

# Analysis of Measurement of the Quality of Using the Web-Based Computer Based Test (CBT) Application on User Satisfaction Using Servqual and CSI Methods at SMK PGRI 6 Denpasar

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## Abstrak

Aplikasi *Computer Based Test* (CBT) berbasis web merupakan inovasi dalam sistem penilaian akademik yang menggantikan metode ujian konvensional berbasis kertas. Penelitian ini bertujuan untuk menganalisis kualitas layanan aplikasi CBT terhadap kepuasan pengguna di SMK PGRI 6 Denpasar dengan menggunakan pendekatan Servqual dan Customer Satisfaction Index (CSI). Sampel penelitian terdiri atas 152 siswa kelas XI dan XII. Data diperoleh melalui penyebaran kuesioner daring dan dianalisis dengan metode Servqual untuk mengidentifikasi kesenjangan antara ekspektasi dan persepsi pengguna, serta perhitungan CSI untuk mengukur tingkat kepuasan secara keseluruhan. Hasil analisis menunjukkan bahwa 90% indikator memiliki nilai gap negative yang mengindikasikan ekspektasi pengguna lebih tinggi dibandingkan dengan pengalaman aktual. Meskipun demikian, nilai CSI sebesar 82,64% termasuk dalam kategori sangat puas yang menunjukkan bahwa aplikasi CBT tetap memberikan manfaat yang signifikan. Oleh karena itu, diperlukan pengembangan fitur dan peningkatan layanan guna memenuhi harapan pengguna secara lebih optimal.

**Kata kunci:** Kepuasan Pengguna, Kualitas Layanan, Aplikasi CBT, Servqual, CSI

## Abstract

The web-based *Computer Based Test* (CBT) application is an innovation in the academic assessment system that replaces the conventional paper-based exam method. This study aims to analyze the quality of CBT application services on user satisfaction at SMK PGRI 6 Denpasar using the Servqual and Customer Satisfaction Index (CSI) approaches. The research sample consisted of 152 students in grades XI and XII. Data were obtained through online questionnaires and analyzed using the Servqual method to identify gaps between user expectations and perceptions, as well as CSI calculations to measure overall satisfaction levels. The results of the analysis show that 90% of indicators have negative gap values indicating that user expectations are higher than actual experiences. However, the CSI value of 82.64% is included in the very satisfied category, indicating that the CBT application still provides significant benefits. Therefore, feature development and service improvements are needed to meet user expectations more optimally.

**Keywords :** User Satisfaction, Service Quality, CBT Application, Servqual, CSI

## 1. Introduction

Changes in the education system brought about by information technology have revolutionized the way learning outcomes are assessed [1]. Web-based Computer Based Test (CBT) applications are one of the innovations that are now widely used in academic and professional assessment systems. CBT applications replace paper-based test methods that have been carried out conventionally (traditionally) in various schools. The advantages of web-based CBT include time efficiency, reduced human error in assessment, and the ability to present tests to a large number of participants simultaneously [2].

One of the schools that was the subject of the study was SMK PGRI 6 Denpasar. SMK PGRI 6 Denpasar is a private vocational school located at Jl. Tukad Gerinding No.21 A Panjer

Denpasar. Currently, SMK PGRI 6 Denpasar uses the 2013 SMK learning curriculum program (grade XII) and the independence curriculum. SMK PGRI 6 Denpasar has 4 (four) expertise programs, namely Hospitality, Automotive Light Vehicle Engineering, Motorcycle Engineering and Visual Communication Design (DKV). SMK PGRI 6 Denpasar is one of the schools that since 2018 has implemented a web-based Computer Based Test (CBT) application to carry out the Mid-Semester Assessment (PTS), End-of-Semester Assessment (PAT), and Computer-Based National Assessment (ANBK) which are followed by students starting from grade X, grade XI and grade XII. Literary quotes use the sign [1], [2] and so on. The implementation of school exams is carried out in a computer laboratory online using PCs and laptops. During the exam, students will be divided into several sessions. The school hopes that the use of this CBT system can make exams more efficient. For example, paperless to reduce the impact of paper waste and get benefits in the form of providing convenience for teachers in saving time to assess and check student answers so that they are in line with the school's vision, mission and goals in maximizing the process and evaluation of student learning [3].

