Evaluating User Experience in a Microservices-Based E-Learning Platform for Technopreneur ship with the UEQ

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Abstract

This paper evaluates the user experience of a microservices-based e-learning platform created for technopreneurship education using the User Experience Questionnaire (UEQ). Microservices present new chances to improve system performance, dependability, and learner involvement when educational systems choose modular and scalable designs. The study presents a benchmarking strategy by contrasting the newly created platform with two extensively utilized commercial platforms, Shopee and Tokopedia, which both use scale microservices. Fifty undergraduates participated in the study and evaluated six fundamental UX dimensions: attractiveness, perspicuity, efficiency, dependability, stimulus, and novelty. Quantitative research shows that the e-learning system works well in terms of pragmatic quality (clarity, efficiency, and reliability) and hedonic quality (stimulus and creativity). Comparatively, in perspicuity and efficiency, T-test comparisons reveal statistically significant benefits of the e-learning platform over Tokopedia; similarly, in stimulation and novelty, over Shopee. These findings imply that the microservices-based design improves emotional involvement and perceived innovation in the learning environment and supports functional performance. The study indicates that tools usually used in commercial environments allow one to assess user experience in education effectively. It also emphasizes how the design of learner-centred digital platforms can be guided by benchmarking against industry systems. The results provide helpful information for teachers trying to match educational technologies with user expectations moulded by actual digital experiences and for e-learning developers.

Keywords: *Microservices, E-learning, Technopreneur ship, User Experience, UEQ, Modular Architecture, Benchmarking.*

1. Introduction

The digital revolution pushed Higher education institutions toward more flexible, scalable, technologically driven learning models [1], [2]. In this regard, e-learning has become a strategic decision that helps dynamic teaching and learning across national borders [3]–[5]. Microservices architecture has evolved as a technical answer supporting the development of distributed, easily extensible, and quickly adaptable e-learning systems [6]–[8] to meet the demand for responsive and modular learning systems [9], [10].

Simultaneously, the Technopreneurship course calls for integrating knowledge of digital technology with innovative entrepreneurial abilities [11], [12]. Consequently, it is imperative to create a learning system founded on experience and a theoretical one [13], [14]. In this regard, a learning strategy including microservices ideas used in contemporary e-commerce systems can provide more contextual and relevant learning opportunities [15]–[17].

Students are exposed to the framework of intricate digital systems and participate in assessing user experience inside real-world systems as part of their educational process [18]–[20]. E-commerce platforms, including *Shopee* and *Tokopedia*, which have extensively adopted microservices architecture, can thus be used as comparative study objects to evaluate how successfully such systems deliver positive user experiences [21]–[27]. Particularly in technopreneur-ship education, these assessment findings can be used as references for developing learner-centred e-learning systems [28]–[30].

This study uses the User Experience Questionnaire (UEQ), an instrument evaluating six fundamental dimensions: Attractiveness, Perspicuity, Efficiency, Dependability, Stimulus, and Novelty [31]–[35]. This helps one to evaluate user experience fully. Through this

approach, the research assesses the technopreneur-ship learning system created utilizing microservices and compares users' impressions with those of established industrial systems such as e-commerce platforms [36]–[38].

By using this method, the study intends to acquire a comprehensive knowledge of the efficacy of microservices-based e-learning systems from a user experience standpoint. Moreover, the research is expected to help create digital learning approaches that are not only technically sound but also creative, fun, and compliant with user experience criteria discovered in actual industrial systems.

2. Literature Review

Analyzing the literature in this part looks at the technological and conceptual roots of the development of modern e-learning systems that are fit for technopreneurship education. Four main sections make up the review. Particularly in support of creativity and entrepreneurship, the first part highlights the pedagogical innovations resulting from e-learning in response to needs for 21st-century skills. The second addresses how microservices design might be included into teaching tools by emphasizing their modular and scalable character. The third looks at how relevant user experience (UX) evaluation—more especially, the User Experience Questionnaire (UEQ) is as a tool to evaluate learner satisfaction and system usability. Finally, the paper addresses the need of contrasting educational systems with industrial platforms such as *Shopee* and *Tokopedia*, which provide actual UX performance benchmarks in microservices-based systems. Taken together, these points of view offer a whole basis for knowing how learner-centered, scalable, user-oriented e-learning systems could be developed and evaluated successfully.

2.1. E-Learning and Technopreneurship

The fast development of digital technologies has affected the delivery of content and the abilities demanded in higher education. More dynamic interactions between teachers and students can be enabled via e-learning, which has become a flexible and scalable solution supporting learning independent of time and location [21], [39]. Particularly in technopreneurship education, learners are required in the framework of 21st-century skills not only to master theoretical knowledge but also to understand and implement digital innovation and entrepreneurship in real-world environments [40].

