Volume 07 Issue 01 (2026) Pages 129 - 139
Journal of Social Science and Education
e-ISSN: 2722-9998, P- ISSN: 2723-0007
Available online at: https://jurnal.iainponorogo.ac.id/index.php/asanka

USABILITY TESTING OF THE E-LEARNING SYSTEM AT SMK TI BALI JIMBARAN USING THE CONCURRENT THINK ALOUD (CTA) AND SYSTEM USABILITY SCALE (SUS) METHODS

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ARTICLE INFO

Article history:
Received: March 27, 2026
Accepted: May 25, 2026
Published: June 20, 2026

Keywords:
E-Learning; Concurrent Think Aloud; System Usability Scale; Satisfaction; User Satisfaction

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ABSTRACT

E-learning serves as a support tool for teachers in fulfilling their responsibilities as educators and homeroom teachers. This system has been implemented as a learning medium; however, some users, particularly new users, still experience difficulties adapting to its interface, which differs from those of commonly used systems. This study aims to evaluate the e-learning system of SMK TI Bali Global Jimbaran in terms of effectiveness, efficiency, and user satisfaction. The usability testing method was selected to evaluate the system based on these three aspects. The techniques used in this study include Concurrent Think Aloud (CTA) and the System Usability Scale (SUS). This evaluation used a sample of 20 teacher respondents. The sample was separated by level of technology proficiency: 10 representatives from the advanced group and 10 representatives from the beginner group. In qualitative research, including CTA, the number of participants is determined based on the principle of data saturation, which occurs when the collected data begin to show repetitive patterns and no significant new findings emerge. With 15–20 users, coverage of usability problems can reach nearly 100% of relevant issues. Therefore, 20 participants are considered sufficient to ensure that the major usability problems in the e-learning system have been identified. To measure user satisfaction, the System Usability Scale (SUS) method was employed, while interface improvement recommendations were derived using the Concurrent Think Aloud (CTA) method. The respondents involved in the SUS method were the same as those participating in the CTA method. The results of the CTA and SUS analyses will serve as a basis for recommendations to improve the e-learning system in the future.

INTRODUCTION

Technology and education have become major areas of attention, particularly in higher education, where communication cannot always be conducted face-to-face. This condition encourages academic communities to develop information systems that can be accessed anytime, anywhere (Baihaqy et al., 2016). The large number of students requires teachers to monitor their progress more practically. The development of systems to support teachers' roles as educators and homeroom teachers has become a viable solution, especially in the digital era, which demands flexibility. The development of information systems, particularly web-based systems, must adhere to usability guidelines to ensure that their intended objectives are achieved (Iryanti et al., 2022).

Globalization has integrated e-learning into education, enabling flexible access through innovations in the internet. Beyond technology, its successful implementation depends on organizational factors and user satisfaction (Putera & Candiasa, 2021). Several factors can serve as guidelines to ensure that a system achieves its objectives when developed. Usability is a primary factor in measuring system success, as it reflects usefulness and user acceptance. This assessment requires parameters related to user satisfaction with the system (Antika & Yulianingsih, 2023). Understanding the level of system usability also helps measure users' ability to operate it. Usability encompasses the process through which users learn and use the system to achieve effectiveness, efficiency, and satisfaction (Amelia et al., 2024).

Effectiveness analysis is required to evaluate respondents' success in completing tasks and the number of errors they make. Meanwhile, efficiency measures the time taken to complete tasks by comparing advanced and beginner users(Fatmawati, 2021). Usability is a crucial aspect in software design; therefore, developers must understand it before beginning system development. System testing is also necessary to assess how easy the interface is for users to use (Putera et al., 2022).

