

Perceptions of Brazilian College Students About Ethics in Computer-Based Data Collection and Interventions for Mental Health

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1 Introduction

The World Health Organization defines mental health as *"...a state of well-being in which an individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and is able to make a contribution to his or her community..."* [1]. According to Auerbach et al. in 2016, 20.3% of college students worldwide exhibited symptoms of mental health conditions under DSM-IV¹/CIDI² categorization, during a consecutive period of 12 months [2].

In Brazilian universities, the indicators are particularly alarming. According to a 2020 study carried out by Brazilian researchers, college students in Brazil have an average **CMD**³ rate of 58.1% [3]. This study found out that the majority of the interviewed identified themselves as feminine, ethnically

¹Diagnostic and Statistical Manual of Mental Disorders

²Composite International Diagnostic Interview

³Common Mental Disorder

Afro-Brazilian, belonging to the lowest income shares (C, D and E socioeconomic classes⁴), non-heterosexual⁵ and who declared not to have any religious or spiritual beliefs.

Based on this context, the **AMIVE**⁶ project proposes a **HCI**⁷ model to aid in proactively assisting college students. The project proposes methods to identify those who have been exhibiting concerning signals of mental strain, and then proposes interventions (automated, human-driven, or even a combination of both). It has been conceived in an effort to help mitigate the growing effects of mental strain on young people, in particular, the aforementioned Brazilian higher education scholars.

Despite the fact that the science produced by **AMIVE**'s researchers is financed through state funded research grants (which gives us reasonable evidence to assume that the interests driving this project are aligned with those of the public), and also considering the high ethical standards that are required by Brazilian universities and research institutes⁸, there was still a need for further investigation on how **HCI** health interventions were perceived in terms of their ethical implications and public opinion.

This was not solely due to the fact that Brazil's higher education students are the target population of this project, but also because of the inherent extra cautiousness that is necessary in managing and treating the data that is needed for the conception of these technologies (which are highly sensitive by definition). The investigation carried out on this work also considers the fact that similar solutions aren't largely used nor known by the general Brazilian public, and, furthermore, takes into account Brazil's specific material and socio-cultural aspects, which could also influence the project's overall results in comparison with studies carried out in different nations [5].

In an effort to deepen our comprehension of the general public's perception about the underlying research themes, it is important to consider Brazil's current worrying political scenario and recent growth in anti-democratic tendencies and authoritarian shifts [6]. This context is directly associated with the adoption of Brazil's new Law for data governance and protection (LGPD⁹) and how these developments are related to social media use and its contribution to the establishment of material conditions for an advancement towards a State of Vigilance¹⁰.

Since these themes are all interconnected [8] and affect the way in which individuals perceive themselves and the society that surrounds them, civil

⁴The criteria used to define socioeconomic classes in Brazil can be found on this article [4]

⁵Researchers have found a special association between masculine identity, sexual orientation and **CMD** score), indicating that sexual behavior or gender identity could be a key aspect for interviewees on this specific group

⁶AMIVE is a portuguese acronym for **AMiGo Virtual Especializado**, which stands for Specialized Virtual Friend, in English. A link to the website of the project can be found [here](#)

⁷Human-Computer Interaction

⁸A page with some of the Brazilian laws regarding ethics in research can be found [on the website for the committee of ethics in research](#)

⁹LGPD, acronym for Lei Geral de Proteção de Dados, it's the Brazilian equivalent of EU's GDPR and California's CCPA

¹⁰Some authors have begun to name the new global economical paradigm developed around data exploitation surveillance capitalism [7])

liberties, human rights and ethical pondering become key factors, that should also be investigated, in order to allow a holistic comprehension of both the project's impact and the manner in which the public will use it.

Afterwards we will present a short view on ethics in Computer Science applied to Mental Health, our study methodology and how we collected the data that is presented here, followed by an analysis of the results of this investigation process and how we can relate them to previous materials found on the literature. Discussions will be proposed based on these results.

2 Ethics in Computer Science Applied in a Mental Health Context

The encyclopedia Britannica defines ethics as a field of study, whose subject: *"consists of the fundamental issues of practical decision making, and its major concerns include the nature of ultimate value and the standards by which human actions can be judged right or wrong."*[9]. But this definition is, as it is the objective of encyclopedias, a synthesis of an entire field of study.

Studies on the *hard sciences* are usually conducted in ways that are diametrically opposite to that of other fields. This is partially due to the epistemological history of these areas, whose advances, interests and funding are usually directed towards productivity and capital increase, which is essential to the advancement of technology [10]. This dynamic gives rise to a recurring problem, usually Cartesian sciences and technology are produced and delivered much faster as opposed to the product of other sciences, which leaves a gap on the exploration and understanding of how they might impact society. However, technology does not function as a purely "apolitical" field, as some would argue, but is produced, funded and executed to serve economical and political interests. Thus, it is a political instrument by its very nature, since politics is, by definition, the study of power dynamics. [11].

This becomes an even more problematic situation as technology becomes highly specialized, because it tends to accumulate a great deal of power (exerted through its implementation in society) on the hands of few people. This degree of specialization also makes interdisciplinary studies quite difficult, since specialists speak almost different languages and thus have a difficulty in discussing ideas with scientists of different areas (imagine a debate between a quantum physicist and a historian). This fact is one of the reasons why ethics is central on the analysis of the potentials of technologies, it enables discussion and understanding between different areas, and also encourages researches to ponder on unforeseen scenarios and situations that they would not be able to conceive amongst their area peers. In short, when we talk about digital technologies and the analysis of the socio-political implications of their applications, there is a gap where ethics fits in perfectly [12].

To bind together the potentialities of technological studies and the socio-political demands of our society, we turn to computer ethics for answers. James

Moor defines the field as: *"the analysis of the nature and social impact of computer technology and the corresponding formulation and justification of policies for the ethical use of such technology" ... "It includes concerns about software as well as hardware and concerns about networks connecting computers as well as computers themselves"*[13]

Late Polish philosopher Zygmunt Bauman proposed to describe our era as **Liquid Modernity**, on the homonymous book, the author states: *"...Forms of modern life may differ in quite a few respects – but what unites them all is precisely their fragility, temporariness, vulnerability and inclination to constant change..."*[14]. Communications, on college campuses and global-north idea exchange markets, take place also via digital computer devices, mostly using the world wide web as a vehicle. Therefore, Computer Ethics is the primary field of study for investigating what may be the characterizing communication medium of the 21st century [15]. Therefore the exploration of how students perceived these platforms was also something that was regarded as being necessary for the studies at hand.

2.1 Social Media

On the last three decades, the main agents that have changed humans dialectical processes operate through the use of **HCI**¹¹. Such agents mostly include digital platforms, amongst which we can separate a subset commonly known as "social media" or "social networks". As Grant Bollmer puts it: *"I suggest that "social media" should refer to, borrowing one of Raymond Williams' definitions of culture, a whole way of life in which a specific set of beliefs about behavior, normalized through connective network technology and the flow of information, comes to stand in for the social, the economic, and the biological"* [16]

The technological tools that these new media platforms dispose of differ significantly from all the previously existent technology dependant media, especially analogical media and other pre-internet platforms in the extent in which nonhuman actors, especially Artificial Intelligence (AI), mostly presented in form of content filtering and selection algorithms, play a key role in conducting the dialectical relationship between individuals and the media itself [17].

Although other media platforms such as newspapers or television also make use of nonhuman actors¹², the technologies of the 21 st century enable virtually instant connectivity and mass means of personalized content targeting, to the extent where authors begin to view these new platforms as frameworks for modeling the very fabric of our social interactions and, through the power of the platforms' modeling forces, our collective subjectivity and meaning construction process. Langlois points that: *"All the popular corporate social media platforms function along the same lines: they pattern and craft relationships*

¹¹human-computer interaction

¹²Here the printing press can be seen as the classical reference, since it revolutionized the velocity with which information could be reproduced and distributed

among disparate actors, they order a specific world within which users can exist and they define a horizon and rules of meaningfulness” [18].

The usual narrative that permeates the industry’s public discourse is that they are mere *enablers* that redistribute information and facilitate intercommunication between human actors, and thus serve as mere mediums through which information flows (pretty much like a telephone line or a mail system). However this perspective fails to acknowledge the fact that social media platforms are *companies*, whose interests are first and foremost the increase in stock price and accumulation of economical capital. The material relations which define this context, give birth to an even more delicate problem, they are optimized by IA to maximize metrics which are skewed towards the goal of further increasing user engagement and, in some cases, pathological addiction to said platforms and other problems that derive from the reprogramming of our neurological pathways.

This fact alone poses an immense ethical concern, especially when considering that this power is accumulated on the hands of private companies whose interests may be in direct conflict with those of our society as a whole. Given the amount of influence these platforms have on our daily lives¹³, it should not be a surprise that their misuse may lead to, for instance, serious influence on people’s opinions about almost any theme (who is the best president among all candidates in an election, for instance)

2.2 Biases and other influences

In literature, we find some examples of technologies that propose solutions analogous to the framework proposed by **AMIVE**, mostly using web-based interventions, some accompanied by human intervention and some even using a mobile application.

