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Design and Development of Romblon State University Romblon Campus Accreditation Data Warehouse

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ABSTRACT

Accreditation is conducted to assess and upgrade the educational quality of higher education institutions and programs, which requires complete documents for the precise information specification before the expert's review. Therefore, the documents and records of an institution must be effectively preserved to facilitate compliance with accreditation requirements. However, the data generally comes from different sources of various types, unstructured and distributed. This study designed a data warehouse to incorporate all the documents in preparation for college accreditation. The data warehouse was developed in a five-step process, considering the accreditation assessment with an emphasis on academics. Systems Development Life Cycle model was used in the development of the system. The ISO/IEC 25010:2011 standard was used to evaluate the system's acceptability using the eight characteristics. However, only applicable sub-characteristics such as suitability, efficiency, compatibility, usability, reliability, security, and maintainability were applied to evaluate the system. This standard ensures that the system meets the user's preference with the system being satisfied, and the essential features like uploading, viewing, and system maintenance by the administrator, are at their most excellent functional operation. The parameters which were created by the system can be used by other satellite campuses of Romblon State University, as well as other universities applying for accreditation of the Accrediting Agency of Chartered Colleges and Universities in the Philippines (AACCUP).

Keywords: *accreditation, data warehouse system, system development, system quality model, data security*

INTRODUCTION

Every accreditation, the faculty in-charge seeks for documents to be prepared. They ask where these documents can be obtained and file them to the accreditation folders. Sometimes, however, the faculty has a hard time searching for the specific documents needed, especially if the person in-charge of the document is absent, on leave or resigned already, some of them might not be readily available. This will lead to delays in the accreditation process. In addition, the source of data is circulated using the manual system of photocopying and scanning of the printed documents. During pandemic, the accreditors could not visit the school personally and the documents need to be saved in digital file format (.docx) or (.pdf), and shared via Google drive. This circumstance makes gathering data a problem. For this reason, the researchers designed a system that will help the faculty and staff of RSU-Romblon Campus in accreditation.

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The accreditation of a program is one of the important parameters needed to determine the standards of universities. It is measured through supported evidence and assessment associated with the standards of the accreditor's judgment or consideration. In the Philippines, the accreditation in chartered higher education is done by an accreditation council called Accrediting Agency of Chartered Colleges and Universities in the Philippines (AACCUP). The university prepares the complete data in a template provided by the AACCUP. This data consists of compliance report, program performance profile, and benchmark statements/parameters for every area as follows: I - Vision, Mission, Goals and Objectives; II – Faculty; III - Curriculum and Instruction; IV - Support to Students; V – Research; VI - Extension and Community Involvement; VII – Library; VIII - Physical Plant and Facilities; IX – Laboratories; and X – Administration.

Access to reliable and accurate information is essential for the management of educational institutions. For this reason, administrative staff should have the access to current and older version of information to perform their administrative duties.

Table 1. A Conceptual Framework for Building an Accreditation Data Warehouse System

Steps	Description
1. Investigation	Understand the problem and recognize the opportunities that can be appreciated with the implementation of system.
2. Analysis	Detailed specification of functional requirements of the system. Determine the cost-benefit ratio of its creation and maintenance.
3. Design	Design the system to satisfy the requirements based on analysis.
4. Implementation	Launch the implementation of the system.
5. Maintenance and Revision	Evaluate the ease of use and understanding of the users (faculty/staff) regarding the system. Evaluate the quality of information stored in Data Warehouse. Evaluate the impact of the implementation of the system in managing the relationship with internal/external users.

