

# Students' Perceptions of the Ethical Aspects of Learning Analytics

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**Abstract** – This paper deals with the students' perceptions of the ethical aspects of learning analytics (LA), including data privacy, students' consent for data collection, and regulations. The existence of statistically significant differences in students with respect to gender, type of study and study year was investigated. The research included 295 Croatian students and was implemented using a questionnaire. Students are moderately concerned about privacy in LA; they want to be informed about the data collection and how the data will be analysed, as well as to decide which data will be saved. They think LA should be regulated using rules and guidelines but are unfamiliar with them. Special focus was put on the students' attitudes towards saving information about their activities and using this data for LA, respecting the data type. Students mostly disagree with all data types being saved for LA purposes, primarily related to the history of Internet browsing and the content of e-mails, and the highest openness to saving for LA purposes is achieved for logs in learning management systems.

**Keywords** – Learning analytics, student perception, data analysis, data privacy.

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## 1. Introduction

With the advancement of Information and Communication Technology (ICT), a diverse range of opportunities has emerged for enhancing educational processes. Numerous modalities now exist for integrating ICT into teaching and learning environments. Initially, teaching materials used in traditional, face-to-face instruction were made available online through server uploads, enabling asynchronous access for students. Subsequently, ICT facilitated interactive communication between students and instructors, expanding the traditional educational paradigm. As Learning Management Systems (LMS) evolved, creating comprehensive e-courses and implementing various pedagogical activities that surpassed content delivery and interaction became possible. These activities included collaborative learning and diverse assessment strategies. As a result, the entire instructional process could be transitioned into an online framework. Today, educational institutions employ diverse instructional models such as blended learning, hybrid learning, fully online learning, HyFlex teaching, and other configurations that leverage ICT to varying degrees [1].

In parallel with the evolution of ICT-supported teaching, there has been a growing capability to monitor and analyse students' behaviours throughout the learning process [2], [3]. This has given rise to the field of Learning Analytics (LA). The primary objective of LA is to analyse extensive datasets related to student engagement and performance, which are collected through various educational systems. By utilising these datasets, LA aims to understand students' learning strategies and contexts, identify potential learning risks, and ultimately optimise the educational process for enhanced learning outcomes. Specialised systems and modules within LMS platforms have been developed to support this endeavour to enable LA functionalities [4].

Effective implementation of LA, however, requires comprehensive data collection on students' activities and performance [6], [7], but has an important mediating role in the education process [8].

This paper investigates students' perceptions of the ethical considerations surrounding LA. Specifically, it explores students' attitudes toward various aspects of LA, with a particular focus on data collection practices, data usage, and the implications of these activities for student privacy and autonomy. The research presented in this paper is part of the project "Improving HEI Maturity to Implement Learning Analytics", a prominent initiative funded by the Croatian Science Foundation. One of the project's primary objectives is to develop an instrument that measures the maturity of higher education institutions (HEIs) in the implementation of LA within blended learning environments. Ethical considerations represent a critical dimension of institutional LA maturity, as high ethical standards and respect for students' perspectives must be upheld to ensure responsible data practices.

This study presents findings on a range of ethical issues associated with LA deployment, including data privacy, students' informed consent for data collection, the sensitivity of various types of student data, compliance with legal and regulatory frameworks, the justifiable purposes for utilising collected data, personalisation of the educational process based on LA insights, and students' confidence in HEIs to handle their data responsibly. The results contribute to a nuanced understanding of how students perceive the ethical use of their data in educational contexts. The research questions of this study are the following:

1. What are the students' attitudes towards general ethical aspects of LA?
2. Are there statistically significant differences among students' attitudes towards general ethical aspects of LA with respect to gender, type of study (informatics and non-informatics) and study year (first year and higher years of study)?
3. What are students' attitudes towards saving information about their activities and using this data for LA, respecting the type of data?

The structure of this paper is as follows: Section 2 reviews the relevant literature on LA and its ethical dimensions. Section 3 outlines the research methodology employed in the study. Section 4 presents the empirical results. Section 5 discusses the implications of the findings in relation to existing theoretical frameworks and practical considerations. Finally, Section 6 concludes the paper by summarising key insights and proposing directions for future research.

