

Effectiveness Analysis of Google Classroom Using TUXEL 2.0 in ICT Learning at Malang Vocational Schools

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ARTICLE INFO	ABSTRACT
<p>Article history Received Dec 19, 2024 Revised Dec 12, 2025 Accepted Dec 28, 2025</p> <hr/> <p>Keywords Usability User experience E-learning TUXEL Effectiveness</p>	<p>The rapid adoption of e-learning platforms has intensified the need for systematic evaluations of usability and user experience, particularly in vocational education contexts that demand practical, skill-oriented learning. This study aims to evaluate the effectiveness of Google Classroom in ICT learning at a vocational high school using the Technique for User Experience Evaluation in E-Learning (TUXEL 2.0). The evaluation focuses on three dimensions: general usability, pedagogical usability, and user experience. The study involved 63 Grade X Computer and Network Engineering students at SMK Negeri 7 Malang who had prior experience using Google Classroom. Data were collected through three TUXEL 2.0 instruments: the Problem Reporting Table, the General LMS Evaluation checklist, and the User Experience Questionnaire (UEQ). The results identified 14 usability issues in the Problem Reporting Table, primarily related to login procedures, interface navigation, assignments, and assessments. Furthermore, 19 pedagogical usability issues were found in the General LMS Evaluation, with dominant problems concerning learning progress tracking, flexibility, and the availability of guidance and documentation. User experience evaluation revealed positive perceptions in five dimensions: attractiveness (mean = 1.39), dependability (1.44), efficiency (2.06), novelty (1.13), and perspicuity (1.09) while the stimulation dimension showed a negative tendency (mean = 0.75), indicating limited motivational appeal. Overall, Google Classroom demonstrates adequate effectiveness as a learning support platform; however, shortcomings in pedagogical support and motivational design reduce its optimal use in vocational learning environments. These findings imply that improving instructional guidance, feedback mechanisms, and engagement-oriented features is essential to enhance the effectiveness of e-learning implementation in vocational education.</p>

I. Introduction

Education is a process that facilitates learning, in which individuals acquire knowledge, values, skills, habits, and beliefs. This process can take place in both formal and non-formal settings. One of the things that distinguishes learning from merely delivering material is the interaction that occurs during the process. This interaction involves the relationships among students and teachers or facilitators, among students themselves, and with the learning material itself [1]. To address that challenge, educational institutions are striving to develop learning that utilizes technology. In the context of education, Information and Communication Technology (ICT) is used to support students in exploring learning topics, solving problems, and finding solutions during the learning process. One form of ICT application in education is e-learning, which serves as a technology-based learning medium [2]. E-learning is an educational system that uses electronic applications to support the teaching and learning process, with media such as the internet and computer networks as the primary tools [3]. Usability and user experience in e-learning are essential considerations. An e-learning platform is considered adequate if it can offer good usability and a positive user experience. This is important because both can enhance user interaction with the platform and encourage more

active engagement in the learning process [4], [5], [6], [7]. Usability refers to the extent to which a product is easy to use, which, in the context of e-learning, helps users feel comfortable accessing information and increases their interest in using it sustainably. Meanwhile, user experience is the perception and response of individuals that arise from their interaction with a particular product, system, or service [8].

Despite the widespread adoption of Learning Management Systems (LMSs) such as Google Classroom, empirical evidence indicates that usability and user experience issues persist, particularly in secondary and vocational education contexts. Several studies have reported that LMS platforms often prioritize content delivery over pedagogical interaction, resulting in limited learner engagement and reduced instructional effectiveness. In vocational high schools, where learning emphasizes applied skills, procedural clarity, and continuous feedback, such limitations may significantly hinder learning outcomes. Therefore, an objective and systematic evaluation of Google Classroom's usability and user experience within vocational education is necessary to ensure its alignment with pedagogical demands

