Privacy: Investigation of Student's Trust to Universities using an Implicit Association Test

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1. ABSTRACT

Social media platforms or other online services are often used for learning by students. Thereby, they (consciously or unconsciously) disclose personal information and metadata which are frequently used as part of business models. Even if universities provide similar services or innovative adaptive learning spaces, students seem to be rather restrained in sharing data. This hinders personalization and adaptation. There even seems to be a general problem with privacy attitudes stated in questionnaires and actual privacy behavior ("informational privacy paradox"). In order to investigate this gap, a preliminary study was conducted. The goal was to investigate the inner attitude of students towards the disclosure of personal data to commercial and non-commercial university services utilizing a so-called Implicit Association Test (IAT) based on the trust dimension. The results of the study show that there seems to be a moderate implicit positive attitude towards the university. Also, the impact of technology affinity on this implicit preference on trust was investigated. Here, only a slight tendency for a difference between the groups of technology affine and not affine students could be found. An exploratory data analysis showed a significant difference on the degree of the implicit preference towards the university regarding the enthusiasm for technology.

2. INTRODUCTION & MOTIVATION

Many students use social media platforms such as Facebook or other services such as Dropbox for learning. By using these services, students have to agree to the terms of service and, therefore, (consciously or unconsciously) disclose personal information and metadata to third-party commercial companies that frequently use this data as part of business models. This is especially an issue as these services are often not operated by European companies. Commonly universities provide similar services or also innovative digital learning spaces to their students which can be particularly helpful for students, e. g. by supporting learning processes through the visualization of the progress (cf. Learning Analytics). Such systems rely on access to user data of varying sensitivity (such as study success, progress solving on tasks, online time, health or demographic data, etc.) but still respect the European General Data Protection Regulation (GDPR) and, therefore, are designed with a high level of privacy. However, the services provided by universities are often not that intensively used compared to commercially provided services. Also, students are rather conservative in sharing data for usage in learning systems (Schumacher & Ifenthaler, 2017). Hence, there seems to be a diverging willingness to provide personal data to commercial rather than university services for personalization and adaptation. This might be a trust issue.

Generally, there appears to be a general problem with privacy and data protection questionnaires (often called "informational privacy paradox"): When explicitly asked about privacy most people underline its importance, however, often they do not act accordingly (cf. Kokolakis, 2017; Thompson, 2019). To further investigate this gap, a preliminary study was conducted. The goal was to examine the inner attitude of students towards the disclosure of personal data to commercial and non-commercial university services utilizing a so-called Implicit Association Test (IAT). Here, participants are not directly asked about their attitude but this test measures implicit preferences without requiring the respondents to be aware of their attitudes or willing to report on them. Therefore, such a test seems to be appropriate to investigate student's trust, which seems to be a driver of privacy concerns (Gerber et al., 2018), to universities. Two hypotheses were investigated:

- Hypothesis 1: There is a discrepancy in the implicit attitudes between the two categories of commercial services and university services.
- Hypothesis 2: The calculated implicit attitude of students with a high technology affinity score differs from the results of students with a low technology affinity score.

The remainder of this article is organized as follows: First, related research is presented. The next section describes the design of the overall study and the Implicit Association Test. Then, the results of the study are presented and discussed. The article concludes with a summary and outlook.

3. RELATED RESEARCH

The following paragraphs provide a brief overview of previous research findings that are related to this paper.

Learning Analytics is defined as the "measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimising learning and the environments in which it occurs." (LAK, 2011). Therefore, collecting and working on data is essential. In this context, there are many approaches published for e. g. visualizing the progress of learners, recommending relevant learning items, or predicting the success of students (cf. Mangaroska & Giannakos, 2018). One of the general challenges in the field of Learning Analytics reported by Ferguson (2012) is "Challenge 4: develop and apply a clear set of ethical guidelines" (Ferguson, 2012). The ethical dimension also comprises privacy and is still an open issue in research. Drachsler & Greller (2016) published an overview of ethical and legal issues as well as a checklist for trusted learning analytics. A comparison study showed that students expect learning analytics systems to provide detailed, adaptive and personalized dashboards, however, are rather restrained in sharing personal data to such systems (Schumacher & Ifenthaler, 2017): Students only seem to agree to share university-relevant data to university but not personal information or metadata about their online activities.

