

# The Role of Privacy and Security Concerns and Trust in Online Teaching: Experiences of Higher Education Students in the Kingdom of Saudi Arabia

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**Keywords:** Online Higher Education, Privacy and Security Concerns in Online Teaching, Trust in Online Teaching, Videoconferencing Technologies, Webcam Use.

**Abstract:** Higher education institutions (HEIs) are increasingly using online teaching, particularly since the COVID-19 pandemic. Numerous digital technologies are now used in online teaching, such as videoconferencing for online classes. This has raised privacy and security concerns for students, as well as a reluctance to have webcams on during online classes. This study investigated the privacy and security concerns in online teaching of HEI students in the Kingdom of Saudi Arabia (KSA), as well as their trust in a range of actors and entities involved in online teaching. It also investigated their use of webcams and their reasons for having their webcams off during online classes. The study was conducted in the real-world context of online courses at a HEI in KSA. It found high levels of concern about online privacy in relation to the institution, but moderate levels in relation to instructors and classmates and in relation to online security. Complex, unexpected relationships were found between online privacy and security concerns and trust. As with previous research, students were reluctant to have their webcams on for a variety of reasons, often concerned with privacy of personal information. Only trust in instructors was a significant predictor of whether students were likely to have their webcams on during online classes.

## 1 INTRODUCTION

Online teaching has become increasingly popular in recent years, especially since the COVID-19 pandemic. Although many higher education institutions (HEIs) were already using online systems such as virtual learning environments (VLEs) before the pandemic, the use of a range of different digital technologies greatly increased when HEIs moved to fully or nearly fully online teaching as a result of the pandemic. The move to online teaching has also highlighted issues around the privacy and security of these technologies for students.


A number of studies in different countries have investigated HEI students' privacy and security concerns about online teaching during the pandemic. These concerns include being recorded without permission during online classes, not knowing where


personal information and recordings are stored and who has access to them, unauthorised people entering and disrupting online classes, and the need to have webcams on during online classes. Cultural and contextual variations add layers of complexity in understanding these concerns.

Our study explores the relationships between privacy, security, and various forms of trust in online teaching. Trust can take various forms, for example interpersonal, institutional, and technological. It may play an important role in students' experience of online teaching. This study also explores the use of videoconferencing technology, particularly the use of webcams, in online teaching. Previous research has identified students' reservations about webcam use, relating to anxiety, shyness, and privacy issues.

Our research questions are:

RQ1: For HEI students in the Kingdom of Saudi Arabia (KSA), what are the levels of concern about

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online privacy, security and trust in a range of actors and entities in online teaching?

RQ2: For KSA HEI students, what is the relationship between trust in different actors and entities in online teaching and their privacy and security concerns about online teaching?

RQ3: For KSA HEI students, what are the levels of webcam use and attitudes to webcams in online teaching?

RQ4: With respect to privacy and security concerns and trust in online teaching, how do these affect KSA students' use of webcams in online teaching?

## 2 BACKGROUND

### 2.1 Students' Privacy and Security Concerns in Online Teaching

Many researchers fail to discuss what they specifically mean by online privacy and security concerns when discussing these concepts. However, the privacy and security issues of online teaching have been analysed for a number of different contexts, including privacy in collaborative tasks (Patil & Kobsa, 2005), protecting students' privacy and security in online teaching environments (by this term we mean not just the VLE, but the whole environment, which may include a range of technologies) (Anwar & Greer, 2012), preserving students' personal and private information during online discussions (Booth, 2012), and maintaining privacy on social networking sites used for online teaching (Salmon et al., 2015).

Recently, Kularski and Martin (2021) conducted a systematic review of issues related to online privacy for HEI students and identified 41 relevant papers. Most of these papers focused on students' online privacy on social network sites and their online privacy beliefs and behaviours in those environments. However, the authors identified a lack of research on privacy concerns in online classes and students' perceptions of interacting and sharing information in online teaching environments.

Since online teaching environments allow students to interact, edit, share, and study using personal and private information sources, security concerns have also gained importance. As a result, it is critical to restrict access to information and resources to authorised users and to safeguard the privacy, accessibility, and integrity of the online teaching environment for those users (Aldheleai et al., 2015). Students' information should not be compromised by an online teaching environment, and

it should be well secured (Zhang & Nunamaker, 2003). For instance, it matters whether or not students are being recorded during online classes, as well as who may access the recordings (especially academic staff members) and where the recordings will be stored.

