# Improving university students' awareness of cookies used by web technologies

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### ABSTRACT

Web technologies are developing rapidly and although the advantages provided by these technologies are quite numerous, they also bring with them problems related to the security of personal data. Especially, the fact that personal data is obtained by using cookies on websites requires web users to be made aware of this issue. While cookies have important advantages in terms of providing fast and easy access to websites, they also have the ability to record and process what web users read, location information, IP addresses, user device information, e-mail addresses, usernames and passwords. It is not legal to record this data without the explicit consent of the person. However, this situation is generally unknown to users or users who have incomplete information. The aim of this study is to raise awareness of university students who frequently use web technologies about cookies so that they can ensure their personal data security with their own efforts. In line with this purpose, a mixed method study was implemented. 25 university students participated in this study. Participants were determined using the convenience sampling method. Online interactive training consisting of 12 lesson hours was organized for the participants. Since quantitative and qualitative data from the participants were collected simultaneously and support each other, a concurrent mixed method model was applied. Quantitative data were collected with awareness pre-test and post-test, and qualitative data were collected with the interview form. Test scores obtained by a single group at different times were analyzed with the Paired Samples t-Test. Qualitative data were also analyzed by content analysis method. As a result of the study, it was revealed that the participants' awareness levels about cookies increased significantly. In addition, the participants' knowledge about risks, advantages and working principles of cookies increased.

## Introduction

The emergence of Internet technologies and their rapid use in various areas can be considered one of the most important developments of the 21st century. In particular, the use of technological tools connected to the Internet has enabled individuals to quickly access information and have fun (watching videos, listening to music, playing digital games, etc.) without

being bound by space and time. While individuals accessed ready-made information when the Internet was introduced, today they can create information themselves on the Internet and quickly share it with other users (Takaya & Talay, 2019). There has been an evolution from Web 1.0 technologies, which only have a static structure and one-way communication, to Web 2.0 technologies, which can develop their own content, and finally, it is noteworthy that there has been an evolution towards the Semantic Web has or Web 3.0 (Bozkurt, 2013). In line with these developments in web technologies, individuals have begun to interact more with technology and develop products. In addition to the convenience that these evolving technologies bring to education, social life and business, they also bring with them some issues regarding the security of personal data. When visiting a website, various information is usually requested from the user. At this point, it is the most obvious right of users to know how securely the personal data they provide is kept. However, in the study conducted by Takaya and Talat (2019), it was found that users' information about the security of personal data was incomplete and therefore they could not protect the situations considered privacy for them. In particular, the fact that personal data is collected using cookies on websites requires that web users be informed of this issue. Therefore, in the context of this study, it is considered important to raise awareness of cookies among university students who frequently use web technologies so that they can ensure the security of their personal information on their own.

In Turkey, the Personal Data Protection Law (KVKK) was enacted in 2016, and the processing of personal data, rights, obligations, complaints and responsibilities were regulated under this law. To implement the rights arising from the law, it is important to first know what personal data is. In law, personal data is any information relating to an identified or identifiable natural person (KVKK, 2016). In addition, it appears that when processing personal data within the framework of the law, attention should be paid to the following points: (1) compliance with the laws and rules of honesty, (2) accuracy and timeliness -up-to-date, if necessary, (3) for certain , clear and legitimate purposes, (4) related to, limited to and proportionate to the purpose for which they are processed, (5) stored for the period specified in the relevant legislation or necessary for the purpose for which they are processed (KVKK, 2016). Viewed from this perspective, the fact that cookies have the potential to obtain what users read on websites, location information, IP addresses, user device information, tracking IDs to identify people on subsequent use of the same device, email -Addresses, usernames, etc. Passwords (Akan & Tanyeri, 2020; Data Protection Commission, 2020) inevitably shows that cookies can bring some disadvantages in terms of the security of personal data. Cookies are briefly described as small pieces of information that are sent from the web server to the user's computer (Oktay, 2009). With this small piece of information, he receives various personal data as part of the user's consent. Based on some personal data collected using cookies, the website is customized according to the user's needs and preferences when the website is accessed again (Gais Security, 2021). This situation shows that cookies not only have disadvantages, but also some advantages. The purpose of using cookies is to:

- Ensure that websites function more smoothly,
- Allow users to revisit websites later
- Provide access to some features offered by the websites,
- present advertising based on user behavior and interests,
- Remember passwords and provide easy access,
- Store some analytics data for websites (Gais Security, 2021).