Combining technology with entrepreneurship, technopreneurship demands students to acquire skills in digital product development, innovation management, and business strategy [39]. Therefore, e-learning systems enabling such immersive and practical learning strategies are absolutely vital [41]. Often by means of integration with industrial processes and real-world technologies, these systems should not only function as knowledge repositories but also replicate genuine problem-solving settings.

2.2. Microservices Architecture in Learning Platforms

Modern software engineering has evolved with microservices architecture breaking down monolithic systems into modular, independently deployable services [42]–[44]. This architecture enables educational technology to be scalable, maintainable, and flexible—qualities definitely required for e-learning systems that have to meet many user needs and continuous material changes [43].

Microservices in education offer smooth integration of learning modules, assessment services, user analytics, and content distribution, therefore allowing each functioning as a loosely connected service to be seamlessly integrated [45]. his is particularly beneficial in technopreneurship courses where students must engage with system components mirroring real-life technology ecosystems [46]. Moreover, using microservices enables students to understand system design concepts extensively applied in corporate environments, especially in domains including banking, health tech, and online markets.

2.3. Evaluating User Experience with UEQ

Knowing user experience (UX) helps one to grasp user interaction in digital learning environments. A system without a decent user experience could be functionally strong yet fail to interest or please users. Capturing both pragmatic (e.g., efficiency, dependability) and hedonic (e.g., stimulation, novelty) aspects of user engagement with a system, the validated tool the 2020 User Experience Questionnaire (UEQ) [47].

Using UEQ Several digital platforms including commercial websites and e-learning apps have been evaluated [48]. Measuring six critical dimensions—attractiveness, perspicuity, Efficiency, reliability, stimulation, and novelty UEQ provides a full picture of how users evaluate a system in educational environments [49], especially those requiring practical learning such as technopreneurship, this information is invaluable for iterative design and improvement of learning systems.

2.4. Bridging E-Learning and Industrial Systems: The Case of E-Commerce Platforms

Although e-learning platforms are usually developed for educational delivery, including industry-based system evaluation—such as benchmarking user experience against established platforms like *Shopee* and *Tokopedia* offers new possibilities to match learning design with market standards [50]. These systems effectively employ microservices to govern scalability, dependability, and user personalization [26].

Analyzing the UX of these platforms using UEQ helps educators and developers to identify crucial design features raising student involvement and happiness. This benchmarking strategy closes the gap between education and business so that students have relevant expectations and experiences like those they would encounter in real-world professional settings.

3. Methods

3.1. Research Design

This study adopts a quantitative descriptive design with a user-centered evaluation approach, aiming to assess the user experience of an e-learning platform for Technopreneurship education that adopts a microservices architecture. To enhance the contextual relevance of the system, user experience is not only evaluated in the developed e-learning system but also benchmarked against leading microservices-based platforms, namely *Shopee* and *Tokopedia*, which have demonstrated mature system scalability and modular service integration.

The study uses the User Experience Questionnaire (UEQ) as a standardized tool to assess reference platforms and the educational system over six experience dimensions.

3.2. Participants

This study included fifty undergraduate students enrolled in a Technopreneurship course at an Indonesian state university. Having previously used the *Shopee* and *Tokopedia* systems as well as the created e-learning system, all participants fit evaluators for user

experience comparison. Purposive sampling was used to choose participants such that every respondent had enough exposure to the benchmark platforms and the learning platform within the microservices framework.

3.3. Instrumentation

The User Experience Questionnaire (UEQ), a consistent instrument measuring user perspective across six dimensions, was the primary tool used for data collecting:

1. Attractiveness: the general system likeability and appeal.
2. Perspicuity: learning how to operate the system and understanding its simplicity.
3. Efficiency: the speed and practicality of reaching objectives with the system.
4. Dependability in system responses is the sense of control and dependability.
5. Stimulus: system use excites and motivates one.
6. Novelty: system design's apparent inventiveness and creativity.

With 0 as neutral, every dimension consists of a set of bipolar items scored on a 7-point Likert scale from -3 (most negative) to +3 (most positive).

3.4. Data Collection Procedure

Online data collecting was done using a structured questionnaire sent via Google Forms. Participants were directed to:

1. Use the e-learning technopreneurship platform for at least one full session including exploration of system features, content modules, and submission tools prior to completing the UEQ.
2. Think back on their usual system usability and performance interactions with *Tokopedia* and *Shopee*.
3. Finish the UEQ for the two benchmark systems and the e-learning platform

Completing the survey in one sitting, each participant spent 15 to 20 minutes expectedly.

3.5. Data Analysis

Using the UEQ Data Analysis Tool—which compiles and analyzes responses from the UEQ—mean scores for every dimension, confidence intervals, and benchmarking against standard UEQ datasets are computed.