System development is a multifaceted process, mainly because of the issue of aligning the system's characteristics with the requirements of an organization, but also because controlling both time and costs of development is difficult (Stair & Reynolds, 2008). The organization must realize and recognize the activities of the development of systems so that it can grow on a program of implementation of a data warehouse system in a mindful and reflected manner. Thus, in systems development, involving either the design of a new system or the modification of an existing one, it must meet the five main steps: (1) Investigation – to gain a clear understanding of the matter to be solved or opportunities to be addressed, the researcher must understand the problem; (2) Analysis – understand solutions, to clearly define the matter and also the expected opportunities; (3) Design – select and plan the best solution, to determine how the new system will work to satisfy the organization needs to be defined during analysis; (4) Implementation – place solution into effect, to create or acquire the system components defined within the design, assembling them, and putting the new system into operation; and (5) Maintenance and Revision – evaluate results of solution, to monitor and evaluate system performance, and resolve on the need for possible changes to improve (Stair & Reynolds, 2008).

Developing a system for a specific organization could be done through research gathering techniques. Different techniques exist for gathering data, such as observations through direct and participants, interviews, questionnaires, and other relevant documents (Shanks & Bekmamedova, 2018). Table 1 shows the conceptual framework adopted from (Simões, 2010) that guides the researcher in developing the data warehouse. However, only the applicable description was applied.

This study aimed to design and develop a data warehouse for Romblon State University - Romblon Campus accreditation. Specifically, the following objectives were addressed: (1) to design an online platform for the RSU Romblon Campus Accreditation Data Warehouse. (2) to design and implement databases for the areas needed in the accreditation process, and (3) to evaluate the system using ISO 25010:2011 standard.

METHODOLOGY

Design and Methodology

Descriptive and developmental research was applied in this study. The descriptive method was used to gather documents as inputs to the system's design, whereas the developmental research was done to produce an online system that could benefit the faculty and staff of Romblon State University-Romblon Campus.

Software Development

The software development life cycle (SDLC), which deals with online programs or computer software, was used in this study.

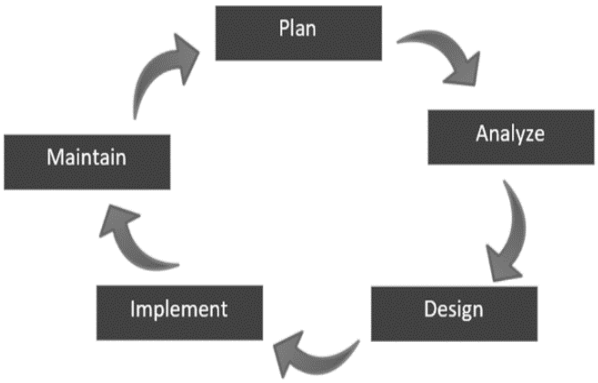

Figure 1. Systems Development Life Cycle Model

Different designs were created to cater to individual developers' needs with other skills, demands, or business environments. The data and process modeling analyzed and defined the data requirements within the scope of the organization's information systems. Data modeling was focused on the documentation of complex system design of software to quickly understand the design and the diagram while applying symbols and texts to illustrate the flow (Vaughan, n.d.). Figure 1 demonstrates that five stages in designing new systems or modifying existing ones.

- *Planning.* Understand the problem and recognize the opportunities that can be appreciated with the implementation of the system.
- *Analysis.* Detailed specification of functional requirements of the system and determine the cost-benefit ratio of its creation and maintenance.
- *Design.* Design the system to satisfy the requirements based on analysis.
- *Implementation.* Launch the implementation of the system.
- *Maintenance.* Evaluate the ease of use and understanding of the users (faculty/staff) regarding the system. Evaluate the quality of information stored in Data Warehouse and its impact with internal and external users.

Software Development Tools

The study was designed to meet the desired needs to satisfy the requirements based on analysis. The development tools used to design an online platform for the RSU Romblon Campus Data Warehouse is shown in Table 2.

