

> *"Should be utilized better."*

> *"Very good idea, but in practice we seem to be very far from actually utilizing data in counseling."*

Finally, some students were negative about the whole idea:

> *"Fully negative, I don't want my data to be collected. Why should I justify this?"*

Table 5 displays the division of answers based on the categories described above.

Table 5. The division of students' answers to open questions about usage of their data.

Category	N	%
All answers	59	100%
Positive	27	46%
Positive but worried about privacy	14	24%
Skeptical that data is not utilized enough	8	14%
Negative	6	10%
No opinion	4	7%

The second open question was about what kind of added value the students hoped learning analytics would bring to their studies. The answers were roughly divided into two categories. First, there were students who saw the potential of analytics, such as

> *"Knowing where to progress and where to focus more."*

> *"Easier tracking of one's progress in studies."*

> *"Clearer and more visible learning goals etc."*

The other group consisted of students who did not find any potential benefits. Most of them were not skeptical about the benefits of analytics as such, but rather argued that the teachers are not likely going to utilize analytics in teaching:

> *"Now that I know that this kind of data is collected, I assume that it will be utilized as well. Until now there have been no signs of using any kind of data by teachers or counselors"*

> *"Nothing. The teachers will track [the progress] like they have always done."*

> *"Nothing, the opposite. I don't think the teachers can utilize the data at all."*

Majority of answers to the second open question (N=34) were positive, only 7 of the answers were classified as negative.

The third open question was about whether the students see learning analytics as an ethically sustainable part of education in the future. There were 53 answers in total. The students who answered the question positively (N=16) listed results such as

> *"I don't see any problem; I have nothing to hide."*

> *"I don't see ethical problems. Education is about completing things and it's important that the teacher gets the necessary information."*

There were also students who felt negatively towards this (N=6):

> *"Not much. Traditional human contact would be nice, as would having fewer students so that the teacher will at least know everyone's names."*

> *"I should be able to refuse without consequences."*

Many students (N=24) however agreed that learning analytics can maybe conducted ethically if special consideration is paid towards data security and ethics in general:

> *"I don't find analytics itself to be an ethical problem, but the rules and data handling need to be clearly announced."*

> *"If analytics is transparent and students know what they are committed to, I don't see a problem."*

> *"It's ethically acceptable as long as students give their permission and can see the data collected concerning them without any delays."*

Finally, we wanted to know what kind of changes the pandemic had to studying. Notably, the students' answers were mostly very strongly positive or negative. Positive comments were mostly related to flexible schedules and not needing to travel, such as

> *"It's easier to study while eating breakfast at home in my pajamas."*

> *"Easier to schedule things I do since traveling won't take any time"*

> *" I have a better computer and more displays at home than in school."*

However, many students found distance learning as a very negative experience:

> *"Schedules are hard to meet when you spend all your time at home."*

> *"I have no structure in life."*

> *"Concentrating and self-motivating at home are nearly impossible."*

"I have no human contacts, all hobbies are forbidden, 14h per day looking at a computer screen [...] I have lost my mental sanity and have no interest in school."

There was a total of 125 answers to the final question, which seems to indicate that the students had strong feelings about distance learning. In 44 of these the students reported positive feelings about distance learning while 61 answers indicated negative. The remaining included students who already had studied remotely before the pandemic.

7   Discussion

It seems that the pandemic has changed some attitudes towards learning analytics strongly, while some attitudes have remained similar. The questions in category 1 (Table 1) reveal that the students still find analytics in general as a positive thing like the study a year ago. However, now the students feel less confident about analytics helping them to follow their own study progress. It is possible that due to the pandemic, the students now need to rely heavier on the analytics and may since feel less satisfied with the results. Students' expectations towards analytics (category 2, Table 2) seem to be like what they were before distance learning: they hope that learning analytics would help them follow, design, and visualize the progress of their studies.