Greater dependence on digital technologies for teaching has brought a new set of online privacy concerns for both students and instructors. Privacy concerns differ by context and might shift over time among different communities. New privacy concerns may arise, and privacy agreements may need to be amended and tailored to new sets of people or a new context (Martin, 2016). In a recent study exploring the attitudes and concerns of HEI students regarding the use of technology in online teaching and studying, distinctions emerged between Saudi Arabian and British students regarding their concerns about online privacy and security about the use of chat technologies (Almekhled & Petrie, 2023a & b). Nevertheless, both Saudi and British students showed similar concerns related to online privacy and security when considering the use of video conferencing for online teaching. Also, British students' ratings of their concerns about online security and privacy were low, but further investigation through open-ended questions revealed concerns such as unauthorised recording of online classes, disruptions during classes, and uncertainty about data access.

Smith et al. (2011) noted that it can be practically impossible to assess privacy overall when considering the diverse definitions of privacy. Given that privacy depends on context, and its measurement will likewise depend on context. The choice of privacy concern measurement scales in this study is driven by a consideration of the online teaching context. Numerous researchers have developed scales to measure online privacy concerns. For example, the scales about Internet users' concerns about the privacy of their information developed by Malhotra et al. (2004) and Buchanan et al. (2007) were not used due to their emphasis on general technology-related concerns and lack of consideration of crucial dimensions in online teaching. Liu et al.'s (2018) scale was also considered unsuitable as it measures privacy risk rather than concerns about privacy.

In contrast, the Concern for Information Privacy Scale (CFIP), initially developed by Smith et al. (1996) and later adapted by Peng and Dutta (2022), was selected due to its suitability in evaluating the privacy concerns of students about online teaching. This scale addresses a broad range of concerns related to personal information and its reliability in the context of online teaching research has been

demonstrated. In addition, the scale developed by Kim (2021) is useful in providing an understanding of students' privacy and security concerns during online classes. It allows for the identification of specific concerns, such as unauthorised access and monitoring during online classes. Finally, we developed new items to measure privacy concerns about the student's location and personal space in online teaching classes and concerns about the privacy of information in a range of different online teaching situations. These were developed as they were considered important concepts to measure but were not covered by previous scales.

## 2.2 Trust in Online Teaching

As with privacy, researchers highlight the complex nature of trust, and have developed a number of definitions emphasising different aspects of the concept. McEvily et al. (2003) gave a definition of trust as "an expectation, a willingness to be vulnerable, and a risk-taking act". On the other hand, Fukuyama (1996) and Van Houtte (2007) emphasized the communal dimension of trust, defining it as "an expectation that other members of the community will behave cooperatively and honestly". Tierney (2006) introduced the idea that trust is not a static concept but rather a dynamic process, involving a series of interactions characterized by risk-taking or faith. For this study we defined trust as a "firm belief in the competence of an entity to act dependably, securely, and reliably within a specific context" (based largely on the definition from Grandison & Sloman, 2000). In the context of online teaching, this belief is what the students have in their instructors and their classmates and the VLE they are using, as well as the institution as a whole.

According to Ejdy (2018), research on trust in technology has considered multiple trust types such as interpersonal trust, institutional, organizational and trust in technology per se. In the context of online teaching, interpersonal trust can take two forms: within the community of students and the trust between students and their instructor. In terms of trust within the community of students, this type of trust is the assumption that other community members (i.e., other students) will behave cooperatively and honestly (Rice & Schroeder, 2021). In terms of trust in instructors, according to Cavanagh et al. (2018) students' trust in their instructors can be defined as the belief that the instructor understands the challenges that students face as they advance through the course, accepts students for who they are, and cares about their educational welfare.

Another type of trust is that in an organisation or institution such as an HEI. Trust in an organisation can be defined as individuals' positive expectations about an organisation (Luhmann, 1979; Misztal, 1996). In the context of online teaching, this type of trust means that students have positive expectations about their institution that reflect the institution's care for its students, its implementation of principles of ethics and social responsibility in its activities, and its offering of opportunities for the personal development of its students.

Thus, trust in online teaching covers a range of components, reflecting trust in different actors (instructors, other students) and entities, both organisational (the institution) and technological (the VLE, as well as other digital technologies such as video conferencing, chat, webcams, microphones which may be used in online teaching). Participating in online teaching, like all teaching, involves sharing one's opinions, information and knowledge, but also in the case of online teaching, potentially one's location and physical environment (e.g., a view of some of one's house) with potentially considerable self-disclosure. Self-disclosure may lead to privacy concerns involving such personal information and how this is shared with others and used by them (Joinson & Paine, 2006). Self and personal information disclosure may be very dependent on trust (Briggs et al., 2004). Trust reduces the perceived risks of disclosing self and personal information (Anwar and Greer, 2012; Steel, 1991).