In the teaching and learning process, effectiveness and efficiency are essential to improve the quality of education without spending too much time. Therefore, an educator needs to be careful in selecting teaching methods that can help students understand the material being presented. Learning is considered adequate if it successfully achieves the goals set in the learning materials. The effectiveness of learning is measured by the success of interactions among students and between students and teachers in educational settings to achieve those goals [9]. Google Classroom is used to deliver material to students as effectively as possible online, ensuring all material is conveyed clearly. This platform meets several e-learning characteristics, making it one of the most popular and widely used learning methods. As a digital tool, Google Classroom allows students to attend classes online with ease [10]. Google Classroom will enable educators to create virtual classrooms that serve as platforms for sharing assignments, collecting students' work, and providing digital assessments, without the need for paper [11]. A Learning Management System (LMS) is a platform that offers functions and resources, such as storage, management, and modification of learning content, assessments, and tasks, as well as mechanisms to monitor student progress [12], [13].

Previous research has measured user experience on LMS. (Learning Management System). Therefore, further research is needed to deepen the analysis and validation of this method. The approach to e-learning is now shifting from user-centered design to learning-centered design (learning-centered design). This change aims to demonstrate the feasibility of the Heuristic Evaluation method in assessing the quality of online learning [15]. Previous research has developed a technique to evaluate usability and user experience on LMS called TUXEL. The Technique for User Experience Evaluation in e-learning (TUXEL) method is designed to measure aspects of usability and user experience on e-learning platforms, including Google Classroom. TUXEL encompasses three main elements: general usability, pedagogical usability, and user experience, with three evaluation stages: Problem Reporting Table, General LMS Evaluation, and User Experience Evaluation [4], [5], [6], [7].

The three stages of evaluation in this method are conducted using questionnaires, as questionnaires are considered easy to implement and relatively low-cost. In this study, the selected respondents are students who are familiar with e-learning and have experience using it, so they are already familiar with the relevant features. Based on this, the research uses the Technique for User Experience Evaluation in E-learning (TUXEL) method to evaluate Google Classroom. Based on the usability and user experience evaluation results for this platform, various issues, user experience descriptions, and recommendations related to learning types and target users were identified. In addition, this study also identifies the

strengths and weaknesses of Google Classroom based on respondents' feedback.

Previous studies have examined LMS usability and user experience using various evaluation frameworks, including heuristic evaluation and UX-based instruments. Nakamura et al. demonstrated that generic UX evaluation techniques are often insufficient to capture the pedagogical dimensions of e-learning environments. Other studies applying the TUXEL framework successfully identified usability and UX issues in LMS platforms; however, most were conducted in higher education or general learning contexts. These studies provide valuable insights but leave a gap in understanding how TUXEL 2.0 performs in vocational secondary education, where learners' characteristics, learning objectives, and instructional practices differ substantially.

The novelty of this study lies in the detailed application of the TUXEL 2.0 framework to evaluate Google Classroom within the specific context of Indonesian vocational high schools, which possess distinctive pedagogical characteristics and user needs. Accordingly, this study aims to comprehensively evaluate the effectiveness of Google Classroom in ICT learning by identifying usability issues, pedagogical usability constraints, and user experience perceptions using TUXEL 2.0.

II. Method

This study uses a correlational method with an ex post facto approach. The ex post facto method is research conducted to examine events that have already occurred, then to look back and identify the causal factors [16]. At the stage of questionnaire preparation, this research refers to the dimensions found in the TUXEL 2.0 method, which has been translated from the original version into Indonesian. The TUXEL 2.0 questionnaire consists of three main components: the Problem Reporting Table, the General LMS Evaluation Checklist, and the UX Evaluation. At the beginning of the research, task definition and checklist matching were conducted. Task definition specifies the tasks that learners, as inspectors, must perform. This task is designed based on an analysis of Google Classroom to determine the pages and features that most represent the platform. This task is divided into four main categories based on TUXEL 2.0, namely: (1) General Interface, (2) User Login, (3) Assignments, and (4) Assessments. The inspector's take in Google Classroom can be seen in Table 1.