## 2. Literature Review

LA is becoming increasingly prevalent in higher education to improve learning. The following literature review highlights several key themes that have been the research focus. These include the application of analytics in different educational contexts, the role of analytics in personalising the educational experience, the perceptions and attitudes of stakeholders, and ethics, privacy, and transparency in LA. Nyland and his colleagues conducted a pilot project for the implementation of LA in a multidisciplinary program at Boise State University. The paper describes the processes of report selection, establishing communication structures, and evaluating results, with a focus on challenges such as intervention effectiveness, data security, and ethical concerns. Instructors and other stakeholders rated the pilot project positively, considering the reports provided to be useful. The results showed that interventions prompted by the reports, which students received via e-mail, had a positive impact on student success [9].

Ochoa and Wise explore the role of LA in enhancing the student learning experience. The authors emphasise the importance of ethical and effective adoption of analytics, with a student-centred approach being the key. In this context, they propose three critical shifts: Involving students in the development of analytical tools, developing transparent and adaptable tools, and empowering students to become active participants in their own learning process [10]. A survey on the perception and value of applying LA was conducted at seven public universities in New Zealand. The research aimed to investigate the role of analytics in decision-making, with participants including rectors, vice-rectors, department heads, and other decision-makers in higher education. This study indicates that different stakeholders interpret analytics differently. Some view it through structural elements such as statistics and data for improving decisions, while others see it as a functional tool for achieving goals.

Some stakeholders combine both approaches [11]. Pardo and Siemens highlight the need for clearly defined principles to ensure trust, accountability, security, and transparency in managing students' data. They also compare how other disciplines, such as medicine, have addressed similar issues and suggest applying similar principles in educational contexts to preserve privacy and ethical behaviour [12]. Semi-structured interviews were also conducted with system developers, academic advisors, and students at the University of Michigan. The research emphasises the importance of transparency and ethical design in LA systems to build stakeholder trust.

Students recognised the benefits of the system but advocated for greater involvement and control over their data [13]. Focus groups with students on the application of LA were conducted in several studies [14], [15], [16]. The results show that students view personalised feedback positively, particularly regarding its quality and task-oriented nature.

However, feedback often evokes negative emotions such as anxiety and guilt, although these emotions motivate students to put more effort into their learning [15], [17]. The research reveals that most students need to learn more about LA but recognise its potential benefits. Thematic analysis identified six key themes: student concerns about privacy, bias, and potential inequality associated with LA [14], [16].

A study on students' perceptions of privacy and their willingness for libraries to use their data for LA showed that most students have a high level of trust in libraries. However, a significant minority express concerns about potential privacy breaches [18].

The importance of involving students in the decision-making process regarding data usage and the need for an ethical approach in the development of LA is emphasised [19]. Studies also analyse LA tools to support student progress, emphasising privacy and transparency [20], [21].

### 3. Methodology

This section describes the questionnaire, participants' demographic characteristics, and the methods applied to answer research questions. The data collection was implemented by 295 students in informatics, economy, and other disciplines. The Ethical Board of the University of Zagreb Faculty of Organization and Informatics approved the research implementation and questionnaire.

#### 3.1. Participants

Participation in the survey was voluntary.

Table 1. Demographic characteristics of respondents

Variable (N=295)	Frequency	%
<b>Gender</b>		
Male	178	60.3
Female	114	38.7
Other	3	1.0
<b>Study programme</b>		
Informatics	196	66.4
Non-informatics	99	33.6
<b>Age (in years)</b>		
	$\bar{x} = 21.01$	$SD = 1.78$
<b>Study level</b>		
Undergraduate	250	84.7
1. year	123	49.2
2. year	31	12.4
3. year	96	38.4
Graduate	45	15.3
1. year	39	86.7
2. year	6	13.3
<b>Average grade during the study</b>		
2.00 – 2.49	21	7.1
2.50 – 2.99	77	26.1
3.00 – 3.49	119	40.4
3.50 – 3.99	57	19.3
4.00 – 4.49	20	6.8
4.50 – 5.00	1	0.3

Participants in this study were 295 students. According to Table 1, 60.3% of students were males, 38.7% were females, and 1% (3 out of 295) did not identify as male or female. 66.4% of students enrolled in a study programme in Informatics, and 33.6% of students did not enrol in a study programme in Informatics.