This causes education to also experience improvements in terms of quality, speed, practicality and also convenience, conventional exams have shifted towards computerization, one of which is with online exams. The online exam system is useful for reducing the level of student cheating because the questions presented will be different from one another. And can save time that is usually used to correct the exam [4]. The effectiveness of this application is highly dependent on the quality of the user experience which means that the application is responsive, intuitive and reliable. Each application has a different user interface and has the same goal, namely that users can use the application properly and are satisfied with its appearance. Service quality analysis must be carried out so that CBT developers can find out what criteria need to be improved and become a priority for service improvement so that user satisfaction can be created to obtain service improvements using the servqual method [5]. The servqual method is a measurement tool designed to assess service quality based on user perception. It allows for analysis of the gap between user expectations and their perceptions of application performance. The categories reviewed include tangibles (physical appearance of the system), reliability, responsiveness, assurance, and empathy [6].

The Customer Satisfaction Index (CSI) provides a numerical measure of user satisfaction resulting from their experience using a web-based CBT application. The CSI helps determine the extent to which a product or service meets, exceeds, or fails to meet user expectations [7]. This study was conducted with the aim of determining the level of customer satisfaction with service quality and to determine whether there is a significant difference between customer perceptions and expectations in each dimension of quality. The results of this study are expected to be able to fill the literature gap related to CBT service quality in the context of education while providing valuable practical insights for the development of better technology-based evaluation systems. In addition, the results of the study can be a guide for schools and application developers in improving service quality and user satisfaction with CBT applications [8].

Previous studies tend to focus more on technical aspects or system implementation. In addition, there are not many studies that specifically discuss service quality from the perspective of users, especially students, as a key element in evaluating technology-based education systems. Therefore, this study is important to conduct in order to provide a deeper understanding of the service quality of web-based CBT applications and the factors that influence user satisfaction at SMK PGRI 6 Denpasar. This study is also novel because it is one of the first to analyze the service quality of web-based CBT applications using a combination of Servqual and Customer Satisfaction Index (CSI) methods in an educational environment in Bali. By combining the Servqual and CSI methods in this study, it is expected to provide a more comprehensive and in-depth picture of the quality of web-based Computer-Based Test (CBT) applications and the level of user satisfaction. This is important, especially as educational institutions and certification bodies continue to explore and adopt digital solutions to improve the efficiency and effectiveness of their assessment processes.

Thus, this study not only provides benefits for SMK PGRI 6 Denpasar but also has the potential to be a reference for other educational institutions that will implement similar applications. This study provides a positive contribution to improving the quality of education through the use of technology, especially in creating an efficient, effective, and user-centered learning evaluation system. This study provides recommendations to school principals and

educational application developers in improving and adjusting application features to meet user needs more effectively.

## 2. Research Method / Proposed Method

The concept of this research is based on the Servqual (Service Quality) and Customer Satisfaction Index (CSI) integration model to measure the quality of service and user satisfaction of the web-based Computer Based Test (CBT) application at SMK PGRI 6 Denpasar. The stages will be described as follows.

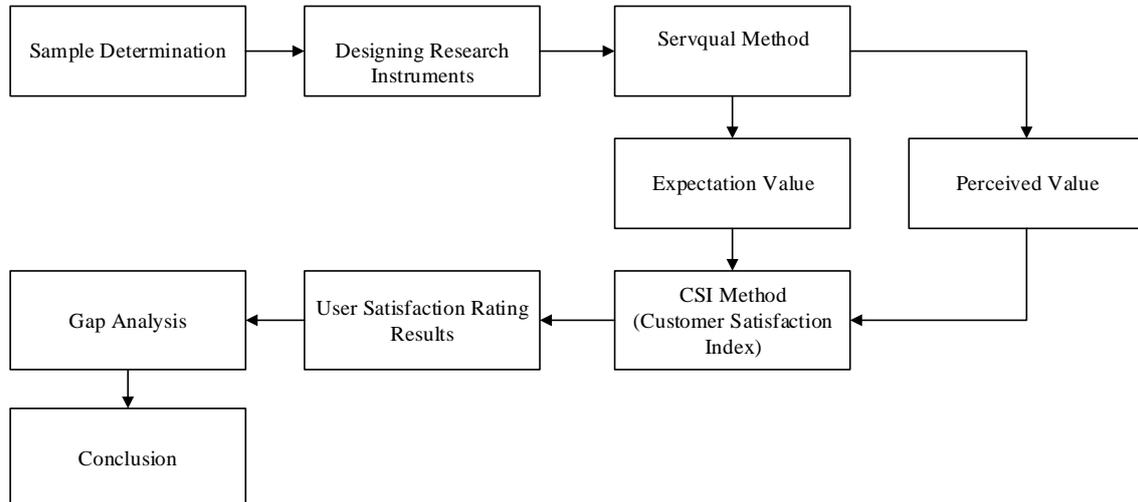


Figure 1. Research Concept

Explanation of the stages of explanation for each step of the research:

1. Determining the sample to be used in the study. In this study, all populations of students in grades XI and XII were used.
2. This study uses a questionnaire instrument using closed questions, online-based (google form) which includes Servqual dimensions and CSI indicators. The scale used in the questionnaire is a Likert scale with a scale of 1 for very satisfied, 2 for satisfied, 3 for neutral, 4 for dissatisfied and 5 for very dissatisfied.
3. Using the Servqual method to measure the value of expectations and perceptions of service quality based on five dimensions, namely Tangibles, Reliability, Responsiveness, Assurance, and Empathy.
4. Using the CSI method to measure overall user satisfaction based on the results of the expectation value and perception value.
5. Combining the results of the Servqual and CSI methods to obtain an overall user satisfaction value
6. Analyzing the gap between user expectations and perceptions. This gap shows areas where service quality does not meet user expectations.
7. Summarize the findings from the gap analysis and user satisfaction scores. This conclusion will provide insight into areas for improvement and strategies to improve service quality and user satisfaction.

## 3. Literature Study

Literature study is a way of solving problems by tracing written sources that have been written previously. Literature studies are obtained from journals, books, the internet, and data sheets to create ideas and concepts in research.

### 3.1 Computer Based Test (CBT)

Computer Based Test (CBT) is a test that is done on a computer so that it does not require paper, pens or pencils to answer questions. The questions are written on the computer and the answer sheet is also provided on the computer so that we only need to click on the correct or incorrect answer or just type if answering essay. This Computer Based Test (CBT) is

widely implemented in various fields such as education and in the world of work. In the field of education, it is usually used to determine the highest score of a student or college student in mastering a subject or course. While in the world of work, Computer Based Testing is used to determine the basic abilities of a job applicant so that it makes it easier for the HRD department to select prospective employees. The use of Computer Based Test (CBT) in schools is increasingly developing as a modern solution in implementing exams. CBT allows students to work on exam questions using computers, laptops, or tablets, replacing paper-based exam systems. The implementation of CBT provides various benefits, such as time efficiency because corrections can be done automatically, exam security with question randomization features, and cost savings because it reduces paper use. In addition, exam results can be directly analyzed by teachers to improve the quality of learning.

Various CBT applications have been widely used in schools, such as CBT ANBK, Google Forms, Moodle, and CBT BeeSmart, which support online and offline exams. However, the implementation of CBT also faces challenges, such as limited infrastructure, teacher and student readiness, and the potential for technical disruptions such as unstable internet connections. Therefore, thorough preparation is needed so that the implementation of CBT in schools can run optimally and provide maximum benefits for the world of education. [9].

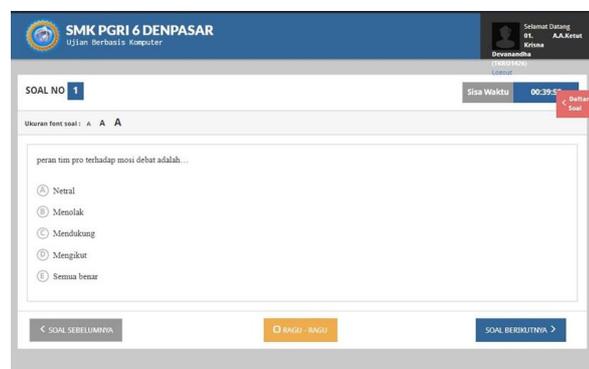


Figure 2. Computer Based Test (CBT) Application View

### 3.2 Instrument Testing

A variable requires a measuring instrument which is usually called an instrument. An instrument is a tool that because it meets academic requirements, it can be used as a tool to measure a measurement object or collect data on a variable. Furthermore, it is stated that basically instruments can be divided into two types, namely tests, for example achievement tests, intelligence tests, talent tests; while those included in non-tests include interview guidelines, questionnaires, observation sheets, checklists, attitude scales, assessment scales, and so on. Measurement is an operation carried out on the physical world by an observer. [10].