Privacy and its importance to users are also investigated in a more generic context (cf. Kokolakis, 2017): On the one hand, most people state in surveys that the protection of their data is very important to them. On the other hand, most people rarely make any effort to protect their private data actively. This inconsistency between named attitudes and real behavior is often referred to as the "informational privacy paradox". Recently, there are some reviews published questioning the paradox because there are different definitions and models to explain it (Kokolakis, 2017; Solove, 2020). A general critique is that many studies focus on behavioral intention instead of actual behavior (Kokolakis, 2017; Gerber et al., 2018). Particularly, Kokolakis (2017) suggests that future studies should not solely be based on self-reported behavior. Generally, trust, privacy concerns and computer anxiety were found as good predictors for privacy attitudes (Gerber et al., 2018).

The Implicit Association Test (IAT) was developed and presented by Greenwald et al. (1998). It is a computer-assisted psychological test in which the respondents have to assign terms or images to specific categories as quickly as possible. The IAT tries to determine the implicit attitudes of people through their performance in this discrimination task (cf. Arendt, 2009) and, thus, follows an empirical approach to ascertaining the implicit preferences. The IAT is the most commonly used implicit measurement method (cf. Arendt, 2016). It has already been used in various contexts: It was used to test subjects whether they have an implicit preference over black or white people by letting them differentiate between African and European faces (Greenwald et al., 1998; Project Implicit website, 2020). It has also been measured that patients who have attempted suicide are more likely to associate themselves with death than patients who have not attempted suicide by assigning words to the categories "life", "death" and "self" (Rath et al., 2018). A similar test design was used to test whether women or men are more likely to be considered as leaders (Van Quaquebeke et al., 2010). The implicit preference of participants on homosexuality was also tested with the help of photos of couples and symbols representing either homosexuality or heterosexuality (Seise et al., 2002; Project Implicit website, 2020).

4. STUDY DESIGN

The study was conducted as an online survey (i.e., a website which the participants had to open on their laptops or desktop computers) consisting of three parts. The target group of the survey was students of the University of Potsdam, Germany. Most participants were directly addressed, e.g. in computer pools of the university. The link to the survey was also shared using information sheets distributed in dormitories.

The first part of the survey served to collect demographic information about the participants. Collected were gender, year of birth, study programme, and optionally an email address (for further inquiries). Possible options for gender were “male”, “female”, “other”, and “refuse to answer”.

The second part of the survey is an especially for this purpose designed Implicit Association Test. The details on the design (process) are described in the following subsection. Using this test, the first hypothesis, whether there is an implicit preference to companies vs. the local university, should be answered. For the online survey, the developed IAT was implemented using the Online IAT (Mason et al., 2019) framework. Because the framework uses an older analysis calculation model, an additional evaluation script that uses the current calculation model (cf. Section 4.2) was used.

Finally, there is the third part of the survey which consists of the technology affinity questionnaire (Karrer et al., 2009). The reason to include this questionnaire was the hypothesis that technological competence/affinity might affect trust resp. privacy considerations (cf. Gerber et al., 2018: computer anxiety is a good predictor for privacy attitude). Hence, this questionnaire is essential to answer Hypothesis 2. The questionnaire was presented to the participants after the actual IAT in order to not influence the results of the IAT.

In the following subsections first, the design of the implicit association test and its evaluation are presented.

4.1. DESIGNING THE IMPLICIT ASSOCIATION TEST

There are two main components of an IAT which need to be properly selected: the attribute and object categories as well as corresponding items that need to be assigned to the categories by participants. For this study, “University” and “Internet company” were chosen as object categories. This was a relatively straightforward decision because non-commercial university services should be compared to commercial services.