The average year of students was 21.01 years with a standard deviation of 1.78 years. 250 students were enrolled in an undergraduate study level: 49.2% (123 out of 250) in the first year, 12.4% (31 out of 250) in the second year, and 38.4% (96 out of 250) in the third year.

On the other hand, 45 students were enrolled in a graduate study level: 86.7% (39 out of 45) in the first year and 13.3% (6 out of 45) in the second year. For 40.4% of students, the average grade during the study was between 3.00 and 3.49 and for just one student, the average grade during the study was higher than 4.5. Also, 33.2% of students' average grades during the study were below 3.00, and 26.1% of students' average grades were between 3.50 and 4.49.

### 3.2. Methods

All responses were analysed using descriptive statistics (RQ1-3). Then, responses were compared by gender, year of study, and study programme using the chi-square test [22], [23] (RQ2). Two categories, male and female, were observed for the gender variable.

The variable 'year of study' was divided into two categories: the first year of undergraduate study and senior students (second and third year of undergraduate study and first and second year of graduate study).

For the statement, "Evaluate the degree of implementation of LA at your university", categories 4 and 5 are connected in one category for performing a chi-squared test because the assumption that all expected values are five or more was not satisfied.

Also, the Kruskal-Wallis test [24] was performed to compare the level of students' agreement on the saving of information about their eight different activities and the saving of this information/data for LA because the assumptions for the one-way analysis of variance (ANOVA) were not satisfied (RQ3). If there was a significant difference in the Kruskal-Wallis test, post hoc tests were done (in this case, Dunn test with multiple testing corrections; p-values adjusted with the Holm method) to find where the difference existed [25].

## 4. Results

Table 2 presents an analysis related to RQ1 and RQ3. Most of them heard about LA before (69.5% answered "No" and 30.5% answered "the students had never Yes").

Table 2. Evaluation of students' responses by gender, study type, and year of study.

