

The Development and Validation of an Enhanced Usability Method (EUM) for User-Centered Electronic Systems in Higher Education Institutions

Born Christian A. Isip

North Eastern Mindanao State University, Philippines

Abstract: The rapid digital transformation of higher education institutions intensifies the need for reliable usability assessment frameworks for electronic systems. Most often existing usability evaluation models fail to address the institutional complexities, user diversity, and operational requirements of university environments. This study proposes and validates an Enhanced Usability Method (EUM) specifically designed for assessing user-centered electronic systems in higher education institutions. The study employed a mixed-methods research design with 100 participants composed of students, faculty members, and administrative staff from North Eastern Mindanao State University (NEMSU). The proposed EUM integrates Human-Computer Interaction (HCI) principles, User-Centered Design (UCD), and the Technology Acceptance Model (TAM) to evaluate usability dimensions including feature compatibility, interface usability, scalability, implementation efficiency, perceived usefulness, perceived ease of use, and user satisfaction. Analysis of Quantitative data uses descriptive statistics, correlation analysis, and regression analysis, while qualitative feedback was subjected to a thematic analysis. Results show high usability ratings for the university electronic systems, particularly in learnability, task completion, and user satisfaction. Furthermore, perceived ease of use and perceived usefulness had significantly influenced user acceptance and satisfaction. The findings demonstrated that the EUM provides a more comprehensive and adaptable framework for evaluating electronic systems in academic institutions. The study contributes to the growing body of usability research through the proposed context-specific usability assessment model suitable for higher education environments.

Keywords: Enhanced Usability Method, User-Centered Design, Technology Acceptance Model, Electronic Systems, Higher Education, Usability Assessment, Human-Computer Interaction

1. INTRODUCTION

1.1 Background of the Study

In higher education institutions, the adoption of electronic systems has significantly increased over the past decade due to the initiatives in digital transformation aimed at improving institutional efficiency, communication, service delivery, and academic management. Nowadays, universities increasingly rely on electronic systems for administrative transactions such as learning management, document processing, and customer engagement. Despite these advancements, still the success of electronic systems largely depends on their usability and acceptability among end users.

In this study the degree to which users can effectively, efficiently, and satisfactorily utilize a system to accomplish specific tasks is the basis for Usability. Based on Human-Computer Interaction (HCI) principles, systems with poor usability will often result in user frustration, low adoption rates, increased errors, and reduced operational efficiency. Subsequently, assessment on usability has become an essential factor in evaluating the quality and effectiveness of electronic systems.



Existing usability evaluation methods in many academic institutions are generic and sometimes it will not adequately capture the unique context of university operations. Diverse stakeholders including students, faculty members, administrative personnel, and external clients with varying levels of technological proficiency are where Universities are involved. Thus, it is necessary for a context-sensitive usability assessment framework.

The North Eastern Mindanao State University (NEMSU) has implemented several electronic systems to support institutional operations, including EPass (Electronic Pass Slip), ESign (Electronic Signature System), ECSSurvey (Electronic Customer Satisfaction Survey) and other electronic systems, the need to systematically evaluate its usability and user acceptability will help achieve its aim to streamline NEMSU transactions.

Thus, the development and validation of an Enhanced Usability Method (EUM), a context-specific usability assessment framework integrating User-Centered Design (UCD), usability engineering principles, and the Technology Acceptance Model (TAM) was conducted.

1.2 Research Objectives

This study aimed to develop and to validate an Enhanced Usability Method (EUM) for the purpose of evaluating user-centered electronic systems in higher education institutions.

Specifically, the study sought to:

1. Develop an Enhanced Usability Method (EUM) with integration of usability engineering principles and Technology Acceptance Model constructs.
2. Evaluate the usability and importance of NEMSU electronic systems in terms of:
 - Feature Compatibility
 - Interface Usability
 - Scalability
 - Efficiency
 - Learnability
 - Memorability
3. Determine or know the relationship between perceived ease of use, perceived usefulness, and user satisfaction.
4. Identify usability strengths and the weaknesses of the identified electronic systems.
5. Propose the most appropriate validated usability assessment model for higher education institutions.