Due to its importance, we investigated the impact of different types of trust on students' concerns about privacy and security in online teaching.

## 2.3 Use of Webcams in Online Teaching

Previous research has explored the role of webcams in videoconferencing technologies and their potential impact on engagement, interaction and learning in online teaching classes. The expectation is that the use of webcams can facilitate a more direct and personal connection between students and instructors, leading to increased engagement and more active and meaningful interaction (Giesbers et al., 2013; Gillies, 2008).

A number of studies have investigated HEI students' attitudes to the use of webcams in online teaching and specifically why students do not want to have their webcams on during online classes (Almekhled & Petrie 2023a; Bedenlier et al., 2021; Castelli & Sarvary, 2021; Dixon & Syred, 2022; Gherheş et al., 2021). These studies have been

conducted in a number of countries (Saudi Arabia, Germany, the USA, the United Kingdom, and Romania, respectively), and all found students were very reluctant to have webcams on during online classes. A range of reasons has been found to explain this reluctance: shyness, anxiety, social norms, and lack of pressure to turn the webcam on unless the instructor specifically requests it. All these studies also highlighted privacy issues as major concerns in relation to webcam use. However, research has also shown that if students in online classes cannot see one another or the instructor, they feel isolated and disengaged (Pallof & Pratt, 2007; Petchamé et al., 2022). While previous studies have explored students' perspectives on webcam use during online teaching, the connection between privacy and security concerns, trust, and the use of webcams remains an unexplored area in the context of online teaching, and is the focus of our research.

### 3 METHOD

#### 3.1 Design

A study was conducted in a real-world blended teaching situation at the Saudi Electronic University (SEU), a blended teaching HEI in Saudi Arabia. The study targeted undergraduate students taking a range of synchronous blended courses in computer science, at all levels of undergraduate study (i.e., Years 1, 2 and 3).

The study took place in Weeks 10 and 11 of courses which lasted 13 weeks in Spring 2023. Students take two classes per week for a course, one online and one in person. Both sessions are lectures and last one hour.

Students taking part in the study were asked to complete three questionnaires: one at the start of the study, one immediately after attending an online class and one at the end of the study. The questionnaires were largely based on previously developed and validated questionnaires and measured concerns about privacy, security and trust in the context of online teaching. Some additional questions were developed to cover aspects of concerns about online teaching not covered in previous questionnaires, such as concern about sharing information about a student's location and physical space, use of webcams and concerns about webcam use.

In the information provided to participants, our interest in participants' webcam use and concerns about it was deliberately not emphasised. This choice was motivated by the aim of preventing any potential

influence on participants' natural webcam behaviour during the targeted online classes.

Ethical approval for the study was obtained from both the Physical Sciences Ethics Committee at the University of York and the Ethics Committee at SEU.

#### 3.2 Participants

Students from eight online courses participated in the study, these courses had a total of 162 students enrolled in them. Course sizes ranged from 7 to 35 students enrolled. The courses covered a range of topics in computer science including decision support systems, system integration, data mining, web technologies, operating systems, Java programming, project management, and mobile applications. Four of the courses were at first year undergraduate level, three at second year level and one at third year level.

116 students in total took part in the study, answering at least one of the questionnaires. 108 students responded to the pre-study questionnaire, 72 students to the post-online class questionnaire, and 75 students to the post-study questionnaire.

Demographic information for the participants is shown in Table 1. The age range of the participants was surprisingly wide for undergraduate students (20 – 45 years), but 42 participants (41.0%) were 25 years or younger. The sample had more women than men (63.0% women, 37.0% men), although the overall enrolment of women at SEU is 46.3% (2021/2022 figures, figures for 2022/2023 academic year not available). This over representation of women in the sample may be due to the tendency of women to volunteer for research more than men (Rosnow & Rosenthal, 2012).

Table 1: Demographics of the participants.