Determining the attribute categories was a more difficult task. Generally, multiple dimensions need to be considered why external services seem to be preferred (cf. Technology Acceptance Model 2, Venkatesh & Davis, 2000): knowledge of services, usability, quality, habits, and trust in the institution. For this preliminary study trust was identified as a major driver for disclosing personal information (cf. Gerber et al., 2018). This is backed by a survey of Akami Research (2018) which showed that 55 % of those surveyed “would let companies they trust use some of their personal data for specific purposes that benefit them in clear ways” (Akami Research, 2018, p. 2). Trust is also a feeling that is influenced by an implicit attitude and does not require prior knowledge of the compared services that many people might not have. Therefore, the dimensions "trust" and the opposite "mistrust" were chosen as attribute categories for this preliminary study.

As the task for participants is to assign items to those categories, the next step was to select proper items. For this study, six different items were selected for each category. Images were chosen for the object stimuli. On the one hand, these make it easier for the respondents to distinguish between the object and attribute stimuli, and on the other hand, this type of stimulus has been used frequently in most of the inspected IATs (cf. Seise et al., 2002; Plischke, 2012; Project Implicit website, 2020; Greenwald et al., 1998; Möller et al., 2011). The logos of the six most popular internet services according to the JIM study 2017 (Feierabend et al., 2017) were chosen for the “Internet company” category: YouTube, WhatsApp, Instagram, Snapchat, Facebook, and Google. For the object category “University”, the logo of the University of Potsdam, the logo of the local Moodle learning management system[1] and press photos of the University of Potsdam, which display university work and life on campus, were selected as items (University Potsdam website, 2019). The specific items of the attribute categories are words because every reviewed IAT uses this type of

[1] https://moodle2.uni-potsdam.de/ (last accessed 2020-05-14)

item for these categories. Those words have been extracted from various publications that deal with the topic of privacy in general. Some of these items had to be replaced by synonyms in order to fit the categories as clearly as possible. The selected items can be found in Table 3.

Attribute Category	Items
trust	Nachvollziehbar (comprehensible), Sicherheit (safety/security), Vertraulich (private/sensitive), Beschützen (protect), Zuverlässig (reliable), Sorgfältig (careful)
mistrust	Ausnutzung (exploitation), Überwachung (surveillance), Missbrauch (abuse/misuse), Risikofreudig (risky), Fahrlässigkeit (negligence/recklessness), Leichtfertig (careless)

Table 3: The original "German" items for the attribute categories "trust" and "mistrust" including possible English translations

Recently developed IATs usually consist of seven phases. However, only the third, fourth, sixth and seventh phases have an impact on the result (cf. Section 4.2). The other three phases are only there for training purposes. A general overview of the seven phases of this study can be seen in Figure 1.

