# A Study of Learner Privacy Issues in Information Education Platforms-Based on Confirmatory Factor Analysis

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**Abstract.** Information-based education is rich in form and has unparalleled advantages over traditional education. The educational approach that became mainstream under the influence of the epidemic. However, in the open web environment, learning analytics technologies need to collect and analyze large amounts of personal data, and online learners' data suffer from challenges in terms of privacy, integrity and security. Through the design of the privacy concern measurement scale, this paper conducts confirmatory factor analysis to obtain and evaluate the influencing factors of online learners' privacy concerns, and proposes privacy protection measures in terms of legal system, technology, and learners' awareness of rights protection.

**Keywords:** information education platform · Privacy Concern Scale · Confirmatory factor analysis · privacy rights

## 1 Introduction

In the years affected by the new crown virus, students around the world have received online information-based education to varying degrees. The advantages of informatization education are reflected in: students in different regions can use the advantageous educational resources and information in developed regions to meet their learning needs; rich and diverse teaching media and forms improve It improves the students' interest and concentration, and further improves the effectiveness of classroom teaching. Learning analytics technology needs to collect and analyze a large amount of personal data, the use of big data platforms scattered in various management and storage systems, complex data aggregation channels, open network environment and unavoidable multi-user access, etc., all make citizens' big data suffer from challenges in terms of privacy, integrity and security, and the security risk of learning data becomes greater.

The leakage of learners' private information not only violates their privacy rights, but also causes property safety, life safety, and even national security. This paper quantifies the impact of learners' privacy concerns and privacy and security threats on the learning experience, and empirically analyzes the factors influencing online learners' privacy concerns and their impact on the online learning experience and learning evaluation. Thus, further measures for privacy protection are proposed.

## 2   Literature Review

At present, most of the academic research concerns are focused on the field of privacy security in social media, while there is less research on privacy security in online learning. Scholars Li Fengying et al. propose to explore the issue of online learner privacy from a human-centered perspective; they propose to use fuzzy authentication technology to achieve biometric-based learner privacy protection [2]. Qing Li and Yingying Li analyze the current state of research on learner privacy protection at home and abroad, and summarize the complex and diverse threats to the privacy of online learning communities by exploring three typical cases of in Bloom, Piazza, and Edmodo [3]. Other scholars have proposed strategies to protect learner privacy using the fusion technique of ORAM (Oblivious Random Access Machine) and group signature to address the privacy and security issues faced by learning communities in online learning spaces and cloud environments [1].

## 3   Empirical Analysis of the Status Quo of Privacy and Security of Learners on Information Platforms

This paper quantifies the impact of learners' privacy concerns and privacy and security threats on the learning experience, to analyze the level of privacy concerns of online learners and the impact on the online learning experience and learning evaluation.

### 3.1   Research Methodology

#### 3.1.1   Research Subjects

The research objects focus on information-based learning platforms such as "Tencent Classroom", "Rain Classroom", "China University MOOC", and "Tencent Conference" relying on universities and official institutions of higher education. The subjects of the survey are all over the major online learning platforms. The age and educational level include graduate students, college students and junior college students. The schools are distributed in the eastern, central and western regions. The disciplines include humanities and social sciences, science, technology, and medicine. "Questionnaire Star" answered questions anonymously, and finally collected 2003 survey data. In terms of the completeness of the content of the questionnaire, the "Questionnaire Star" can only be submitted after all the answers are completed. Regarding the processing of outliers in questionnaire answers, this study used abnormal answering time (less than 120 s or more than 1000 s) and highly consistent item answers (ten or more consecutive scale questions with the same option) as the main criteria for data screening, 327 pieces of data were regarded as invalid data because of abnormal answering time or highly consistent answers, and the remaining 1676 pieces of data were valid data, and the effective rate of data recovery was 83.67%.

### 3.1.2   Study Design

According to the scholars, based on the existing Privacy Concern Scale and Learner Experience Questionnaire, the Privacy Concern Scale for Information Technology Platform Learning and the Questionnaire for Information Technology Platform Learning Experience were formed; exploratory factor analysis and validation factor analysis were conducted on the questionnaires, respectively, in order to test the reliability of the questionnaires.

