USER NEEDS OF ONLINE TUTORING APPLICATIONS USING HOUSE OF QUALITY

Qurrata Aini[*)1], Eko Ruddy Cahyadi[*)], Faqih Udin[**)]

[*)]Department of Management, Faculty of Economics and Management, IPB University
Jl. Agatis, IPB Dramaga Campus, Bogor, West Java, 16680, Indonesia
[**)]Department of Agroindustrial Technology, Faculty of Agricultural Technology, IPB University
Jl. Lingkar Akademik, IPB Dramaga Campus, Bogor, West Java, 16680, Indonesia

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Abstract:

Background: Technology has significantly influenced the education sector, particularly with the rise of mobile learning through online tutoring applications. However, users have reported several shortcomings, such as overly minimalist user interfaces, excessive animations, and suboptimal video and audio content quality. Additionally, data security concerns in mobile learning remain a critical issue.
Purpose: This research aims to analyze the user needs of online tutoring applications as identified by users and potential users and translate these needs into actionable technical responses.
Methodology: The study employs the House of Quality method and was conducted in the Jabodetabek area from 2021 to 2022. Data collection methods included voluntary and purposive sampling, using questionnaires distributed via Google Forms, as well as interviews and focus group discussions.
Results: The House of Quality analysis highlights the prioritized user needs in the following order: 1) security and privacy, 2) performance, 3) information, 4) responsiveness, 5) technical reliability, and 6) design. The technical requirements identified to address these needs include network coverage, storage capacity, data transmission speed, application size, power consumption, network accessibility, and display resolution.
Conclusion: The top user priorities for online tutoring applications are security and privacy, performance, and information. The most critical technical responses to meet these needs are improvements in network coverage, storage capacity, and data transmission speed.
Originality/Value (State of the Art): This study translates user needs for online tutoring applications into specific technical responses, providing a foundation for the development and improvement of such applications.

Keywords: online tutoring applications, mobile learning, house of quality, user needs, technical responses

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[1] Corresponding author:
Email: qurrata.aini@apps.ipb.ac.id

INTRODUCTION

Currently, technology is entering the education sector. According to Raja and Nagasubramani (2018), there are several roles of technology in education, namely as part of the curriculum, as an instructional delivery system, as a tool to assist instruction and also as a tool to improve the overall learning process. One of the technologies used is mobile learning. According to Warsita (2018), mobile learning is a learning model that adopts the development of mobile technology that does not depend on time and place, and the potential and development of mobile learning in the future is very wide open because the community is dynamic and mobile, in addition to the demands of the community's needs for diverse and quality education.

There are advantages of mobile learning, namely the ability to provide learning content outside the classroom and have a good effect on academic achievement (Demir and Akpinar, 2018). According to Yusuf (2021), the benefits of online learning are flexible time and place; cost efficiency; active, varied, creative, and independent learning; getting more information; better use of technology; material can be re-read; paperless; all activities are recorded; and even delivery of material. According to Iwasaki et al. (2019), electronic learning is effective for academic literacy in students.

According to Hanham et al. (2021) tutoring can contribute to understanding, analyzing, elaborating, and applying their conceptual knowledge. According to Alfalah (2023), there are several factors that influence students' intention to use mobile learning, namely the belief in getting good learning results by using mobile learning, the ease of using mobile learning, and the support for using mobile learning from lecturers. Online courses can be better at attracting substitutes, increasing the standard of dependency by up to 60% on certain occasions (Widjaja et al. 2021). According to Pangalo (2022), mobile learning can be a media, learning support tool, and learning resource and can be applied to high school students. Some online tutoring applications used by high school students are Ruang Guru, Zenius, and Quipper. According to Indah and Mahyuni (2021), education business platforms can disrupt conventional education businesses.

Besides the advantages, mobile learning also has disadvantages. According to Criollo-C et al. (2018), there are disadvantages of mobile learning in terms of technology such as limited storage capacity, usability based on device size, low visual quality, insufficient coverage and link failures in wireless communication, scarce standards in the design and evaluation of mobile applications for learning, incompatibility with some educational approaches, limited bandwidth and low information exchange rates. There are also issues in mobile learning regarding technology that include data security and privacy, application size, limited storage space on the device, limited battery, limited screen size makes the information displayed limited (Criollo-C et al. 2021).