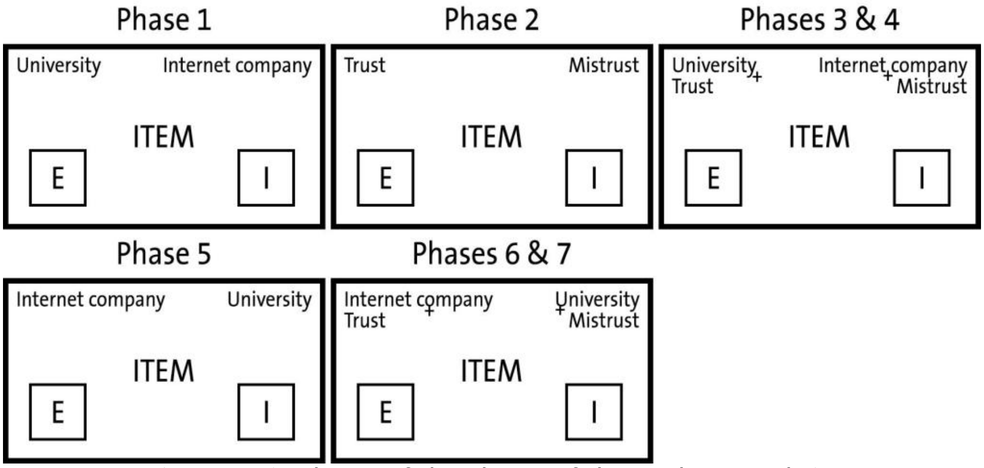

Figure 1: A schema of the phases of the implemented IAT

In the first phase, the participant gets introduced to the two object categories and their items. In total, 20 images are displayed in this phase, which either belong to the category "university" or "internet company". Depending on the item, the participant is expected to press 'E' to assign the displayed image to the category shown on the upper left or 'I' to assign it to the category shown on the upper right. In case of an erroneous allocation, a red X appears and the error is logged internally. It was also pointed out to the participants that the test should be carried out as quickly as possible, as a short processing time is essential for the results of this test.

According to Nosek et al. (2007, p. 272), the order of the phases influences the result. To compensate for this influence as much as possible, in about half of the tests, the university is the left-hand category first, in the other half it is the internet companies. Additionally, the (appearance) order of the attribute items and target concept items were randomly determined.

After the 20 images have been assigned in phase 1 by the participant, there is an information page displayed to inform the participants that the categories have now changed to the attribute categories: trust (left) and mistrust (right). Apart from that, the second phase runs exactly as in phase 1, only that the items are now the words from Table 3.

The overall design of the third and the fourth phase are absolutely the same. There are now two categories on each side. The two left-handed categories are the same ones that were already on the left side in phases 1 & 2. The two right-handed categories are the other two correspondingly. Both phases present 40 items that have to be assigned by the participants.

In phase 5, the two object categories ("university" and "internet company") now change their position and there are again 20 assignments.

The last two phases 6 & 7 are nearly the same as phases 3 & 4. The only difference is that the object categories got switched according to the change in phase 5 (cf. Figure 1). In total, 220 assignments needed to be made by each participant during the study.

4.2. EVALUATION OF THE IAT

Critical to the outcome of the IAT are the phases 3 & 4 as well as 6 & 7 and the quick assignment of the items to the categories by the participants. The main idea behind the IAT is that the assignment of elements is easier/quicker if categories that are more closely linked in the brain use the same button. The implicit setting is now understood as the difference between the average response times of the first and second combination tasks: If a test person is significantly faster in phases 3 & 4 than in phases 6 & 7, then a test person has an implicit preference according to the IAT towards the first left-handed category (cf. Arendt, 2016; Greenwald et al., 1998).

To compare the different results of all participants, the so-called D-Score is calculated. In simplified terms, this is the average difference in response times of phases 3 and 4 and phases 6 and 7. The exact formula can be found in Greenwald et al (2003). The resulting D-Score is a value between -2 and 2 (cf. Greenwald et al., 2006) which quantifies the test subject's relative implicit preference for one of the two object categories. A positive value expresses in case of this study that the test person has an implicit trust preference towards the university, a negative value, thus, indicates an implicit trust preference towards the internet companies. If the score is close to 0, there is no preference for either of the two categories. To make it easier to interpret the results, the D-Score was sometimes represented with words. This means the following: A D-Score of [0.15; 0.35) is a slight, of [0.35; 0.65] a moderate and above 0.65 a strong expression (cf. Project Implicit website, 2019).

5. RESULTS

A total of 34 students participated in the study from mid-June to early August 2019. Of these, 10 were women, 22 men and 2 did not want to state their gender. The ages ranged from 19 to 49 years (average: 25.7; standard deviation: 8.2; median: 22). 16 of the participants were computer science students (e.g., computer science, business informatics) and 18 studied other subjects (e.g., geosciences, sports, law).

In the remainder of this section, the results of the IAT (D-Score), the technology affinity scores as well as the evaluation of the combination of the D-Scores with the technology affinity scores are presented.