Have you ever heard of learning analytics before?		
Yes: 90 (30.5%)	No: 203 (69.5%)	
Gender: <b>pv= 0.003576</b>	Study type: <b>pv= 0.0263</b>	Year of study: <b>pv=0.00469</b>
Evaluate the degree of implementation of learning analytics at your university.		
1 (low): 18 (6.1%)	2: 29 (9.8%)	3: 76 (25.8%)
4: 25 (8.5%)	5 (high): 7 (2.4%)	I can't estimate: 140 (47.5%)
Gender: <b>pv= 0.1121</b>	Study type: <b>pv= 0.03438</b>	Year of study: <b>pv= 0.3941</b>
Do you find collecting data about student behaviour through learning analytics useful for improving the educational experience?		
Yes: 156 (52.9%)	No: 28 (9.5%)	I'm not sure: 111 (37.6%)
Gender: <b>pv= 0.7372</b>	Study type: <b>pv= 0.4614</b>	Year of study: <b>pv= 0.7658</b>
How concerned are you about privacy when using learning analytics since analytics requires collecting large amounts of personal data?		
Not at all: 106 (35.9%)	Moderately: 132 (44.8%)	Very: 57 (19.3%)
Gender: <b>pv= 0.06471</b>	Study type: <b>pv= 0.5473</b>	Year of study: <b>pv= 0.8698</b>
Do you think that students should be informed about the collection and use of their data in learning analytics?		
No, it is not necessary: 16 (5.4%)	Only in certain situations: 53 (18%)	Yes, always: 226 (76.6%)
Gender: <b>pv= 0.7723</b>	Study type: <b>pv= 0.1365</b>	Year of study: <b>pv= 0.0573</b>
What types of data collected through learning analytics do you consider most sensitive?		
Demographic data: 80 (27.1%)	Academic data: 77 (26.1%)	Activity on LMS: 138 (46.8%)
Gender: <b>pv= 0.05982</b>	Study type: <b>pv= 0.5668</b>	Year of study: <b>pv= 0.07286</b>
Would you be comfortable accessing learning analytics that collects data regarding your activities on the LMS?		
Uncomfortable: 105(35.6%)	Partially comfortable: 140 (47.5%)	Yes, completely comfortable: 50 (16.9%)
Gender: <b>pv= 0.8664</b>	Study type: <b>pv= 0.135</b>	Year of study: <b>pv= 0.5835</b>
Do you think that learning analytics should be regulated by rules and guidelines?		
No: 15 (5.1%)	Maybe: 109 (36.9%)	Yes: 171 (58%)
Gender: <b>pv= 0.6075</b>	Study type: <b>pv= 0.6762</b>	Year of study: <b>pv= 0.3103</b>
Do you think learning analytics should be used to evaluate individual students?		
Yes: 40 (13.6%)	No: 48 (16.3%)	Only if students give their consent: 207 (70.2%)
Gender: <b>pv= 0.07778</b>	Study type: <b>pv= 0.583</b>	Year of study: <b>pv= 0.9084</b>
In your opinion, is learning analytics important for adapting teaching methods to the individual needs of students?		
Not important: 31 (10.5%)	Partially important: 170 (57.6%)	Very important: 94 (31.9%)
Gender: <b>pv= 0.5278</b>	Study type: <b>pv= 0.6438</b>	Year of study: <b>pv= 0.5056</b>
Do you think learning analytics should be used to make decisions about student progression?		
No: 59 (20%)	Only if it is used in combination with other factors: 164 (55.6%)	Yes: 72 (24.4%)
Gender: <b>pv= 0.2104</b>	Study type: <b>pv= 0.5439</b>	Year of study: <b>pv= 0.9447</b>
How familiar are you with the legal and regulatory framework related to learning analytics?		
Not familiar: 193 (65.4%)	Partially familiar: 91 (30.8%)	Completely familiar: 11 (3.7%)
Gender: <b>pv= 0.06886</b>	Study type: <b>pv= 0.1706</b>	Year of study: <b>pv= 0.6072</b>
Do you think learning analytics should be used to personalize educational content?		
No: 44 (14.9%)	Partially: 155 (52.5%)	Yes: 96 (32.6%)
Gender: <b>pv= 0.4351</b>	Study type: <b>pv= 0.2936</b>	Year of study: <b>pv= 0.71</b>
What is your level of confidence about the responsible and secure utilization of data collected by learning analytics?		
1 (low): 65 (22%)	2: 178 (60.3%)	3 (high): 52 (17.6%)
Gender: <b>pv= 0.3285</b>	Study type: <b>pv= 0.1013</b>	Year of study: <b>pv= 0.4525</b>
Do you think that learning analytics could lead to an overemphasis on quantitative data instead of qualitative aspects of education?		
Yes: 93 (31.5%)	No: 81 (27.5%)	Don't know: 121 (41%)
Gender: <b>pv= 0.2439</b>	Study type: <b>pv= 0.6908</b>	Year of study: <b>pv= 0.5881</b>
Would you like to have the right to determine what information about you may be shared?		
Yes: 266 (90.2%)	No: 29 (9.8%)	
Gender: <b>pv= 1</b>	Study type: <b>pv= 0.01691</b>	Year of study: <b>pv= 0.304</b>

Hearing about LA also revealed a statistically significant difference in gender, study programme, and study year. 40% of females had heard of LA, and 25% of men had.

Also, 21% of students in the first year of undergraduate study had heard of LA and 37% of students in other years (senior students).

According to the study programme, 26% of informatics and 39% of non-informatics students heard of LA. As the results showed, senior students are expected to know more about LA than first-year students. It was also expected that informatics students would know more about LA than non-informatics students, but that prediction was wrong.

Almost half of students (47.5%) are not able to evaluate the degree of implementation of LA at their university, and if they are able, they evaluate the implementation of LA with 3 (25.8%) on a scale from 1 to 5. There was a statistical difference between informatics and non-informatics students in the ability to evaluate the degree of implementation of LA at their university, although most informatics and non-informatics students evaluate the degree of implementation with 3 (23% of informatics and 31% of non-informatics).