There are meta-analysis that tend to corroborate the idea that a computer-based solution may in fact be effective in mitigating the onset of mental illness in college students. A systematic review of 89 studies, concluded that: *“...digital mental health interventions can be effective for improving depression, anxiety, and psychological well-being among college students, but more rigorous studies are needed to ascertain the effective elements of these interventions. Continued research on improving the user experience of, and thus user engagement with, these programs appears vital for the sustainable implementation of digital mental health interventions on college campuses...” [5].* Davies et. al. states in a meta analysis of 17 trials that: *“The findings suggest Web-based and computer-delivered interventions can be effective in improving students’ depression, anxiety, and stress outcomes when compared to inactive controls, but some caution is needed when compared to other trial arms and methodological issues were noticeable. Interventions need to be trialed on more heterogeneous student samples” [20]*

Although the meta analyses seem to be consensual on the fact that the reviewed studies’ results indicate that HCI techniques show improvement in

¹³(Facebook alone has a pool of 2.7 monthly active users (MAU) as of 2020 [19])

patients suffering from mental health conditions, they also conclude that there is a moderate to high risk of bias in these studies. Lattie et al states: *"The moderate-to-severe risk of bias found in many of the included randomized and nonrandomized trials indicates that the results reported may be biased in favor of the digital mental health tools and should be evaluated in that context. Bias primarily emerged because the outcomes were self-reported in nature and the participants were aware of the intervention they received, 2 issues that are exceedingly common in digital health research."*, they go on to conclude: *"Without the gold standard interventions in digital health for college students that could serve as comparisons with newly developed interventions, several studies that were reviewed used active controls or comparison interventions that produced similar effects to the intervention of interest. In addition, none of the included studies utilized non-inferiority analyses. Therefore, the true efficacy of most of the interventions was unclear."*[5]. There were also biases regarding the student sample itself, as it is consistent among reviews that the studied populations are very similar in regards to ethnicity and social status.¹⁴

During a deeper exploration of the existing literature on the subject, studies were found suggesting that some groups of students to whom these interventions would be more valuable (students with lower offline social support, for instance) are also usually the ones that would be more reluctant to use these resources or even would have more difficulties to learn about their existence on the first place. Ruppel et al states that: *"These patterns are potentially problematic for individuals who have little social support because they might have a limited view of what resources are available to them and be less likely to take advantage of OMHR when necessary. The positive bivariate correlation between perceived usefulness of Web sites and previous use of those Web sites supports this possibility. Given that previous research finds that people with high social anxiety or low offline social support are particularly likely to benefit from receiving online social support, these findings suggest that finding ways to improve the perceived usefulness of OSGs to people with low social support and high social anxiety might help such people better cope with mental health issues"*[21].

Another interesting angle of approach, to understand the predominance of seemingly biased studies, is to focus on a gap on the investigation of socio-political factors that permeate these researches, and the ethical questions that follow these considerations. There seems to be an accumulation of researches on the medical, technical and functional implications of the technologies, while the political and societal facades are often forgotten or cast aside *en lieu* of metric evaluation and result-oriented research. As the aforementioned applications are designed for the treatment of people and an improvement in their quality of life, researchers are often lead to think that these solutions are inherently beneficial, because of their purpose, which sometimes leads to an

¹⁴The sample is mainly constituted of white, nationally endogenous middle-class individuals, who are usually the groups with the lowest rates of incidence of mental health conditions, and also the highest chance of having access to these treatments, especially in countries where these researches have been conducted

unconscious bias as to their usefulness and utility. When structural and structuring socio-political forces are sometimes not even taken into consideration.¹⁵ Also, regarding private research funding, sometimes there is an under evaluation on how these technologies may be exploited overlooking society's best interests, and the general concerns that arise from a critically oriented ethical investigation. This led, for instance, to the **Cambridge Analytica** case, in which the homonymous company gained access to restricted psychometric data through a joint-research program with research institutions [22].

3 Asking Brazilian college students about ethics in computer-based data collection and interventions for mental health

In order to better understand the perceptions that Brazilian students in particular have about the previously discussed themes, a public opinion survey was designed to comprehend how the different factors exposed in previous sections of this work might affect Brazilian scholars' perceptions about the topic as a whole. From student's collective imaginary to their specific opinions about technological aspects that might be present on the project, and how they would perceive the implementation of this technology and the uses that might come from the application of the methods described above.

This is particularly relevant on the context of mental health applications as previous studies and meta-analysis have pointed out the specific necessity for this development. To further assure the methodological rigor necessary for a work that proposes to understand ethical perceptions, a deep social, political and philosophical investigation was also carried out in order to aid in comprehending the results obtained from the survey and what the subject's opinion might or might not mean.

3.1 Elaborating the questions

The first step was to come up with a set of questions that would help in clarifying some of the possible perceptions surrounding the theme, both from student's opinion on the theme of ethics itself, and also from their opinions on the use of such technologies and the assessment of the possibilities that could arise from specific use cases. This directly dialogues with the theory of discourse ethics [23], in which ethical value can be extracted from the very act of dialogue and conversation between individuals, which presumes projection and moral pondering from multiple parties, and can thus serve as a mean to establish a consensus on the moral grounds in which to act. We also borrowed Kropotkin's contributions to the theme, particularly the notion that ethics is

¹⁵We can exemplify this scenario by theorizing that students have a higher prevalence of mental illnesses because of how our society views knowledge as a commodity, and how our economical interests frequently oppose those of individuals and societies, or maybe even because they have a limited perspective on their future, given the increasingly alarming signals of man induced natural catastrophes

humanity's attempt to establish a common societal ground, from a Darwinist perspective. "*Do unto others as you would have them do unto you*"[24]

In this sense, the proposal of practical scenarios is an attempt to use the projection capabilities of students, through the act of empathy, in order to comprehend their views and their perceptions of both the ethical questions surrounding data collection and governance (as presented on the first part of the questionnaire ¹⁶).

The general structure of the questionnaire can be described as follows: socio-demographic data, technology use, privacy and use of digital data, factors that affect mental health, strategies to preserve mental health, and 3 scenarios to be judged according to the utility of technology, willingness to use it and ethics. It is important to mention that this research was categorized as collecting public opinion, according to resolution 510 of the Brazilian National Research Council. Therefore, we only collected data that could not lead to identifying a person.

4 Results

The results of our survey can help us to get a glimpse on the overall perception in regard to computer-aided mental health solutions of the average Brazilian college student.

4.1 Statistical confidence and margin of error

Firstly we can compare the demographic characteristics of our sample with official government census data to analyze the degree of similarity with corresponding variables on the general population:

We note that the reference data from INEP ¹⁷ amounts to a population of $N = 11.340.346$ students given the same geographical regions we got answers for in our study, in which the sample size adds up to $n = 160$ ¹⁸. Based on this data, we estimated that for a population whose total size is N , assuming a normal distribution curve, we assume an $\epsilon = 8\%$ error margin with a confidence level of 90%.

4.1.1 Sample's characteristics

Below we display pie charts representing the proportion of our sample regarding 3 distinct aspects, Gender Identity, Age and Area of Knowledge (originally we had asked for participant's CNPQ's ¹⁹ knowledge area course classification, then we proceeded to combine the different areas into three major categories). These categories were then used to analyse how the answers change amongst

¹⁶For the full reproduction of the questions see Appendix A

¹⁷INEP stands for national institute of studies and educational research. [The official government site can be accessed here](#)

¹⁸See figure 4 for more demographics data

¹⁹Acronym for [National Centre for Research](#)

the population. In the following subsections, these same divisions (Age, Gender Identity and Area of study) will be used to compare how the answers to the survey change relating to each of these subgroups.

Generally speaking, our sample is mainly composed of people who identify themselves as woman(86), people aged between 21 to 23 years (56) and whose area of study consists mainly of people studying hard sciences (108). Unfortunately, during our analysis, we decided to not consider answers from people with Non-Binary identities and those aged up to 18 years , as these individuals only represented 2.5% and 0.6% of the total sample, respectively, and therefore whose answers could be considered as anecdotal evidence as opposed to statistically significant data.