The biggest changes in students' attitudes were in the third category (Table 3), which was about students' attitudes about ethics and security of learning analytics. It seems that students now feel significantly less informed about the collection, utilization, and removal of their data. The students still accept the collection and utilization of their data for their own benefit but seem to be much stricter about the ethical and security issues related to their data. Again, we find it likely that the students are more concerned about these issues because they have been dealing with them a lot more than before. Students did not have as much experience about distance learning and about ethical issues related to it when we conducted the survey last time before the pandemic started.

While the questions in the fourth category (Table 4) seem to indicate that the students' attitudes towards distance learning are quite neutral, the open answers draw a different picture. In fact, many students seem to have very strong positive or negative attitudes towards distance learning. While many of them appreciate the flexible schedules and working from home, many of them are worried about lack of motivation and the (sometimes devastating effect of) missing human contacts. Since the division seems to be quite deep, the organizations should seriously consider providing distance learning chances for some students even after the pandemic while returning to normal routines with those who want it.

The students' open answers reveal that many students are positive about the potential possibilities of learning analytics, but at the same time they are worried about the safety of their data and ethical conduct of analytics. It also seems that many students don't find the teachers' competence about utilizing analytics as sufficient. Again, some students seem to think that their data can be utilized freely (as they "have nothing to hide"), but in general there seems to be a stronger demand towards safer conduction of

analytics. This is a positive thing, because it may indicate that the students are more aware of data collection and its effects on them.

8   Conclusion and Future Work

We conducted a survey collecting students' perceptions about learning analytics and ethical and security issues related to them. The study was a follow-up to a study conducted a year ago, and our goal was to find out whether the pandemic had any effects on students' perceptions. Based on the results, it seems that the students' expectations towards analytics have not changed, but their attitudes toward data security and ethical conduction of analytics have become much stricter. We also found out that the pandemic has had a diverse effect on students: while some have enjoyed the flexibility and working from home, others felt strongly that their motivation had decreased and loss of contacts had been close to unbearable.

There are naturally limitations to this study, which we need to address in future studies. Unfortunately, due to different scheduling of the courses, we were not able to collect data from university students like we did a year ago when conducting the first iteration of the study. Hence, a comparison like what we did earlier was not possible this time. Hence, in the future we are going to conduct the survey in the university as well. Other future work should include finding the connection between students' perceptions and their actual utilization of learning analytics based on the statistics. We are also very interested to find out what kind of effect the return to contact learning will have on students' attitudes towards ethical conduction of learning analytics.

References

AnalytiikkaÄly project. (2019). Research, development and implementation of learning analytics in higher education. Referenced on 31.05.2021. Retrieved from https://analytiikkaaly.fi/in-english/

APOA project. (2019). Learning analytics in the Universities of Applied Sciences. Referenced on 31.05.2021. Retrieved from http://apoa.tamk.fi/in-english/

Ferguson, R., Hoel, T., Scheffel, M., & Drachsler, H. (2016). Guest Editorial: Ethics and Privacy in Learning Analytics. Journal of Learning Analytics, 3(1), 5-15. https://doi.org/10.18608/jla.2016.31.2

Hartikainen, S., Koskinen, M. & Aksovaara, S. (2019). Kohti oppimista tukevaa oppimisanalytiikkaa ammattikorkeakouluissa. Jyväskylän ammattikorkeakoulu. (Finnish only) ISBN: 978-951-830-547-0. Referenced on 02.06.2021. Retrieved from http://urn.fi/URN:ISBN:978-951-830-547-0

Heath, M. K. (2020). Buried treasure or Ill-gotten spoils: the ethics of data mining and learning analytics in online instruction. Education Tech Research Dev 69, 331–334 (2021). https://doi.org/10.1007/s11423-020-09841-x

Gartner. (2013). Levels of Learning Analytics. Top 10 Moments from Gartner's Supply Chain Executive Conference. Referenced on 03.06.2021. https://blogs.gartner.com/matthew-davis/top-10-moments-from-gartners-supply-chain-executive-conference/

Nevaranta, M., Lempinen, K. & Kaila, E. (2019). Insights on the Finnish field of Learning Analytics -Applications and Ethics in Adaptive Education Models. IAFOR, theAsian Conference for Education 2019: Official Proceedings, pp. 331-342. ISSN: 2186-5892.