### 3.3 Servqual Method

Measurement of service quality with the Service Quality measurement model is based on a multi-item scale designed to measure customer performance perceptions and expectations, as well as the gap between the two in the main dimensions of service quality [11]. Service quality is an assessment of the level of good and bad service delivered according to customer expectations, quality becomes a strategic tool in realizing efficiency in operations and performance has provided a detailed explanation of the servqual dimensions[12]. Dimensions contained in servqual are [13], [14], [15]:

1. Tangible is the ability of a company to show its existence to the external through the appearance of physical facilities, equipment, and staff. Tangible refers to equipment, facilities, and personnel appearance. Tangible is one of the highest dimensions based on perceptions of service quality. This shows that it is important for an agency to consider investing in physical form.
2. Reliability is the ability of a company to provide services as promised accurately and reliably. Reliability is the ability to perform services reliably and correctly. Reliability shows a high satisfaction value with timely performance, content items for reliability assessments include providing reliable services. This shows that the service provider

- must be able to provide its services correctly from the beginning of the service, fulfill what was promised accurately, deliver data correctly and work on time as promised.
3. Responsiveness is a willingness to help and provide fast service to customers through clear information delivery. Responsiveness implies readiness to provide timely service and help clients. In urban management, responsiveness is important by considering the willingness of authorities to solve problems, sincerity, availability and regularity in checking facilities to ensure responsiveness. Therefore, service providers must be able to provide fast and clear service and good responsiveness.
  4. Assurance is the knowledge, courtesy and ability of company employees to foster customer trust in the company. Assurance shows the knowledge and ability of employees to build trust in customers. Assurance shows the credibility, knowledge, capacity, courtesy and ability of service providers to achieve consumer trust. Workforce, behavior and local knowledge are considered here to get an idea of service assurance. Therefore, service providers must be able to provide comfort and trust to customers by having the appropriate skills and knowledge.
  5. Empathy is the capability of a company or its staff to provide sincere personal attention through efforts to understand customer desires, in the form of being easily contacted, good communication and understanding consumer needs. Empathy is the consideration of all staff in designing facilities, awareness, and having empathy for customers.

Service quality is the output and evaluation of the process of comparing expectations with the services received by consumers [16]. Service quality can be seen in the following formula 1 [17].

$$Q = P - E \tag{1}$$

Description:

- Q :Service Quality (service quality)
- E :Expectation (user expectations of user quality)
- P :Perception (actual service received)

To obtain the expectation value and perception value, the following formulas 2 and 3 can be obtained:

$$\bar{E} = \frac{\sum E_i}{n} \tag{2}$$

$$\bar{P} = \frac{\sum P_i}{n} \tag{3}$$

Description:

- $\sum E_i$  :Total expectation score divided by the number of respondents (n)
- $\sum P_i$  :Total perception score divided by the number of respondents (n)
- $\bar{P}$  :Average perception
- $\bar{E}$  :Average expectation

### 3.4 Customer Satisfaction Index (CSI)

Customer Satisfaction Index is a measurement to determine the level of consumer satisfaction with the service as a whole by providing an assessment based on performance considerations on the attributes being measured. Customer Satisfaction Index (CSI) satisfaction level, Customer Satisfaction Index is an important consumer for business actors to know to measure how satisfied consumers are with the performance they have done [18].

Consumer satisfaction can also affect the continuity of a business. If consumer expectations are greater than the performance of a company, then consumer satisfaction will not be met and consumers can react negatively. Conversely, if performance is higher than consumer expectations, satisfaction is met and consumers will react positively. Consumer satisfaction will affect whether or not repeat purchases occur [19].

Customer Satisfaction Index (CSI) is an index to determine the level of customer satisfaction as a whole with an approach that considers the level of importance of the product or service attributes being measured [20]. To find out the size of the Customer Satisfaction Index (CSI), you can use Table 1 below.

Table 1. Customer Satisfaction Index (CSI)

Attribute	Expectation (I)	Satisfaction (P)	Score (S)
	Average (I)	Average (P)	(S) = (I) x (P)
.....			
Total score	Total (Y) = $\sum i$	Total (T) = $\sum S$	

Description:

- I : Average value of expectation
- P : Average value of satisfaction
- S : Score or result of multiplying the average value of expectation and satisfaction
- Y : Total of expectation value
- T : Total of score value

To obtain the index value, it can be calculated using the following formula equation.

$$CSI = \frac{T}{5v} \times 100\% \tag{4}$$

After getting the CSI (Customer Satisfaction Index) value, it can be determined whether the user or customer is satisfied with the service or product provided according to the level of satisfaction obtained from the formula above. Then it will proceed to the next stage, namely determining the criteria for the level of satisfaction according to the following satisfaction criteria table.