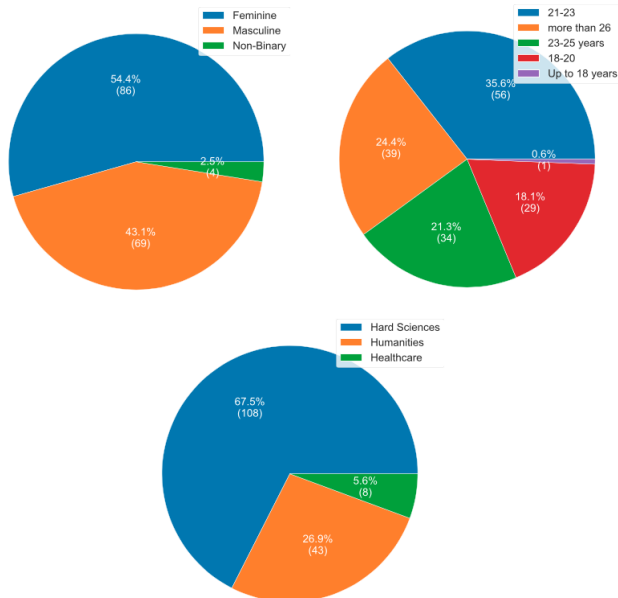


Fig. 1 Demographic characterization of survey participants

4.2 Sample features correlation

As a first step, a data analysis was conducted using popular data science approaches assisted by the python3 programming language in it's popular Anaconda distribution. We also used the software Jupyterlab and the Pandas and pandas_profiling APIs ²⁰.

²⁰These applications are mainly used for machine learning and data processing. We leveraged their easiness of use for processing data in batches and graph generation in order to observe the statistical significance that could be extracted from the gathered data

With these tools a two-dimensional correlation matrix was built, using the $\phi(k)$ [25] index. Allowing the visualisation of high-level relationships between variables that could have statistically significant meaning ²¹

Although not all of the variables used were binomial, the process of analysing the correlation matrix generated was still useful because it allowed us to get a top-level vision into some of the correlations that could be extracted.

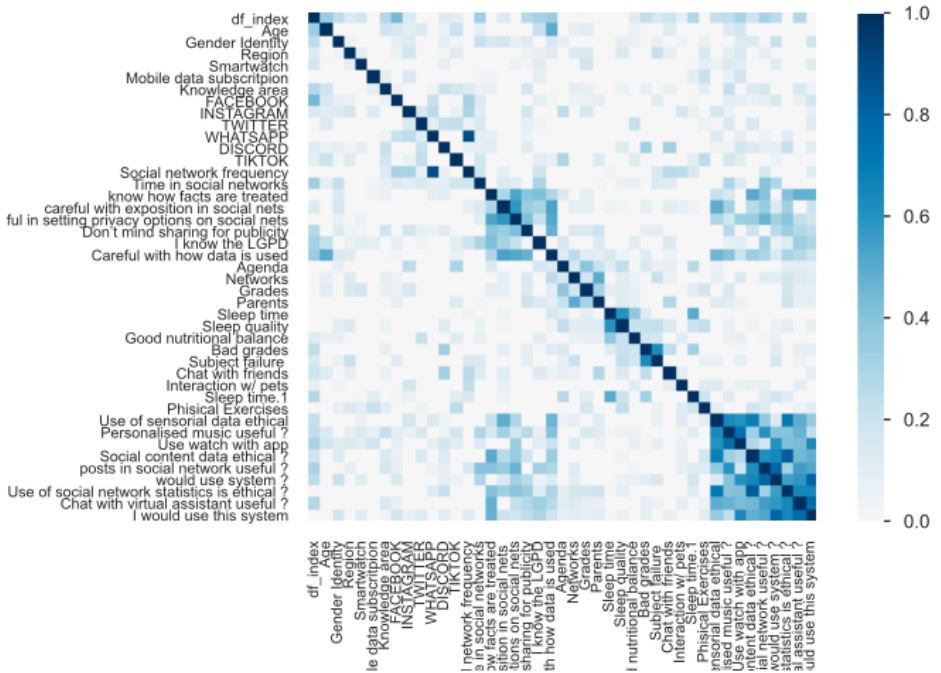


Fig. 2 Phi(k) correlation matrix for survey answers

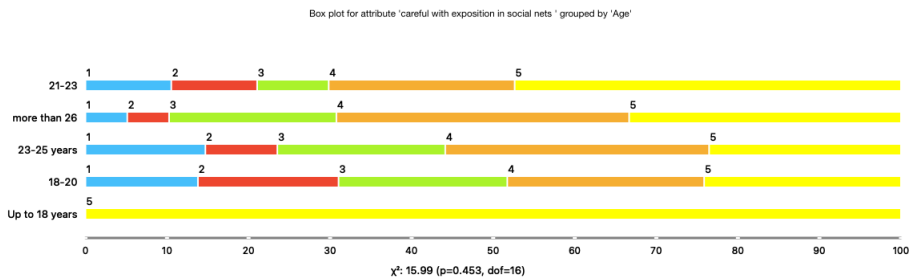
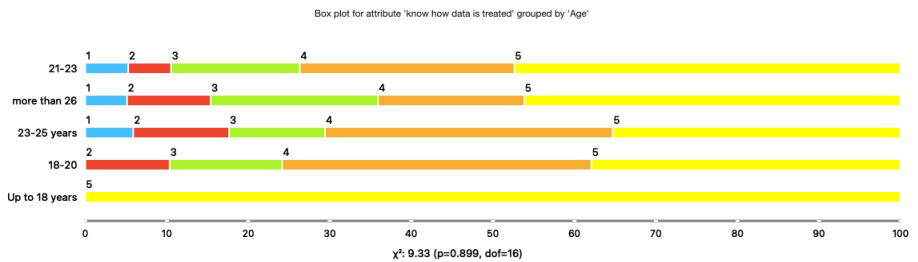
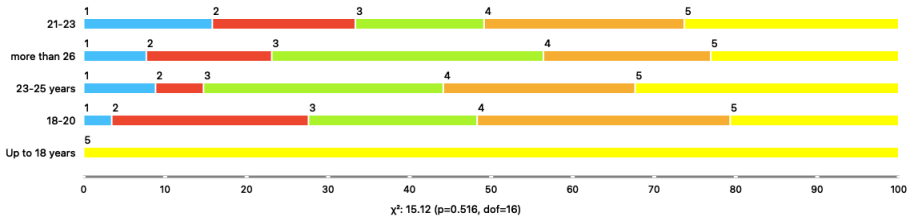
4.3 Perceptions about data privacy

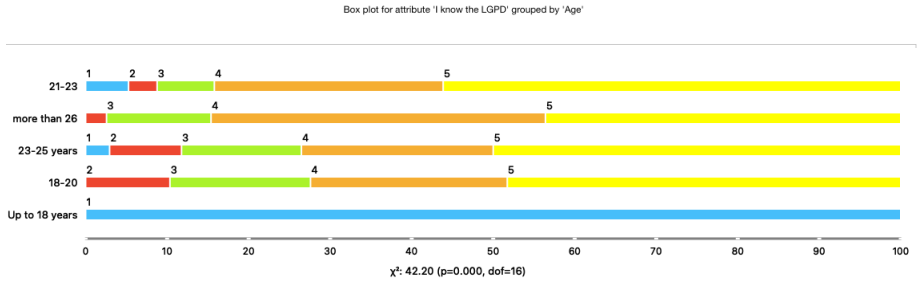
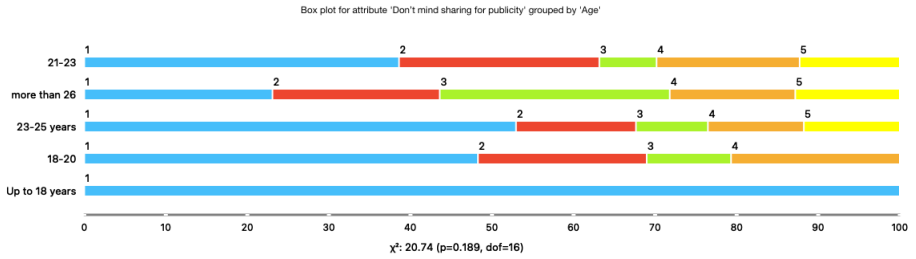
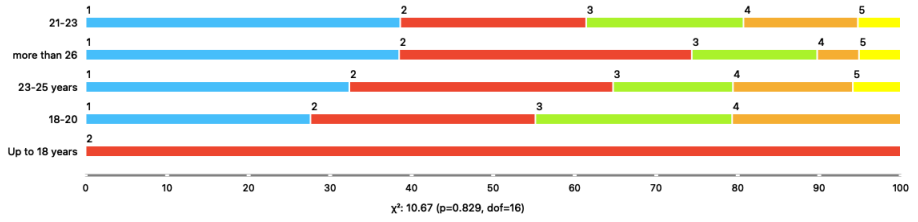
A section of the survey was dedicated to analyse the perceptions of our subjects regarding data privacy and governance. The methodology used was the exhibition of a series of statements to the participants, after reading each statement the subject had to choose between one out of five circular selection elements, followed by a short phrase that represented perceptions about the above statement. The phrases represented a 5 point Likert scale, with the labels "Strongly Disagree, Disagree, Indifferent, Agree, Strongly Agree". Following we have compiled the results and grouped answers by subject's Age, Gender Identity and Knowledge Area. The graphics display the proportion of participants from the total in each category that chose each statement, with

²¹see figure 4

each line representing a subgroup of the sample and where the colors represent the cardinal value, with blue, red, green, orange and yellow representing Likert's score from 1 to 5 respectively.

