Smart Tools, Smarter Concerns: Navigating Privacy Perceptions in Academic Settings

Yimeng Ma
Duke University

Weihan Xu
Duke University

Hongyi Yin
Duke University

Yuxuan Zhang
Duke University

Pardis Emami-Naeini
Duke University

1 Introduction

Educational institutions are increasingly adopting smart tools–tools enabled by the Internet of Things (IoT) and Artificial Intelligence (AI)– to enhance learning experiences, streamline administrative tasks, and facilitate innovative teaching methodologies [1]. Previous works have proven the IoT to be a highly cost-effective approach to educating young minds and a powerful tool for providing a world-class learning experience to everyone [2, 8, 10].

However, the rapid adoption of these technologies raises privacy and security concerns of smart tools [3, 7, 9, 13]. The ambiguity surrounding data usage, data rights, and the extent of surveillance possible through these tools presents a critical area of concern for students, faculty, and staff alike [5, 6, 14]. These concerns are heightened by the sensitive nature of educational environments, where the balance between technological benefits and individual privacy rights must be carefully managed [4, 12].Moreover, existing U.S. federal laws fail to adequately protect students as data subjects amidst these emerging technologies [11].

This study aims to explore the utilization of smart tools in academic environments, assess the privacy concerns and attitudes of the academic community, and provide insights into the acceptance and risks associated with these technologies. The findings will inform the development of guidelines and policies that ensure privacy while enhancing technology use in education, focusing on three research questions:

RQ1: How are smart tools being used in academic settings, and what are the perceived risks and benefits from the perspective of college students, faculties, and staff members?

RQ2: What are college students', faculties', and staff members' privacy attitudes toward smart tools in different academic settings?

RQ3: What are the differences between college students' privacy attitudes and faculties' and staff members' privacy attitudes toward smart tools?

2 Methodology

Recruitment: Recruitment was conducted via email and Slack, targeting all members of the academic community. Participants' eligibility was determined by a screening process assessing basic knowledge of smart tools.

Survey Questions: The survey has 30 questions in total and was structured into three distinct parts. The first part contains 7 multiple-choice and open questions on frequency of use, valued attributes, perceived risks, most frequently used types of smart tools, privacy concerns, and data protection preferences. The second part of the survey assessed participants' reactions to a hypothetical "Smart Assistant Program" at their university, presented through two scenarios to explore their comfort levels and privacy concerns. The first scenario featured technology enhancements like Smart Classroom Upgrades, Assessment Tools, Administration Systems, and Pedagogy Approaches, where participants rated their comfort and voiced privacy concerns. The second scenario added Artificial Intelligence (AI) to the same program to see how AI integration affects their attitudes. This allowed for direct comparisons between participant responses with and without AI integration, highlighting shifts in attitudes due to the introduction of AI. The last part collects basic demographic data, such as participants' roles within the institution, age, gender, primary language, and departmental affiliation.

Data Collection and Analysis: Data were collected through Duke Qualtrics, an online survey platform, ensuring that participants could complete the survey anonymously.

For data analysis, we identified patterns and behaviors among the responses, comparing student and faculty/staff groups and quantifying trends across different user groups. Responses to Likert scale questions were numerically coded from 1 (least agreement) to 5 (most agreement), with means and standard deviations calculated to assess response trends and variability. Open-ended questions were collaboratively coded to extract nuanced opinions and synthesize diverse perspectives. Vignette questions, blending Likert and narrative responses, were processed using a mixed-methods approach to both quantify comfort levels and explore the detailed reasoning behind participants' attitudes towards AI and smart technologies in educational settings.

Ethical Considerations: The study was approved by the Campus Institutional Review Board (IRB) at Duke University. Informed consent was obtained from all participants, who were informed about the confidentiality of their responses and the voluntary nature of their participation.

3   Results

Forty-two participants completed the screening questions, and 23 of them passed the screening. However, one of them did not complete the survey, which leads to 22 valid responses. Of the 22 participants, 16 were college students, and 6 were college faculties or staff members.