Using Microsoft Excel, a two-sample T-Test with unequal variances was also performed to find the statistical relevance of variations in user experience ratings amongst platforms ($\alpha = 0.05$). Whether the variations in user perception between the e-learning platform and commercial microservices-based platforms were significant and could guide design enhancements was the question this test sought to answer.

3.6. Ethical Considerations

The study was voluntary, thus informed permission was obtained before any data collecting started. To guarantee participant confidentiality, all responses were anonymized; data were only used for academic and system development needs. The study followed ethical guidelines specified by the institutional review board.

4. Results and Discussion

4.1. Results

The results of the User Experience Questionnaire (UEQ) answered by 50 microservices-based technopreneurship e-learning platform users as well as with *Shopee* and *Tokopedia* as industry benchmarks are presented in this part. Descriptive statistics for every UX dimension, comparative analysis between platforms, and two-sample T-Test statistical testing of significance are among the outputs.

4.1.1. Descriptive Statistics of UEQ Results

Table 1 lists the e-learning platform Shopee's mean scores over the six UX dimensions as well as Tokopedia's with 0 denoting a neutral assessment, all scores fall on a range from -3 (very negative) to +3 (very positive).

Table 1. Mean UEQ Scores for Each Platform

UEQ Dimension	E-Learning System	*Shopee*	*Tokopedia*
Attractiveness	0.60	0.60	0.63
Perspicuity	0.77	0.77	0.52
Efficiency	0.69	0.69	0.44
Dependability	1.78	1.78	1.44
Stimulation	2.00	2.00	2.17
Novelty	1.09	1.09	0.84

Particularly in terms of perspicuity, dependability, and novelty, these results show that the e-learning system performs rather like Shopee. In many respects, especially in clarity (perspicuity) and Efficiency, it even beats Tokopedia.
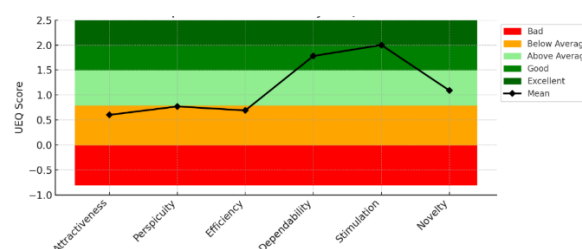

Fig 1. User Experience Evaluation by UEQ Dimention

Figure 1 shows, mapped against standardized quality categories from Bad to Excellent, the average UX scores across six UEQ dimensions. Falling in the Good to Excellent range, the e-learning system excelled in Dependability and Stimulus. While Perspicuity and Efficiency were near the same level, novelty was judged Above Average. Attractiveness stayed in a reasonable range even though it scored somewhat lower. All things considered, the figure emphasizes how dependable and engaging the system is, so supporting its success in a digital learning environment.

4.1.2. Pragmatic and Hedonic Quality Analysis

Two main quality types usually define the UEQ scales:
1. Pragmatic quality consists in dependability, Efficiency, and simplicity;
2. Hedonic quality consists in stimulation and novelty

Based on the UEQ data, Figure 2: Radar Chart of UX Scores Across Platforms shows user's opinions of the six UX dimensions on the Technopreneurship E-Learning platform, Shopee, and Tokopedia. Comparatively to industry benchmarks, the e-learning system excels in dependability, novelty, and perspicuity according the chart.
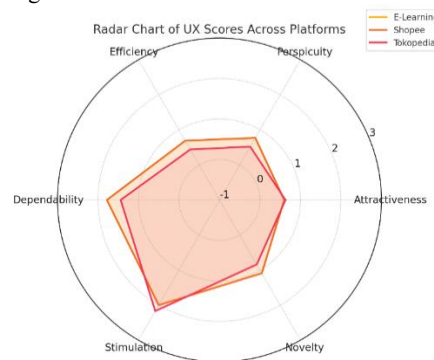

Fig 2. Radar Chart UX Scores

Particularly in dependability (1.78), vital for learning continuity, the e-learning system shows excellent pragmatic quality overall. It also shows its capacity to involve and inspire students by doing well in hedonic aspects.

4.1.3. T-Test Results: Significance of UX Score Differences

To find whether the variations between the benchmark platforms and the e-learning system were noteworthy statistically, using an independent two-sample T-Test ($\alpha = 0.05$), Table 2 shows the p-values for every UX dimension, contrasting the e-learning platform against *Shopee* and *Tokopedia*.