More than half of students (52.9%) find collecting data about student behaviour through LA useful for improving the educational experience, 37.6% are not sure, and 9.5% of students do not find it useful. There was no statistical difference by gender, type of study or year of study for this variable.

Students are moderately (44.8%) or not (35.9%) concerned about privacy when using LA. These answers were a surprise because it was expected that students, especially informatics students, would be more concerned about privacy. Although the level of concern was not statistically significant by gender, additional analysis showed that female students are more concerned than male students.

Also, 76.6% of students think that they should always be informed about the collection and use of their data in LA, 18% of them think that they should be informed in certain situations, and just 5.4% of them think that it is not necessary. Additionally, 80.4% of first-year students and 73.8% of senior students think they should always be informed about the collection and use of their data in LA. On the other hand, 22.1% of senior students and 12.2% of first-year students think that they should be informed in certain situations.

The activity of LMS is considered the most sensitive data collected through LA (46.8%). 27.1% of students think that demographic data is the most sensitive data, and 26.1% of students think that, but for academic data. First-year students (54.5%) and males (52.8%) are more sensitive about collecting data through their activity on LMS than senior students (41.3%) and females (38.6%).

Students are partially (47.5%) or not comfortable (35.6%) with accessing LA on data collected regarding their activities on the LMS.

Most of the students think that LA should be regulated by rules and guidelines (58%), and just 5.1% of them do not think that it is necessary.

Students think that LA should be used to evaluate individual students only if students give their consent (70.2%). Additionally, 72.5% of male students and 66.7% of female students think that students need to give their consent, and 17.4% of male students and 14% of female students think that LA should not be used for the evaluation of students.

More than half of students (57.6%) considered LA partially important for adapting teaching methods to the individual needs of students, 31.9% of them considered it very important, and 10.5% of them then considered it not important at all.

A similar percentage of students (55.6%) agree that LA should be used to make decisions about student progression only if it is combined with other factors.

Most of the students (65.4%) are not familiar with the legal and regulatory framework related to LA, 30.8% are partially familiar, and just 3.7% of students are completely familiar with the legal and regulatory framework related to LA. Male students are less familiar with the legal and regulatory framework related to LA than female students (70.8% of males and 57.9% of females answered not familiar).

Also, they partially (52.5%) or completely (32.6%) agree that LA should be used to personalise educational content. Only 14.9% of students do not agree with that statement.

From one to three, in most cases, students graded their level of confidence about the responsible and secure utilisation of data collected by LA with two (60.3%).

Students are undetermined what to answer to the question: "Do you think that LA could lead to an overemphasis on quantitative data instead of qualitative aspects of education?" 41% of them answered, "I do not know.", 31.5% answered "Yes", and 27.5% said "No".

Almost all students (90.2%) would like to have the right to determine what information about them may be shared. There was a statistically significant difference between informatics and non-informatics students. 93.3% of informatics and 83.8% of non-informatics students would like to have the right to determine what information will be shared.

Table 3 and Figure 1 contain the analysis related to the RQ3. On a scale from 1 (strongly disagree) to 5 (strongly agree), students usually evaluate their agreement with carrying information about logs of all their activities within the learning management system (Elf, Merlin, Moodle, etc.) with 2 (23.4%), then with 3 (22.7%), equally with 1 and 4 (20.3%), and just 13.2% with 5.