Majority of respondents (77%) use smart tools daily, integrating technologies such as learning management systems (e.g., Zoom, Canvas), online assessment platforms (e.g., Gradescope), and personalized learning apps into their educational routines. This high utilization underlines the tools' integral role in modern education, with students predominantly using dynamic tools for learning and interaction, while faculty and staff utilize administrative and management tools, reflecting their distinct professional needs. Both groups value efficiency, ease of use, and effectiveness in smart tools, though students show a heightened sensitivity to cost, preferring free tools, and faculty and staff prioritize features like automation and integration that enhance their professional tasks.

Concerns among participants include plagiarism, distractions, and data security, necessitating robust security measures and ethical considerations in technology use. Students are particularly wary of poor interface quality and the potential for over-reliance on technology, while faculty and staff fear impacts on knowledge retention and assessment integrity. Despite a general comfort with data privacy measures, faculty express more substantial concerns, likely due to a deeper awareness of the risks. This variance in comfort levels is highlighted by one respondent's choice to avoid using tools like ChatGPT due to privacy concerns, underscoring that while such apprehensions are not universal, they are significant enough for some to limit their use of certain technologies.

In the scenario-based evaluation, comfort levels were used to measure participants' ease with data usage in smart ed-

ucational tools, rated from 1 (least comfortable) to 5 (most comfortable). Both student and faculty/staff groups exhibited moderate comfort, with average scores of 3.666 and 3.33 respectively; however, differences were not statistically significant (p = 0.5596), indicating similar levels of acceptance across the groups despite the small sample size. Notably, faculty and staff displayed a greater concern towards AI integration, with their comfort level dropping from 3.95 to 3.17, possibly due to heightened awareness of potential privacy and learning impacts. In contrast, students showed less concern, particularly in smart classroom settings where the average comfort level was highest at 4.34. They perceived minimal privacy threats and valued the efficiency and performance enhancements from AI. Concerns arose more with smart assessment tools, where AI integration reduced their comfort from 3.46 to 3.33, driven by fears of grading biases. These insights, although based on limited data, suggest nuanced perceptions between different user groups towards smart tool applications in educational settings.
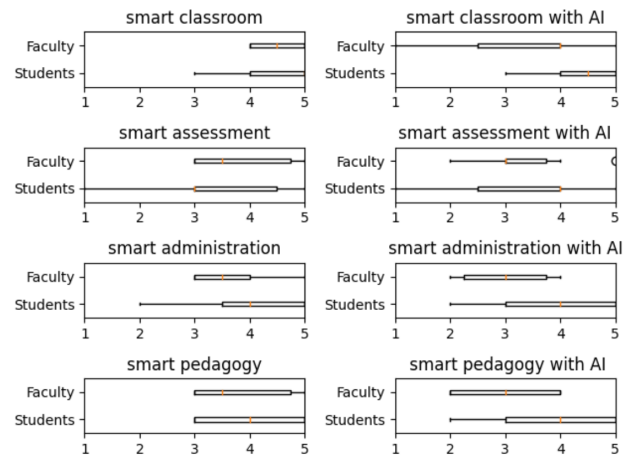

Figure 1: Comfort levels among participants for scenario-based questions

4   Discussions

The screening survey used in our study primarily selected participants with a technical background, mainly students and faculty from STEM-related fields, which may limit the generalizability of our findings. Future research should focus on expanding the sample size to minimize variance and bias, potentially utilizing platforms like MTurk or Prolific to recruit a more diverse group of participants from various universities and fields. Additionally, to enhance the generalizability of our results, incorporating participants from non-collegiate educational levels in future studies would provide a more comprehensive understanding of user perceptions across different educational contexts.

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5 Appendix

5.1 Consent Form

Study Title: Concerns Toward Smart Tools in Academic Settings

Principal Investigator: Dr. Pardis Emami-Naeini

Other Investigators: Yimeng Ma, Weihan Xu, Hongyi Yin, and Yuxuan Zhang.

Key Information:

Summary: Thank you for your interest in our study. We are researchers at Duke University, and we are conducting a survey study to explore people's privacy attitudes toward different smart tools in various academic settings.