When one examines the uses of cookies, one finds that they provide various conveniences to web users. However, this is where the concept of explicit user consent emerges. It is understood that

when entering a website, consent to the storage of our personal data by the web server is required. When we enter the websites, a warning appears, and users must agree to the cookie and privacy policies to benefit from this service. However, this is considered forced consent (Takaya & Talay, 2019). Additionally, users generally do not read cookie and privacy policies and do not know what they are approving. Most users have come across advertisements for this product on various websites after examining a product on a shopping site. This situation arises due to the cookies that web users have accepted. Information about which product pages we have visited is collected through cookies and therefore we encounter advertising based on this information on various websites. However, not every website may use the same cookies. Cookies are divided into three categories according to their sources, storage times and purposes (Doan & Bozkurt, 2020). Table 1 classifies cookies and contains their descriptions.

**Table 1** Classification of cookies

| Cookie types by source | Explanation |
|---|---|
| First party cookies | These are cookies created by the website visited by users and directly related to the user. |
| Third party cookies | Allow third parties to track users with these cookies by enabling their use on their own websites (Skouma & Lonard). |
| Cookie types by storage type | Explanation |
| Temporary cookies (session cookies) | These cookies are less risky and only work when the website is open (Aksoy & Halıcıoğlu, 2021). |
| Persistent cookies | These are cookies that are not deleted when the website is closed (Aksoy & Halıcıoğlu, 2021). |
| Cookies by purpose | Explanation |
| Mandatory cookies | These are cookies that must be accepted by the user to navigate the website and use the service. |
| Functionality cookies | These are cookies that remember the preferences that the user has set in the past on the internet (Aksoy & Halıcıoğlu, 2021). |
| Performance cookies (analytical cookies) | These are cookies that track how the user uses the website (Aksoy & Halıcıoğlu, 2021). |
| Advertising/marketing cookies | These are cookies that record the user's navigation information and display advertisements according to their interests (Aksoy & Halıcıoğlu, 2021). |

Examining Table 1, it becomes clear that users may knowingly or unknowingly share their personal information while visiting websites. However, from the information in Table 1, personal data obtained through cookies also provide significant convenience to web users when processed in accordance with KVKK. At this point, web users should know and agree to what purpose, by whom and for how long cookies use personal data. Therefore, it is considered that information security requires users to be informed and have a high level of awareness about cookies.

In the early years of web technologies, websites did not require personal information from users because they had a static structure. Today, websites require cookies for processes such as user login, advertising and content creation. Studies have examined cookies, which have the potential to speed up and facilitate transactions on websites. In their study of advertising/marketing cookies, Anton, Earp and Young (2010) concluded that cookies storing personal information are a concern. This study also found that the 29 to 35 age group had greater concerns. In a study by McDonald and Cranor (2010), it was shown that more than half of users had limited knowledge about cookies. Users in the know thought that cookies only had to do with storing passwords. Another study was conducted by Akan and Tanyeri (2020) on online behavioral advertising. As a result of the study, it was found that users did not know the names of the cookies and their purposes. In addition to applied research, theoretical studies on cookies have also been carried

out. Takaya and Talay (2019) conducted a study focusing on explicit consent regarding cookies. According to this study, problems arose due to the uncertainty in defining the concept of explicit consent in relation to the use of cookies. Aksoy and Halıcıoğlu (2021) examined the problem of cookies in the legal framework. This study concluded that Turkish law should be compatible with European Union legislation and technological developments in order not to fall behind the digital age. Finally, the data protection authority organized two seminars on cookies in 2021. During these seminars, various information on cookies and explicit consent as well as cookies in Turkish Law considering the European Union Data Protection Regulations were presented. These seminars focused on the importance of cookies and regulatory issues based on evolving technology. However, since these seminars are broadcast online, it does not seem possible to experience a learning process based on mutual interaction. Since the focus is on deeper technical and legal aspects, it does not seem possible to reach target groups with low technology skills. This study carried out activities based on interactive applications in face-to-face learning environments that university students who have no knowledge of cookies can understand and use.