4.3.1 Age vs Perceptions about data privacy

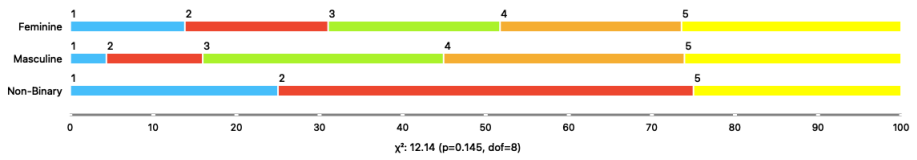




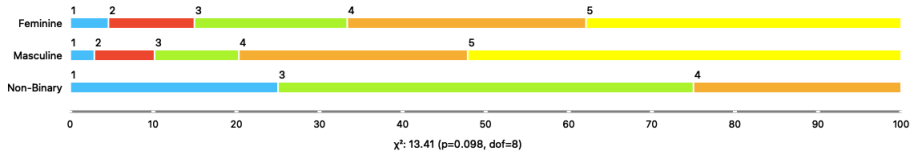
Box plot for attribute 'Careful with how data is used' grouped by 'Age'

Fig. 3 Cumulative distribution for Likert answers, grouped by participant's age

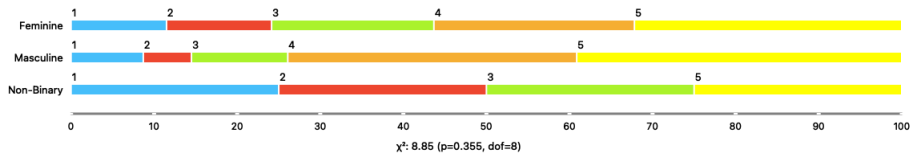
4.3.2 Gender Identity vs Perceptions about data privacy



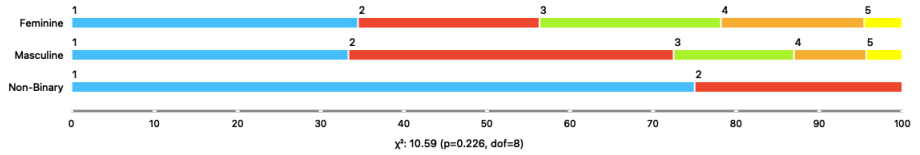
Box plot for attribute 'know how data is treated' grouped by 'Gender Identity'



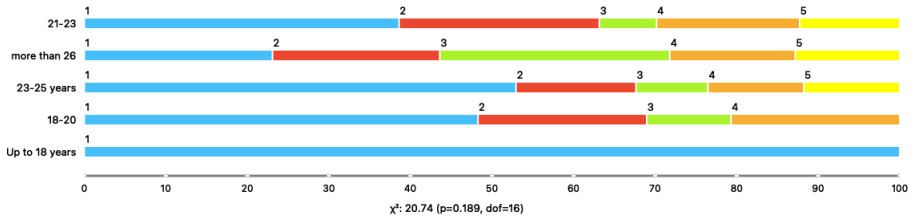
Box plot for attribute 'careful with exposition in social nets' grouped by 'Gender Identity'



Box plot for attribute 'Careful in setting privacy options on social nets' grouped by 'Gender Identity'



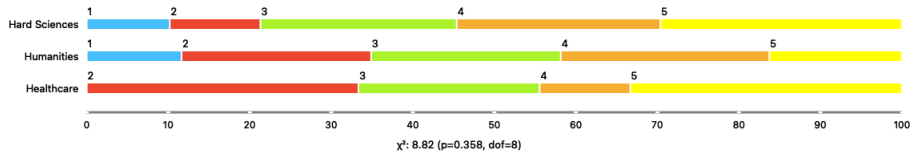
Box plot for attribute 'Don't mind sharing for publicity' grouped by 'Gender Identity'



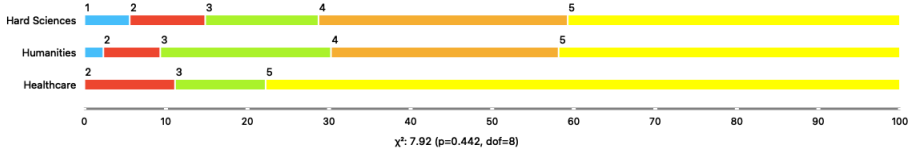
Box plot for attribute 'I know the LGPD' grouped by 'Age'

Fig. 4 Cumulative distribution for Likert answers, grouped by participant's gender identity

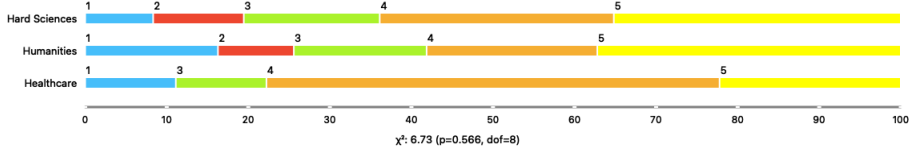
4.3.3 Knowledge Area vs Perceptions about data privacy



Box plot for attribute 'know how data is treated' grouped by 'Knowledge area'



Box plot for attribute 'careful with exposition in social nets' grouped by 'Knowledge area'



Box plot for attribute 'Careful in setting privacy options on social nets' grouped by 'Knowledge area'

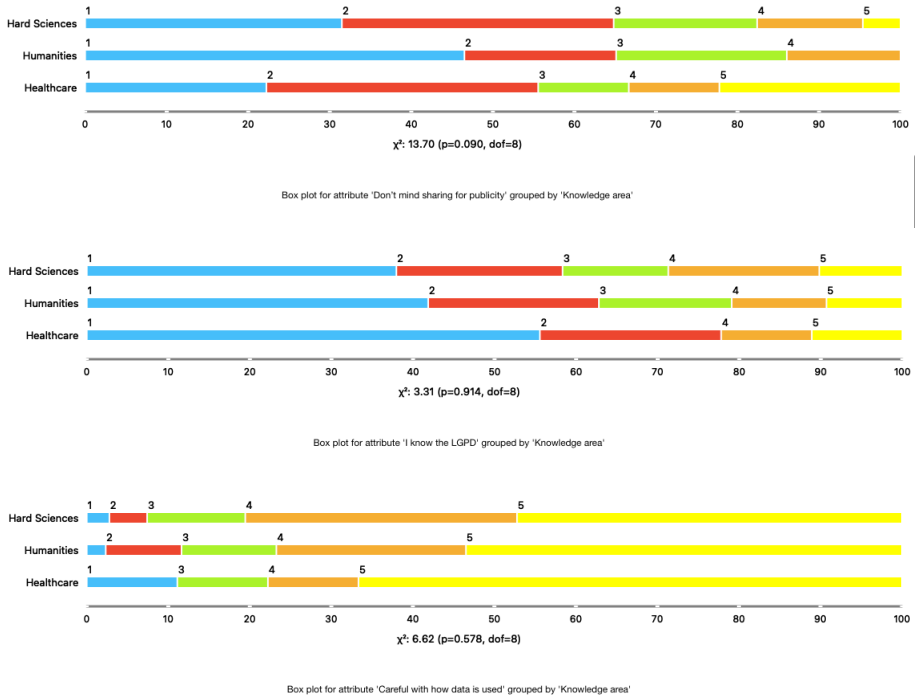


Fig. 5 Cumulative distribution , grouped by participant’s knowledge area

4.4 Perceptions about mental health factors

On the coming section, we present the results obtained from the survey section where we asked the participants to enumerate factors that contributed to their mental health state (by selecting any number amongst pre-defined categories), either by affecting it negatively or by improving their well-being. The top ranking factors (by absolute number) where then analysed in regard to gender identity, knowledge area and Age, with the same method used on the previous subsection. (Some factors where discarded in favor of others because they seemed too similar, so only the most chosen categories were considered)

Factor	Number of votes
Inadequate sleep quality	113
Subject failure	100
Bad grades	99
Insufficient Sleep Time	96
Good nutritional balance	79

Table 1 Top factors that negatively impact participant’s mental health state

Factor	Number of votes
Interact with dogs or cats (pets)	94
Sleep time	92
Physical Exercises	83

Table 2 Top strategies that participants adopt to improve their mental health state