5.1. RESULTS OF THE IAT (D-SCORE)

The average D-Score of all participants is 0.39 (standard deviation of 0.42, median of 0.47). This means that the presented images of the object category “university” lead to a longer processing time if they are presented with negative attribute stimuli (words of the category "mistrust") instead of positive attribute stimuli (words of the category "trust"). At the same time, the processing time of items of the category "internet company" is longer if they are presented with positive instead of negative attribute stimuli. According to the Project Implicit website (2019), the degree of this implicit trust preference towards the university can be characterized as moderate.

Overall, there were six D-Scores with such low levels (absolute value smaller than 0.15) that it is not possible to detect a clear implicit preference. If one takes these six D-Scores out of the calculation, the average D-Score is 0.463 (standard deviation of 0.43, median of 0.49).

Out of 34 respondents, 4 have a negative D-Score (-0.013; -0.164; -0.435; -0.924). One participant of these four has a D-Score close to zero (-0.013), i.e. no clear implicit preference. So, for exactly three participants (approx. 9 %) an implicit preference for internet companies could be determined.

Based on these results, Hypothesis 1 “There is a discrepancy in the implicit attitudes between the two categories of commercial services and university services.” could be confirmed.

5.2. RESULTS OF THE TECHNOLOGY AFFINITY QUESTIONNAIRE

The technology affinity questionnaire consists of a total of 19 questions from five subcategories. Therefore, there are five sub scores additionally to the mean of all of the subcategories: general (the overall score), enthusiasm, competency score, and in addition, there are two scores that indicate to which degree the participants think that technology has a positive or a negative impact on our lives.[2]

The technology affinity score takes a value between 1 and 5. A value of 1 means a full affinity for technology and 5, therefore, no affinity for technology. All participants with a score less than or equal to 3 will be categorized in the remainder as so-called *technically-minded* participants.

The average technology affinity score of all participants is 2.60 with a standard deviation of 0.56. 26 of the 34 respondents have a value less or equal than 3, so they can be categorized as technically-minded. Detailed scores are shown in Table 1 and the boxplot in Figure 2.

According to the technology affinity scores, 18 of the 34 respondents can be categorized as enthusiastic about technology and 30 as technically competent. All 34 participants see a rather positive impact of technology on their lives and 21 participants see “more” negative consequences of the usage of technical devices. The average technology affinity score of the last category (negative impact) with a value of 2.91 as well as a standard deviation of 0.71 shows, however, that some negative effects are seen by almost all participants (only two have a score less than 2 here).

Technology affinity score category	average technology affinity score	standard deviation	# Participants with a score <= 3; “technically-minded”
general	2.60	0.56	26
enthusiasm	2.97	1.08	18
competence	2.11	0.79	30
technology has a **positive** impact on our lives	2.14	0.52	34
technology has a **negative** impact on our lives	2.91	0.71	21

Table 1: Technology affinity scores (1 = full affinity for technology and 5 = no affinity for technology)

[2] In the original publication of the technology affinity questionnaire in Karrer et al. (2009) the two categories “negative impact” and “positive impact” seem to be mixed up.