Table 3. Descriptive statistics for the level of students' agreement on the saving the information about their activities and the utilization of this data for LA

Strongly Disagree (1)	2	3	4	Strongly Agree (5)	Mean	SD
<b>D1:</b> Logs of all your activities within the learning management system (Elf, Merlin, Moodle, etc.).						
60 (20.3%)	69 (23.4%)	67 (22.7%)	60 (20.3%)	39 (13.2%)	2.827	1.497
<b>D2:</b> Logs of all your activities in other electronic systems (foi.nastava, foi.events, intranet, etc.)						
93 (31.5%)	68 (23.1%)	77 (26.1%)	40 (13.6%)	17 (5.8%)	2.39	1.353
<b>D3:</b> Logs of all activity on your computer during the exam for which you were required to bring own device.						
117 (39.7%)	54 (18.3%)	69 (23.4%)	33 (11.2%)	22 (7.5%)	2.285	1.412
<b>D4:</b> The content of your email messages.						
185 (62.7%)	30 (10.2%)	56 (19.0%)	16 (5.4%)	8 (2.7%)	1.753	1.069
<b>D5:</b> History of Internet browsing when your PC was connected to the university network.						
179 (60.7%)	34 (11.5%)	57 (19.3%)	14 (4.7%)	11 (3.7%)	1.793	1.109
<b>D6:</b> An overview of your activity on university-owned computers.						
88 (29.8%)	44 (14.9%)	78 (26.4%)	48 (16.3%)	37 (12.5%)	2.668	1.548
<b>D7:</b> Audio-visual recordings from cameras positioned in classrooms.						
128 (43.4%)	50 (16.9%)	75 (25.4%)	27 (9.2%)	15 (5.1%)	2.156	1.315
<b>D8:</b> Audio-visual recordings from cameras positioned at the university.						
121 (41.0%)	49 (16.6%)	72 (24.4%)	38 (12.9%)	15 (5.1%)	2.244	1.368

The average level of agreement is 2.827, with a standard deviation of 1.497. 31.5% of students strongly disagree with collecting information about logs of all their activities in other electronic systems, and just 5.8% strongly agree with that statement.

The average level of agreement is, in this case, a little bit lower, at 2.39, with a standard deviation of 1.353.

The average level of agreement is 2.285 when collecting data about logs of all activities on their computers during the exam for which they were required to bring their own device because most of the students evaluate their level of agreement with grades 1 (39.7%), 2 (18.3%) or 3 (23.4%).

Most of the students disagree with collecting data about the content of their e-mail messages (62.7%) and the history of Internet browsing when they connect their PCs to the university networks (60.7%). This is the reason why the average level of agreement is so low (1.753 for content of e-mail messages and 1.793 for history of internet browsing). However, the average level of agreement when data are collected according to activity on a university-owned computer is higher and it counts at 2.669 with a standard deviation of 1.548.

Students similarly evaluate their level of agreement with collecting data from audio-visual recordings from cameras positioned in classrooms or at the university. That is the reason why average level of agreement is also similar (2.156 for audio-visual recordings from cameras positioned in classrooms and 2.244 for recordings from cameras at the university).

In Figure 1, it can be seen that, on average, students agree the most with carrying information about logs of all their activities within the learning management system. Hence, the level of agreement is not statistically significantly different, only from carrying information about students' history of Internet browsing when they connect their PCs to the university networks.

The average level of students' agreement with the collection of logs from their activities in other electronic systems and all PC activity (when using their own device during an exam) differs statistically. This differs significantly from their agreement with the collection of data about the content of their email messages. It also differs from their agreement to collect data on the history of internet browsing when connected to the university network using their own computers. As mentioned before, students similarly evaluated the level of agreement with collecting the content of e-mail messages and the history of internet browsing when the PC was connected to the university network. That is the reason why those two statements statistically significantly differ from collecting data about all activities on university-owned computers as well as audio-visual recordings from cameras positioned in classrooms and at the university. Also, the average level of agreement with collecting data about all activities on university-owned computers statistically significantly differs with the collecting data about all activities on the PC (students need to bring their own device) during the exam as well as with the collecting information about audio-visual recordings from cameras positioned in classrooms and at the university.

