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Usability and Performance of the Web-based Frontline Services and Laboratories System

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Abstract

Objectives: The study developed a Web-based Frontline Services and Laboratories Evaluation System for NIPSC to identify the needs and concerns of attending students in NIPSC by giving ratings and posting comments or suggestions in laboratories and frontline services. The main objectives of the research were to determine the level of usability of the developed features of a Web-based Frontline Services and Laboratories Evaluation system for NIPSC. Evaluate the system's performance in terms of functionality, reliability, and efficiency of the information provided to clienteles. **Methods:** Descriptive and developmental research designs were employed in this study. It also helps the researcher analyze the information by the deployed standard survey questions to ensure the developed system meets its developed features and functions. The researcher used the Rapid Application Development (RAD) model as the software development life cycle for the software development activities. The researcher gets the total sampling size using sloven's formula. **Findings:** The finding implied was very good in using the developed system to get feedback from the students. The developed system gives satisfaction to the users in which they can easily rate and give their comments and suggestions to the services and laboratories of the NIPSC. The administrator can easily gather feedback from the students in helping them to know what were the lacking needs of their services are. Using the developed system, it can continuously progress and outgrow the services of Northern Iloilo Polytechnic State College when it comes to evaluating the school's frontline services and laboratories. The system's overall performance in terms of functionality, reliability, and efficiency implied that using the developed system is very good in getting feedback from the students. **Novelty:** The developed system can evaluate the comments and suggestions of the students of NIPSC using their mobile phones and tablets. Be able to give results quickly, and it is user-friendly. It is very good if the school may continue to update the developed system, which may help to maximize its potential and improve its functionalities, reliability, and efficiency.

Keywords: Usability and Performance; Frontlines services and laboratories; Evaluation; Rating; Webbased; RAD Model

1 Introduction

Web-based applications (WBA) are up-to-date trends in the technological era. WBA allows users to interact with a remote server through a web browser interface [1] . They have a huge impact on small and large businesses as a central instrument for replacing desktop applications. In previous years, web-based applications had limited functionality, but the advancement of technology increased the potential of the systems. Thus, web-based software offers crucial advantages over traditional approaches and benefits various businesses [2]. The web-based application utilizes web browsers. A browser interacts with languages like HTML, XML, Flash, Perl, ASP, and PHP. Thus, designing web-based applications adopting the variability of browsers is important. An open-source code is useful in developing a web-based application [3]. Browser is Mozilla Firefox, Microsoft Internet Explorer, or Google Chrome. Therefore, the application logic executes on the webserver, not the user's workstation. Internet connectivity is very significant in a web application [4]. Today's current events, connectivity is critical to many organizations and sectors.

Web-based appointment systems for medical appointment results showed positive changes in the process and procedures. There is an impact in web-based appointment systems such as reduced no-show rate, decreased staff labor, decreased waiting time, and improved satisfaction [5]. The study on web-based support systems suggested the single extended machine to single user computerized support system. Like in the academe, many are hesitant to adopt e-learning because they are comfortable with traditional approaches [6]. Medical practitioners state the web-based communication apparatuses were easy to use. Thus, user satisfaction depends on the tasks that allow goals to come competently. For instance, giving the needed tools improve nurses' services and functions [7]. In these pandemics, medical practitioners depend on technology and connectivity to understand the crisis and the status of outbreaks.

Web performance aims to measure the degree and observe the user experience of a website or application. Thence, web performance is about making the websites fast. This includes the following major areas: reducing overall load time, making the site usable as soon as possible, smoothness and interactivity, perceived performance, and performance measurements [8]. Thence, for so many years, a new application has been introduced to upgrade the services of websites and other applications.