4.4.1 Age, Gender Identity and Knowledge area Vs perceptions about mental health factors (impact)

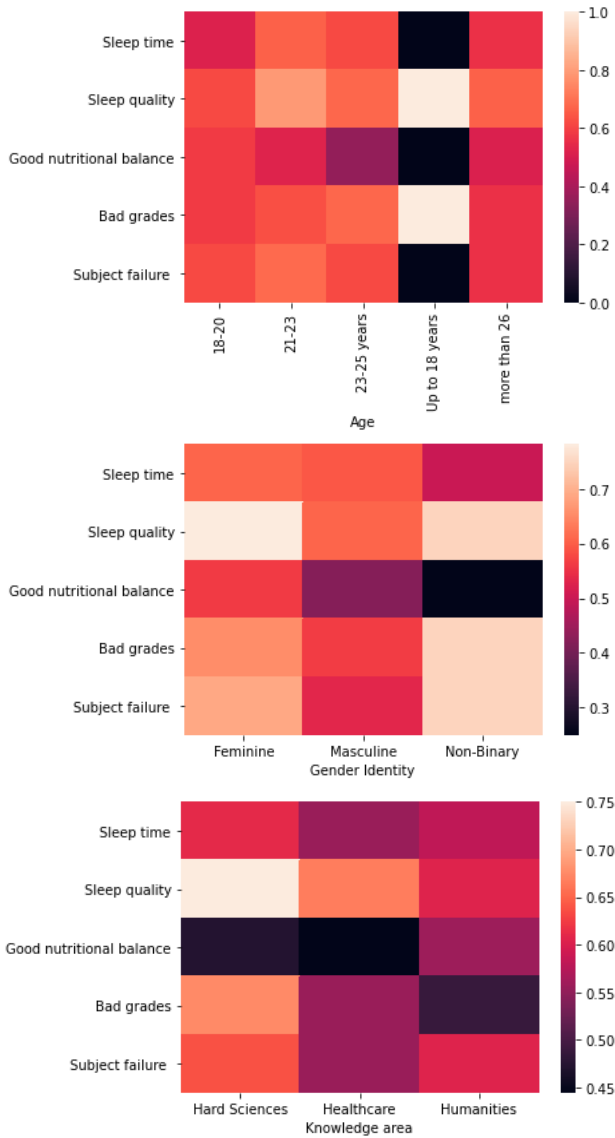


Fig. 6 Heatmaps displaying perception about which factor contributes the most to negatively impact participant's mental health state, the closer to 1, the higher the average importance noted by the participants

4.4.2 Age, Gender Identity and Knowledge area Vs perceptions about mental health factors (improvement)

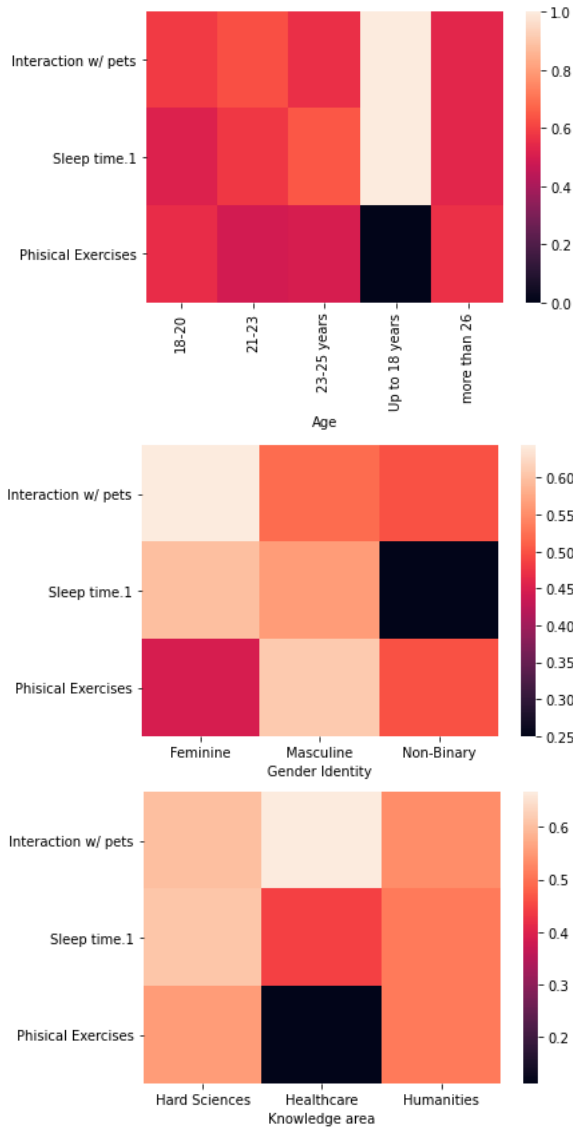


Fig. 7 Heatmaps displaying perception about which factor would contribute to improve their mental well-being, the closer to 1, the higher the average importance noted by the participants

4.5 Scenarios

At the end of the survey, we described three scenarios to the participants, with their content reproduced below in the same order as they were shown. Each of these representing a story in which an individual used the AMIVE project, afterwards we asked the participants the same three questions regarding each of these scenarios, again in the same order. The results are presented below, as well as the text describing each scenario, in their respective sections. We also grouped some results to better understand the reasons behind their perceptions.

the first set of graphics on each scenario, show the histogram for participant's answers on the three statements presented to them (figures 8, 11 and 14)

The following two figures show, in respective order, how the users perception of usefulness and willingness to use the systems relate to their ethical perception of them. Note that we represent the Likert scale, numerically, as follows:

Perception	Value
Strongly Agree	5
Agree	4
Neither Agree nor Disagree	3
Disagree	2
Strongly Disagree	1

Table 3 Perceptions and their numerical values

4.5.1 Scenario 1

Paul is a college student and is worried about an exam due tomorrow. He uses a smartwatch that, with his permission, gathers his heart-rate data and also his indoor location, and sends it to his cellphone. Using this data, an app installed on Paul's phone texts him asking about what is going on. Paul answers about the exam. The app starts playing a custom music created specific for Paul's situation, aiming to calm him so that he can concentrate on the necessary preparations for the exam.

Was the collection of data, in this scenario, ethical?



Have you found the suggested intervention to be useful?



Would you use the system as described above?



Fig. 8 Perceptions about scenario 1

For this scenario, we get the following degree of perceived usefulness (Have you found the intervention useful) and participant's willingness to use the system (would you use the system described):

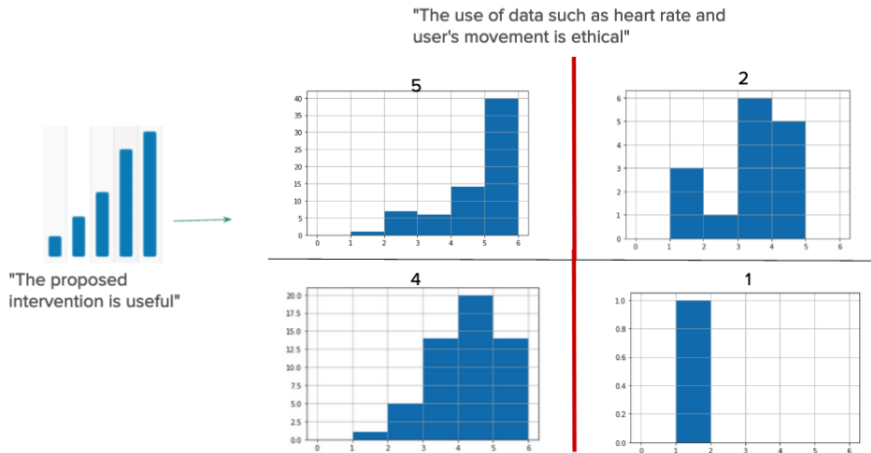


Fig. 9 How participants that chose 5, 4, 2 and 1 on the phrase "the proposed intervention is useful" voted on the phrase "the use of data such as heart rate and user's movement is ethical" x axis represents Likert numerical value and y axis represents number of answers for that value

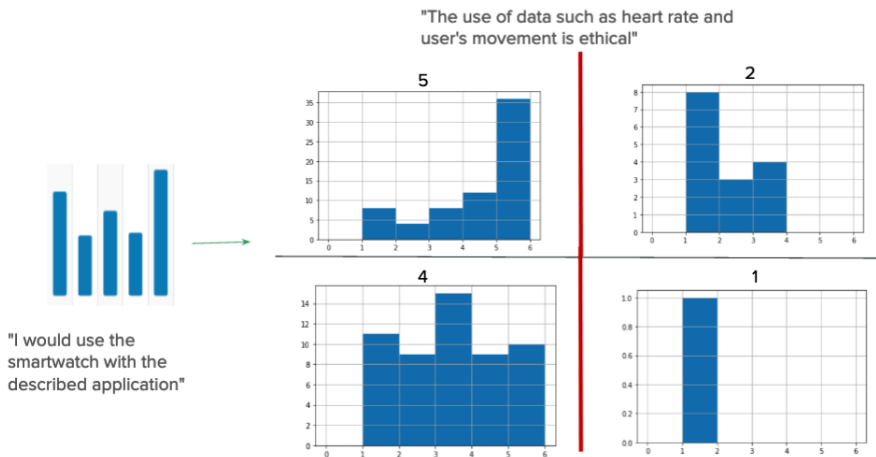


Fig. 10 How participants that chose 5, 4, 2 and 1 on the phrase "I would use the smartwatch with the described application" voted on the phrase "the use of data such as heart rate and user's movement is ethical" x axis represents Likert numerical value and y axis represents number of answers for that value

4.5.2 Scenario 2

Cynthia is a college student that hasn't been attending the lectures lately. She has been staying up late browsing social networks and posting using terms like "my life sucks". By staying up late, she oversleeps and misses some of her

appointments. She has been avoiding her relative's calls. A computer system, with Cinthia's previous consent, verified the content of her social media's posts, as well as their time and frequency. The system has concluded that she needs to adjust her bedtime and increase interactions with her friends and family. The system send private messages on Cinthia's social network with guidance to help her improve her sleep patterns and also with tips about how to reestablish her social bonds.