Usability Testing is a commonly used method because it is considered more accurate. This testing evaluates a product by allowing users to interact with it directly (Kamilia, Ana Wati, and Yudha Kartika 2024). It is generally used to measure the effectiveness and efficiency aspects of a system (Nugraha, Sukarsa, and Rusjayanthi 2022). Meanwhile, the Concurrent Think Aloud (CTA) technique is used to assess user satisfaction, and the Inquiry method, through questionnaires, is utilized to facilitate users in expressing what they do while completing tasks and how satisfied they are when using the system (Thaib, Papuangan, and Hizbullah 2022). Concurrent Think Aloud involves participants verbalizing their thoughts while performing given task scenarios, whereas Retrospective Think Aloud requires participants to verbalize their thoughts after completing the tasks (Wibisono, Rokhmawati, and Hanggara 2023).

Currently, teachers are still required to monitor students' progress. Therefore, a system that can be accessed anytime and anywhere is needed. At SMK TI Bali Global Jimbaran, teachers use an e-learning system to manage assignments and examinations. However, based on interviews with three teachers, several issues were identified. New

teachers experience difficulties adapting because the system interface differs from what they are accustomed to. In addition, the lack of a notification feature delays task completion, as teachers must check menus individually. These shortcomings necessitated a comprehensive usability evaluation to identify areas for improvement within the system.

Given the background emphasizing the importance of evaluating usability in e-learning systems, the research problems can be formulated as follows: What is the level of usability of the e-learning system at SMK TI Bali Jimbaran, as measured using the Concurrent Think Aloud (CTA) and System Usability Scale (SUS) methods? What are the results of measuring user satisfaction and ease of use of the e-learning system based on the System Usability Scale (SUS) questionnaire?

This study uses a user-centered evaluation approach to identify and address usability issues in the e-learning system at SMK TI Bali Jimbaran. The problem-solving process is carried out systematically through several stages. The first stage is problem identification and the determination of research objectives, which involves identifying obstacles and issues users (teachers and students) encounter when using the system. These include difficulties with navigation, interface design, feature understanding, and the system's effectiveness in supporting the learning process. The main objective is to improve usability and user satisfaction.

The next stage is initial data collection, conducted through direct observation of user activities while accessing the system and preliminary interviews to understand their perceptions and experiences. This stage provides an initial overview of potential usability issues. The analysis stage uses the Concurrent Think Aloud (CTA) method to understand users' thought processes in real time as they interact with the system. Respondents are asked to "think aloud" and express what they feel, think, and do. The data obtained helps identify cognitive barriers, confusion, and navigation errors. Following the CTA session, usability is measured using the System Usability Scale (SUS), in which respondents complete a questionnaire to provide quantitative ratings of ease of use, consistency, and overall satisfaction. The SUS scores provide an objective numerical measure of the system's usability level.

Finally, the data obtained from CTA (qualitative) and SUS (quantitative) are analyzed integratively. This analysis aims to identify patterns of usability issues, assess their severity, and provide concrete recommendations to improve interface design and user experience. Based on the analysis results, recommendations are formulated to enhance the e-learning system's interface design, navigation flow, and interactive features. These recommendations are compiled into a research report that can serve as a reference for system developers and school stakeholders to improve the quality of e-learning in the future.

RESEARCH METHOD

In this section, the authors discuss several previous studies related to usability testing. These studies are used as references to support the current research. A study

conducted by Candiasa, Gunadi, and Putra (2023) on the evaluation of user experience on an e-commerce website using first click, performance measurement, retrospective think aloud (RTA), and questionnaires concluded that: (1) the evaluation resulted in recommendations to improve the website interface to make it more effective and efficient; and (2) the effectiveness of the website was still hindered, as some participants made errors or failed to complete the assigned tasks.

A study conducted by Yuono, Hadi Wijoyo, and Rokhmawati (2021) In the usability evaluation of an e-learning system at SMK PGRI 3 Malang using the human-centered design approach and usability testing, it was found that efficiency increased by 36%. At the same time, effectiveness showed 67.2% success, 23.3% Non-Critical Errors, and 9% Critical Errors. The satisfaction aspect scored 81.5, placing it in the Acceptable category. Another study conducted by Sulistiya et al. (2016) The usability evaluation of the Department of Education of City MNO's website using the Think Aloud method yielded improvement recommendations in the form of an HTML prototype for further website development.