The advancement of technology is also one of the main thrusts of state universities and colleges (SUCs) in the Philippines. Northern Iloilo Polytechnic State College (NIPSC) is one of the colleges that give good quality education to everyone [9]. The main campus has a lot of student population. One of the responsibilities of the campus is to make the students feel comfortable while they are inside the campus. The Officials of NIPSC have multifold work to be processed; they cannot easily read the comments and suggestions of the student in the suggestion box. Therefore, online services are being introduced in the college to easily track the comments and suggestions of the various stakeholders of the institution.

The students of NIPSC take too much time and effort waiting before the campus can process their transactions. Some students keep complaining about their negative and positive observations inside the campus by using the manual process of collecting feedback by writing a suggestion on a piece of paper and putting it in a suggestion box. Still, the administration cannot easily hear it due to their multifold works. To make all the students' transactions in all NIPSC services, this study was formulated.

The researcher developed a Web-based Frontline Services and Laboratories Evaluation System to identify the needs and concerns of attending students of NIPSC by giving ratings and posting comments or suggestions in laboratories and Frontline Services of NIPSC. A modern process of evaluating since students can use mobile phones and tablets. Many agencies, both local and international, are into web-based evaluation systems. Like, the children's Trust of South Carolina (Children's Trust) requested a proposal to develop a web-based data collection, analysis, reporting, and visualization system. This innovation reports state and site-level planning and guidance for continuous quality improvement strategies and initiatives and advocacy efforts [10]. Currently, the COVID 19 is working out the twists on a web-based application specifically in building a PCR laboratory. Hence, a web-based application is a safest and most efficient laboratory collection site for COVID-19 testing [11].

The study developed a Web-based Frontline Services and Laboratories Evaluation System for NIPSC.

1. Designed and developed a web-based system that was able to view the school laboratories and Frontline services of the campus in which the students can evaluate, give comments and suggestions.

2. Determine the level of usability of the developed features of a Web-based Frontline Services and Laboratories Evaluation system for NIPSC.

3. Evaluate the performance of the developed Web-based Frontline Services and Laboratories Evaluation System in terms of functionality, reliability, and efficiency of the information provided to clienteles.

2 Methodology

2.1 Research Design

A descriptive and developmental research design was employed in this study to help the researcher gather information from the users that will help develop the system. The researcher used the Rapid Application Development (RAD) model as the software development life cycle for the software development activities.

2.2 Data Model

Upon completion of the outline design, interactions between procedures and data are identified. Then, the data usage per function is defined. The deliverables produced in this task include functions required for the system, reusable design components to be incorporated into the system design, system structures, and tentative layouts of critical screens and reports supported by the system.

The entity-relationship diagram (ERD) is a graphical representation of a problem domain being modeled. The ERD assists the database designer in identifying the data and the rules that will be represented and used in a database. The ERD is an implementation-independent representation of a problem domain, and it facilitates communication between the end-users and the analyst. It is also widely used in database design that represents the conceptual level of the database system and describes things and their relationships at a high level[12].

The developed system has five entities: user, evaluation, school, course, and student. Relationships are set between among these entities through cardinalities. Thus, the following relationships were designed. One and only one user can accept one too many students. One and only one student can evaluate one too many evaluations. One of many schools contains one and only one evaluation. One and only one school provides one of many courses. One and only one course can have one too many students. Figure 1 shows the Entity Relationship Diagram of the developed system.
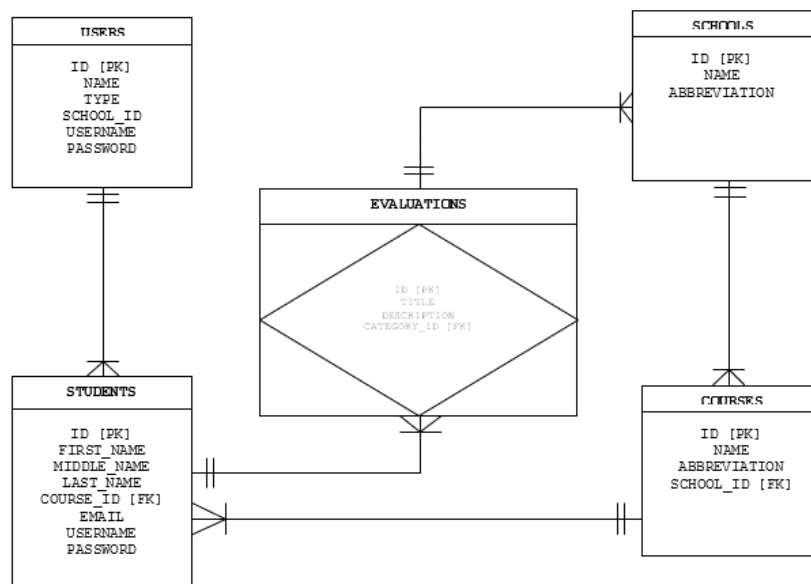