## Related studies

Pelau, Niculescu and Stanescu (2020) focused on consumers' perceptions of the advantages and disadvantages of this technology. The study found that consumers generally perceived the advantages of cookies at an average level but had a higher awareness of the disadvantages and risks (Pelau, Niculescu, & Stanescu, 2020). Furthermore, a large proportion of consumers reported that they are not careful about reading cookie policies and therefore approve websites' data collection practices without fully understanding them (Pelau, Niculescu, & Stanescu, 2020). Boerman, Kruikemeier and Zuiderveen Borgesius (2017) put their study in the context of online behavioral advertising (OBA). It was stated that OBA is the practice of delivering personalized advertisements by tracking users' online behavior and using the information obtained from this behavior (Boerman, Kruikemeier, & Zuiderveen Borgesius, 2017). It has also been emphasized that the information obtained using cookies is often collected without the consumer being aware of it, which can lead to ethical and privacy issues (Boerman, Kruikemeier, & Zuiderveen Borgesius, 2017). Consumer privacy concerns are exacerbated by OBA's lack of transparency and secrecy of data collection processes (Boerman, Kruikemeier, & Zuiderveen Borgesius, 2017).

Mathews-Hunt (2016) presented a study explaining how cookies used in online advertising are used to track users' activities on the internet. In this study, it is emphasized that cookies are both an important tool for data collection and a potential threat to user privacy (Mathews-Hunt, 2016). Nill and Aalberts (2014) conducted a study on the use of cookies in Online Behavioral Targeting (OBT). In the study, although it is stated that OBT has potential advantages for both consumers and advertisers, it is emphasized that this practice carries the risk of violating consumer privacy and generally falls short of transparency and consumer control (Nill & Aalberts, 2014). As a result, the study has elaborated that cookies are a critical tool in the context of Online Behavioral Targeting, but that this practice poses ethical and legal challenges (Nill & Aalberts, 2014). In Kelly's (2005) study, while discussing the effects of information technologies on education, it is stated that cookies on children's computers may have more information than their teachers. The implication is that cookies collect information about students' interests and preferences, but that this information is not used by educators and that they fail to shape education according to the individual needs of these students (Kelly, 2005).

As a result of the literature review, it is understood that users generally do not have sufficient knowledge and awareness about cookies. In addition, cookies are not only a helpful tool but also harbor various threats. Therefore, it is important to raise the awareness of digital natives who

spend most of their time in the digital world. Therefore, this study aims to increase the awareness of university students about cookies.

**The purpose of the study**

As a result of the literature review, it is also noteworthy that web users have incomplete information about cookies or even no information at all. In addition, with the development and widespread use of internet technologies, the security of personal data has become important. It is also seen that users' incomplete information about cookies within the scope of personal data security can lead to privacy problems for users. In this context, the aim of the research is to increase the awareness of university students about cookies. In line with this purpose, the following research questions will be answered:

1. Is there a significant difference in participants' awareness of cookies after the training?
2. What effect do the training courses offered have on raising awareness of the topic of cookies?

# Method

## Research model

This study was conducted as mixed-method research. A mixed method is the combination of both qualitative and quantitative methods, approaches, and strategies in one study (Creswell, 2003). The reason for choosing this research method is to capitalize on the strengths of both qualitative and quantitative research methods (Baki & Gökçek, 2012). In this study, an interactive online training consisting of 12 lessons was conducted to raise awareness about cookies. After the training, both quantitative and qualitative data were simultaneously collected from the participants based on the research questions. Therefore, the concurrent mixed method model was used as the research model. In this model, quantitative and qualitative data are collected from participants simultaneously, which support each other (Brannen, 2005).