Furthermore, a study conducted by Indra Pratama, Utami, and Hady Permana S (2023) In the usability evaluation of the M-Pise LPD digital application in Jembrana Regency, the application was found ineffective due to errors during task performance. Statistical results indicated no significant difference in completion time between beginner and advanced users, although advanced users completed tasks more quickly. At this stage, the flow/process of implementing the research from start to finish is explained, as shown in Figure 2. Research Flow.

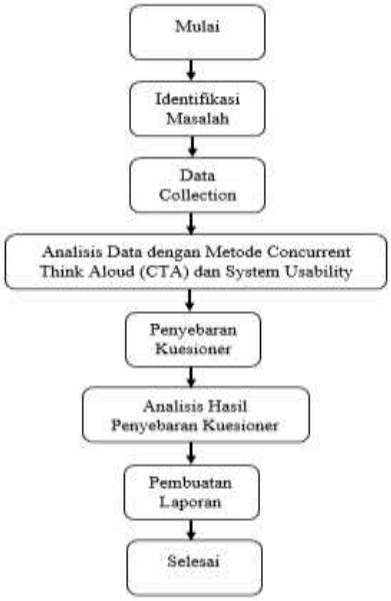

Figure 2. Research Flow

The figure above presents a flowchart illustrating the stages of the research process or system evaluation using the Concurrent Think Aloud (CTA) and System Usability methods. The process begins with the “Start” stage, indicating the initiation of the

research activity. This is followed by problem identification to determine the main issues that will serve as the study's focus. Once the problems have been identified, the next stage is data collection, in which the researcher gathers relevant information as the basis for analysis.

Subsequently, the collected data are analyzed using the Concurrent Think Aloud (CTA) method. This technique is a type of Think Aloud method, a user-based testing approach in which end users continuously verbalize their thoughts as they interact with the system. According to Nielsen, this verbalization allows observers to interpret which parts of the interface contain usability issues. When users interact with a system interface, they may perceive the process as complicated because the steps they take to complete a task may differ from their expectations. The primary benefit of this technique is not only to understand users' mental processes but also to identify ideas or functions users expect for future system development. These insights can contribute to the design of system improvements. The Concurrent Think Aloud (CTA) method evaluates usability as users actively interact with the system, enabling them to express their thoughts and feelings in real time.

Furthermore, this technique demonstrates higher sensitivity in identifying usability issues related to navigation, graphics or symbols, error messages, layout, and information organization within the interface. During the evaluation process, participants are encouraged to think aloud more intensively while completing assigned tasks or usability testing scenarios (Dwipayana, Candiasa, and Dewi 2025). Meanwhile, the facilitator (in this case, the researcher) attempts not to influence or interfere by offering assistance. The effectiveness of the Concurrent Think Aloud method is higher in detecting usability issues related to actual task performance, as it stimulates participants to express their short-term memory during task execution.

In addition, the System Usability Scale (SUS) is used to understand user experience and to assess system usability. After obtaining respondents' final evaluation results, the next step is to determine the grading. There are two approaches used to determine the evaluation grade. The first is based on user acceptability, grade scale, and adjective rating. The acceptability ranges consist of three categories: not acceptable, marginal, and acceptable. The grade scale consists of six levels: A, B, C, D, E, and F. Meanwhile, the adjective ratings include worst imaginable, poor, ok, good, excellent, and best imaginable, as illustrated in the figure below.