Table 1. The inspector takes in Google Classroom.

Task	Category
Access Google Classroom, log in to your account, or register (sign up) if you don't have one.	Login, General Interface
Join the prepared Google Classroom class and enter the provided code.	Login, General Interface

Task	Category
Review and study the materials available on the class page in Google Classroom.	General Interface, Task
Write comments related to the materials you have studied in the comment section.	General Interface
Submit assignments as described in the class and complete the test.	General Interface, Task, Assessment
Answer practice questions in Google Classroom.	General Interface, Assessment
Log out of your account.	Login, General Interface

The pedagogical usability stage refers to the ease of use that supports users in achieving learning objectives, thereby directly impacting the effectiveness of the learning platform [17]. This pedagogical usability is divided into four categories: Help and Documentation, LMS Learnability, Learning Through the LMS, and LMS Flexibility [4], [5], [6], [7]. Variables in problem reporting are shown in Table 2.

Table 2. variable in problem reporting

Variable Category	Description
Help and Documentation	Determines whether the LMS provides help, reading materials, or additional guidance.
LMS Learnability	Assesses how easy it is for users to learn and use the LMS.
Learning Through LMS	Evaluates whether the LMS supports users in utilizing the platform for learning purposes.
LMS Flexibility	Examines whether the LMS allows users to have control over the learning process and platform.

The user experience evaluation stage involves assessing the LMS using a semantic differential scale, and respondents can provide comments, including criticism and suggestions. The goal is to evaluate students' perceptions regarding the learning experience when using the LMS. The questionnaire is based on the User Experience Questionnaire (UEQ) technique, using twelve adjectives divided into six UEQ dimensions, as shown in Table 3.

Table 3. user experience dimensions in tuxel

Dimension	Adjectives	Description
Attractiveness	Disliked / Pleasant / Uncomfortable to Use / Comfortable to Use	How attractive the platform is overall, based on the user's perception.
Efficiency	Inefficient / Efficient / Impractical / Practical	How easily the platform can be used without unnecessary effort.
Perspiciuity	Difficult / Easy / Confusing / Very Clear	How easily the platform can be used

Dimension	Adjectives	Description
Dependability	Does Not Meet Expectations / Meets Expectations	How well the platform aligns with user expectations and provides a sense of control.
Stimulation	Uninteresting / Interesting / Unmotivating / Motivating	How enjoyable and motivating the platform is for users.
Novelty	Conventional / Innovative / Uncreative / Creative	How innovative and creative the product feels, according to the user's perception.

User experience evaluation includes three categories of perception levels based on the average (mean) values obtained. Each item's mean value will be classified into the appropriate perception-level category as shown in Table 4.

Table 4. user perception level categories

Perception Level	Mean Value Range
Positive (Good)	> 0.8
Neutral	-0.8 to 0.8
Negative (Poor)	< -0.8

The population in this study consists of Class X Computer and Network Engineering students enrolled in the Computer and Network Engineering subject at SMK Negeri 7 Malang. The data source comprises all Class X students in this program who use Google Classroom for online learning.

Respondents were selected using probability sampling, a method that ensures all members of the population have an equal chance of being selected for the sample. The research population consists of 63 students from Class X Computer and Network Engineering at SMK Negeri 7 Malang, who are currently studying the Basics of Computer and Networks. Data collection involves two sources: secondary data, which already exists and is further processed for analysis, and primary data, which is collected directly from respondents through interviews or questionnaires.

If the number of respondents is less than 100, the entire population is used as the sample. For a population exceeding 100, a sample of 10%–15% or 20%–25% is usually taken [18]. Because the population is less than 100, 100% of the population is included, covering all Class X Computer and Network Engineering students at SMK Negeri 7 Malang, as shown in Table 5.

Table 5. data processing and analysis overview

Stage	Description
Data Processing	Recap of responses from the three questionnaires and presentation in table format.
Problem Analysis	Identification and explanation of issues for each questionnaire item and related variables.
Data Visualization	Graphical representation of dominant issues and the number of respondents affected.
User Experience Analysis	Conversion of scores into median and mean values, categorized by perception levels (-3 to 3).