## Participants

In determining participants, preference was given to the convenience sampling method. This will make it possible to reach enough participants (Baltacı, 2018). The number of participants was limited to 25 students based on their applications. As a criterion, the participants were selected from people with low and medium basic knowledge in the field of information technologies. Therefore, only first- and second-semester students were included in the study. Table 2 shows the demographic information of the participants.

**Table 2** Demographic Information of the Participants

| Demographic Information | | f |
|---|---|---|
| Gender | Female | 16 |
| | Male | 9 |
| Age | 18-20 | 20 |
| | 21-23 | 5 |
| Classroom | 1 | 17 |
| | 2 | 8 |
| Department | Social | 4 |
| | Technical | 15 |
| | Health | 6 |

## Data collection

Application form: An online application form will be provided to students who would like to take part in the application. This form was used to obtain demographic information (first name, last name, department, class information) and information about their basic information technology status. When designing this form, two different expert opinions were considered to ensure the validity of the content.

Awareness test: To measure the participants' awareness of cookies before the start and after completion of the training, a test was carried out on the cookies used in the study by McDonald and Cranor (2010). With this tool, quantitative data could be obtained and changes in awareness could be revealed. It was stated that the questions used in the study were prepared to measure users' knowledge and perceptions about cookies. These questions were first developed based on the findings obtained through qualitative interviews and then tested with an online survey (McDonald & Cranor, 2010).

Interview form: A semi-structured interview form was developed to obtain qualitative data. During the form development process, opinions were obtained from two different experts. This form was used to collect qualitative data on the effectiveness of the training. The interview questions are as follows:

1. What are your general thoughts on cookies?
2. What are your thoughts on education?
3. Do you think having cookies is positive or negative for the internet environment? Why?
4. Is there a difference between before and after the training? Can you explain whether this difference is positive or negative?
5. What is the most memorable point in education?

## Data analysis

The awareness test was used as a pre-test and post-test. The quantitative data obtained from this test were analyzed with the SPSS program. Whether there was a significant difference between the test scores obtained by a single group at different times was analyzed with the Paired Samples t-Test.

The qualitative data obtained from the interview form was subjected to content analysis. Content analysis is a systematic and repeatable technique in which text expression is converted into smaller content through coding within certain rules (Büyüköztürk, Çakmak, Akgün, & Demirel, 2017).

## Research process

This research consists of preparation, implementation and reporting phases. Initially, data collection tools were developed in the preparation phase based on expert opinions and with literature support. The participants were then identified, and the place and time of the training were announced on the promotion website. In this phase, the subtopics, content and activities of the training were prepared according to the topic. Training topics include a general overview of personal data security, types of cookies (pros and cons), access to cookies, examples from everyday life and legal rights. In addition, concrete examples and applications were carried out to increase the persistence of these topics. In the other phase, the implementation process, 12-hour online training sessions were conducted. The lessons were determined by obtaining the opinions of two experts who have scientific studies on information security. A pre-test was carried out before the application began and a post-test was carried out after the application was completed. In addition, at the end of the application, interviews were conducted with 10 students