<b>Age</b>	
Range	20 – 45 years
Mean	28.5
Standard deviation	6.0
<b>Gender</b>	
Men	40 (37.0%)
Women	68 (63.0%)
<b>Level of Study</b>	
Year 1	32 (29.6%)
Year 2	49 (45.4%)
Year 3	27 (25.0%)

#### 3.3 Online Questionnaires

Three questionnaires were developed and deployed in the Qualtrics survey software (www.qualtrics.com): a pre-study questionnaire, a post-class questionnaire, and the post-study questionnaire. Questionnaires

comprised mainly 7-point Likert items, with some multiple-choice and open-ended questions. Most of the Likert item questions were mandatory, but the open-ended questions were optional.

**Pre-Study Questionnaire:** measured students' privacy and security concerns about online teaching and their trust in different actors and entities in online environments. This questionnaire included seven previous questionnaires on online privacy, security and trust in online teaching, adapted for use in the current context:

- Privacy concerns in online teaching (11 items, adapted from Peng & Dutta, 2022)
- Privacy concerns about instructors and classmates during online teaching (3 items, adapted from Kim, 2021)
- Security concerns in online teaching (4 items, adapted Kim, 2021)
- Trust in the VLE (in this case, Blackboard) (6 items, adapted from Ejdys, 2018)
- Trust in the institution (7 items, adapted from Ejdys, 2018)
- Trust in the instructor (5 items, adapted from Cavanagh et al., 2018)
- Trust in classmates (5 items, adapted from Rice & Schroeder, 2021).

A set of new items was also developed, these measured:

- Privacy concerns about the student's location and personal space in online teaching classes (1 item)
- Concerns about the privacy of information in online teaching situations (3 items).

This questionnaire also collected basic demographic information about age, gender and year of study.

**Post-Class Questionnaire:** gathered information about the use of webcams during online classes. At the end of the online class, students were asked whether they had their webcam on during the class and their reasons for having the webcam on or not.

**Post-Study Questionnaire:** measured students' frequency of having their webcam on during online classes in general (plus a number of other questions, not included in this paper, so details are not included here).

The questionnaires were all developed in English and then translated into Arabic with back translation to check their accuracy.

A pilot study was conducted with five undergraduate computer science students. They completed all the questionnaires and were asked to assess the clarity of the questions and the time required to complete the questionnaire. A number of

small adjustments to the questionnaires were made as a result.

The questionnaires are available from the authors on request.

### 3.4 Procedure

The questionnaires were electronically delivered to students through their SEU email addresses. To optimize accessibility and engagement, this method ensured that participants received the questionnaires directly in their university email accounts. We also encouraged participation by reminding all participants to complete questionnaires. Participants were given an information sheet about the aims of the study and how their responses would be processed and stored. In particular, participants were assured that their individual responses would not be shared with their instructors or the institution and that only aggregate data would be shared or made public. The study was conducted during weeks 10 and 11 of the 2023 Spring semester.

### 3.5 Data Analysis

The data collected included both quantitative and qualitative data. The Likert item ratings were often skewed towards the lower end of the scale, so non-parametric statistical methods were used. The Wilcoxon One Sample Signed Ranks Test was used to investigate whether distributions of ratings differed from the midpoint of the scale. As the sample size exceeded 30 observations, the Z statistic for the normal distribution approximation was used as an extension of the Wilcoxon test to compare different ratings (Siegel & Castellan, 1988). Spearman's non-parametric correlations were used to investigate relationships between groups of measures.

To analyse the large number of items measuring online concerns about privacy and trust, Principal Component Analysis (PCA) was used, grouping the items by topic. Thus, one PCA was conducted on the 18 privacy items, and another on the 23 trust items. As there were only four items on online security concerns about online teaching, these were analysed with Spearman non-parametric correlations, as this is not enough items to conduct a PCA.

A linear regression was used to investigate whether a range of measures could predict participants' self-reported frequency of webcam use in online classes.

Table 2: PCA of privacy concerns about online teaching.