According to Sophonhiranrak (2021), issues in mobile learning also include internet connection, keyboard feasibility and screen size, and distraction when learning using mobile learning. Security issues in electronic learning (e-learning) are also conveyed by Pramudita et al. (2020) where there are several information system vulnerabilities in e-learning, namely user privacy vulnerabilities, content vulnerabilities, and website vulnerabilities. According to Assiddiqi and Vanany (2021), there is dissatisfaction felt by high school students in using online learning applications, this dissatisfaction is found in learning content and instructors. Online tutoring applications also have shortcomings that are felt by users, as shown in Table 1.

Due to the scarcity of standards for the design and evaluation of mobile applications for learning and the shortcomings of each online tutoring application as well as data security issues in e-learning, to overcome this, an analysis of the needs of users of online tutoring applications was carried out.

Table 1. Disadvantages of online tutoring application

Application	Disadvantages	Source
Zenius	The user interface looks minimalist	Fitranto (2022)
Ruang Guru	Too much animation, delivery of material is not to the point	Prasya (2022)
Quipper	The quality of video and audio content is not maximized	Wirahadie (2021)

The approach taken to solve the problems of online tutoring application users is by collecting assessments from online tutoring application users regarding user needs when using online tutoring applications.

The purpose of this study is to analyze user needs when using online tutoring applications, focusing on aspects such as responsiveness, information, privacy and security, application design, performance, and technical reliability.

METHODS

The research was conducted in December 2021–August 2022 in the Jakarta, Bogor, Depok, Tangerang and Bekasi (Jabodetabek) areas. The data used were primary data and secondary data. Primary data was obtained through questionnaires, interviews, and focus group discussions (FGDs). Secondary data was obtained from data processing. There are 2 types of respondents, namely user/potential user respondents and expert respondents. The data collection method for user/potential user respondents uses voluntary sampling, while expert respondents use purposive sampling.

User respondents were used to obtain feedback on the level of satisfaction with the online tutoring applications studied, namely Ruang Guru, Zenius, and Quipper. Meanwhile, potential user respondents are defined as people who have not used online learning applications but wish to participate in online tutoring. User/potential user respondents provide feedback on the needs of using online tutoring applications. The population in this study are high school/equivalent students in Jabodetabek in 2019–2021 amounting to 3,396,412 students, the number of samples is calculated using the slovin formula so that the number of user respondents / potential users consists of 100 people. The criteria for user respondents are high school/equivalent students who use online tutoring applications, namely Ruang Guru/Zenius/Quipper in the time span between 2019–2022. Potential user respondents are high school/equivalent students in the time span between 2019–2022. Data collection from user/potential user respondents using an online questionnaire through Google Form.

Expert respondents are respondents who translate user needs into technical responses. The data collection technique uses interviews and focus group discussions. The criteria for expert respondents are having experience in the field of mobile application development and experts in the field of information systems. Expert respondents consisted of 3 people consisting of Specialist IoT Solution Architect with information technology expertise and 12 years of experience, Android Developer Lead with web programming expertise and 5 years of experience, and information systems lecturer with web development expertise and 4 years of experience.

The variables and indicators used in this study are based on literature studies that refer to Wulfert's research (2019) and research indicators refer to Almaiah and Alamri's research (2018). The responsiveness variable (X1) consists of the availability of user services to interact with tutors (X1.1), the ability of the application to allow discussions between users and tutors (X1.2), politeness and kindness of teachers and user services (X1.3), and instructions and instructions for using the application (X1.4). Information variables (X2) consist of the availability of learning materials (X2.1), useful learning materials (X2.2), and accurate learning materials (X2.3). Security and privacy variables (X3) consist of user information security (X3.1), user data protection (X3.2), and user data collection (X3.3). The display application design variable (X4) includes an application user interface that is easy for users to use (X4.1), the quality of multimedia content (X4.2), ease of navigation for users (X4.3), and the 'search and filters' function (X4.4). The performance variable (X5) consists of the speed of accessing data and uploading and downloading (X5.1), the storage space in the device required for the application (X5.2), and the use of mobile networks and devices (X5.3). The technical reliability variable (X6) consists of application and feature reliability (X6.1), mobile service availability (X6.2), and continuity of operation after updates (X6.3).

Data analysis techniques are carried out using the house of quality (HOQ). House of quality (HOQ) is described in a matrix that describes user needs and technical responses to meet user needs (Ficalora and Cohen, 2010). According to Erdil and Arani (2018), the process flow in QFD is (1) consumer needs, (2) technical requirements, and (3) preventive or corrective actions. There are several parts in the HOQ matrix, namely (1) user requirements matrix, (2) assessment matrix, (3) technical response, (4) relationship matrix

between user requirements and technical response, (5) correlation matrix, and (6) technical requirements matrix.