Was the collection of data, in this scenario, ethical ?



Have you found the suggested intervention to be useful ?



Would you use the system as described above ?



Fig. 11 Perceptions about scenario 2

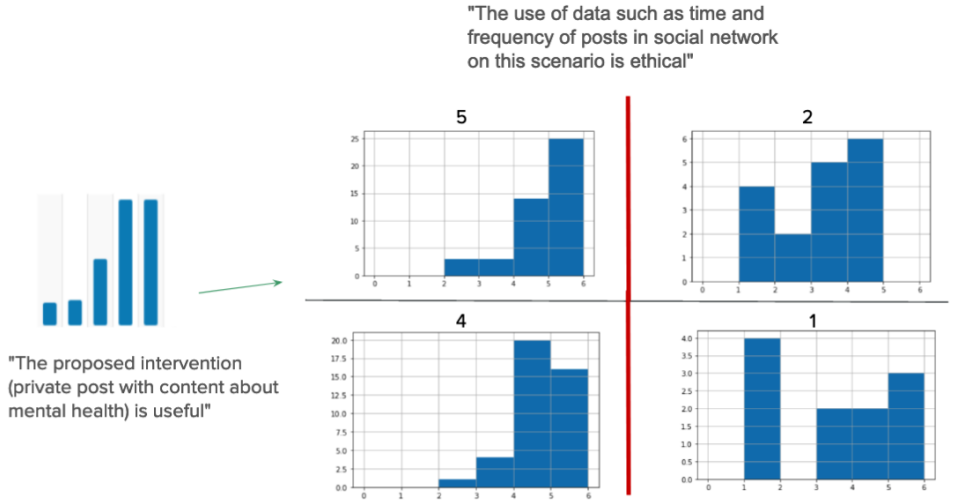


Fig. 12 How participants that chose 5, 4, 2 and 1 on the phrase "the proposed intervention is useful" voted on the phrase "the use of data such as time and frequency of posts in social network on this scenario is ethical" x axis represents Likert numerical value and y axis represents number of answers for that value

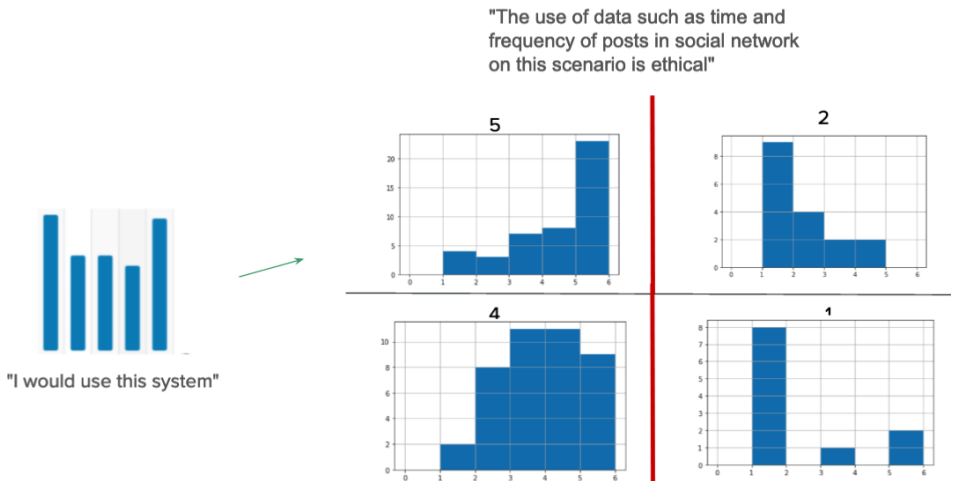


Fig. 13 How participants that chose 5, 4, 2 and 1 on the phrase "I would use this system" voted on the phrase "the use of data such as time and frequency of posts in social network on this scenario is ethical" x axis represents Likert numerical value and y axis represents number of answers for that value

4.5.3 Scenario 3

John has always been a student interested in academical content and very active in social media, posting 4 to 6 times a day. However, during this semester's first lecture, he asked a question to his Professor that wasn't well understood by lecturer. The teacher then proceeded to give some sarcastic remarks about John's question, who in turn felt very ashamed. John uses a smartwatch that, with his consent, collects his heart rate data and sends it to his cellphone.

The system identified abrupt changes in John's heart rate during the incident. In the next two days, John missed classes and stopped posting content on social media. A computational system identified John's recent escape from social networks after the heart rate change incident. Through the use of a chatbot (A computer system that tries to simulate a human being in conversations) Available in an app, the system talks with John to learn more about the incident. After perceiving the lack of empathy in the teacher's comments (use of violent communication), the system recommends that John should seek his course's director and speak up on the incident.

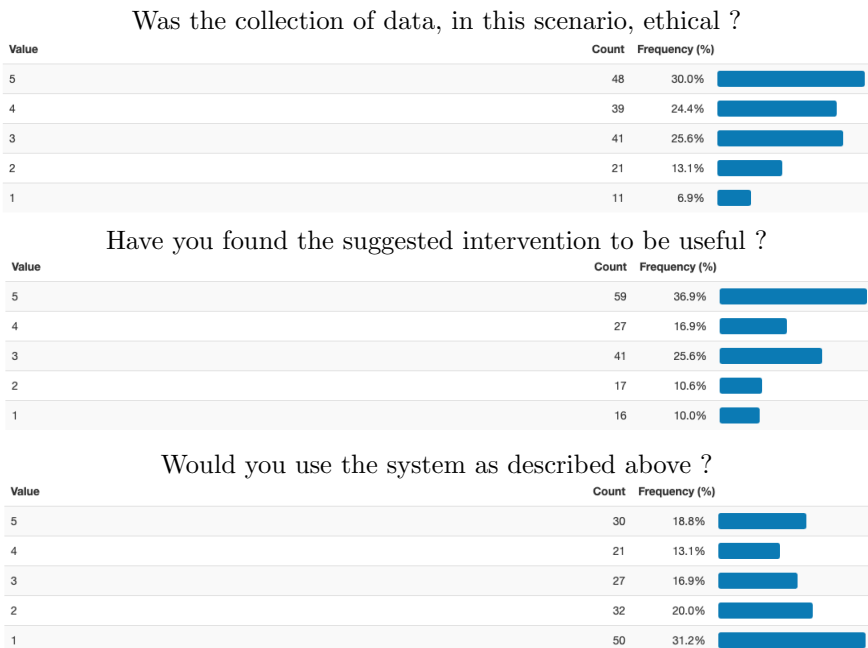


Fig. 14 Perceptions about scenario 3

5 Discussion

After seeing the results, processing the data and analysing the outcomes, we started to see if we could find any possible correlations between the demographic and students perceptions, and also between the perceptions themselves.

Another aspect of the results that we found interesting is that Male-oriented gender identities seem to perceive every item as less relevant to negative impact their mental health, although related researches show the masculine identity seems to have a special relationship with **CMD** score. Again looking at gender identity, feminine oriented participants seem to perceive themselves as being more impacted by sleep quality

Grouping by knowledge area, we found that students of hard sciences seem to be more impacted overall by negative mental health factors, also they seem to perceive themselves as more impacted by bad grades.

We also found that, when looking at the relevance of strategies adopted to improve mental health state, we see an inverse relation between impact on male and female gender identities

By crossing data with age and perception of knowledge about privacy, the results suggest that older university students tend to know more about how data is treated. Likewise, the oldest students are among the most careful with data exposure on social media. Besides them, 21-23 years old students are the most careful with data exposure on social media and are the most careful in setting privacy options. On the other hand, between 18-20 years old students we find the biggest group that disagrees that they know how data is treated and also mostly disagree about being careful in setting privacy options. Between the youngest, it is also the second biggest group that definitely disagree they know about LGPD.

Regarding gender identity, the largest group that chose: "I totally disagree", in the section where we asked students about how they perceived the way that their data is treated, are female students. Between woman we also find the biggest group that definitely disagrees or disagrees they are careful in setting privacy options. On the other hand, male students seem to be more careful with exposition in social media.

This may be because male students tend to already have been in contact with forms of media exposure that negatively exposes someone, and have more insider perspective on how gender dynamics operate. Therefore they tend to be more careful with their own social image. Furthermore, Aside from woman's higher rate of usage of social media systems, actions in favour of spreading knowledge about how to set privacy options could be useful to this public.

Analysing data divided by knowledge area, more than 70% of healthcare students say that they definitely agree they are careful with their exposition in social media. Also, between healthcare students there is a larger proportion that definitely agrees that they know how their data is treated. We also find that they are careful in setting privacy options. We may speculate that this difference in privacy perceptions of healthcare students may come from their

education for a career based on reputation, and also from historical epistemological construction of these Fields, since they tend to be male-centered and highly exclusionary.