<b>Component 1: Institutional use and protection of students' personal information</b>
Universities should never sell students' personal information to another organization Universities should not share students' personal information with other organizations unless it has been authorised by the students Universities should devote more time and effort to preventing unauthorised access to students' personal information Universities should prevent unauthorised people from accessing students' personal information without considering the cost Universities should take more measures to ensure that unauthorised people cannot access students' personal information
<b>Component 2: Information collection by institution</b>
It bothers me when I am asked for personal information during online teaching classes I think for a while if I am asked to provide personal information during online teaching classes It bothers me to give personal information to so many different courses for online teaching It bothers me that so much personal information is collected during online teaching courses
<b>Component 3: Unauthorised information use by instructors and classmates</b>
I am concerned that another student will use my personal information (e.g. captured facial images) without my permission. I am concerned that my personal information will be leaked by another student against my will I am concerned about my personal information (e.g. facial expressions, physical appearance, etc.) being exposed online
<b>Component 4: Privacy during online teaching (in relation to instructors and classmates)</b>
I am not comfortable with my physical location and personal space (e.g. my room, my whereabouts etc.) being seen by other participants in online teaching classes I am concerned that my instructor will use my contribution to an online class (e.g. my work being used as an example) without my permission. I am concerned that my classmates will use my contribution to an online session (e.g. my idea provided in an online group discussion) without my permission. Overall, I am concerned about my personal information when participating in online class activities (e.g. online group discussions)
<b>Component 5: Unauthorised information use by institution</b>
Universities should never use students' personal information for any other purposes unless it has been authorized by the individual student When students give personal information during online teaching classes for some particular reason, the university should never use the information for any other purpose

Table 3: PCA of questions on trust in online teaching

<b>Component 1: Trust in instructor</b>
My instructor can be described as someone who listens very carefully to me It's important to my instructor to understand what my educational goals are My instructor understands me My instructor accepts me for who I am My instructor is careful not to dismiss my concerns My instructor cares about my education My instructor truly cares about my educational welfare
<b>Component 2: Trust in institution</b>
(Name of institution) takes care of its students Graduates of (name of institution) have no problem finding a job in their profession (Name of institution) is well recognised by employers in the labour market (Name of institution) applies the principles of ethics and social responsibility in its activities (Name of institution) provides opportunities for students' personal development (Name of institution) is recognised internationally (Name of institution) uses new technology to improve my studies and gain knowledge and skills
<b>Component 3: Trust in classmates</b>
Overall, the students in my (name of course) class are very trustworthy The students in my (name of course) class are friendly I can rely on my (name of course) classmates I trust that my (name of course) classmates will keep my personal information confidential We are usually considerate of one another's feelings in this (name of course) class
<b>Component 4: Trust in VLE</b>
(Name of VLE) guarantees the anonymity of users In (name of VLE), I can express my opinion about studies, subjects and instructors without any fear (Name of VLE) ensures the security of my personal data (Names of VLE) is efficient and always works reliably I can rely on (name of VLE)

Table 4: Security concerns about online teaching.

I do not feel secure about the online teaching resources and tools used in my online teaching classes. I am concerned that online teaching resources and tools will not implement appropriate security measures for my protection. I am concerned that hacking might occur during online teaching classes which will lead to the disclosure of my personal information. I am concerned that online teaching resources
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## 4 RESULTS

### 4.1 Initial Analysis of the Privacy, Security and Trust Questions

108 participants answered the pre-study questionnaire which presented the questions about concerns about privacy and security in online teaching and those about trust in different actors and entities in online teaching. Separate PCAs were conducted on the ratings of privacy concerns and those of trust to investigate whether they formed meaningful groups for the participants.

The PCA of the privacy concern questions produced an optimal solution with five components that accounted for 70.0% of the variance (see Table 2). The components were: *Institutional use and protection of students' personal information* (accounted for 24.5% of the variance); *Information collection by institution* (21.8%); *Unauthorised information use by instructors and classmates* (9.1%); *Privacy during online teaching (in relation to instructors and classmates)* (7.1%); and *Unauthorised information use by institution* (6.5%).

The PCA of the trust questions produced an optimal solution with four components that accounted for 62.4% of the variance (see Table 3). The components were: *Trust in instructor* (accounted for 26.4% of the variance); *Trust in institution* (15.7%); *Trust in classmates* (11.4%); and *Trust in VLE* (8.9%).

For the four questions about security concerns about online teaching all the questions correlated with each other at  $p < 0.001$  (Spearman non-parametric correlations), so these were treated as one component, *Security concerns about online teaching*.

### 4.2 Levels of Concern About Privacy and Security and Trust in a Range of Actors and Entities in Online Teaching (RQ1)

To investigate participants' levels of concern about privacy in online teaching, their scores on each of the

components which emerged from the PCA were calculated by taking the median of the relevant items. The same procedure was followed for the ratings of concerns about security and the level of trust in different actors and entities in online teaching.

Participants' scores on the five components of concern about privacy in online teaching are given in Table 5. Participants showed significantly high levels of concern about *Institutional use and protection of students' personal information*, *Information collection by institution*, and *Unauthorised information use by institution*, but only moderate levels of concern (not significantly different from the midpoint of the scale) about *Unauthorised information use by instructors and classmates* and *Privacy during online teaching (in relation to instructors and classmates)*. Thus, their privacy concerns are related to their institution and the information it might collect about them and how it would use that information, but not their instructors or their classmates to such an extent.