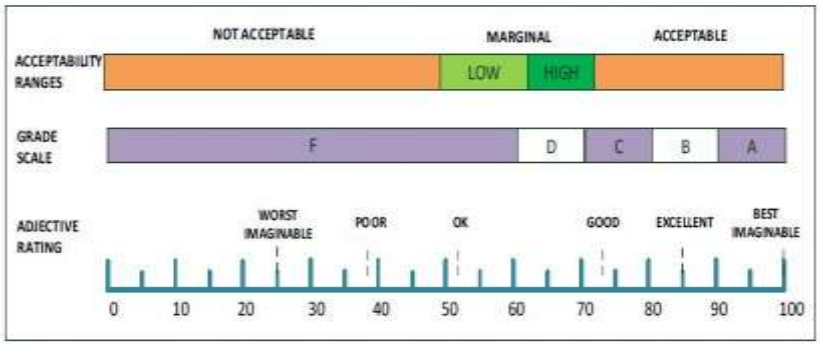

Figure 2. SUS Score Results

SUS Score Percentile Rank: The determination of evaluation results using the SUS score percentile rank differs from the Acceptability, grade scale, and adjective rating approaches. The difference lies in the evaluation categories; the SUS percentile rank compares user evaluation results against a general benchmark, whereas Acceptability, grade scale, and adjective rating classify results into specific categorical groups. The criteria for determining the SUS percentile rank are as follows:

a) Grade A: score ≥ 80.3
b) Grade B: 74 ≤ score < 80.3
c) Grade C: 68 < score < 74
d) Grade D: 51 ≤ score ≤ 68
e) Grade F: score < 51

After the initial analysis, the next stage involves distributing questionnaires to respondents to collect additional data on user perceptions and evaluations of the system being tested. The data collected from the questionnaires are then analyzed, with the researcher processing and interpreting respondents' answers to gain deeper insights into the system's usability.

Once all data have been analyzed, the researcher proceeds to the report-writing stage, which includes research findings, interpretation of results, and conclusions from the overall process. The final stage of this process is "End," indicating that the entire research process has been completed. Overall, this diagram illustrates a systematic workflow for conducting usability-based evaluative research to produce valid and structured results.

RESULTS AND DISCUSSION

After distributing the questionnaires to the respondents, the next step is to calculate the scores using the System Usability Scale (SUS), which measures user satisfaction with the e-learning information system, as previously explained in the scoring method. After the calculation, the next step is to summarize the respondents' evaluations to determine the average score for e-learning users. The following table presents the recapitulation results of user satisfaction with the e-learning system. Based on the recapitulation of responses from 20 system users using the System Usability Scale (SUS), the processed SUS scores are presented in Table 1.

Table 1. Processed SUS Score Results

Respondent Code	Question Answer Value (After Processing: Odd n-1 | Even 5-n)									
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
KM001	4	3	4	4	3	3	3	4	4	3
KM002	4	4	4	4	4	4	4	4	4	4
KM003	4	3	3	3	3	3	4	4	3	2
KM004	4	3	4	4	3	2	3	3	4	1
KM005	4	3	3	4	3	2	2	4	3	3
KM006	4	4	4	4	4	4	4	4	4	4
KM007	3	3	3	3	3	3	3	3	3	3
KM008	3	3	3	3	3	3	3	3	3	1
KM009	3	3	4	3	4	3	3	3	3	3
KM010	4	4	4	4	4	4	4	4	4	4
KP001	3	1	4	1	3	1	3	1	4	1
KP002	3	2	2	3	3	3	3	3	3	1
KP003	3	1	2	1	2	1	2	2	2	1
KP004	4	0	2	0	2	1	2	2	2	1
KP005	3	1	4	3	3	3	3	2	4	1
KP006	4	3	3	3	4	3	3	3	3	1
KP007	3	2	3	3	3	2	2	2	3	1
KP008	3	1	2	1	3	2	2	2	1	1
KP009	4	1	1	0	1	1	2	2	1	1
KP010	4	1	2	1	2	0	2	2	2	0

The data from respondents' questionnaires were analyzed using the System Usability Scale (SUS). The procedure for calculating SUS scores is as follows:

1. Determining the weight for each response option, namely: Strongly Disagree (SD) = 1, Disagree (D) = 2, Neutral (N) = 3, Agree (A) = 4, and Strongly Agree (SA) = 5. These values are based on the Likert scale.
2. The data processing is conducted as follows:
    a) For odd-numbered statements (1, 3, 5, 7, 9), the score for each statement is calculated by subtracting 1 from the selected response value. For example, if statement number 1 is answered with "Agree" (score 4), then the calculated score is $4 - 1 = 3$.
    b) For even-numbered statements (2, 4, 6, 8, 10), the score for each statement is calculated by subtracting the selected response value from 5. For example, if statement number 2 is answered with "Neutral" (score 3), then the calculated score is $5 - 3 = 2$.
    c) The scores for each statement are then multiplied by 2.5 and summed. The total score for each respondent will range from 0 to 100.

d) The overall SUS score is calculated by summing the total scores of all respondents, and the average usability score is obtained by dividing the total SUS score by the number of respondents.