Table 2. Software development tools

Development tools	
Software:	Visual Studio Code
Operating system:	Windows 10
Web/Mobile platform:	Deluxe Linux Hosting with cPanel
Database:	Phpmyadmin, MySQL
Subscriptions:	Deluxe Linux Hosting
Programming Languages:	HTML, PHP, JavaScript, CSS

The coding was written, and configuration was done to interlink the software via the network. The designed system was deployed on the server for a series of actual tests of the users. Testing of functionalities was done, and training of the users was conducted to ensure that they knew how to navigate the system. In this phase, the researcher worked on the actual function of the website. Although it is already an eye candy for the users, it is essentially a shell with limited features. Constant development, review of function, and constant revision were accomplished.

Sampling Procedure

The population of this study included faculty members and staff of Romblon State University – Romblon Campus. Purposive sampling was utilized to test the acceptability of the system. The evaluation was done by the 10 accreditation chairpersons, two team members in every area, and two internal Accreditors, with a total of 32 respondents.

Acceptability Test

To test the acceptability of the software, the researcher used the ISO/IEC 25010:2011 standard applying these eight characteristics: suitability, efficiency, compatibility, usability, reliability, security, maintainability, and portability, as shown in Figure 2 (Garcés & Nakagawa, 2017). Table 3 summarizes the questions used to evaluate the acceptability of the system while Table 4 shows the numerical rating and descriptive scale used to evaluate the result.

Table 4. Likert Scale

Scale	Verbal Interpretation
4.50 – 5.00	Strongly Agree (SA)
2.50 – 4.49	Agree (A)
2.50 – 3.49	Neutral (N)
1.50 – 2.49	Disagree (D)
0.50 – 1.49	Strongly Disagree (SD)

Statistical Tool

The statistical tool that was used in the interpretation of data is the arithmetic mean. Some items refer to the number of respondents who evaluated the system. In this study, the arithmetic mean was used to get the result of the sub-characteristics. Taking the mean will evaluate if each sub-characteristic obtains the level of acceptance of the system considering the Likert Scale.

Table 4 shows the numerical rating and descriptive scale used to measure the result evaluation. This is the tool used to interpret the output of the ISO/IEC 25010:2011 evaluation and has a scale of 4.50 to 5 being the highest and 0.50-1.49 as the lowest.

Each characteristic arithmetic mean and the general arithmetic mean of all sub-characteristics was used to obtain the final result. The result of taking the individual characteristic arithmetic mean is called Composite Mean. It is the partial arithmetic mean of the general weighted arithmetic mean.

After taking the composite mean of each characteristic, the average of the composite mean or the general weighted mean was calculated to get the final value that identifies the system's acceptability.

RESULTS AND DISCUSSION

The system was designed to have convenient uploading, browsing, viewing, and retrieving of files needed for the accreditation process. The evaluation focuses on the system's objective as a developed platform for Romblon State University – Romblon Campus Accreditation Datawarehouse.

Shown in Figure 3 are the parameters in the Level 3 accreditation of Bachelor of Science in Secondary Education (BSED).