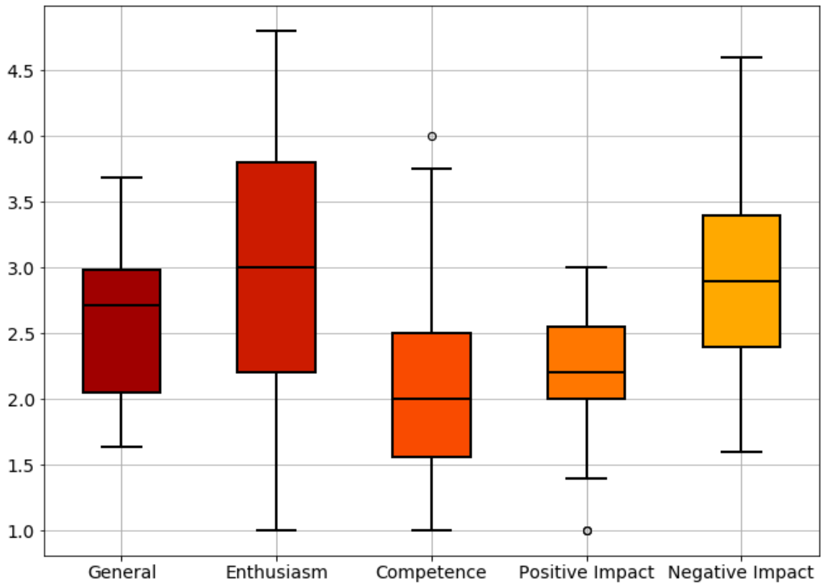

Figure 2: Boxplots of the different technology affinity score categories

5.3. RESULTS OF THE TECHNOLOGY AFFINITY AND IAT

In this section, the D-Scores are analyzed regarding the technology affinity of the participants. The average D-Score of the technically-minded participants based on the general affinity for technology is 0.342 (standard deviation of 0.42), whereas non-technically-minded participants have an average D-Score of 0.524 (standard deviation of 0.41). However, this result is not statistically significant ($p = 0.3$) and can be seen only as a slight tendency. Therefore, Hypothesis 2 “The calculated implicit attitude of students with a high technology affinity score differs from the results of students with a low technology affinity score.” needs to be rejected.

Exploratively, the D-Score regarding the subcategories of the technology affinity questionnaire were analyzed. Table 2 and Figure 3 show the average D-Score values for the general technology affinity as well as its subcategories.

Technology affinity score category	average D-Score of technically-minded participants	average D-Score of non-technically-minded participants	p-value
general	0.342	0.524	0.33
enthusiasm	0.259	0.538	0.04
competence	0.362	0.604	0.35
technology has a **positive** impact on our lives	0.390	n/a	n/a
technology has a **negative** impact on our lives	0.356	0.445	0.55

Table 2: D-Scores based on the different technology affinity score categories; significance tested using the Mann-Whitney-U test

Noteworthy is that 18 of the 34 participants who can be classified as enthusiastic about technology based on the technology affinity questionnaire have an average D-Score of 0.259 (standard deviation of 0.46). The other 16 respondents have a significantly higher implicit preference towards the university with an average D-Score of 0.538 (standard deviation of 0.33). This difference is statistically significant (p = 0.04). This implies that enthusiasm for technology might influence the implicit attitudes of participants regarding the trust dimension.

For the “positive impact” no comparison was possible as all participants are technically-minded. In the "negative impact" category, the 21 technically-minded respondents have an average D-Score of 0.356 (standard deviation of 0.46) and the 13 non-technically-minded respondents also have very similar values with an average D-Score of 0.445 (standard deviation of 0.36).

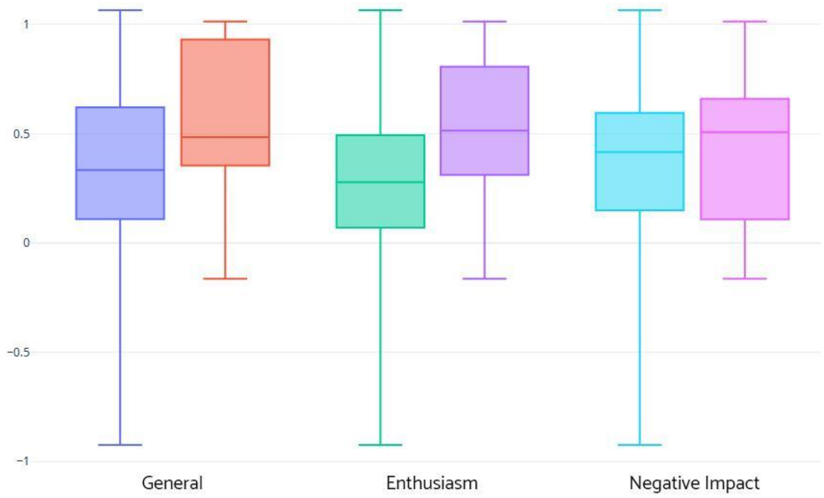

Figure 3: Boxplot diagram of the D-Scores regarding different technology affinity (sub)categories