Fig 1. The entity-relationship diagram of the developed system

2.3 Process Model

Software development was applied for the data flow diagram. This innovation is helpful in the interactions between the users and the development system. A process model is a core diagram in structured analysis and design. The data flow diagram (DFD) is a graphical representation of the "flow" of data through an information system and modeling process aspects. DFDs are also used to visualize data processing (structured design) and show what kind of information will be input to and output from the

system, where the data will come from and go to, and where the data will be stored. It does not show information about the timing of processes or whether processes will operate in sequence or parallel [13].

In this study, the administrators, chairman, and students are the users. As the primary user, the administrator has full authority or control of the developed system. The primary user can add, edit, delete, and upload the different information needed by the developed system. The secondary users of the developed system were the students and the chairman. They can view the updated information. Students can give their comments and evaluate using rating the given evaluation item. The chairman can view information from the developed system using the tablet. Figure 2 shows the context data flow diagram of the developed system.
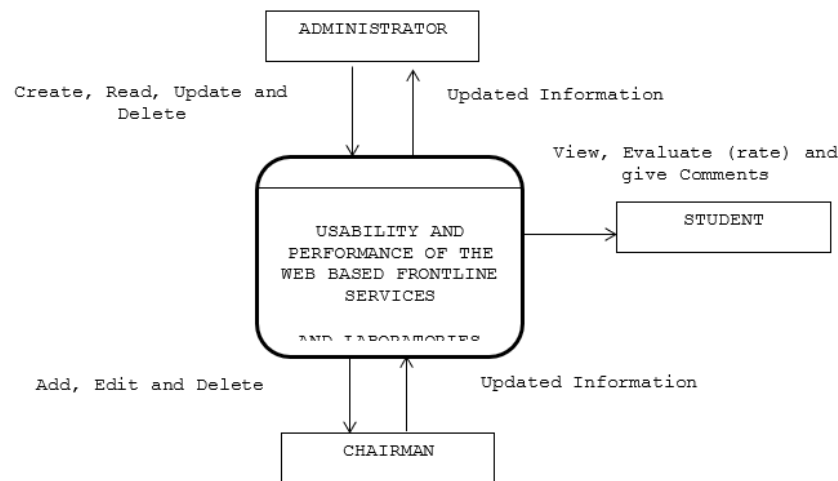

Fig 2. The context data flow diagram of the developed system

2.4 Logical Architecture Design

A plan for the implementation of the system was developed. The implementation approach is selected after reviewing the design of the system. Parallel development and time box development can be adopted to speed up delivery. An implementation plan was prepared, listing all the tasks that must be performed in developing the system and converting it into operational use called Logical Architectural Design. The layout should denote the hierarchy of major logical components comprising the developed system [14]. Logical Architecture describes the system in terms of its conceptual organization in layers, packages, classes, interfaces, and subsystems. Layers are a coarse-grained grouping of class packages or subsystems that have cohesive responsibility for the system's major aspects.