The data processing and analysis stage is conducted after responses are collected from participants. Data processing involves summarizing respondents' answers from the three distributed questionnaires. The summarized data is then presented in tables for each questionnaire, with explanations detailing the issues identified by users for each item and related variable. Data analysis focuses on identifying the most prominent issues reported by respondents, as reflected in the Problem Reporting Table and User Experience Evaluation. These findings are then visualized using graphs that show the number of respondents for each issue. For the User Experience Evaluation, analysis is conducted by converting the scale into median and mean values, with categorization based on perception levels derived from the mean scores. The evaluation uses a semantic differential scale ranging from -3 to 3.

III. Results and Discussion

The results of the data collection from the Problem Reporting Table indicate four variables, each with a different number of problem items, based on respondents' feedback. In the login category, three items were identified as sources of problems, as shown in Figure 1.

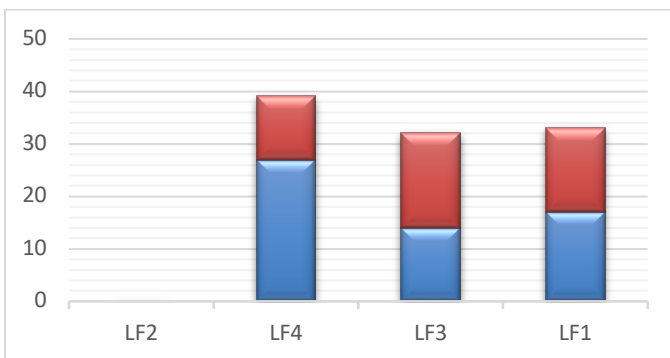


Fig. 1. Login

The issues found in the login variable include several points, namely: LF4, where Google Classroom does not guide how to fill in specific fields correctly; LF3, where the platform does not indicate which sections or fields are unfilled; and LF1, where Google Classroom does not

provide feedback when users take an action. In the General Interface category, five main issues were found, as shown in Figure 2.

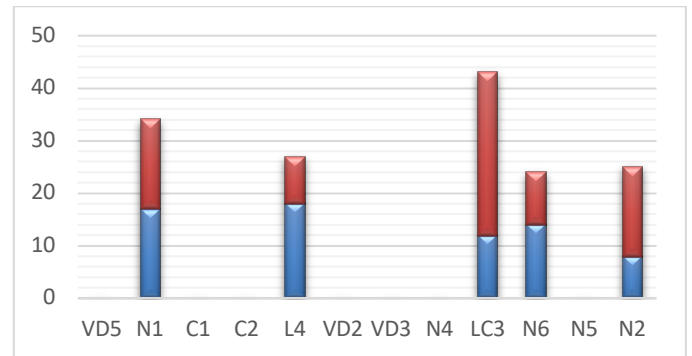


Fig. 2. General Interface

Issues with the General Interface variable include several points, namely: N1, the navigation menu is difficult to see or remember; L4, icons, buttons, labels, or links do not have clear functions or meanings; LC3, the page does not provide an option to log out at any time; N6, the page does not have a search feature to find information quickly; and N2, there are no indications of the current page location and the next destination in Google Classroom. Meanwhile, in the assignment category, three items were identified as the source of the problems, as shown in Figure 3.