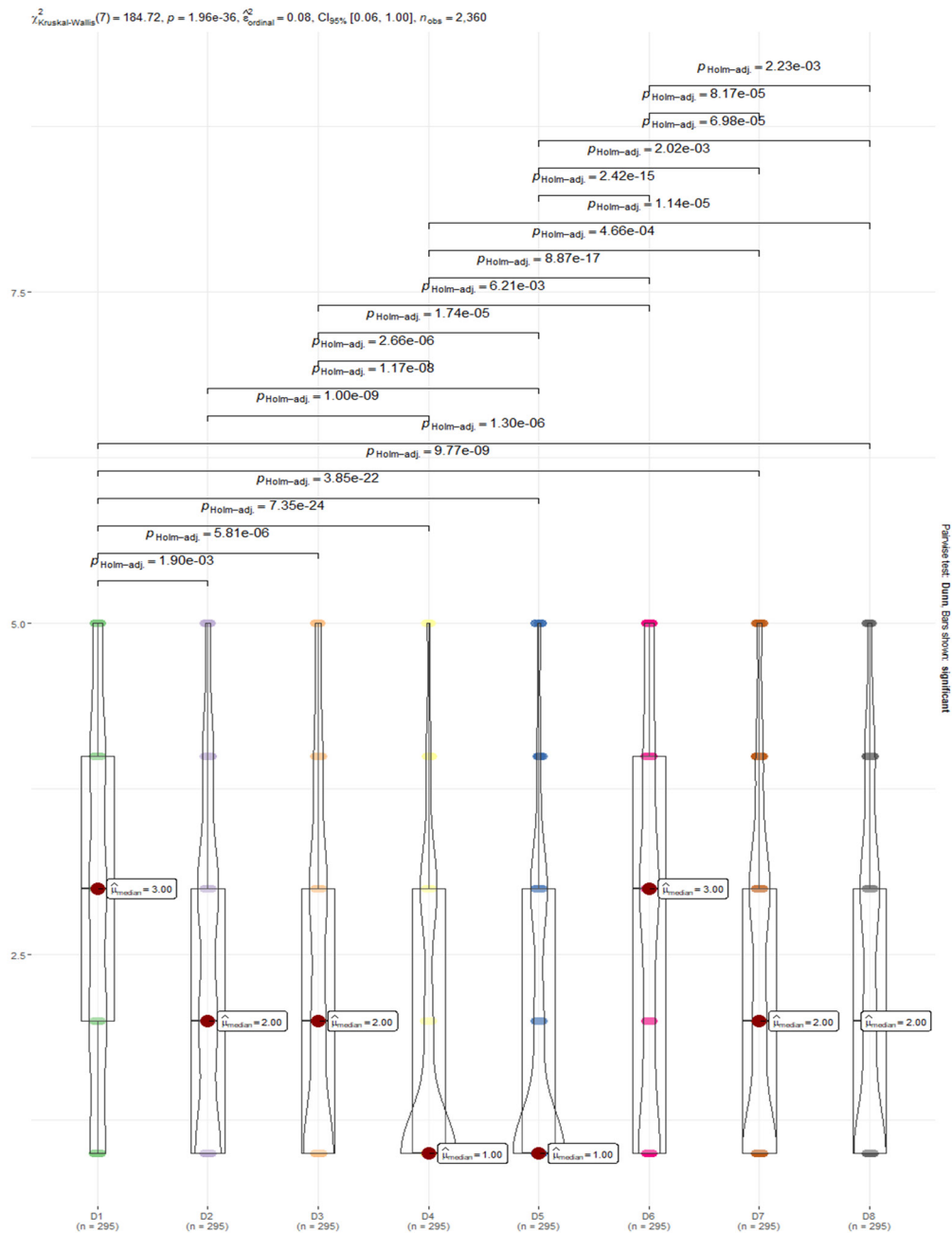


Figure 1. Boxplots for comparison of the level of students' agreement on the retention of information about their eight different activities

## 5. Discussion

In this study, three research questions are set up, and the summarized answers are presented as follows.

*What are the students' attitudes towards general ethical aspects of LA?*

The investigated aspects include data privacy, students' informed consent for data collection, the sensitivity of various types of student data, compliance with legal and regulatory frameworks, the justifiable purposes for utilising collected data, personalisation of the educational process based on LA insights, and students' confidence in HEIs to handle their data responsibly.