randomly selected from the participants to find out their general thoughts on cookies and education. Finally, in the reporting phase, all data was analyzed and converted into a report. The research process is summarized in Figure 1:
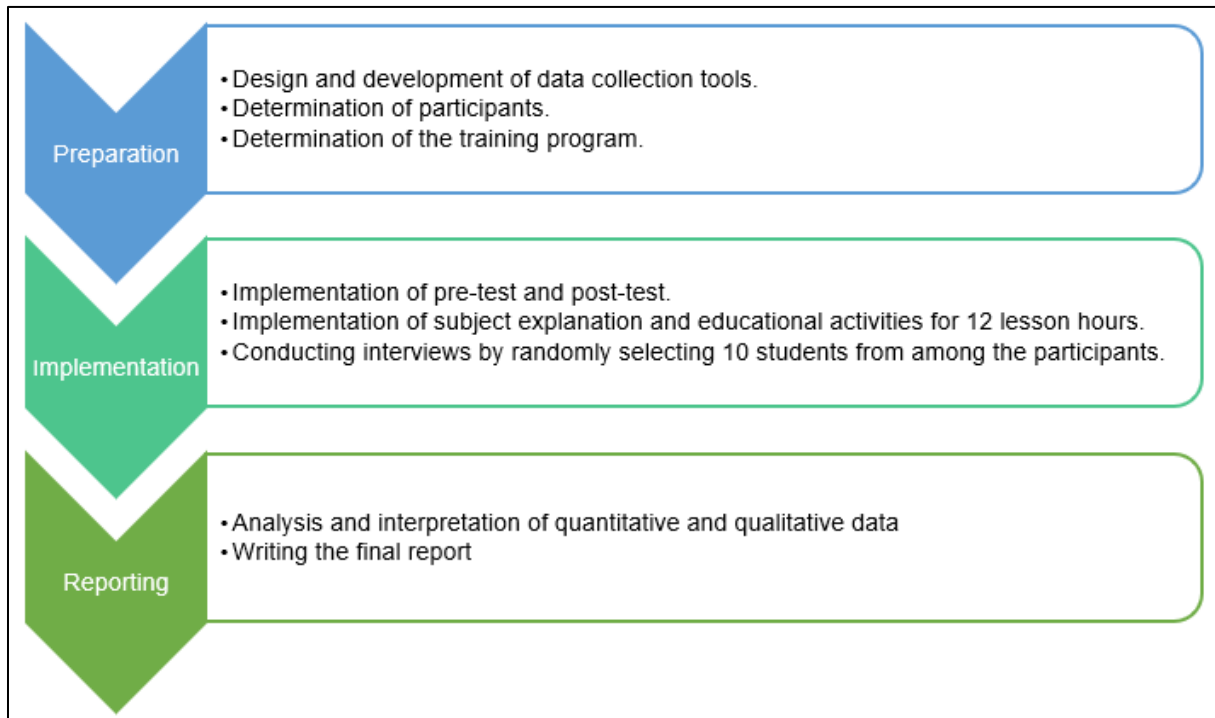


**Figure 1** Research process

## Results

Before and after the training, the awareness of students about cookies within the scope of personal data security was measured with pretest and posttest. A paired samples t-test was applied to reveal whether there was a significant difference between pre-test and post-test scores. Descriptive statistical information is given in Table 3.

**Table 3** Descriptive statistics

|  | Group | Mean | N | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| Pair 1 | Pre-test | 0,440 | 25 | 0,249 | 0,049 |
|  | Post-test | 0,666 | 25 | 0,118 | 0,023 |

The number of individuals who were applied pre-test and post-test was 25 for both tests. It was observed that the posttest mean score of this group ($\bar{x}$=0.66) was higher than the pretest mean score ($\bar{x}$=0.44). A paired samples t-test was applied to determine whether this difference between the scores was significant (Table 4).

**Table 4** Paired samples t-test results

|  | Mean | Std. Deviation | t | df | p |
|---|---|---|---|---|---|
| Pre-test-Post-test | -,226 | ,303 | -3,732 | 24 | ,001 |

When Table 4 is examined, it is seen that the difference between the pretest and posttest scores is significant in favor of the posttest. This shows that the training on cookies was positively effective, and the students' awareness improved.

In addition to quantitative data, qualitative data was also obtained in this project. Interviews were conducted with 10 different students about cookies and education. The interviews were examined

by 2 field experts through content analysis. As a result of the examination, 8 different codes emerged (Table 5).