Table 2. Satisfaction Level Criteria

No	CSI Value %	Information
1	81%-100%	Very Satisfied
2	66%-80%	Satisfied
3	51%- 65%	Quite Satisfied
4	35%-50%	Not Satisfied
5	0%-34%	Not Satisfied

#### 4. Result and Discussion

This study used all students of grade XI and XII at SMK PGRI 6 Denpasar in the 2024-2025 academic year as the population which also became the research sample. The total population consisted of 152 students. The selection of all students of grade XI and XII as respondents was carried out because of their active involvement in the use of web-based CBT applications during the implementation of exams at school. Direct participation in exams, both paper-based and digital, makes students of grade XI and XII relevant to provide information, experiences, and input related to the research.

##### 4.1 Servqual Variable GAP Value

Servqual is a concise scale selection but has a fairly high level and truth and can be used by company management to better understand the level of consumer interest and consumer expectations of the services provided. The servqual concept is used to calculate the gap between consumer perceptions of services and expectation values. The following are the results of calculating the gap value between consumer perception values and expectation values in the following table.

Table 3. Gap Value Calculation

Statement	Average E	Average P	GAP	Rangking
P1	4.27	4.19	-0.08	9
P2	4.22	4.14	-0.09	10
P3	4.30	4.30	-0.01	4

P4	4.29	4.22	-0.07	8
P5	4.36	3.91	-0.45	20
P6	4.27	4.18	-0.09	11
P7	4.26	4.27	0.01	3
P8	4.24	3.99	-0.25	19
P9	4.15	3.97	-0.18	16
P10	4.30	4.13	-0.18	16
P11	4.28	4.03	-0.24	18
P12	4.24	4.22	-0.03	5
P13	4.15	4.05	-0.11	12
P14	4.29	4.23	-0.06	7
P15	4.05	4.02	-0.03	6
P16	4.26	4.09	-0.17	15
P17	4.28	4.42	0.14	1
P18	4.36	3.88	-0.47	21
P19	4.28	4.13	-0.15	13
P20	4.30	4.13	-0.16	14
P21	4.14	4.27	0.13	2

Table 3. shows the Gap between The table above shows the results of data processing on each servqual variable. The highest value is P17 on the assurance factor "The exam score is displayed on the application in real time after completing the exam" with 0.14 while the lowest gap value is P18 on the empathy factor "Interactive guide, before the exam starts the system provides a short tutorial on how to use CBT." for users with a gap value of -0.47.

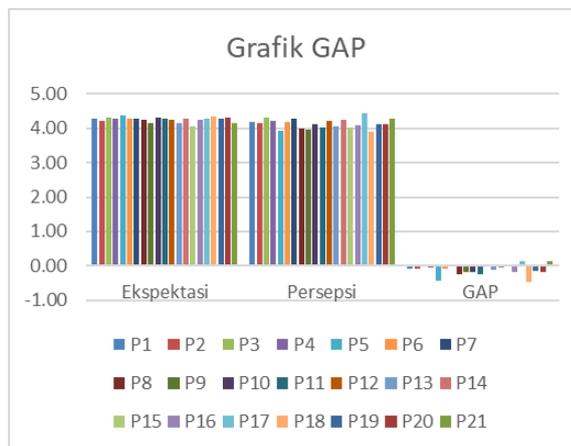


Figure 3. Results of Data Analysis on Perception, Expectations, and GAP

Based on the analysis results, it was found that the Gap value was mostly negative, meaning that the expectation value was higher than the perception. A higher expectation value indicates that the service using the CBT application is not in accordance with the purpose of the application. The highest negative Gap value was in the empathy factor in the statement "Interactive guide, before the exam starts the system provides a short tutorial on how to use CBT." This factor needs to be improved because the results show that users have not felt the features of the interactive guide, a short tutorial on how to use CBT. CBT service users have difficulty using it so they feel that the CBT application is not user friendly. Feature improvements need to be made to make it more user friendly so that user satisfaction increases. Another highest negative Gap value is in the system reliability factor in the statement "access speed and response from the application when using the features". This shows that CBT application users do not feel the speed of access and response offered. Improvements to CBT services need to

be made in terms of system reliability because it is an important line in CBT services. Good access speed and response are very much needed by users. If the system is slow or unresponsive, users can feel frustrated so that they interfere with concentration during the exam and even risk losing answers due to system delays. The system reliability aspect must be improved so that users can experience the speed of access and application response when using the features offered.