Participants' scores on their *Security concerns in online teaching* are also given in Table 5. These scores did not differ significantly from the midpoint on the scale, showing the participants had moderate levels of concern about security in online teaching.

Finally, participants' scores in their trust in different actors and entities are given in Table 6. These showed that participants had significantly high levels of trust in their classmates and the VLE used for online teaching (in their case the VLE was Blackboard), moderate levels of trust in the institution (the scores did not differ significantly from the midpoint of the scale) and significantly low levels of trust in their instructors.

### 4.3 Relationship Between Trust in Different Actors and Entities, and Security and Privacy Concerns in Online Teaching (RQ2)

To investigate the possible relationships between students' trust in different actors and entities in online

Table 5: Levels of concern about privacy and security in online teaching.

	Median	SIQR	Z	p
Privacy concerns in online teaching ...				
Institutional use and protection of students' personal information	7.00	0.00	9.40	<0.001
Unauthorised information use by institution	7.00	0.25	9.01	<0.001
Information collection by institution	5.25	1.13	4.49	<0.001
Privacy during online teaching (in relation to instructors and classmates)	4.75	1.35	1.74	n.s.
Unauthorised information use by instructors and classmates	4.50	2.09	1.39	n.s.
Security concerns in online teaching	4.00	2.00	0.55	n.s.

Table 6: Students' Trust in Different Actors.

Trust in ..	Median	SIQR	Z	p
Instructors	2.00	1.75	-4.49	< 0.001
Institution	4.00	1.25	1.47	n.s.
Classmates	6.00	1.50	5.51	< 0.001
VLE	6.00	1.50	5.83	< 0.001

Table 7: Correlations between privacy concerns and trust in different actors and entities in online teaching.

	Instructors	Institution	Classmates	VLE
Institutional use and protection of students' personal information				
Information collection by institution		< 0.005		
Unauthorised information use by instructors and classmates				
Privacy during online teaching (in relation to instructors and classmates)	< 0.005		< 0.05 neg	
Unauthorised information use by institution			< 0.05	< 0.05

Table 8: Reasons why participants leave their webcam off during online classes (N = 58).

Reason	N (%)
I am concerned if other students made recordings or screenshots without my permission (e.g., using their camera phone)	34 (58.6%)
It makes me focus on how I look instead of the course content	32 (55.2%)
I do not know who can access recordings of online sessions or where they are stored	31 (53.4%)
It impairs my flexibility of where I can attend the session from (e.g., attending from a café)	29 (50.0%)
It makes it hard for me to conduct other activities during the class	28 (48.3%)
It makes it hard for me to move away from my computer	26 (44.8%)
It would distract other students	19 (32.8%)
I am concerned that online sessions might be hacked which will lead to disclosure of my personal information	19 (32.8%)
It overloads the bandwidth I have	18 (31.0%)
I am concerned about my physical location being seen	13 (22.4%)

teaching and their online privacy concerns, Spearman's non-parametric correlations were calculated between the components which emerged from the PCA. Table 7 shows the pattern of correlations. There was a significant positive correlation between concerns about *Information collection by institution* and *Trust in institution*. This is a counter-intuitive direction for the correlation, as one would expect that as trust in the institution increases, concern about privacy issues related to information collection by the institution would decrease. But a strong positive correlation ( $p < 0.005$ ) was found. Thus, although some students may have general trust in their institution, they still have concerns about the information the institution is collecting about them. Interestingly, there were no other significant correlations between trust in the institution and privacy concerns, for example there was no correlation between trust in the institution and the institution's unauthorized use of information.

There was also a strong significant positive correlation ( $p < 0.005$ ) between *Privacy during online teaching (in relation to instructors and classmates)* and *Trust in instructors*. This direction of this correlation is also counter-intuitive, as one would expect that as trust in instructors increases, concern about privacy during online teaching in relation to instructors and classmates would decrease. As with trust in the institution, there was no other significant correlations, particularly between *Trust in instructor* and *Unauthorised information use by instructors and classmates*.

There was also a significant positive correlation between *Unauthorised use of information by institution* and *Trust in VLE*. This was another correlation in the unexpected direction, although the link between the institution and the VLE is not necessarily clear. Do students see the VLE as "belonging" to the institution or as an entirely separate entity? This point needs further investigation.