Among the factors that most influence the students mental health there are: inadequate sleep quality and/or insufficient sleep time, subject failure and/or bad grades, and difficulties in having good nutritional balance. These aspects are not exclusively related to college life, but they seem to be of great impact in students' life. Institutional actions to support students in these 3 aspects may increase their quality of live and act as protective features.

On the other hand, among aspects that students perform to improve their mental health there are: interaction with animals, sleep time and the practice of physical exercises. Interaction with animals was the factor most voted probably meaning some loneliness college students may face and the need of interacting.

During the analysis of the scenarios we can say there is a positively perception that the use of the systems is ethical, but several students are in doubt (neutral vote). And although they judge the technology as mainly useful (definitely agree or agree with "this technology is useful"), some of them would not use it. (definitely disagree or disagree with "I would use this technology").

We noted that in general users judged the scenarios as ethical. However, when social media posts' content enters into the analysis, the data collection process is perceived as less ethical. Another point of interest to us was that, even though users mostly perceive the systems to be useful and ethical, the willingness to use them is lower than expected in all of the scenarios. This may be a result of psycho-phobia and taboos related to mental illnesses.

We also realized that the willingness to use the systems may be related to ethical perception of the system, although usefulness is not. This may indicate that students think that the system is useful when used with others, but are reluctant to use it themselves because of ethical questions (indicating individualism) Or maybe users just don't feel like they need such a system (indicating that interviewees generally perceive that they are mentally healthy).

6 Final remarks

Based on the data gathered from our collection instruments, and also considering the revision, literature exploration and theoretical construction that have been developed throughout the writing of this work, we may infer that there is a mostly negative view of the systems when we associate it social media data collection and ethically sensible data processing.

This can be due to the fact that human relationships are dialectical by nature and a conversational robot might not (and should not) replace the role of a professional psychologist. However, if we consider other studies in the area, and the high demand for this kind of health intervention (as our survey evidences) we believe that a chat bot might be an effective mean to approach students that show signals of mental health strain, since this subject is still a

taboo and a very stigmatized condition in our society, and thus, the role of an automated entity could be a good fit for this scenario.

Furthermore we realized that students have several ethical concerns with this subject, which might be explained by the ongoing demonstrations of disregard for users privacy by the technological industry. Thus, we believe that the data collection process should have the highest ethical standards, not just because it is a formality and requirement to realize health centered research, but also because they are possibly functionally fundamental to fill the gap caused by distrust that has been found to be a major issue on the implementation of these solutions in previous researches, and that can also present as a challenge to the AMIVE project. Thus, we recommend that the team working on AMIVE adopt a strategy called "Privacy by design" when creating the technological tools necessary for the functioning of the project, as this seems to be one of the key factors that influence student's willingness to use the system.

This last remark also shows the importance of looking at ethical questions regarding technological development, as they might be a decisive factor for the success of these technologies.

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Appendix A Questionnaire

The original questionnaire that was sent out to students can be found reproduced bellow in it’s integrity:

Percepções sobre ética na coleta de dados e possibilidades de intervenções na saúde mental

Olá. Me chamo Pedro Vinicius e sou estudante de Engenharia da Computação na UFSCar. Estou realizando uma pesquisa para um trabalho de conclusão de curso orientado pela professora Vânia Neris. O título do trabalho em questão é "Percepções de estudantes universitários brasileiros sobre ética na coleta de dados e oferta de intervenções para a saúde mental por sistemas computacionais."

Este trabalho está vinculado ao projeto AMIVE (<https://amive.ufscar.br>), que tem como objetivo a criação de um sistema de apoio aos estudantes que passam por dificuldades relacionadas à saúde mental. Sabemos que, infelizmente, nestes tempos de pandemia, a saúde mental do estudante Brasileiro encontra-se mais fragilizada do que nunca, por isso pedimos sua colaboração para nossos esforços em auxiliar a comunidade estudantil.

Preparamos como principal instrumento de coleta, este questionário online (leva no máximo 10 minutos para ser respondido) em formato de pesquisa de opinião pública* a ser respondida por estudantes universitários.

O nosso intervalo de respostas é curto dados os prazos apertados (será até o dia 15/10), por isso pedimos sua colaboração.

Me coloco à disposição para eventuais esclarecimentos e solicito também seu apoio na divulgação.

* Esta pesquisa está dispensada de avaliação pelo Comitê de Ética em Pesquisa, conforme previsto na resolução 510/2016, parágrafo primeiro a saber:

"Parágrafo único. Não serão registradas nem avaliadas pelo sistema CEP/CONEP:

I – pesquisa de opinião pública com participantes não identificados;"

Fontes: <http://conselho.saude.gov.br/resolucoes/2016/Reso510.pdf>
<http://www.propq.ufscar.br/etica/cep/duvidas-frequentes>

Qual a sua idade ? *

- até 18 anos
- entre 18 e 20 anos
- entre 21 e 23 anos
- entre 23 e 25 anos
- 26 anos ou mais

Qual das seguintes opções melhor descreve sua identidade ? *

- Homem
- Mulher
- Pessoa não binária
- Pessoa Gênero Fluido
- Pessoa Agênera
- Prefiro não dizer
- Autre...

Você habita em qual região do Brasil ? *

- Norte
- Nordeste
- Centro Oeste
- Sudeste
- Sul

Você usa um Smartphone ? *

- Sim
- Não

Você usa um Smartwatch (relógio inteligente)? *

- Sim
- Não

Você possui um plano privado de acesso à internet móvel ? *

- Sim
- Não

Você é estudante universitário ? *

- Sim
- Não

Estudantes Universitários



Description (facultative)

Seu curso está inserido em qual área do conhecimento ? *

- Ciências Exatas e da Terra
- Ciências Biológicas
- Engenharias
- Ciências da Saúde
- Ciências Agrárias
- Ciências Humanas
- Linguística, Letras e Artes
- Ciências Sociais Aplicadas

Quais redes sociais você utiliza ? *

- Facebook
- Instagram
- Tik Tok
- Twitter
- Whatsapp
- Discord
- Não utilizo redes sociais
- Autre...

Com qual frequência você utiliza as redes sociais ? *

- Diariamente
- De 5 a 6 dias por semana
- De 3 a 4 dias por semana
- De 1 a 2 dias na semana
- Menos de 1 vez por semana

Nos dias em que utiliza as redes, quantas horas em média você passa nelas ? *

- Menos de 2h por dia
- Entre 2h e 4h por dia
- Entre 6h e 8h por dia
- Mais de 8h por dia



"Eu conheço a legislação relacionada à proteção de dados do Brasil (LGPD)." *

1 2 3 4 5

Discordo totalmente Concordo totalmente

"Me preocupo com a forma como meus dados são ou podem ser utilizados." *

1 2 3 4 5

Discordo totalmente Concordo totalmente

Après la section 3 Passer à la section suivante

Rubrique 4 sur 8

Dados Sensíveis e Saúde Mental

Description (facultative)

Selecione os dados que considera sensíveis, isto é, dados delicados que você teria receio em compartilhar *

- Nome
- Idade
- Curso
- Filiação
- Rendimento acadêmico
- Agenda de compromissos
- Conteúdo de postagens em redes sociais
- Horário de postagens em redes sociais
- Tempo de sono
- Alimentação consumida
- Frequência cardíaca
- Grau de atividade eletrodérmica
- Rede de amigos
- Tempo de realização de exercícios físicos
- Tempo de estudo
- Tempo em sala de aula
- Tempo de uso da rede social

Quais desses aspectos relacionados à vida universitária afetam negativamente a sua saúde mental? *

- Pouco sono
- Sono com baixa qualidade
- Alimentação insuficiente ou desequilibrada
- Conversas com amigos
- Conversas com familiares
- Nota ruim
- Reprovação ou dependência em disciplinas
- Assistir aula
- Avaliações como provas e testes
- Realizar trabalhos em grupo
- Realizar trabalhos em grupo online
- Conversar ou ler sobre política
- Ler postagens em redes sociais
- Publicar conteúdo em redes sociais
- Festas
- Bebida alcoólica em excesso
- Conversar com professores
- Apresentar seminário
- Apresentar seminário online
- Orçamento doméstico
- Matrícula em disciplinas
- Assistir vídeo-aulas
- Emissão de documentos
- Autre..

Quais destas estratégias você adota para melhorar sua saúde mental ? *

- Dormir tempo suficiente
- Dormir bem
- Alimentação equilibrada
- Prática de exercícios físicos
- Yoga ou pilates
- Massagem
- Busca por apoio institucional
- Conversa com professores
- Conversas com técnicos administrativos
- Horários pré-determinados para atividades
- Orçamento doméstico equilibrado
- Trabalho voluntário
- Trabalho remunerado
- Uso das redes sociais
- Conversa com amigos
- Conversa com familiares
- Terapia com profissionais
- Uso de chatbots especializados
- Interação com cães, gatos ou outros animais
- Andar de bicicleta
- Jogos de cartas ou tabuleiro físicos
- Jogos digitais
- Consumo de bebida alcoólica
- Uso de medicamentos
- Autre..