1.3 Research Questions

This study sought to answer the following research questions:

1. What is the level of usability of NEMSU electronic systems based on the Enhanced Usability Method?
2. How do users evaluate the systems in terms of perceived usefulness and perceived ease of use?
3. Is there a significant relationship between usability dimensions and user satisfaction?
4. What specific usability issues are experienced by users of the electronic systems?
5. How can the proposed EUM model help improve usability assessment in higher education institutions?

1.4 Hypotheses

The study tested the following hypotheses:

- H1: Perceived Ease of Use significantly influences User Satisfaction.
- H2: Perceived Usefulness significantly influences User Satisfaction.
- H3: Interface Usability significantly affects User Acceptance.
- H4: Feature Compatibility significantly affects System Efficiency.

1.5 Significance of the Study

The study contributes to usability engineering and electronic system evaluation in higher education institutions. The findings may benefit specifically to the following:

- **Higher Education Institutions** through enhanced usability evaluation practices;
- **System Developers** by delivering usability design insights;
- **University Administrators** through data-driven decision-making.
- **Researchers** by extending usability assessment literature using a context-specific framework.

2. REVIEW OF RELATED LITERATURE

2.1 Usability and Human-Computer Interaction

Usability is a fundamental concept in Human-Computer Interaction (HCI) used to measure the effectiveness, efficiency, and satisfaction experienced by users while interacting with systems. Nielsen (1993) identified usability components which includes learnability, efficiency, memorability, errors, and satisfaction.

There were studies shown that systems with high usability promote better user engagement, increased productivity, and higher adoption rates. In the context of educational environments, usability plays a critical role because users possess varying technological competencies.

2.2 User-Centered Design (UCD)

User-Centered Design emphasizes designing systems based on user needs, preferences, and limitations. Norman (1988) argued that users who are involved during system development improves usability outcomes. Likewise, Gulliksen et al. (2003) emphasized that user participation throughout system development reduces usability problems.

2.3 Technology Acceptance Model (TAM)

The Technology Acceptance Model developed by Davis (1989) explains user acceptance of technology based on two major constructs:

- Perceived Usefulness (PU)
- Perceived Ease of Use (PEOU)

The above-specified model has been widely applied in information systems research to predict technology adoption and user behavior. Some studies indicate that systems perceived as useful and easy to use are more likely to be accepted by users.

2.4 Usability Assessment Models

Various usability assessment tools exist including:

- System Usability Scale (SUS)
- Post-Study System Usability Questionnaire (PSSUQ)
- Computer System Usability Questionnaire (CSUQ)
- Heuristic Evaluation Methods

However, the generic usability tools may not fully address institutional and appropriate requirements within higher education settings.

2.5 Conceptual Framework

The study adopted an integrated conceptual framework that combines both User-Centered Design, Human-Computer Interaction principles, and the Technology Acceptance Model.

The Independent Variables are the following:

- Feature Compatibility
- Interface Usability
- Scalability
- Efficiency
- Learnability
- Memorability
- Perceived Ease of Use
- Perceived Usefulness

The Dependent Variables composed of the following:

- User Satisfaction
- User Acceptance

Proposed EUM Model

The proposed Enhanced Usability Method (EUM) suggests that usability dimensions directly influence user satisfaction and acceptance of electronic systems.

3. THEORETICAL FRAMEWORK AND PROPOSED MODEL

3.1 Technology Acceptance Model (TAM)-Integrated EUM

The study integrates the Technology Acceptance Model into usability assessment to strengthen the predictive capability of the proposed framework.

The proposed model assumes that:

1. Feature Compatibility and Interface Usability will influence Perceived Ease of Use.
2. Perceived Ease of Use will affect system's Perceived Usefulness.
3. Perceived Usefulness and Perceived Ease of Use also influence User Satisfaction.
4. User Satisfaction will also affect User Acceptance.

3.2 Proposed Structural Model

Exogenous Variables

- Feature Compatibility
- Interface Usability
- Scalability

Mediating Variables

- Perceived Ease of Use
- Perceived Usefulness

Endogenous Variables

- User Satisfaction
- User Acceptance

The proposed model may as well be validated using Structural Equation Modeling (SEM) in future studies.