These counter-intuitive and unexpected correlations suggest that trust in actors and entities in online teaching is separate from possible privacy concerns about them. This possibility clearly needs further investigation.

Finally, there was a significant negative correlation between *Privacy during online teaching (in relation to instructors and classmates)* and *Trust in classmates*. This is a correlation in the expected direction, in that as trust in classmates increases, privacy concerns decrease. It is interesting that this expected relationship is with classmates, which may suggest that because students know each other personally, their perception of trust in their classmates is of a different nature to their perception of other, more remote and in some cases, abstract actors and entities.

To investigate the possible relationships between students' trust in different actors in online teaching and their online security concerns in online teaching, Spearman's non-parametric correlations were also calculated between these components. There was no significant correlation between *Security concerns in online teaching* and trust in any of the different actors and entities in online teaching. This result was also quite unexpected.

#### 4.4 Students' Use of and Attitudes to Webcams in Online Teaching (RQ3)

At the end of one of the online classes during the two week study period, 72 participants completed the post-class questionnaire. One set of questions in this questionnaire was about their webcam use in the class. 58 participants (80.6%) reported having their webcam off during the preceding online class, 14 (19.4%) reported that they did not remember whether they had it on or off and none reported having it on.

In the post-study questionnaire, participants were asked to rate how often they were turned on their webcam during online classes in general (scored as Never = 1 to Very frequently = 7). 67 participants answered this question. They rated their frequency of turning on their webcam as very low (median: 1.00, SIQR: 0.50), the median was significantly below the midpoint of the rating scale ( $Z = -6.85, p < .001$ ). Indeed, 47 (70.1%) of participants stated that they never turned their webcam on, and only 20 (29.9%) stated that they turned it on at least occasionally, with only one participant stating that they turned it on all the time.

In the post-class questionnaire participants were also asked why they left their webcams off in online

classes in a multiple-choice question with a set of options developed from previous research results. Table 8 gives the frequency of responses (answered by 58 participants). Two of the three most frequent answers were about privacy and security of personal information in online teaching, and mentioned by more than half the participants: "I am concerned if other students made recordings or screenshots without my permission (e.g., using their camera phone)" (mentioned by 34 participants, 58.6%) of responding participants and "I do not know who can access recordings of online sessions or where they are stored" (mentioned by 31 participants, 53.4%). Interestingly the first statement is about privacy and security in relation to other students, whereas the second is more about privacy and security in relation to instructors and the institution. Also of note is that fact that concern about the participant's physical location being seen, which we predicted would be a prominent concern, was only chosen by less than a quarter of participants (13, 22.4%).

#### 4.5 Relationship Between Webcam Use and Trust, Privacy and Security Concerns in Online Teaching (RQ4)

To investigate the relationship between participants' webcam use and their trust in different actors and entities and concerns about privacy and security in online teaching, a linear regression was conducted to predict their frequency of webcam use from the other measures. Overall, there was no significant prediction of frequency of webcam use from this set of predictor variables ( $F_{10, 57} = 1.75, n.s.$ ). However, one individual variable, *Trust in instructors* was a strong predictor of frequency of webcam use ( $t = 2.76, p < 0.008$ ). There was a positive relationship between *Trust in instructors* and frequency of use of webcams.

## 5 DISCUSSION AND CONCLUSIONS

This study explored the relationship between the privacy and security concerns of HEI students in the KSA in relation to online teaching, their level of trust in the various actors and entities involved in online teaching and the relationship between these variables. In addition, it investigated their use of and attitudes to webcams in online teaching and how their use of webcams related to privacy and security concerns and trust in various actors and entities.

In relation to RQ1, participants showed high levels of privacy concern about their institution, but only moderate levels of concern about their instructors and classmates and about security in online teachers. This raises important questions about how HEIs deal with the privacy of students' information and how they communicate their policies and actions in that area to students. The levels of trust in actors and entities in online teaching also produced interesting results, with high levels of trust in classmates and the VLE, but low levels of trust in instructors. Again, this raises important questions for HEI instructors (and the institutions employing them), as to why students appear not to trust them.

In relation to RQ2, the correlations between privacy and security concerns among HEI students in the KSA and their trust in various actors and entities in online teaching revealed complex and somewhat perplexing results. While there were a number of significant correlations, they were not always the ones we were predicting or more importantly in the directions we were predicting, with increased concerns about the institution and instructors aligned with increased trust. This suggests that having a high level of concern about privacy does not necessarily mean a lack of trust; in fact, it may be associated with a higher level of trust. Clearly the relationships between these variables in online teaching needs further investigation.