In the user requirements matrix there is an assessment of the level of importance of needs according to users. In this study, the assessment of the level of importance of user needs uses the pairwise comparison method. The assessment weight is 1-9, namely 1 = equal importance, 2 = weak importance, 3 = moderate importance, 4 = more moderate importance, 5 = strong importance, 6 = stronger importance, 7 = very strong importance, 8 = more very strong importance, and 9 = absolutely very important (Saaty, 1987). The pairwise comparison is shown in Table 2.

The steps of using pairwise comparisons are normalizing and weighting (Wi) on each variable by dividing the number of variable assessments by the total number of assessments of all variables, then calculating the eigen value (λi) by dividing the number of matrix rows by the weighting value, then calculating the maximum eigen value by dividing λi by the number of matrices (n), then calculating the consistency index (CI), namely the maximum eigen vector minus the number of matrices then divided by the number of matrices that have been reduced by 1. Then calculate the consistency ratio (CR), namely CI divided by the random consistency index (RI). According to Saaty (1987), the RI value has a reference based on n, namely n : 1= 0; n : 2 = 0; n : 3 = 0,58; n : 4 = 0,90; n : 5 = 1,12; n : 6 = 1,24; n : 7 = 1,32; n : 8 = 1,41; n : 9 = 1.45; and n: 10 = 1,49. For valid and accurate results, the consistency ratio value should be 10% or less. If the consistency ratio is more than 10%, then the assessment is still random and needs to be improved.

For the assessment on the assessment matrix, this study uses a Likert scale with an assessment weight of 1–5, namely 1 = very dissatisfied, 2 = dissatisfied, 3 = quite satisfied, 4 = satisfied, and 5 = very satisfied (Sugiyono, 2019). User satisfaction assessment is carried out on online tutoring applications, namely Ruang Guru, Zenius, and Quipper. The assessment weight in the relationship matrix between user needs and technical responses is 1 (weak relationship), 3 (strong relationship, and 5 (very strong relationship). Then for the calculation in the technical requirements matrix is the sum of the multiplication of the level of importance of user needs with the weight of the assessment of the user needs - technical response relationship matrix on each technical response. For the overall assessment in the assessment matrix is the sum of the multiplication of the level of importance of user needs with the weight of the variable assessment value in each online tutoring application. The correlation assessment matrix shows the relationship between technical responses which is described by symbols, namely very positive (+) meaning it has an absolute strong relationship, positive (+) meaning it has a strong relationship, negative (-) meaning it has a relationship that is not strong, and very negative (-) meaning it has an absolute relationship that is not strong.

This research begins with the existence of deficiencies in online tutoring applications and issues in mobile learning. Next is to analyze user needs using HOQ where user needs are translated into technical responses user needs are met. The research framework is described in Figure 1.

Table 2. Pairwise comparison matrix

	a	b	c	d	e	f
Responsiveness (a)	1	…	…	…	…	…
Information (b)	…	1	…	…	…	…
Security and privacy (c)	…	…	1	…	…	…
Application display design (d)	…	…	…	1	…	…
Performance (e)	…	…	…	…	1	…
Technical reliability (f)	…	…	…	…	…	1

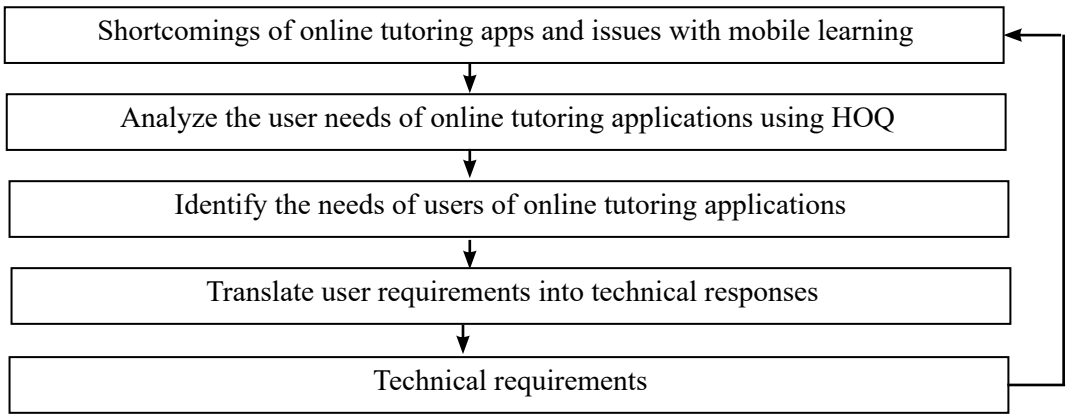


Figure 1. Research framework

RESULTS

HOQ analysis is carried out to analyze user needs, determine the level of importance of variables according to users, technical responses, user assessments of existing products/services, and determine the value of the results of the correlation between user needs and technical responses. Figure 2 explains the house of quality analysis in this study.