Nevaranta, M., Lempinen, K. & Kaila, E. (2020). Students' Perceptions about Data Safety and Ethics in Learning Analytics. CEUR Workshop Proceedings, vol. 2737, pp. 23-37. http://ceur-ws.org/Vol-2737/

Moodle.org. (2021). Moodle - Open-source learning platform. Home page of Moodle LMS. Referenced on 01.06.2021. https://moodle.org/

OKM. (2021). Higher education. Finnish Ministry of Culture and Education. Referenced 01.06.2021. https://minedu.fi/en/higher-education-and-degrees

Pappas, I. O. & Giannakos, M. N. (2021). Rethinking Learning Design in IT Education During a Pandemic. Front. Educ., April 2021, vol. 6, article 652856. https://doi.org/10.3389/feduc.2021.652856

Pastor, G. (2020). About the role of Learning Analytics in the COVID-19 pandemic. Article. Digital Education Magazine Ruta Maestra. Referenced on 14.08.2021. https://rutamaestra.santillana.com.co/about-the-role-of-learning-analytics-in-the-covid-19-pandemic/

Peppi-consortium. (2021). Peppi - Voimaa ja vääntöä. Home page of the Peppi-consortium. (Finnish only). Referenced on 01.06.2021. https://www.peppi-konsortio.fi/

Qiyuan, L. (2021). Stepping Out from Emergency Remote Teaching: What Can Learning Analytics Tell Us? Article. Department of Digital Learning and Innovation, Boston University. Referenced on 14.08.2021. https://digital.bu.edu/bu-learning-analytics/

SAMMAKKO. (2021). "Aika yksin on jäänyt." Etäopiskelun tulos koonti 2021. Student unions survey on distance and online learning. (Finnish only). Referenced on 04.06.2021. https://sammakko.fi/wp-content/uploads/2021/05/Eta%CC%88opiskelukysely2021_Tuloskoonti_06052021_KORJATTU.pdf

Saqr, M. & Wasson, B. (2020). COVID-19: Lost opportunities and lessons for the future. Editorial article. International Journal of Health Sciences, vol. 14, issue 3, May-June 2020. https://www.ijhs.org.sa/index.php/journal/article/view/5030/994

Schumacher, C. & Ifenthaler, D. (2018). Features students really expect from learning analytics. Computers in Human Behavior, vol. 78, 2018, p. 397-407, ISSN 0747-5632, https://doi.org/10.1016/j.chb.2017.06.030

Slade, S. & Prinsloo, P. (2013). Learning Analytics Ethical Issues and Dilemmas. American Behavioral Scientist. 57. 1510-1529. 10.1177/0002764213479366.

Siemens, G. (2013). Learning Analytics: The Emergence of a Discipline [online]. American behavioral Scientist, 57(10), pp. 1380-1400. Referenced on 29.05.2021. https://journals.sagepub.com/doi/pdf/10.1177/000276421349885

THL. (2021). Coronavirus COVID-19, Latest Updates. Finnish Institute for Health and Welfare. Referenced on 30.05.2021. https://thl.fi/en/web/infectious-diseases/what-s-new/coronavirus-covid-19-latest-updates

Viberg, O., Hatakka, M., Bälter, O. & Mavroudi, A. (2018) The current landscape of learning analytics in higher education. Computers in Human Behavior, vol 89, p. 98-110, ISSN 0747-5632. https://doi.org/10.1016/j.chb.2018.07.027

Willis, J. E., Slade, S. & Prinsloo, P. (2018) Ethical oversight of student data in learning analytics: a typology derived from a cross-continental, cross-institutional perspective. Education Tech Research Dev issue 64, p. 881–901. https://doi.org/10.1007/s11423-016-9463-4