Procedures: You will be asked a number of questions related to your privacy attitudes toward different smart tools in various academic settings. In addition, we will ask you some general demographic questions, including your age and education. The survey will take about 10 to 15 minutes.

Participant Requirements: Participants must be at least 18 years old and live in the US.

Risks: We do not expect this survey to pose any harm or discomfort to participants.

Benefits: Enhance Participants' Public awareness on privacy of smart tools in academic settings

Compensation: There is no compensation offered.

Confidentiality: We will not collect any direct identifiable information in this survey. We will store your survey responses securely in Duke Box, which will also be encrypted. Data will not be used in future research or shared publicly.

Voluntariness: Your participation is voluntary. You can also stop the survey at any time, for any reason.

Right to Ask Questions & Contact Information: If you have any questions about this study, desire additional information, or wish to withdraw your participation, please contact the Principal Investigator by e-mail in accordance with the contact information listed at the beginning of this consent form. For questions about your rights, please contact the Duke University Campus Institutional Review Board at 919-684-3030 or campusirb@duke.edu. It will be helpful if you include Protocol ID# 2024- 0357 in your communication.

I am 18 years or older.

o Yes o No

I have read and I understand the information above.
    o Yes o No
I want to participate in this survey and continue with the task.
    o Yes o No

5.2 Screening Questions

Participation in the survey requires a foundational understanding of smart tools. The following three questions serve as a screening process. If any response is incorrect, the participant will be directed to the conclusion of the survey.

S1: Which of the following is an example of a smart device?
    o A traditional wall clock
    o A programmable thermostat that learns your schedule
    o A manual coffee grinder
    o An analog television
S2: What does IoT stand for?
    o Internet of Things o Inside of Tech
    o Internet over Time o Intelligent Online Tools
S3: What is AI?
    o A type of robot o Artificial Ice
    o Artificial Intelligence o Advanced Internet

5.3 Survey Questions

5.3.1 Part 1

Q1 How often do you use smart tools (such as canvas, ChatGPT, etc) for learning, assessment, administrative tasks, or in classroom?
    o Daily o Several times a week o Weekly o Rarely o Never
Q2 What attributes do you value the most when choosing smart tools for educational purposes?
Q3 What do you perceive as the greatest risks of using smart tools in education?
Q4 Which types of smart tools do you use most frequently? (Select all that apply)
    o Learning management systems (e.g., Zoom, Ed, Canvas, etc)
    o Online assessment platforms (e.g., Gradescope)
    o Personalized learning or teaching apps (e.g., LLMs)
    o Administrative tools (e.g., Enrollment, Grade tracking)
    o Other (please specify)
Q5 How concerned or comfortable are you about the privacy of your data when using these smart tools?
    o Very comfortable o Pretty comfortable o Neutral
    o Pretty concerned o Very concerned
Q6 What types of data privacy protections do you believe are the most important when using smart tools for education? (Select all that apply)
    o Encryption of data
    o Anonymization of user data
    o Regular audits of data usage
    o Clear privacy policies

    o User consent before data collection
    o Other (please specify)
Q7 Have you ever refrained from using a particular smart tool for educational purposes due to privacy concerns?
    o Yes (please specify the tool and concern) o No

5.3.2 Part 2

Scenario 1: Imagine you are part of an innovative Smart Assistant Program at the university. The program is designed to enhance educational experiences through advanced technologies and encompasses several key initiatives:

1) Smart Classroom Upgrades: Classrooms are now equipped with technologies to adjust lighting and temperature based on occupancy and time of day, utilize dynamic content display systems that adapt to lecture topics, and offer interactive digital whiteboards. These features aim to create a more engaging learning environment but require collecting data on student engagement and classroom usage.

2) Smart Assessment Tools: The program includes tools to automate the grading process, provide immediate feedback on assignments and tests, and analyze students' academic performance and educators' job performance. This system seeks to improve learning and teaching outcomes while tracking academic interactions closely.