Cenários de Uso do AMIVE



Nesta última seção, serão apresentadas algumas possíveis situações que podem transpassar com os usuários do projeto AMIVE. Leia os cenários e escolha a opção que mais se adequa à sua opinião.

Cenário 1

Paulo é estudante universitário e está preocupado com uma prova que deve ser realizada no dia seguinte. Ele usa um relógio inteligente (smartwatch) que, como a permissão de Paulo, coleta seus dados de frequência cardíaca e também a sua movimentação indoor e envia para o seu celular. Com esses dados, um aplicativo instalado em seu celular lhe manda uma mensagem perguntando sobre o que está acontecendo. Paulo responde sobre a prova. O aplicativo toca uma música criada para a situação do Paulo que visa acalmá-lo para que ele possa se concentrar nos procedimentos necessários para realizar a prova.

Considerando o cenário acima, avalie as afirmações:

Description (facultative)

O uso de dados como frequência cardíaca e movimentação do usuário no cenário descrito é ético. *

	1	2	3	4	5	
Discordo totalmente	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Concordo totalmente

A intervenção oferecida (música personalizada) é útil. *

	1	2	3	4	5	
Discordo totalmente	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Concordo totalmente

Eu usaria este relógio com o aplicativo descrito. *

	1	2	3	4	5	
Discordo totalmente	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Concordo totalmente



Cenário 2



Cíntia é uma estudante universitária que não tem frequentado as aulas. Ela tem ficado acordada até tarde navegando em redes sociais e tem feito postagens usando termos como "minha vida é uma droga". Por ficar acordada até tarde, ela dorme pela manhã e perde compromissos. Ela tem evitado atender aos telefonemas da família. Um sistema computacional, previamente autorizado por Cíntia, verificou o conteúdo das postagens dela na rede social, bem como o horário das postagens e a frequência. O sistema concluiu que ela precisa ajustar seu horário de descanso e interagir mais com os amigos e familiares. O sistema envia mensagens privadas na rede social de Cíntia com orientações para a higiene do sono e também orientações para restabelecer vínculos afetivos.

Considerando o cenário acima, avalie as afirmações:

Description (facultative)

O uso de dados como conteúdo, horário e frequência de postagens em rede social no cenário * descrito é ético.

	1	2	3	4	5	
Discordo totalmente	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Concordo totalmente

A intervenção oferecida (postagem privada com conteúdo sobre saúde mental) é útil. *

	1	2	3	4	5	
Discordo totalmente	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Concordo totalmente

Eu usaria esse sistema computacional. *

	1	2	3	4	5	
Discordo totalmente	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Concordo totalmente



Cenário 3

João sempre foi um estudante interessado nos conteúdos académicos e muito ativo nas redes sociais realizando postagens de 4 a 6 vezes por dia. No entanto, na primeira aula deste semestre, ele fez uma pergunta na sala de aula que não foi bem compreendida pelo professor. O professor fez comentários sarcásticos sobre a dúvida de João que ficou muito envergonhado. João usa um relógio inteligente (smartwatch) que, como a permissão dele, coleta seus dados de frequência cardíaca e envia para o seu celular. O sistema identificou alterações bruscas na frequência cardíaca de João durante o incidente. Nos dois dias seguintes, João não apareceu nas aulas e nem fez postagens nas redes sociais. Um sistema computacional identificou a ausência de João nas redes sociais após a alteração brusca na frequência cardíaca. Por meio de um chatbot (um programa de computador que tenta simular um ser humano na conversação) disponível em um aplicativo, o sistema dialoga com João para saber mais sobre o ocorrido. Ao perceber a situação de comunicação não empática (comunicação violenta) por parte do professor, o sistema recomenda a João que procure a coordenação do curso e relate o ocorrido.

Considerando o cenário descrito acima, avalie as afirmações:

Description (facultative)

O uso de dados como frequência cardíaca e ausência de manifestação em rede social no cenário descrito é ético. *

	1	2	3	4	5	
Discordo totalmente	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Concordo totalmente

A intervenção oferecida (diálogo com um assistente virtual) é útil. *

	1	2	3	4	5	
Discordo totalmente	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Concordo totalmente

Eu usaria esse sistema computacional. *

	1	2	3	4	5	
Discordo totalmente	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Concordo totalmente

Fig. A1 Screenshots of original survey, showing Portuguese text

Appendix B Data extraction code

```
'''
////////////////////////////////////
\\//
\\// IMPORTS \\//
\\//
////////////////////////////////////
.....
import numpy as np
import pandas as pd
import pandas_profiling as pp
import seaborn as sns

df = pd.read_csv("Privacidade e dados nas redes.csv")
```

```
'''
////////////////////////////////////
\\//
\\// TREAT TABLE \\//
\\//
////////////////////////////////////
'''
# Drop date of answer (useless)
df = df.drop('Horodateur', axis = 1)
# Drop suggestions (Not part of statistical data)
df = df.drop("Se desejar, deixe sugestões e/ou comentários.", axis = 1)
# Filter only answers given by College students
df = df[df['Você é estudante universitário ?'] == 'Sim']
# Discard column
df = df.drop('Você é estudante universitário ?', axis = 1)
# Treat Dataframe
```

```
## Save column name on list for convenience
cat = []
cat.append("Quais redes sociais você utiliza ?")
cat.append("Quais destas estratégias você adota para melhorar sua saúde mental ?")
# Treat Dataframe

# Goes through all categorical columns
for column in cat:
    df = pd.concat([df, df[column].str.split(',', expand=True)], axis=1)
    #df = pd.concat([df[[column]],

df.head()

# View dataframe
df.to_csv()

pp.ProfileReport(df, explorative = "True")
```



```

'''
////////////////////////////////////
'''
'''  IMPORTS  '''
'''          '''
////////////////////////////////////

Bibliotecas necessárias para análises

.....

import numpy as np
import pandas as pd

df = pd.read_csv("phik.csv", sep=";")

'''
////////////////////////////////////
'''
'''  TREAT TABLE  '''
'''              '''
////////////////////////////////////

Pré processamento dos dados para realização da análise exploratória
Melhora os resultados obtidos a partir do módulo pandas_profiling

'''

# Filter only answers given by College students
df = df[df['Student'] == 'Yes']
# Discard column
df = df.drop('Student', axis = 1)

```

```

# Filter only answers given by College students
df = df[df['Student'] == 'Yes']
# Discard column
df = df.drop('Student', axis = 1)

# TABLE Perceptions

## iloc serve para localizar por índice no dataframe populado pelo csv
## para não ter que escrever o nome dos índices, o que eu fiz foi selecionar por grupos

dfC1 = df.iloc[:,33:36]
dfC2 = df.iloc[:,36:39]
dfC3 = df.iloc[:,39:42]

dfs = [dfC3]

dfs5 = []
dfs4 = []
dfs2 = []
dfs1 = []

import seaborn as sns
import matplotlib.pyplot as plt

from pandas_profiling import ProfileReport as pp

for dframe in dfs:
    dfs5.append(dframe[dframe.iloc[:,0] == 5])
    dfs4.append(dframe[dframe.iloc[:,0] == 4])
    dfs2.append(dframe[dframe.iloc[:,0] == 2])
    dfs1.append(dframe[dframe.iloc[:,0] == 1])

dfss = [dfs5,dfs4,dfs2,dfs1]

```

```

dfss = [dfs5,dfs4,dfs2,dfs1]

for scenario in dfss:
    for frame in scenario:
        print(frame.columns.to_list())
        print(frame.head())
        #pp(frame, explorative = True).to_notebook_iframe()
        print(frame.iloc[:,1])
        frame.iloc[:,1].hist(bins = range(7))
        plt.show()
        print(frame.iloc[:,2])
        frame.iloc[:,2].hist(bins = range(7))
        plt.show()

#pp(dfC1, explorative = True).to_file("cenario1.html")
#pp(dfC2, explorative = True).to_file("cenario2.html")
#pp(dfC3, explorative = True).to_file("cenario3.html")

```

Fig. B2 Some of the several different lines of code that were used to extract the graphs displayed herein

Appendix C Example of the data collected in table form

Interaction w/ pets	Sleep time	Physical Exercises	Use of sensorial data ...	Personalised music u...
1	1	1	3	2
1	0	1	2	3
0	0	1	2	2
0	0	0	5	5
1	0	1	3	5
0	1	1	5	4
0	1	1	4	4
1	1	0	4	3
0	0	0	4	5
1	1	0	5	5
1	0	0	5	5
0	1	1	5	5
1	0	1	5	5
0	1	1	5	4
0	0	1	2	4
1	1	1	2	1
1	1	0	4	4
0	1	0	5	2
0	0	0	5	5
1	0	1	5	5
1	0	0	3	1
1	0	0	3	5
1	0	0	5	2
1	0	0	4	5

Fig. C3 An example of the data after processing the sheets resulting from the public opinion poll