4. METHODOLOGY

4.1 Research Design

The study employed a mixed-method research design combining both quantitative and qualitative approaches. The quantitative component was used to assess usability metrics and technology acceptance variables, while the qualitative component was applied in exploring user experiences and usability concerns.

4.2 Research Locale

The study was conducted at North Eastern Mindanao State University (NEMSU), Surigao del Sur, Philippines.

4.3 Participants of the Study

The 100 participants as respondents were composed of the following:

- Students
- Faculty members
- Administrative staff

Participants were selected using purposive sampling according to their experience in using the university electronic systems.

4.4 Research Instruments

The study utilized:

1. Researcher-made usability questionnaire;
2. TAM-based user acceptance questionnaire;
3. Interview guide questions and;
4. Usability testing checklist.

The survey instrument employed a 5-point Likert scale.

4.5 Data Collection Procedure

The following procedures were conducted:

1. Permission to conduct the study was secured.
2. Distributed the Survey questionnaires.
3. Conducted the Usability testing sessions.
4. Administered the interviews and focus group discussions.
5. Data were consolidated and analyzed.

4.6 Data Analysis

Quantitative data were analyzed using the following:

- Frequency and percentage.
- Mean and standard deviation.
- Pearson correlation analysis and;
- Multiple regression analysis.

Thematic analysis were employed to analyze Qualitative data.

4.7 Ethical Considerations

The study observed ethical standards including voluntary participation, confidentiality, anonymity, and informed consent.

5. RESULTS AND DISCUSSION

5.1 Usability Evaluation Results

Usability Metric	Mean	Standard Deviation	Interpretation
Task Completion Rate	8.5	0.5	Very High
Time on Task	8.0	0.8	High
Error Rate	7.5	1.0	Moderate
User Satisfaction	8.5	1.2	Very High
Learnability	9.0	0.8	Very High
Efficiency	7.5	1.5	Moderate
Memorability	8.0	1.3	High

The results indicate strong usability performance throughout the evaluated systems. Learnability had obtained the highest rating, indicating that users can easily understand and utilize the systems.

5.2 Relationship Between TAM Variables and User Satisfaction

The analysis shown that perceived ease of use and perceived usefulness significantly influenced on user satisfaction.

Interpretation

- Systems that are easy to use are more likely to be accepted by users.
- Users value systems that improve efficiency and simplify transactions.
- User satisfaction increases when systems reduce task complexity.

These findings support the Technology Acceptance Model and previous usability studies.

5.3 Qualitative Findings

Thematic analysis revealed the following themes:

Positive Themes

- User-friendly interface
- Faster transactions
- Reduced paperwork
- Improved accessibility

Negative Themes

- Browser compatibility issues
- Occasional system delays
- Need for additional training
- Scalability concerns during peak usage

5.4 DISCUSSION

The findings demonstrate that the Enhanced Usability Method effectively evaluates electronic systems in academic institutions, compared to generic usability tools, the EUM incorporates contextual institutional factors, user diversity, and technology acceptance variables.

The integration of TAM helped strengthen the explanatory capability of the model by linking usability dimensions to user acceptance and satisfaction.

The study also confirms that user-centered approaches improve electronic system usability and acceptance within university environments.

6. CONCLUSION

The study had developed and validated successfully an Enhanced Usability Method (EUM) for assessing electronic systems in higher education institutions. The findings revealed that the identified systems generally possess high usability, particularly in terms of learnability, user satisfaction, and task completion.

The integration of User-Centered Design principles and the Technology Acceptance Model provided a more comprehensive usability assessment framework. Results further confirmed that perceived ease of use and perceived usefulness significantly influence user satisfaction and technology acceptance.

The proposed EUM contributes to usability engineering literature by offering a context-sensitive usability assessment model suitable for higher education institutions.

7. RECOMMENDATIONS

Based on the findings below, the following recommendations are proposed:

1. The need to Improve system compatibility across browsers and devices.
2. It is recommended to Enhance scalability to support increasing system demand.
3. Develop continuous user training programs.
4. Implement iterative feedback mechanisms.
5. Conduct future studies using Structural Equation Modeling (SEM).
6. The possibility to expand validation of the EUM across multiple institutions.

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