User needs

After determining the variables and indicators to be used, the next step is to weight the variables. The purpose of variable weighting is to determine the level of importance of each variable according to application users. Based on Figure 2, it can be seen that the order of variables based on the level of importance according to users is security and privacy (34.59%), followed by performance (17.71%), information (17.71%), responsiveness (12.52%), technical reliability (9.05%), and finally application display design (8.22%). The results of this study confirm the research conducted by Criollo-C et al, (2021) and Pramudita et al. (2020) regarding data security issues in mobile learning.

Assessment matrix

The assessment matrix contains an assessment of user satisfaction with the online learning application used by users. The results obtained were 43 Ruang Guru users, 34 Zenius users, and 7 Quipper users who gave an assessment of satisfaction with the online learning application used by each user. Based on Figure 3, Ruang Guru outperforms Zenius and Quipper on responsiveness, technical reliability, and design variables For information variables, Zenius is superior compared to Ruang Guru and Quipper. The performance variable with the highest rating was obtained by Quipper. While the security and privacy variables, all online learning applications are at the same level of assessment.

Technical response

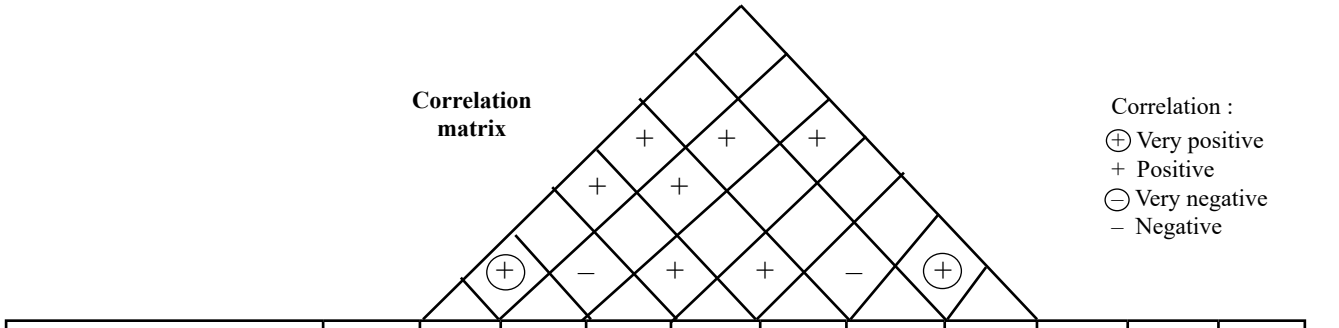
Technical response is the translation of user requirements into technical components. Technical components are used as the basis for forming a product or service. In the development of mobile applications for college entrance preparation, technical responses were obtained from the results of FGDs with expert respondents as follows:

Network coverage

Network coverage is the internet network used to run the application. Network coverage can be different from the application developer's side and the user's side. Network coverage from the application developer's side is how far the area is reached so that the application can be accessed by users, while from the user's side is the ability of the user's device to capture the internet network so that the application can be run. The unit used is megabytes per second (MBPS).

Data transmission speed

Data transmission speed is the speed of the application in processing data. Processing data can be in the form of entering data, downloading data, searching data, and the speed of the application in providing information to users.



User priority (%) / User needs	Technical response	Network coverage	Data transmission speed	Display resolution	Power consumption	Network access	Storage	Application size	Ruang guru	Zenius	Quipper
Responsiveness	12.52	5	5						4.44	4.35	4.25
Information	17.71	5					3		4.44	4.5	4.29
Security and privacy	34.59	5							4.15	4.13	4.14
Application design display	8.22		3	5					4.37	4.21	3.93
Performance	17.90				3	3	5	5	4.15	4.13	4.33
Technical reliability	9.05	5	3		3	3			4.23	4.17	4
Total score		3.69	1.14	0.41	0.81	0.81	1.43	0.90	4.26	4.23	4.18
Total score (%)		40	12	4	9	9	16	10			