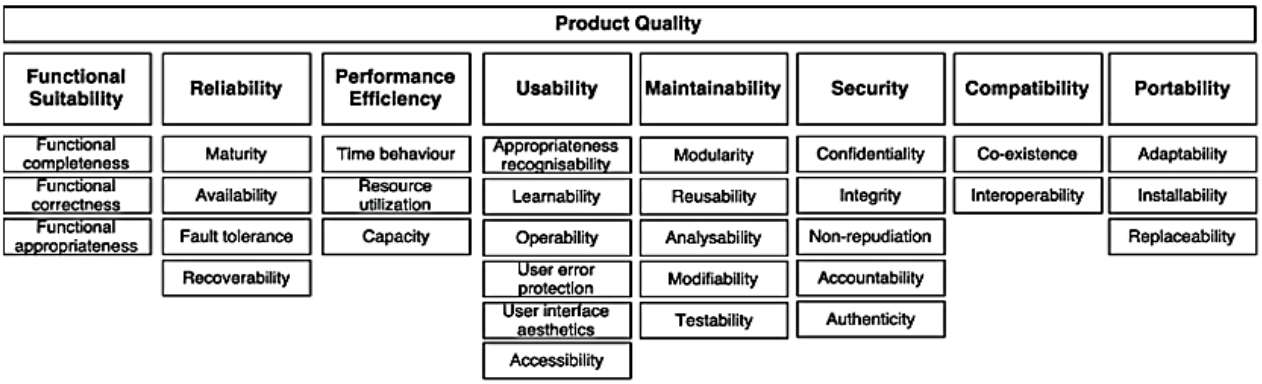

Figure 2. Eight Characteristics of Software Product Quality Model and System Quality in Use Model (Garcés & Nakagawa, 2017)

Table 3. ISO Characteristics and Sub-Characteristics Adopted in the Study

Characteristics	**Sub-characteristics**	**Questions**
Functional Suitability	Functional Completeness	Can software perform the task required?
	Functional Correctness	Is the result as expected?
Performance Efficiency	Time behavior	Does the system quickly respond?
	Resource utilization	Does the system utilize resources efficiently?
	Capacity	Does the system parameter meet the system's requirements?
Compatibility	Coexistence	Can the system perform the functions efficiently in sharing the resources?
	Interoperability	Can the software capable of exchanging information and using the information that has been exchanged?
Usability	Appropriateness/ recognizability	Does the system appropriate to your need(s)?
	Learnability	Can the user learn to use the system easily?
	Operability	Can the user use the system without much effort?
	User error protection	Does the system protect users against making errors?
	User interface aesthetics	Does the system interface look good?
	Accessibility	Can the system be used with the widest range of characteristics and capabilities?
Reliability	Availability	Can the software capable of providing necessary data or information all the time?
	Fault tolerance	Is the software capable of handling errors?
	Recoverability	Can the software resume working and restore lost data after failure?
Security	Confidentiality	Does the system have access level and can be use by authorized user?
	Integrity	Does the system prevent people from unauthorized access?
	Non-repudiation	Can the system provide assurance that someone cannot deny validity and authenticity of user's signature?
	Accountability	Can the system can audit and trace the events done by the users?
	Authenticity	Can the software preserve its original form without any falsification or tampering?
Maintainability	Modularity	Can the system be modified or changed without major impact to the entire system?
	Reusability	Can the system be enhanced?
	Analyzability	Can faults be easily diagnosed?
	Modifiability	Can the software be easily modified?
	Testability	Can the software be tested easily?

Adapted to ISO/IEC 25010:2011 - Systems and software engineering -- Systems and software Quality Requirements and Evaluation (SQuaRE) -- System and software quality models (2017).

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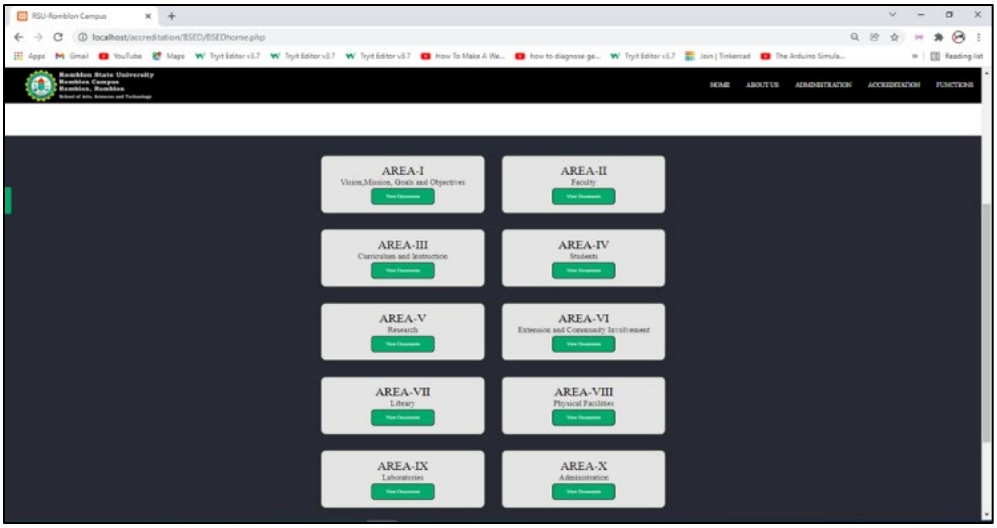