Tiers are concerned with the physical distribution of components and functionality on servers, computers, networks, and remote locations. The model, which is N-tier architecture, refers to software with several layers rendered by distinct IT environments (tiers) under client-server logic [15]. The client-Server architecture consists of four layers: the presentation layer, the application, and logic layers, also known as the business layer, the data manipulation layer, and the database layer. The application logic can run on a server, for the developed system will have a server version. The user interacts with the server. The presentation layer component implements the functionality required to allow the user to interact with the system. The server version provides the presentation and business layer executed at the web browser by way of local hosting [16]. The server runs the server version of the Web-based Frontline Services and Laboratories Evaluation System. The business layer implements the system's primary functionality and encapsulates the relevant business logic. The data manipulation layer implements the processes involving the management of records of students used by the developed system. It provides access to data hosted within the system's boundaries. This was implemented using the Hypertext Preprocessor (PHP) language. The fourth layer is the database layer which is the physical repository of records of students, the evaluation items such as the frontline services and laboratories of the campus. It comprises the different relational databases with their appropriate tables, fields, and attributes. Figure 3 shows the logical architecture design for the developed system.
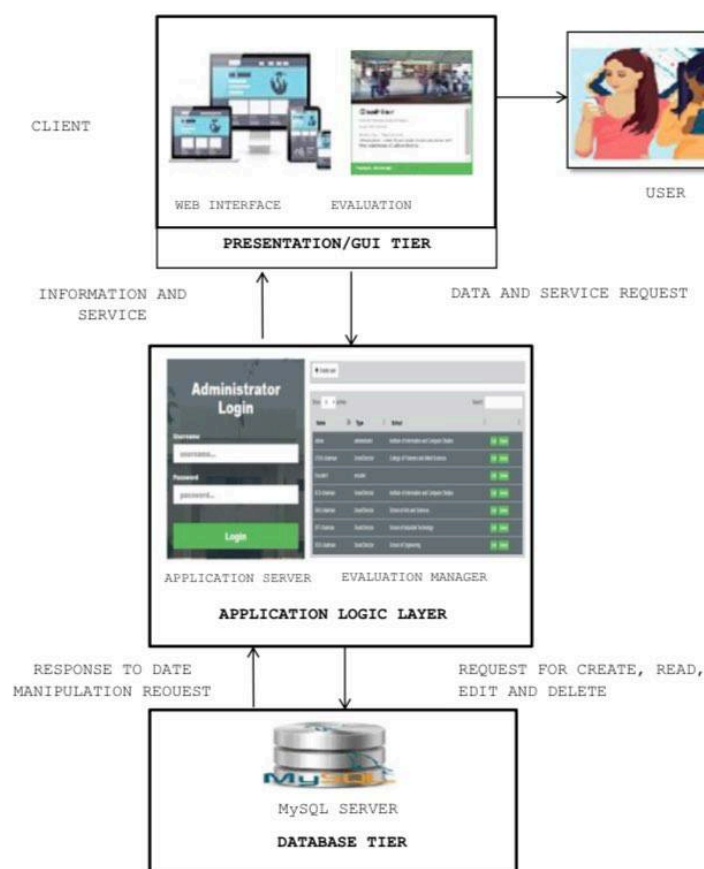
Fig 3. The logical architecture design of the developed system.

2.5 Physical Network Topology

The final task in the UD Phase was to present a model that showed physical network topology that envisions the communication structures of physical networks and their network arrangement. The physical network topology illustrates the placement of the components in the network. It shows the configuration of cables, computers, and other devices. Since the developed system was web-based[17], it can run on one or more mobile phones or tablets in a network. It can be accessed via a web browser using an assigned Internet Protocol (IP) address of the server where the program and data manipulation were stored. Figure 4 shows the physical network topology of the developed system.

Fig 4. Physical network topology of the developed system.