Generally, it can be said that the majority of the students were not familiar with the term LA (almost 70%). However, after the definition of LA together with the examples that were presented to the students as part of the questionnaire, it can be concluded that students understood the ideas behind LA and could identify concrete examples from their learning experience. However, they were not aware that the term for those ideas is LA. On a scale of 1 (low) to 5 (high), students evaluated their universities' LA implementation with an average grade of 2,83. Students mostly find LA useful for improving the educational experience. They are moderately concerned about their privacy during the LA process.



Consequently, they are partially comfortable with using the systems that save their data. Most research participants believe that they should be informed about the collection and use of their data and the data they generate in different (learning) systems. Most students think that LA should be regulated by rules and guidelines, even though they are not familiar with the existing regulatory framework related to LA. Students believe that LA should be used for personalised educational content but think that LA is only partly important for adapting teaching methods to individual needs. Furthermore, they want to keep the right to give consent if collected data are planned to be used to evaluate them as individuals. Their confidence related to the responsible usage of the stored data is mostly medium. A vastmajority of them would like to have the right to determine what information can be shared further.

*Are there statistically significant differences among students' attitudes towards general ethical aspects of LA with respect to gender, type of study (informatics and non-informatics), and study year (first year and higher years of study)?*

The research identified some significant differences. The most interesting differences considering gender are related to concerns about privacy in LA, using the LA for individuals' evaluation, the most sensitive systems, and familiarity with the legal framework. Female students are generally more careful, so consequently, they are more concerned about privacy and more familiar with the legal framework. The most interesting differences considering the study type are related to the level of LA implementation at their universities and the right to determine what personal data can be shared. This is possible because informatics programs have a higher level of LA implementation, and informatics students are better familiar with the value of their data. The most interesting difference, considering the year of study, is related to the informed consent about data collection and usage. First-year students are still not aware enough of how their data are stored and what the potential of their use is, and consequently are more careful.

*What are students' attitudes towards saving information about their activities and using this data for LA, respecting the type of data?*

Students could evaluate eight types of data that can be stored and further used for LA purposes. On average, students have a neutral attitude towards collecting data by learning management systems and logs stored on university-owned computers. Also, they have a negative attitude towards storing the data on the other six sources.

The highest disagreement with storing the data is related to the content of e-mail messages and the history of Internet browsing on a personal PC connected to the university network.

All things considered, it can be summarized that students welcome LA but are very careful. Overall, while students are receptive to LA, they approach it cautiously. This article enhances the understanding of students' views on the ethical aspects of LA, emphasizing data privacy, student consent for data collection, and regulatory measures. The connection regarding the knowledge of the terminology and meaning of LA can be drawn from earlier research, which identified this result as one of six critical themes through thematic analysis of the focus group transcripts [16]. Students' perception of the importance of incorporating LA for personalized learning support has been recognized [10], [15], [21]. The results highlight the importance of introducing procedures and regulations for managing LA [21]. Deviations from previous studies can be observed in the segment related to concerns about privacy when using LA [12], [19]. The findings align with previous research but highlight unique differences, especially in privacy-related areas and the necessity for regulations. Limitations of this study include its anonymous, voluntary nature, which could introduce bias, and the use of a convenience sample, impacting the generalizability of the results. Future studies should track changes in student attitudes over time, broaden the research to include perspectives from other stakeholders and evaluate the impact of personalized feedback.

## 6. Conclusion

The research results show similarities but also certain deviations compared to previous studies on students' perceptions of LA.

This study also has several limitations that should be considered for future research. The research was anonymous and voluntary, so comparing the survey results with individual student performance was impossible. This could lead to bias, as students may have exaggerated or diminished their perceptions of LA or constructed positive responses because they believed that was expected of them. The study included a convenience sample of students, which may limit the generalization of the results to a broader student population and field. Their perception and participation in the research may be influenced by a need for more knowledge about the legal regulations related to LA.

Looking ahead, it is crucial to consider a longitudinal study to track changes in students' attitudes towards LA. Moreover, it is recommended that the research be broadened to include other stakeholders such as teachers, faculty administration, and IT staff. This will provide a more comprehensive understanding of LA's impact. Additionally, future research should focus on analyzing the effectiveness of personalized feedback provided to students, as this is a key aspect of LA that has not been extensively studied.

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