#### 4.2 CSI Value

Determining the value of CSI, taking steps such as measuring the results of the questionnaire with the CSI table, calculating the CSI index value using the formula and measuring it according to the criteria. In general, if the CSI value is above 50%, it can be said that the service user is satisfied, conversely if the CSI value is below 50%, the service user is not yet said to be satisfied. The following are the results of the analysis of the CSI value calculation.

Table 4. CSI Value Analysis Result

Statement	Expectation (I)	Satisfaction (P)	Score (I) x (P)
<i>Tangible</i>			
P1	4.27	4.19	17.89
P2	4.22	4.14	17.48
P3	4.30	4.30	18.48
P4	4.29	4.22	18.12
<i>Reliability</i>			
P5	4.36	3.91	17.07
P6	4.27	4.18	17.84
P7	4.26	4.27	18.20
P8	4.24	3.99	16.95
P9	4.15	3.97	16.50
<i>Responsiveness</i>			
P10	4.30	4.13	17.75
P11	4.28	4.03	17.25
P12	4.24	4.22	17.89
P13	4.15	4.05	16.80
<i>Assurance</i>			
P14	4.29	4.23	18.15
P15	4.05	4.02	16.26
P16	4.26	4.09	17.39
P17	4.28	4.42	18.91
<i>Emphaty</i>			
P18	4.36	3.88	16.91
P19	4.28	4.13	17.70
P20	4.30	4.13	17.75
P21	4.14	4.27	17.70
Total	89.30	86.77	368.97

From Table 4, above, the Y value (Total of expected values) and T value (Total of score values) are known, so the next step is to calculate the user satisfaction value using the CSI (Customer Satisfaction Index) research method.

If known:

T1 : 368.97  
5 : Maximum value on the measurement scale  
Y : 89.30  
CSI =  $T / 5y \times 100\% = 368.97 / 5 \times 89.30 \times 100\% = 82.64\%$

Based on the results of the calculations that have been carried out, the CSI value is 0.8264 on a scale or 82.64% in percentage. This CSI value is obtained by dividing the total Weight Score (WS) value by the maximum scale used in this study, which is 5 and multiplying it by 100%. The satisfaction index is in the range of 0.81 - 1.0, which means that overall CBT users feel very satisfied with the quality of CBT performance. CSI analysis obtained in general that the level of user satisfaction of the service is high so that it is included in the very satisfied category. The value of 82.64% is in the range of the "very satisfied" category, namely in the range of 81% - 100%. The statement that has the highest satisfaction value seen from the positive gap value is the guarantee factor with the statement "the test score is displayed on the application in real time after completing the test". The features of the CBT service can display scores in real time and have the impression that the results displayed are accurate, becoming a superior feature felt by users. This feature is one of the strengtheners that produces high user satisfaction values even though several other features have less good values.

## 5. Conclusion

Based on the research results, the Servqual method has proven effective in assessing and identifying gaps between user expectations and perceptions of the quality of web-based Computer Based Test (CBT) application services. The gap can be seen from the gap value which is dominated by negative values, indicating that user perceptions are higher than their expectations of CBT services. In addition, the measurement results using the Customer Satisfaction Index (CSI) showed a value of 82.64%, which is included in the very satisfied category. This indicates that the CBT application service has been able to provide satisfaction to users, although there are some features that are still not optimal. Therefore, it is recommended for CBT application developers to make improvements to features that are not fully user-friendly and increase the speed of system access and response. Developers are also advised to improve the UX/UI aspect with a more intuitive interface and efficient navigation, optimize performance through server and caching improvements, and improve system reliability through automatic backups and load testing. Technical support needs to be strengthened through real-time customer service and chatbots, and system security must be improved with data encryption, dual authentication, and audit logs. Finally, the aspect of empathy towards user needs can be considered by adding inclusive features and interactive guides, as well as providing a short tutorial before the exam begins so that exam participants at SMK PGRI 6 Denpasar can better understand the flow and functionality of the CBT application.

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