Table 2. SUS Score Results of Advanced Users

Respondent Code	Question Answer Value (After Processing*2.5)										SKOR SUS
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	
KM001	10	7.5	10	10	7.5	7.5	7.5	10	10	7.5	87.5
KM002	10	10	10	10	10	10	10	10	10	10	100
KM003	10	7.5	7.5	7.5	7.5	7.5	10	10	7.5	5	80
KM004	10	7.5	10	10	7.5	5	7.5	7.5	10	2.5	77.5
KM005	10	7.5	7.5	10	7.5	5	5	10	7.5	7.5	77.5
KM006	10	10	10	10	10	10	10	10	10	10	100
KM007	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	75
KM008	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	2.5	70
KM009	7.5	7.5	10	7.5	10	7.5	7.5	7.5	7.5	7.5	80
KM010	10	10	10	10	10	10	10	10	10	10	100
Average Sus Score of Proficient Respondents											84.75

Table 2 shows that the average System Usability Scale (SUS) score for the e-learning information system among advanced users is 84.75. According to the Acceptability Ranges, this score falls into the Acceptable category, indicating a high level of user acceptance of the system. Furthermore, based on the Percentile Rank, a score of 84.75 is classified within Grade A+.

The interpretation of SUS scores indicates that a score above 68 signifies that the system's usability is above average (good). In contrast, a score below 68 indicates that the system's usability is below average (poor).

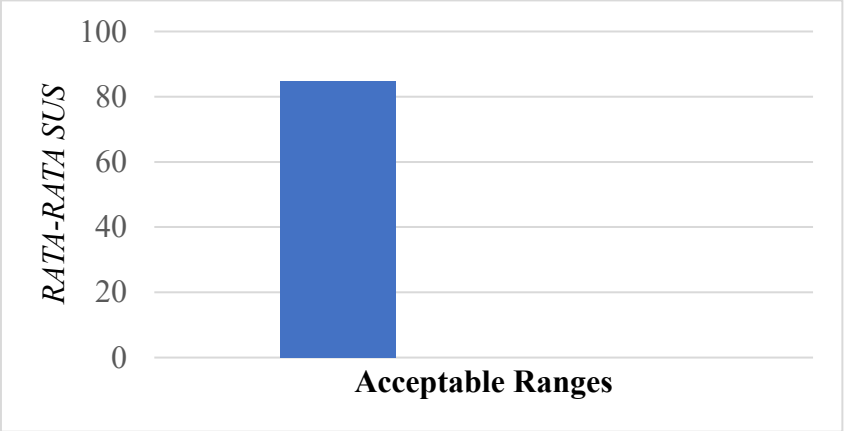

Figure 2. Average SUS Score of Advanced Users

Based on the data obtained, it can be concluded that the e-learning information system is acceptable to users. In terms of user satisfaction (Adjective Ratings), the system achieved a score of 84.75, placing it in Grade A.

Table 3. SUS Score Results of Beginner Users

Respondent Code	Question Answer Value (After Processing*2.5)										SKOR SUS
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	
KP001	7.5	2.5	10	2.5	7.5	2.5	7.5	2.5	10	2.5	55