2.6 Participants of the Study

There were a total of 367 participants in this study. A Slovin's formula was used to get the sample size from the total population of NIPSC Estancia, Iloilo. The researcher got an unlimited number of respondents in every course. The Institute of Information and Computer Studies has 45 respondents; the Graduate school has 44, Laboratory High school has 29; Senior High school has 34; School of Arts and Sciences has 30; Bachelor of Science in Business Administration has 33; School of Industrial Technology has 45; School of Engineering has 25; School of Education has 47; College of Fisheries and Allied Sciences has 17; Bachelor of Science in Tourism has seven and faculty has 11.

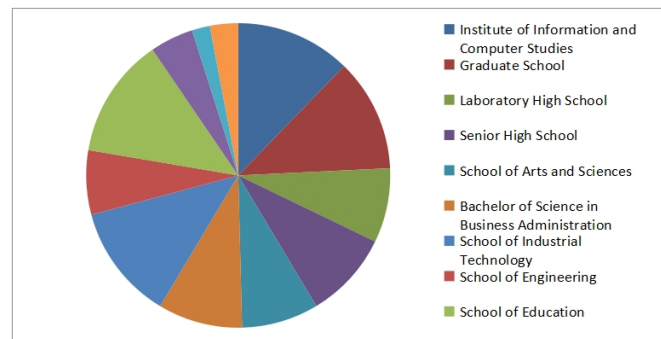Figure 5 shows the frequency of respondents per group of the developed system.

Fig 5. Frequency of respondents per group

2.7 Data Gathering Procedure

A group of beta-testers (students and faculty) was requested to evaluate the system regarding its reliability, functionality, efficiency, and overall acceptability. The developed system had undergone a series of evaluations by the expert of the field of study, IT experts who were allowed to use the system, and a questionnaire was made. The questionnaires were based on the ISO 9126 standard [18] that describes a software quality model which categorizes software quality into six characteristics (factors) and is sub-divided into sub-characteristics (criteria). The questionnaire was based on McCall's Software Quality Model for the experts. A 5-point Likert scale comprising one as Poor and five as Very Good was used. The mean statistics were applied to compute whether the developed system passes the evaluation criteria statistically.

3 Results and discussion

3.1 Level of usability of the developed features of the Web-based Frontline Services and Laboratories Evaluation System.

Table 1 shows the result of the mean score for the respondent's feedback on the level of usability of the developed features of the Web-based Frontline Services and Laboratories Evaluation System in terms of Appropriateness Reconcilability, Learnability, Operability, User Error Protection, User interface aesthetics, and Accessibility.

In terms of Appropriateness Reconcilability, the developed system had a computed mean of 4.25. At the same time, Learnability had a computed mean of 4.29. The Operability had a computed mean of 4.21, User Error Protection had a computed mean of 4.23, User interface aesthetics had a computed mean of 4.24, and the Accessibility had a computed mean of 4.24, which is inferred as Very Good. The overall result had a grand mean of 4.24, being taken as Very Good.

Users were contented when a purpose was effective and efficient for accomplishing a task [17]. The research on a decision support system (DSS) revealed that it could be used to decide to improve the usability and quality of design of web-based information systems (WIS) [18]. The study on Microsoft HealthVault had higher scores in terms of several usability factors [19].

Furthermore, research on methods for website usability evaluation on airlines proved that the procedures were encouraging [20].

The software quality metrics play a significant role. But to measure the usability is too heavy for experts; thus, individual metric components are considered. The usability evaluation of web applications can be done by identifying problems in the design of interfaces and efficient comparison of competing products and products at different stages of their life cycle [21].

Table 1. Level of usability of the developed features of the Web-based Frontline Services and Laboratories Evaluation System

Categories		Mean	Verbal Description
Usability Characteristics	Appropriateness Reconcilability	4.25	Very Good
	Learnability	4.29	Very Good
	Operability	4.21	Very Good
	User Error Protection	4.23	Very Good
	User interface aesthetics	4.24	Very Good
	Accessibility	4.24	Very Good
Overall		**4.24**	**Very Good**

1.00-1.80 (Poor); 1.81-2.60 (Fair); 2.61-3.40 (Average); 3.41-4.20 (Good); 4.21-5.00 (Very Good)

3.1 Performance of the Developed System of Functionality, Reliability, and Efficiency

Table 2 presents the evaluation of the respondents to the developed system. The table showed the mean score voted by the respondents in terms of Functionality, Reliability, and Efficiency.