User rating

The relationship between user needs and technical responses

Figure 2. HOQ analysis

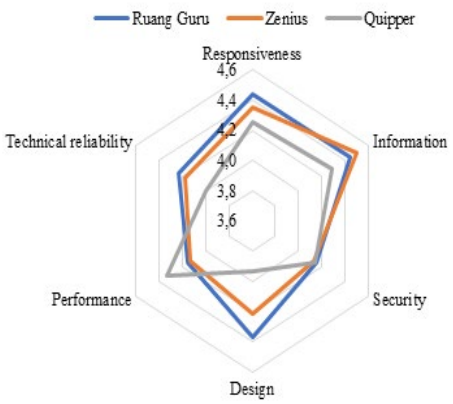


Figure 3. Assessment matrix radar diagram

Display resolution

Display resolution is related to the graphics displayed in the application. The unit used for display resolution is density-independent (DP).

Power consumption

Power consumption is how much the app uses the device's battery power when the app is running.

Network access

Network access is related to the application database which is stored in the cloud. To run an application, the storage on the server required is 2 terabytes (tb).

Storage

Storage relates to the data storage space required to download the app. For users to access the information in the app, a minimum of 20 MBPS of storage is required.

Application size

Application size is the overall size of the application which is influenced by the features and data used by users.

Relationship matrix between user requirements and technical responses

Based on Figure 2, there is a relationship that has a value of 5 or means very strong, namely responsiveness - network coverage, because a strong network will produce optimal responsiveness; information - network

coverage, because to download / upload data requires a good network; security and privacy - network coverage, this is because a strong network is needed to build a security system in the application; responsiveness - data transmission speed, the speed of the application in managing the flow of data in and out and also the speed of presenting data, affects the responsiveness of the application; technical reliability - network coverage, a strong network is needed to update the application to the latest version; application display design - display resolution, the display resolution in question is the image density including pixel density which will affect the display quality of the application when run; performance - storage, the amount of application storage on the device will affect the performance of the application when run; performance - application size, the data stored in the application can affect application performance.

Then for relationships that have a value of 3 or meaning that the relationship is moderate, namely application display design - data transmission speed, this is because the display design affects application workloads such as processing data when the application is running; technical reliability - data transmission speed, good data processing and presentation will optimize application technical reliability; performance - power consumption, if application performance is high, the battery power consumption used will also be high, and vice versa; technical reliability - power consumption, high battery power consumption is needed when updating the application and using many features and activities in the application; performance - network access, data download/upload activities involve the database on the central server, so network access to the database affects application performance; technical reliability - network access, network access to the database is also needed to maintain technical reliability in the application; information - storage, the flow of information that takes place when the application is used will affect storage.

The correlation matrix

Correlation matrix is the relationship between technical components derived from technical responses. Based on Figure 2, technical correlations that have a very positive relationship (+) are network coverage - data transmission speed and storage - application size, where each technical response greatly influences each other. Technical responses that have a positive relationship (+) are network coverage - power consumption, network coverage - network access, data transmission speed - network access, data transmission speed - storage, display resolution - power consumption, display resolution - application size, and power consumption - network access, where each technical response has an influence but depends on the use when the application is run. While those that have a negative relationship (-) are data transmission speed - display resolution and network access - storage, which means that the relationship between each technical response does not have much influence on each other.

Technical requirements matrix

The technical requirements matrix is a calculation to determine the level of importance obtained from the calculation between the customer needs weight value and the calculation in the correlation matrix. Based on Figure 2, the results of the technical requirements matrix calculation are network coverage of 3.69 (40%), storage 1.43 (16%), data transmission speed 1.14 (12%), application size 0.9 (10%), power consumption 0.81 (9%), network access 0.81 (9%), and display resolution 0.41 (4%).

Managerial Implications

Based on the results of the research conducted, what can be done to meet user needs in using online tutoring applications is to prioritize security and privacy variables, performance, and information. The technical response that is the main focus to meet user needs is network coverage, storage, and data transmission speed. For network coverage, application developers can expand the coverage area and add servers so that they can be easily accessed by users. For storage, application developers use the application protocol interface (API) so as not to burden the work on the server, then create content in the application that can be compressed so that the size is smaller so as not to take up too much space on the user's device. Then for data transmission speed, this is related to network coverage.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Based on the research results, the user needs that are a priority for users are security and privacy, performance, and information. To meet these user needs, the technical response based on the results of the house of quality for mobile application development is network coverage, storage, and data transmission speed.

Recommendations

This study is not free from limitations, because this study was conducted limited to analyzing the needs of online tutoring application users. Then, the study used data from 2019 - 2021. The researcher suggests conducting further research on the development of mobile learning outside the classroom based on user needs.

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