(1)   Scale design and exploratory factor analysis

"Personal Information Protection Law" defines the principles and rules for the handling of personal information in China in a unified legislative model, making it clear that the right to privacy includes the right to collect, control and use personal information [6]. This study refers to the design of scholar Feng-Ying Li, whose study combines the characteristics of various international privacy concern measurement scales and a comparative analysis of relevant foreign scales by Chinese scholars to measure learners' privacy concerns in three dimensions: collection, control, and use of personal information [5]. Meanwhile, according to the characteristics of online learning, only the questions related to this study were selected, as shown in Table 1. KMO and Bartlett's sphericity tests were performed on the privacy concerns scale using SPSS 24.0, and the KMO value was equal to 0.878 (>0.7) and the Bartlett's sphericity test was significant (p < 0.001), indicating that the data were suitable for exploratory factor analysis. In Table 1, the number of question items and Cronbach's alpha coefficients of the scale are described descriptively accordingly, with all α > 0.60, indicating that the internal consistency reliability of the dimensional scale is relatively satisfactory.

(2)   Validation factor analysis of the questionnaire

This study used AMOS 24.0 to conduct validated factor analysis on the relevant subscales of the Information Platform Learning Privacy Concern Scale and the Information Platform Learning Experience Questionnaire. The validated factor analysis goodness-of-fit indicators for the Information Platform Learning Privacy Concern Scale were: χ2/df was 2.836, which was in the reasonable range; TLI and CFI were both greater than 0.9, 0.953 and 0.977, respectively; RMSEA value was equal to 0.060 (<0.08), which was in the standard range; SRMR was 0.042 (<0.05), which was also in the standard range [7]. The model fit of the 6-information platform learning privacy concern scale was good compared to the ideal evaluation criteria.

## 3.2   Study Results

### 3.2.1   Basic Information About the Information Platform Learners

In terms of gender, of the 1408 questionnaires, 53.6% and 46.4% were male and female respectively, with a relatively balanced gender ratio. In terms of age, more than 75% of the survey respondents are in the age range of 18 (inclusive) to 22 years old, and 23.16% of the survey respondents are greater than or equal to 22 years old and less than 26 years old. In terms of education, 62 of the 1,676 respondents received less than a

**Table 1.** Informative platform learning privacy concern question items and confidence level

| Dimensionality | Title item | Number of items | α |
|---|---|---|---|
| Collection | (1) Feel hesitant to provide personal information when requested by the information technology platform | 4 | 0.871 |
| | (2) Consider carefully before providing personal information to the information technology platform | | |
| | (3) Feel annoying to provide personal information to multiple information technology platforms | | |
| | (4) Worried that the information technology platform collects too much personal information | | |
| Control | (1) Learner privacy is actually reflected in the control and autonomy of learners in making decisions about the collection, use and sharing of their personal information | Privacy concerns | 0.815 |
| | (2) The control of personal information by informational platform learners is the core of online learners' privacy | | |
| | (3) Belief that loss of control violates personal online privacy | | |
| Know the facts Use | (1) Information technology platforms should disclose the way in which user information is collected, used and processed | 3 | 0.713 |
| | (2) Online learning privacy policy should be clear and unambiguous | | |
| | (3) The importance of knowing how personal information is used | | |
| Unauthorized use | Information technology platforms should not use learners' personal information for any purpose unless authorized by the learner | 4 | 0.963 |
| | Information technology platforms should not sell learners' personal information | | |
| | (4) Online learning platforms should not share learners' personal information with other companies | | |

college education, 178 received a college education, more than 81% received a college education at the undergraduate level, and 78 received postgraduate education or higher. In terms of study courses, 1,486 of the 1,676 survey respondents matched their online study courses with their majors, and only 190 of them studied online across majors. In

**Table 2.** Level of privacy concerns of survey respondents (N = 2003)

| Dimensionality | Minimum value | Maximum value | Average value | Standard deviation | Privacy Concerns | |
|---|---|---|---|---|---|---|
| | | | | | Average value | Standard deviation |
| Average value | 1.000 | 7.000 | 3.282 | 1.345 | 3.447 | 1.143 |
| Control | 1.000 | 7.000 | 3.349 | 1.351 | | |
| Use | 1.000 | 7.000 | 3.801 | 1.239 | | |

terms of learning motivation, 72.49% of the respondents were motivated to complete school requirements, 21.88% were motivated by professional needs, and only 5.72% were motivated to learn online based on their personal interests. As for the length and frequency of study, 1009 respondents said they study within 1–7 days according to the progress of online course updates, 530 respondents said they have regular online study time every week, 376 respondents tend to study online at their leisure according to their personal schedule, and fewer respondents are accustomed to studying all the knowledge points before the examination or assignment submission deadline. Fewer respondents are accustomed to studying all the knowledge points centrally before the examination or assignment submission deadline.