KP002	7.5	5	5	7.5	7.5	7.5	7.5	7.5	7.5	2.5	65
KP003	7.5	2.5	5	2.5	5	2.5	5	5	5	2.5	42.5
KP004	10	0	5	0	5	2.5	5	5	5	2.5	40
KP005	7.5	2.5	10	7.5	7.5	7.5	7.5	5	10	2.5	67.5
KP006	10	7.5	7.5	7.5	10	7.5	7.5	7.5	7.5	2.5	75
KP007	7.5	5	7.5	7.5	7.5	5	5	5	7.5	2.5	60
KP008	7.5	2.5	5	2.5	7.5	5	5	5	2.5	2.5	45
KP009	10	2.5	2.5	0	2.5	2.5	5	5	2.5	2.5	35
KP010	10	2.5	5	2.5	5	0	5	5	5	0	40
Average Sus Score of Beginner Respondents											52.5

Table 3 shows that the average System Usability Scale (SUS) score for the e-learning information system among beginner users is 52.5. According to the Acceptability Ranges, this score falls into the *Marginal* category, indicating moderate user acceptance. Furthermore, based on the Percentile Rank, a score of 52.5 is classified as *Grade D*. The interpretation of SUS scores indicates that a score above 68 signifies that the system's usability is above average (good). In contrast, a score below 68 indicates that the system's usability is below average (poor).

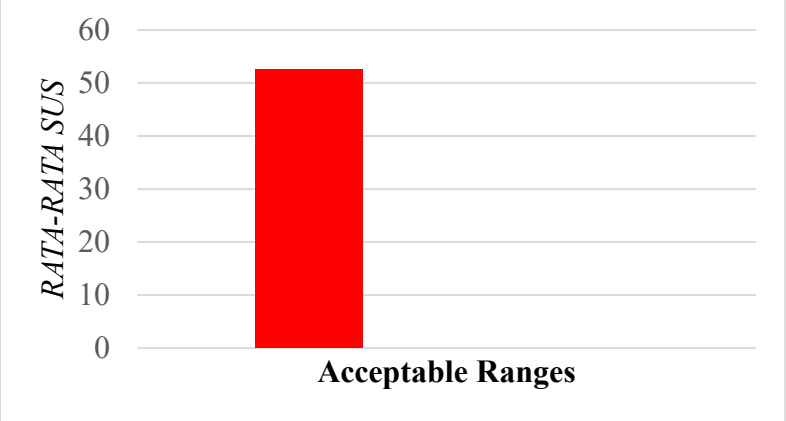

Figure 3. Average SUS Score of Novice Users

In the Concurrent Think Aloud method, respondents were asked to verbalize their thoughts as they used e-learning. The collected data reveals various issues and difficulties users encounter. Some of the most frequent problems include synchronization delays or errors, navigation and system interface issues, and technical issues such as loading times and session duration. Overall, users primarily struggled with navigation difficulties, short session durations, and poor synchronization between the system and the data. The following are the results of the Concurrent Think Aloud conducted with 10 advanced respondents (code: ADV) and 10 beginner respondents (BGN), excluding minor issue conditions.

CONCLUSION

Based on the results of the usability evaluation of the e-learning system at SMK TI Bali Global Jimbaran using the Concurrent Think Aloud (CTA) and System Usability Scale (SUS) methods, it can be concluded that the system's usability differs between advanced and beginner users. The SUS results indicate that the advanced user group achieved an average score of 84.75, placing it in the Acceptable category with a Grade A. This result shows that the e-learning system has a very high level of usability for users who are already familiar with it. They use the system effectively and efficiently, and report a high level of satisfaction. In contrast, the group of beginner users obtained an average score of 52.5, placing it in the Marginal category (Grade D). This indicates that the system still has a relatively low level of usability for new users. Improvements are needed, particularly in terms of ease of use, navigation, and interface clarity.

Based on the analysis using the Concurrent Think Aloud (CTA) method, several key issues were identified, including difficulties in understanding system workflows, an unfamiliar interface design, and the lack of supporting features such as notifications, which led to delays in task completion. Beginner users experienced these issues more frequently than advanced users. Overall, the e-learning system is acceptable and performs well for experienced users. However, to improve overall usability, further development is necessary, particularly in enhancing interface design, simplifying navigation, and adding features that support ease of use for new users. With these improvements, the system is expected to provide a better user experience, increase user satisfaction, and more effectively support the learning process going forward.

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