6. DISCUSSION

Generally, using an IAT as the implicit measurement method in this preliminary study is a reasonable choice. First, this type of survey does not require that the respondents are aware of their attitudes or are willing to report on them (cf. Plischke, 2012). Also, subjects have little opportunity to influence the outcome of the IAT. Thus, the determined value can be seen as relatively unaffected by attempted regulations based on social desirability or self-presentation. The main reason for this is that the respondents do not know what exactly is being measured (cf. Arendt, 2016; Shanahan et al., 1999). Additionally, the IAT is the most commonly used implicit measurement method and it has been used in various contexts as well as has been praised for the good results (cf. Arendt, 2016; Nosek et al., 2007).

In literature, it was described that age plays a significant role in IAT scores ("[...] older subjects tend to show larger IAT effects than younger subjects (Greenwald & Nosek, 2001; Hummert, Garstka, O'Brien, Greenwald & Mellott, 2002)”, Nosek et al., 2007, p. 272). If only the D-Scores of the seven respondents age >= 30 are considered, there is an average D-Score of 0.476 (standard deviation of 0.38, median of 0.48). Comparing this D-Score with the scores of the respondents’ age < 30, there is a clear deviation: This group has an average D-Score of 0.368 (standard deviation of 0.44, median of 0.46). Therefore, this effect could be replicated in our study.

There are two main limitations of this study. First, it must be noted that only a comparatively small number (34) of students were surveyed. Besides, women were significantly underrepresented at 29 %, only students from one single university (University of Potsdam, Germany) were interviewed and the subjects were largely selected through self-selection. Second, the designed IAT was not systematically psychologically verified before, however, IATs, in general, are attributed a high reliability and convergent and discriminant validity (cf. Arendt, 2016; Nosek et al., 2007). These aspects certainly limit the generalizability; however, the study was only planned and conducted as a preliminary study. These issues can be addressed in a larger follow-up study.

Please note, that this study (design) did neither investigate reasons why students prefer their university over internet companies nor why students prefer some (commercial) services over other (university) services. The focus of this study was to investigate implicit preferences on the trust dimension. In order to investigate why specific services seem to be preferred, multiple dimensions have to be considered. Possible dimensions can be extracted from e.g. the Technology Acceptance Model 2 (cf. Section 4.1; Venkatesh & Davis, 2000), but also other aspects such as popularity in the peer group, actual or feared vendor lock-ins, or the limited time of the university account might play an important role. To explore these reasons, further research is needed, maybe in combination with an IAT.

In recent literature, it is noted that explicit surveys focusing on behavioral intention instead of actual behavior are not an optimal way of investigating privacy attitude and behavior (cf. Kokolakis, 2017). Therefore, another interesting question for further research is whether explicit privacy attitudes and implicit ones differ.

7. CONCLUSION & OUTLOOK

In this paper, the results of a preliminary study investigating the inner attitude of students towards the disclosure of personal data to commercial and non-commercial university services using an Implicit Association Test on the trust dimension are presented.

There were 34 participants taking part in a study. The main finding is a moderate implicit positive attitude towards the university regarding trust. As a second part of the study, it was investigated whether technology affinity influences the effect size of the result. There only seems to be a slight tendency for a difference between the groups of technology affine and not affine students (not statistically significant). However, an exploratory data analysis showed a significant difference in the implicit preferences regarding the enthusiasm for technology.

There is a need for further research, particularly to investigate the difference between explicit and implicit privacy attitudes or to find reasons why specific online services are preferred over other services. Based on these preliminary results our goal is to conduct a more comprehensive study. Particularly, it would also be interesting to extend this study to other universities across Europe.

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