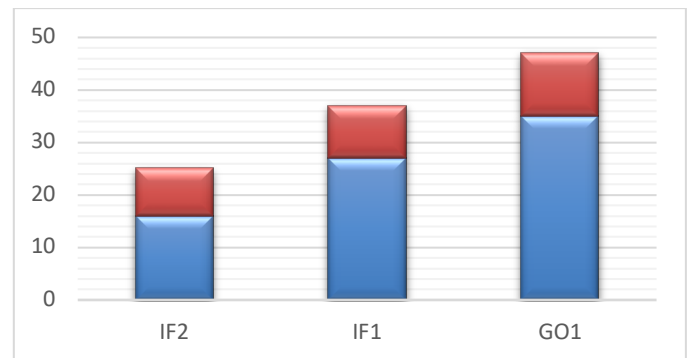


Fig. 3. Assessment

The issues found in the assessment variable include: GO1, where Google Classroom does not display the user's score after completing the assessment activity; IF1, the absence of immediate feedback indicating whether the answers are correct or incorrect while completing the task; and IF2, the unavailability of additional materials or links after the task is completed. Meanwhile, the results of the General LMS Evaluation data collection show five variables with different numbers of problem items. In the Help and Documentation category, three items were identified as sources of problems, as shown in Figure 4.

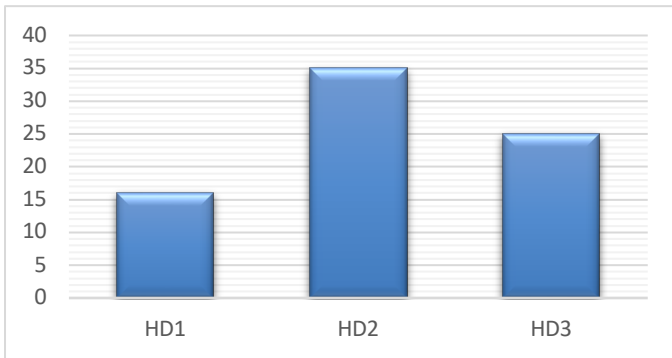


Fig. 4. Help and Documentation

The issues with the Help and Documentation variable include: HD1, Google Classroom does not provide help guides either manually or online; HD2, users have difficulty finding the information they need through manual or online guides; and HD3, the instructions provided in the manual or online guides to resolve problems or challenges are presented in a way that is not straightforward and unclear. Meanwhile, in the Learnability category, three main issues were found, as shown in Figure 5.

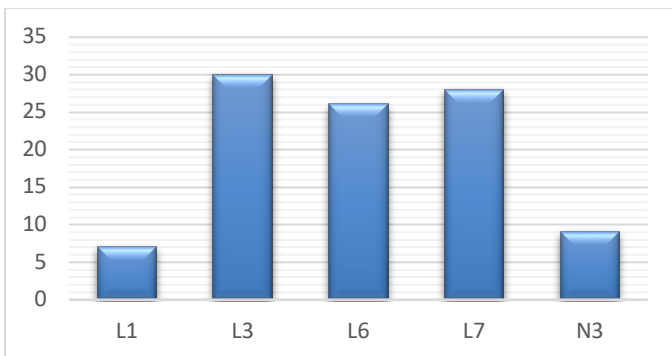


Fig. 5. Help and Documentation

Issues with the LMS Learnability variable include: L3, users cannot complete activities or tasks without assistance from others; L6, users find it difficult to use Google Classroom again after a long time; and L7, tasks in Google Classroom cannot be completed quickly or with simple steps. Meanwhile, in the Learning Through LMS category, six main issues were identified as shown in Figure 6.

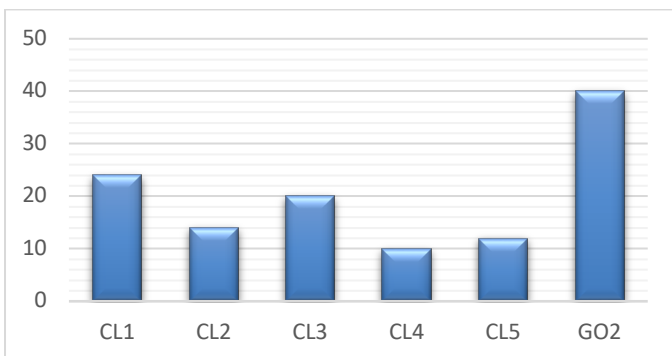


Fig. 6. Learning Through LMS

The issues found in the variable Learning Through LMS include: CL1, Google Classroom does not provide access for group activities such as discussion forums or collaboration; CL2, access to communicate with friends or teachers is not easy; CL3, users cannot see the activity history of other peers, such as the most read content or popular assignments; CL4, the platform does not allow sharing of files, photos, videos, or educational materials; CL5, there is no access to send complaints or answer questions from users; and GO2, users cannot see their learning progress. Meanwhile, in the Flexibility category, seven main issues were identified as shown in Figure 7.