Table 2. T-Test Results for UX Dimensions (E-Learning vs. Other Platforms)

UEQ Dimension	E-Learning vs. *Shopee*	E-Learning vs. *Tokopedia*	Significance (p < 0.05)
Attractiveness	0.1936	0.1762	Not Significant
Perspicuity	0.7647	0.0341	Significant (vs. *Tokopedia*)
Efficiency	0.0921	0.0284	Significant (vs. *Tokopedia*)
Dependability	0.0468	0.0412	Significant
Stimulation	0.0024	0.1138	Significant (vs. *Shopee*)
Novelty	0.0000	0.0187	Significant

The results show statistically noteworthy variations in several aspects:
1. Perspicuity and Efficiency: the e-learning system suggests better clarity and usability since it significantly beats *Tokopedia*.
2. Dependability: the system is regarded as surpassing commercial platforms.
3. Stimulus and Novelty: *Shopee* is not as interesting or creative a learning environment as the e-learning platform offers.

These results confirm that the microservices-based architecture improves the learner experience in digital education systems.

4.2. Discussion

The findings of this study show that a microservices-based architecture applied on an e-learning platform for Technopreneurship education can significantly improve many facets of the user experience. The results with respect to the research questions, body of current knowledge, and more general consequences for educational technology design are interpreted in this part.

4.2.1. Enhancing Pragmatic Quality through Microservices

Particularly in pragmatic quality—dependability, Efficiency, and clarity—the e-learning platform displayed rather excellent performance. These features are intimately related to users' learning ease of use, task completion efficiency, and dependability of the system

performance. With a high score of 1.78 for dependability, the microservices approach—which stresses service isolation and fault tolerance—offers a strong basis for consistent system performance.

This result is consistent with those who observed that, especially in modular learning environments, microservices help scalable and resilient systems to be created. Moreover, the higher perspicuity score of the system than *Tokopedia* shows that educational platforms designed with pedagogical simplicity and user-centered structure can surpass even developed commercial systems in terms of clarity and usability.

4.2.2. Hedonic Experience: Engagement and Innovation in Learning

Regarding hedonic quality, the system got good responses; stimulation and novelty scored 2.00 and 1.09, respectively. These aspects are indispensable in e-learning, particularly for Technopreneurship, where deep learning depends much on learner motivation and curiosity. High stimulation scores imply that the system was seen as interesting, probably because of its responsiveness, modular content layout, and realistic simulation scenarios.

This outcome is consistent with research by Hinderks et al. (2023), who contend that, particularly in self-regulated learning environments, systems with high hedonic quality support consistent user engagement. The novelty element also reflects the learners' impression of the system as creative and unique from conventional learning management systems, implying that the use of industry-grade technologies in education promotes not only skill acquisition but also learner excitement.

4.2.3. Benchmarking against Industry Platforms

This work is unique in that it uses a benchmarking strategy whereby the UX of the e-learning platform was matched to that of reputable microservices-based systems like *Shopee* and *Tokopedia*. Teachers and developers can use this comparison to evaluate how well learning technologies meet industry benchmarks.

Fascinatingly, the e-learning platform excelled in most other aspects, while *Shopee* and *Tokopedia* scored somewhat higher in stimulation. This helps to underline how experiences offered by educational systems, when built with consideration for modularity, responsiveness, and user feedback, can rival or even exceed those of commercial applications.

This cross-domain analysis confirms the technological approach (microservices) and provides an understanding of learner expectations moulded by daily contact with commercial digital platforms. Future digital education depends on this kind of benchmarking since students want learning environments to be as seamless and responsive as the tools they use in daily life.

4.2.4. Implications for E-Learning Design in Technopreneurship

The good user experience in several aspects validates the fit of microservices in enabling e-learning for technological entrepreneurship. The modular character of microservices fits the framework of technoparanoia learning materials—such as business modelling, prototyping, and digital service development—because this field calls for both conceptual understanding and practical application.

Furthermore, the evaluation structure applied—which combines UEQ with cross-platform comparison—offers a valuable model for the next researchers and developers trying to validate new e-learning systems, particularly those aiming to mix education with real-world technological frameworks.

4. Conclusion

This study used the User Experience Questionnaire (UEQ) as an analytical tool to assess, using a microservices-based e-learning platform intended for Technopreneurship education, the user experience. The study has underlined the possibilities of using industry-grade technologies to improve learning environments by including a benchmarking approach against developed digital systems (Shopee and Tokopedia).

The results show that the e-learning system performs rather well in both pragmatic and hedonic spheres of user experience. It shows especially excellence in dependability, clarity (perspicuity), and novelty, so verifying that microservices architecture enhances both functionality and engagement. Furthermore, the comparison with commercial platforms shows that, in some cases even surpassing the user experience criteria of high-traffic digital systems, well-designed educational technologies can satisfy them.

The results support the view that, particularly in practice-oriented fields like technopreneurship, where system responsiveness and engagement directly influence learning outcomes, user experience must be fundamental in developing modern e-learning systems. The UEQ instrument turned out to help offer a sophisticated knowledge of learner opinions, which can guide ongoing system development.

Acknowledgement

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