3) Smart Administration System: Campus operations are enhanced with sensors and IoT devices for resource management, smart scheduling of rooms and facilities, and automated maintenance alerts. This initiative aims to improve efficiency and reduce operational costs through real-time data-driven decisions, necessitating the collection of extensive campus data.

4) Smart Pedagogy Approaches: Advanced teaching and learning methodologies are integrated, employing smart technology to adapt learning materials, virtual reality for immersive experiences, and analytics to support students needing extra help. This approach enhances educational quality by analyzing data on learning styles and engagement.

While these smart technologies promise significant benefits in educational quality, efficiency, and personalized learning experiences, they also involve various degrees of data collection and analysis, raising questions about privacy and data security.

Given the scenario described, how comfortable or concerned are you with the use of the following technologies in a Smart Classroom, and what are your primary concerns regarding data privacy and security? Please explain your level of comfort and any concerns for each technology.
Q8 Smart Classroom Upgrades
    o Very comfortable o Somewhat comfortable o Neutral
    o Somewhat uncomfortable o Very uncomfortable
Q9 Please briefly elaborate your choice for the previous question.
Q10 Smart Assessment Tools

o Very comfortable o Somewhat comfortable o Neutral

o Somewhat uncomfortable o Very uncomfortable

Q11 Please briefly elaborate your choice for the previous question.

Q12 Smart Administration System

o Very comfortable o Somewhat comfortable o Neutral

o Somewhat uncomfortable o Very uncomfortable

Q13 Please briefly elaborate your choice for the previous question.

Q14 Smart Pedagogy Approaches

o Very comfortable o Somewhat comfortable o Neutral

o Somewhat uncomfortable o Very uncomfortable

Q15 Please briefly elaborate your choice for the previous question.

Q16 Which of the four use cases concerns you the most, and could you please explain why it's your primary concern?

Scenario 2: Now, envision the Smart Assistant Program at your university has been updated to integrate AI, enhancing its capabilities across the same domains. With all its initiatives remain the same, AI promises to personalize learning environments, provide deeper insights through assessment tools, optimize campus operations, and offer advanced pedagogical approaches.

Given the scenario described, how comfortable or concerned are you with the use of the following technologies in a Smart Classroom, and what are your primary concerns regarding data privacy and security? Please explain your level of comfort and any concerns for each technology.

Q17 Smart Classroom Upgrades

o Very comfortable o Somewhat comfortable o Neutral

o Somewhat uncomfortable o Very uncomfortable

Q18 Please briefly elaborate your choice for the previous question.

Q19 Smart Assessment Tools

o Very comfortable o Somewhat comfortable o Neutral

o Somewhat uncomfortable o Very uncomfortable

Q20 Please briefly elaborate your choice for the previous question.

Q21 Smart Administration System

o Very comfortable o Somewhat comfortable o Neutral

o Somewhat uncomfortable o Very uncomfortable

Q22 Please briefly elaborate your choice for the previous question.

Q23 Smart Pedagogy Approaches

o Very comfortable o Somewhat comfortable o Neutral

o Somewhat uncomfortable o Very uncomfortable

Q24 If your answers were to change from your previous response, what factors would contribute to that change, and what reasons would prompt such a shift in your choices?

5.3.3 Part 3

Q25 Could you kindly specify whether you're a student, professor, or administrator?

o Student o Professor o Administrator

o Other (please specify)

Q26 What is your age?

Q27 What is the gender you most identify with?

o Male o Female o Prefer to self-describe (please specify)

o I prefer not to answer

Q28 What language do you primarily use in your daily life?

o English o Spanish o Mandarin o Hindi

o Other (please specify) o Prefer not to answer)

Q29 What is your affiliated department?

o Stem related fields o Others o Prefer to self-describe (please specify)

Q30 What is your understanding about the permanence of the information you provide to the AI study assistant (such as a ChatGPT based learning assistant)?

o the study assistant does not retain your information

o The information is retained in the model with a determined amount of time

o The information is retained indefinitely but can be deleted by you

o The information is retained indefinitely but the developer can choose to delete that information

o The information is retained indefinitely and cannot be deleted

o Others (please specify)