### 3.2.2 Level of Privacy Concerns of Learners

This study used a 7-level Likert scale to measure the level of online learning privacy concerns in three dimensions of personal information collection, control and use, as shown in Table 2. Of these, the mean privacy concern equals 3.477, indicating that the surveyed online learners have some privacy concerns. The average values of "collection", "control" and "use" are 3.282, 3.349 and 3.801 respectively, indicating that among the three dimensions of "collection", "control" and "use", the most concerned is the collector's "use" of individuals way of information.

It was found that privacy concerns had a significant negative effect on satisfaction with information platform learning, and gender, education, and online learning motivation had no significant differential effects on privacy concerns and learner satisfaction; gender differed in influencing learner attitudes, and education differed on learner recommendations and willingness to continue learning.

## 4 Analysis of Results

### 4.1 Analysis of the Overall Level of Privacy Concerns and Expected Variability

The results of the study showed that the mean value of online learners' privacy concerns was 3.477, and the mean values of "collection," "control," and "use" dimensions were 3.282, 3.349, and 3.801, respectively. This indicates that the learners are concerned about privacy and security, but the young learners do not pay enough attention to important personal information and are not strongly aware of privacy protection. The reasons for

this analysis may lie in the lack of legal security concepts among online learners and their lack of clear understanding of the consequences of privacy infringement; compared to business information and health care information, the personal sensitive information of learners in the use of information technology platforms is not too much involved, resulting in less concern of users about the leakage of privacy.

### 4.2  Privacy Concern Specific Variability Analysis

In terms of studying learners' privacy concerns, the author selected three stages of information platforms for information processing to do the analysis - information collection, control, and use. The results of the study showed that learners were most concerned about how the information collected by their platform was used and processed, most concerned about the control of the information being collected the second highest and concerns about information collection the lowest.

## 5  Conclusion

The above study shows that the right to privacy, as an important right of citizens, should be given attention and adequate protection. The issue of learner privacy and security is inevitable in the process of online learning using information-based education platforms. Learners' concern about the privacy of the information technology education platform needs to be improved, and most of them have concerns about how to use the information materials collected by the platform system but lack awareness of their rights. Measures to protect learners' privacy rights urgently need to be improved in three ways: the legal system, technology, and the learners themselves.

### 5.1  Legal Measures for Privacy Protection

The current "Personal Information Protection Law", "Cyber Security Law" and other legal provisions lack the establishment of supervisory agencies; in terms of legal responsibility settings, the punishment of criminal legal responsibility for infringing citizens' privacy rights is relatively light. It is suggested that a corresponding monitoring and evaluation system can be formulated to strengthen the supervision of the use and processing of information by national administrative departments and third-party social institutions, and protect the privacy of citizens' information.

### 5.2  Improvement of Technology

Develop information and education systems that can be used without uploading native learning data to reduce the risk of learner privacy leakage [4]; Adopting humanities-based biometric authentication, fuzzy identification and encryption technology, replacing traditional non-biological technologies such as passwords, smart card technology, hardware tokens, etc., can protect learner privacy; setting up prevention software to prevent illegal invasion of learner privacy and strengthening artificial intelligence and regional Blockchain fusion technology, etc. can also protect the privacy of learners [5].

## 5.3  Increased Awareness of Rights Protection

Legal courses and lectures are offered to strengthen the educational awareness of students' knowledge of privacy laws and regulations, so that students can understand the hazards and risks of privacy leaks and enhance their awareness of their rights; it is necessary to provide students with smooth channels to defend their rights so that they can defend their rights through legal channels when they encounter privacy risks.

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