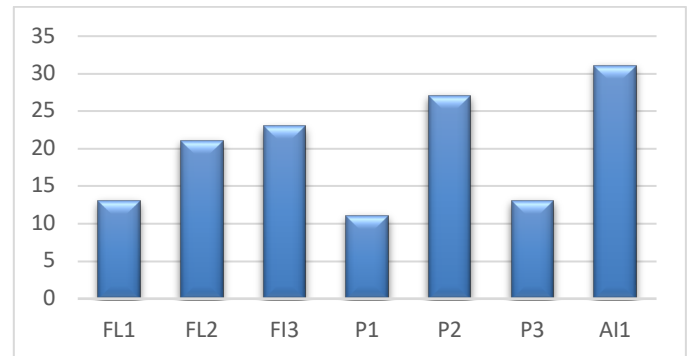


Fig. 7. LMS Flexibility

The issues with the LMS Flexibility variable include: FL1, Google Classroom does not allow users to access the sequence, steps, or parts of the course; FL2, users cannot access previous learning materials when experiencing doubts; F13, there is no opportunity to receive additional feedback from the teacher regarding content, activities, or other issues. P1, users cannot change the interface; P2, there are no shortcut keys to improve productivity; P3, the platform does not provide an option to select a language; and AI1, users cannot self-evaluate their learning outcomes. The median user experience results were measured on a scale of -3 to 3, based on 12 parameters evaluated by respondents as shown in Figure 8.

	1	2	3	4	5	6	7	
Not enjoyable					●			Enjoyable
Uncomfortable to use						●		Comfortable to use
Not meeting expectations					●			Meeting expectations
Hindering							●	Supporting
Inefficient						●		Efficient
Impractical							●	Practical
Conventional						●		Innovative
Not creative							●	Creative
Difficult							●	Easy
Confusing						●		Very clear
Uninteresting					●			Interesting
Not motivating					●			Motivating

Fig. 8. User Experience Questionnaire

The mean scores for each item are categorized by perception level across the six parameters. Based on the analysis results from the Problem Reporting Table questionnaire using the TUXEL dimension, it can be concluded that usability refers to the extent to which users

can use a system, product, or service to achieve specific goals in an effective, efficient manner, and provide satisfaction in its usage context [8]. Analysis shows 14 issues, with 3 items in the login variable, and the main problem is that Google Classroom does not guide how to fill out specific fields correctly. Additionally, there are five items in the general interface variable, with the main problem being the absence of a log-out option from the system at any time. This is in accordance with the principle of Recognition rather than recall, which states that the system should provide choices, objects, or actions that minimize user effort and make it easier for them to find something within the system [19]. There are three items in the assignment variable, with the main issue being that Google Classroom does not provide feedback when users take action. Additionally, in the assessments variable, three items of concern were identified, the most notable being Google Classroom's inability to inform users of their scores after completing activities that assess their performance. The use of feedback in Google Classroom is essential, as it allows learners to immediately see their results or answers, serving as a tool to evaluate the success of the learning process [3], as shown in Table 6.