These findings are interesting in relation to issues raised in the literature, which emphasise the importance of transparent and responsible information handling in fostering institutional trust (Teng & Song, 2022). According to Anwar (2021) institutions need to address privacy concerns and exhibit ethical conduct to build and maintain trust, reinforcing the significance of transparent data practices. In addition, these findings are interesting in relation to previous work of the impact of trust on institutions and its influence on individuals' attitudes towards information sharing (Nwebonyi et al., 2022). Ejdays (2018) also notes the significance of institutional trust in the implementation, adaptation, and use of new technologies, especially in the public sector. This highlights the necessity to address not only the technical functionality of digital technologies but also the broader societal and ethical implications, encompassing concerns about data privacy and security.

The unexpected positive correlation between privacy concerns during online teaching and trust in instructors is also interesting. Contrary to expectations, increased privacy concerns were positively associated with higher levels of trust in

instructors. This finding does not align with the idea that a positive instructor-student relationship, extending beyond academic matters to include personal understanding, respect, and a genuine concern for the student's well-being and educational success, contributes significantly to building trust in instructors. This result raises questions about the role of privacy perceptions in shaping interpersonal relationships within online teaching.

In relation to RQ3, the fact that no participant reported their webcam being during the online class agrees with previous research from a number of countries that students are very reluctant to have their webcams on during online teaching (Almekhled & Petrie 2023a; Bedenlier et al., 2021; Castelli & Sarvary, 2021; Dixon & Syred, 2022; Gherheş et al., 2021). Thus, Saudi students are no different in this respect to students in other countries. The most frequently mentioned reasons for not wanting the webcam on related to privacy concerns about personal information, which only partly aligns with the ratings of privacy concerns in online teaching. The most frequently mentioned reason was the concern that other students would make recordings without permission, but in the ratings, only moderate levels of concern were expressed about other students and instructors. It may be that when presented with a specific scenario, participants did feel this was a concern. However, there was good alignment between the reason for not having the webcam on, which was that participants did not know who could access the recordings or where they are stored with the high levels of concern about institutional use and unauthorised use of students' information. These results highlight the fact that the way questions are worded may affect the outcome, as well as the complex relationships between these variables.

In relation to RQ4, only *Trust in instructors* was a significant predictor of participants' self-reported frequency of having their webcam on during online classes. This makes sense as a finding, and the low levels of trust in instructors may be a further reason for not having the webcam on. In this study, instructors also did not have their webcams on (this is typical in this institution) and it would be very interesting to explore whether if instructors had their webcams on, would that increase trust and encourage students to have theirs on as well.

The study had a number of limitations which need addressing. The first is related to the cultural and linguistic context. All the questionnaires used in the research were translated into Arabic from English due to the absence of prior validation with Saudi participants. The original validation of these

instruments was conducted with samples from North America, Europe, and East Asia, so their validity for the Saudi context is not established.

Secondly, the results relied on the honesty and accuracy of the participants' self-reports. Because the study is about online teaching and participants were assured that their individual responses would not be shared with their instructors or the institution, however they may still have been hesitant to answer completely frankly on certain questions. But even if participants are trying to be honest, it may have been difficult to be accurate to answer in terms of largely rating items. Triangulation with other research methods such as interviews and logging actual behaviour (which may in itself raise serious ethical issues) is clearly need to explore the issues further.

Thirdly, in an effort to not overburden participants with too many time-consuming questions, wherever possible, rating items and multiple-choice options were used. In retrospect, it many have been preferable to include a greater number of open-ended questions. Particularly on the issue of why participants did not have their webcam on during online classes, although we based the multiple-choice options on reasons found in previous research, this may have primed the participants, and an open-ended question would have been better for that issue.

As highlighted in the Introduction, our study focused on KSA students enrolled in Saudi HEIs. It is important to acknowledge that the concerns and behaviour of students in other countries are likely to differ. However, our research complements research conducted in a range of other countries and expands the variables considered in relation to students' concerns about online teaching.

In conclusion, our research makes a contribution to the existing body of research on privacy and security concerns and trust in different actors and entities in online teaching. The findings offer questions for future investigations, to further investigate the specific factors influencing students' concerns and trust in this area.

## ACKNOWLEDGEMENTS

We would like to thank the Saudi Electronic University for their support in conducting this research, as well as the instructors and students who participated. This research is part of the PhD programme for the first author which is funded by the Saudi Electronic University.

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