**Table 5** Content analysis results

| Code | f | Sample Student Statement |
|---|---|---|
| Security | 7 | S1: "I don't want it to be used for malicious purposes." |
| | | S10: "Cookies may pose a security risk." |
| | | S5: "Cookies can be used with bad intentions." |
| Ease of Use | 8 | S3: "Cookies make my online experience easier." |
| | | S6: "Cookies make my job easier." |
| | | S4: "Cookies prevent me from entering information over and over again." |
| Information | 6 | S3: "I learned more about cookies." |
| | | S6: "I didn't know about cookies before this tutorial." |
| | | S7: "I didn't know much about cookies." |
| Education | 7 | S4: "The training was beneficial for me." |
| | | S2: "This training was really informative." |
| | | S9: "Thanks to the training, I became more aware of cookies." |
| Negative Aspects | 5 | S5: "There are security risks." |
| | | S4: "It can be used maliciously." |
| | | S8: "Cookies can sometimes collect unnecessary information." |
| Positive Aspects | 8 | S7: "I use the internet more comfortably." |
| | | S8: "Cookies make my job easier." |
| | | S3: "Cookies make shopping faster." |
| Awareness | 7 | S10: "I'm more careful now." |
| | | S3: "I am more conscious now." |
| | | S6: "I think more before I accept cookies." |
| Personal Opinions | 2 | S2: "I understand the importance of cookies better now." |
| | | S9: "I think twice before accepting cookies." |
| | | S1: "I changed my mind about cookies." |

## Conclusion and discussion

Within the scope of the study, it was concluded that the awareness training given to university students regarding cookies had a positive effect on the development of students' awareness. There was a significant difference in the awareness status of the students before and after the training. Taşkaya and Talay (2019) state that although there are various regulations regarding cookies today, complaints continue. This indicates that the awareness levels of users are not fully developed. With this study, this awareness level was improved for users who participated in the training. Similarly, Pelau, Niculescu, and Stanescu (2020) reported that most consumers are not careful about reading cookie policies and therefore approve websites' data collection practices without fully understanding them.

The potential security threats posed by cookies were identified as one of the most concerning issues among students. Most students highlighted the risk of cookies being used for malicious purposes and expressed serious concerns about this issue. Security concerns were found to have a significant impact on how students evaluated cookie policies. In the study conducted by McDonald and Cranor (2010), it was observed that the participants had confusion about the purpose and effect of cookies. In this study, it was determined that the participants had a similar situation before the training, but their awareness increased after the training. Boerman, Kruikemeier, and Zuiderveen Borgesius (2017) emphasized that the information obtained using cookies is often collected without the consumer being aware of it, which can lead to ethical and

privacy issues. There was a strong consensus that cookies make it easier to navigate websites and improve the user experience. Students stated that cookies make internet use more efficient and are therefore aware of the positive aspects of this technology. Knowledge about cookies is an important factor in determining how students interact with cookies. The training process helped students learn more about the functions and potential risks of cookies. Torres-Hernández and Gallego-Arrufat (2023) showed in their study that teacher candidates are aware of the risks of cookies they encounter while surfing the internet. In this study, it is understood that they are aware of the risks after the training. The training increased students' knowledge about cookies, enabling them to make more informed decisions about internet security. The negative aspects were generally associated with security risks and concerns about the misuse of personal data. Students accepted that the use of cookies could bring such risks. On the other hand, the positive aspects of cookies, such as ease of use and improving personal experience, were also emphasized. Nill and Aalberts (2014) stated in their study that cookies are a critical and important tool in the context of Online Behavioral Targeting. After the training process, a significant increase in students' awareness of cookies was observed. Students began to examine cookie policies more carefully and made more conscious decisions about accepting or rejecting cookies. McDonald and Cranor (2010) concluded in their study that most of the participants understood that cookies were saved on the computer and how they worked. Students' personal views on cookies tended to balance the benefits and risks of cookies in general. While some students appreciated the benefits of cookies, others drew attention to potential privacy issues.

In conclusion, this study demonstrates how student knowledge and awareness about cookies can be increased through an informative educational process. Providing students with the necessary knowledge and awareness to make informed decisions about cookie policies should be at the core of internet security and data protection strategies in the digital age.

### Recommendations

Within the scope of this study, it was tried to increase the awareness levels of university students about cookies with training. In this context, different training courses with longer duration and more interaction can be organized. This study was conducted for university students. Similar studies can be conducted to raise awareness at primary, middle and high school levels. In addition, topics on cookies and the protection of personal data can be added to the information technologies course.

### Limitations

This study was limited to 25 university students. In addition, implementations were carried out during 12 courses.

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