Table 6. mean scores for tuxel dimensions

Dimension	Item	Mean
Attractiveness	Not enjoyable / Enjoyable	1.39
Dependability	Not meeting expectations / Meeting expectations	1.44
Efficiency	Hindering / Supporting	2.06
Novelty	Conventional / Innovative	1.13
Perspiciuity	Difficult / Easy	1.09
Stimulation	Uninteresting / Motivating	0,75

The evaluation results from the General LMS Evaluation questionnaire using the TUXEL method identified 19 issues. In the Help and Documentation variable, 3 problem items were identified, with the most representative being difficulty finding the needed information in the manual or online guide. In the LMS Learnability variable, there were three problem items, with the most dominant being the inability to complete activities or tasks without assistance from others. For the Learning Through LMS variable, 6 problem items were identified, with the most representative being that Google Classroom does not provide access to view learning progress. Meanwhile, in the LMS Flexibility variable, seven problem items were identified, with the most prominent being that Google Classroom does not allow users to evaluate and assess their own learning outcomes. This highlights the importance of pedagogical usability, which concerns the types of learning materials that help users achieve their goals, thereby directly impacting the effectiveness of the learning platform. [17].

The evaluation results from the user experience questionnaire using TUXEL show positive median and mean values across six dimensions. Five dimensions fall

into the positive perception category, while one dimension is in the negative category. The five positive dimensions meet the criteria with mean values greater than 0.8: attractiveness (mean 1.39), dependability (mean 1.44), efficiency (mean 2.06), novelty (mean 1.13), and perspicuity (mean 1.09). However, the stimulation dimension falls into the negative category, with a mean of 0.75, below the threshold of 0.8, indicating issues with items such as uninteresting/engaging and motivating/not motivating. The distribution of responses supports this finding. Failure to meet these quality standards can lead to dissatisfaction, resistance, confusion, or misuse of the LMS, ultimately resulting in criticism and low platform acceptance [20].

The findings indicate that although Google Classroom performs adequately in terms of efficiency and clarity, several critical usability and pedagogical issues undermine its effectiveness in vocational learning. For instance, the absence of immediate feedback and learning progress indicators (e.g., G01 and G02) directly affects students' self-regulation and motivation, key components in vocational education. This result aligns with previous UX studies emphasizing that timely feedback and transparency are essential for sustaining learner engagement.

Notably, the stimulation dimension yielded a negative score (mean = 0.75), suggesting that Google Classroom lacks motivational affordances. Unlike findings from studies conducted in higher education settings that reported neutral or positive stimulation scores, this result highlights a contextual discrepancy. Vocational students may require more interactive, visually engaging, and task-oriented features to maintain motivation. Therefore, this study extends prior research by demonstrating that LMS effectiveness is highly context-dependent and that vocational education demands stronger pedagogical and experiential support.

IV. Conclusion

Based on the study conducted on Google Classroom using the TUXEL method and three questionnaires, several key conclusions were drawn. Based on the analysis of the Problem Reporting Table, 14 issues were identified. These include three issues with the login variable, with the most significant being a lack of guidance on how to fill specific fields correctly. In the general interface variable, five issues were noted, the most prominent being the absence of a log-out option. For the assignment variable, three issues were highlighted, particularly the lack of feedback after completing activities. Similarly, three issues in the assessment variable were observed, with the primary concern being that users are not shown their scores after completing tasks to evaluate their performance. Meanwhile, the General LMS Evaluation questionnaire revealed 19 issues across four variables: three in help and documentation, with difficulty finding

helpful manuals being the most significant; three in LMS learnability, where tasks could not be completed without external support; six in learning through LMS, particularly the inability to track learning progress; and seven in LMS flexibility, with the lack of self-assessment and evaluation options being the primary concern. Furthermore, the user experience evaluation showed positive median and mean values across six dimensions, with five categorized as positive and one as negative. The positive dimensions included attractiveness (mean 1.39), dependability (mean 1.44), efficiency (mean 2.06), novelty (mean 1.13), and perspicuity (mean 1.09). However, the stimulation dimension scored 0.75, falling below the threshold of 0.8, indicating issues with motivation and engagement. Addressing these shortcomings is essential, as failure to meet usability and user experience standards can lead to dissatisfaction, resistance, and reduced acceptance of the LMS. Improving these aspects would significantly enhance the effectiveness and user satisfaction with Google Classroom as a learning platform.

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