Table 2. Performance of the developed system of functionality, reliability, and efficiency

Categories		Mean	Verbal Interpretation
Functionality	Functional Completeness	4.27	Very Good
	Functional Correctness	4.28	Very Good
	Functional Appropriateness	4.24	Very Good
Reliability	Maturity	4.26	Very Good
	Availability	4.27	Very Good
	Fault Tolerance	4.31	Very Good
	Recoverability	4.24	Very Good
Efficiency	Time Behavior	4.22	Very Good
	Resource Utilization	4.43	Very Good
	Capacity	4.37	Very Good
Overall			Very Good

1.00-1.80 (Poor); 1.81-2.60 (Fair); 2.61-3.40 (Average); 3.41-4.20 (Good); 4.21-5.00 (Very Good)

Functional Completeness had a mean score of 4.27, Functional Correctness had a mean score of 4.28, and Functional Appropriateness had a mean score of 4.24, which is interpreted as Very Good. In terms of reliability, the Maturity had a computed mean of 4.26, the Availability had a computed mean of 4.27, Fault Tolerance had a computed mean of 4.31, and the Recoverability had a computed mean of 4.24, which is interpreted as Very Good. In terms of efficiency, the Time Behavior had a mean score of 4.22, the Resource Utilization had a mean score of 4.43, and the Capacity had a mean score of 4.37, which is interpreted as Very Good.

The comprehensive strategy for performance, reliability, and scalability (PSR) testing of multi-tier web applications showed rapid changes in technology and the business environment. PSR testing ensures the successful functioning of web-based applications. Also, the high usability brings choices to general users, makes employees work smoothly, and enables investors to obtain satisfying potential benefits. Based on the scholars' studies about the usability guide and usability evaluation, this article starts from the desired goal of user groups. It IS usability of different models is compared, but still lacks data supporting analysis from enterprises. Overall, the comprehensive assist in usability design from multiple perspectives for usability experts and developers in the life cycle of systems development can meet the usability needs of all users and lay the foundation for the usability evaluation model in the next step[22,23].

In the study on improving the quality of services of public health centers, the output developed a lab application to help practitioners collect, process, and present data. This application enhanced the quality of lab application by making it structured, easy-to-read, appropriate, and precise. The lab application features meet the standard of ISO/IRC[24].

The COVID-19 resulted in the adoption of the development of health informatics. This innovation is linked to artificial intelligence and natural language processing. Thus, telehealth plays a critical role in times of critical response. Also, bioinformatics assisted in translating the sequence of the Coronavirus. Technology in times of pandemics contributed to timely information to help governments and experts control the spread of the outbreaks[25].

4 Conclusions

The usability of the Web-based Frontline Services and Laboratories Evaluation System implies that the system is needed by the administrator to easily gather feedback from the students in helping them to know what the lacking needs of their services. Also, students can easily hear their suggestions because the system and user-friendly appropriately provide it. The users believed that the developed system could help the campus be more productive. The system's performance in terms of functionality, reliability, and efficiency implied that using the developed system is very good at getting feedback from the students. The developed system can provide an easy and effective way of giving ratings for every service and laboratory of the campus and giving comments and suggestions. The developed system can help the campus to hear out students' suggestions and comments that they can use to progress and outgrow their service continuously. The developed system has features and designs that the students and administrator can easily manage.

5 Recommendation

The school may continue to update the developed system, which may help to maximize its potential and improve its functionalities, reliability, and efficiency. Also, the administration should recognize the innovation and allocate enough financial assistance for entire operation.

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