Figure 3. Accreditation Areas

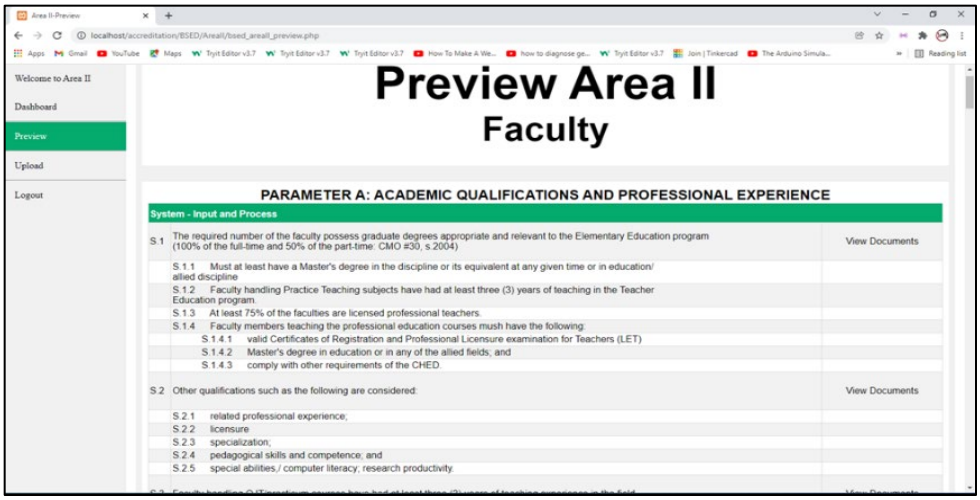

Figure 4. Area Chairman Dashboard

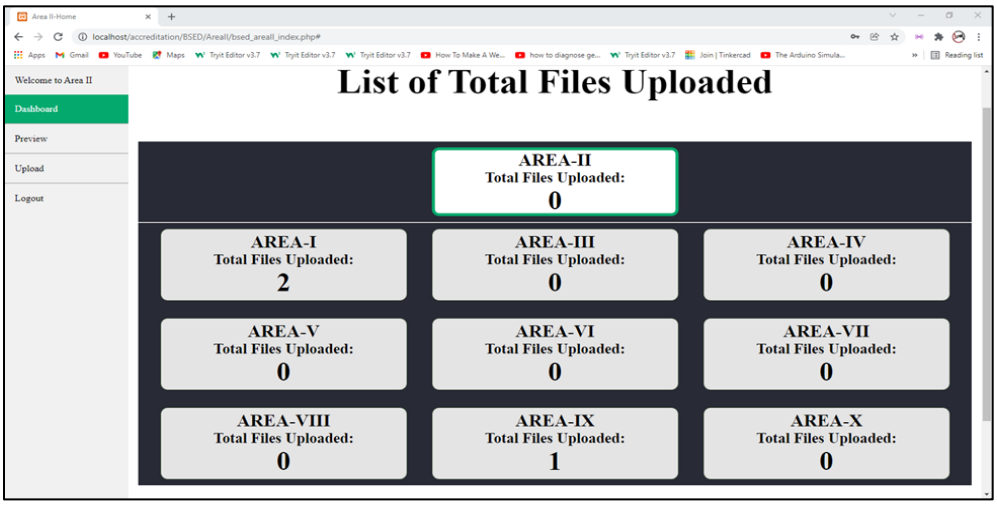

Figure 5. Area Chairman Upload Function

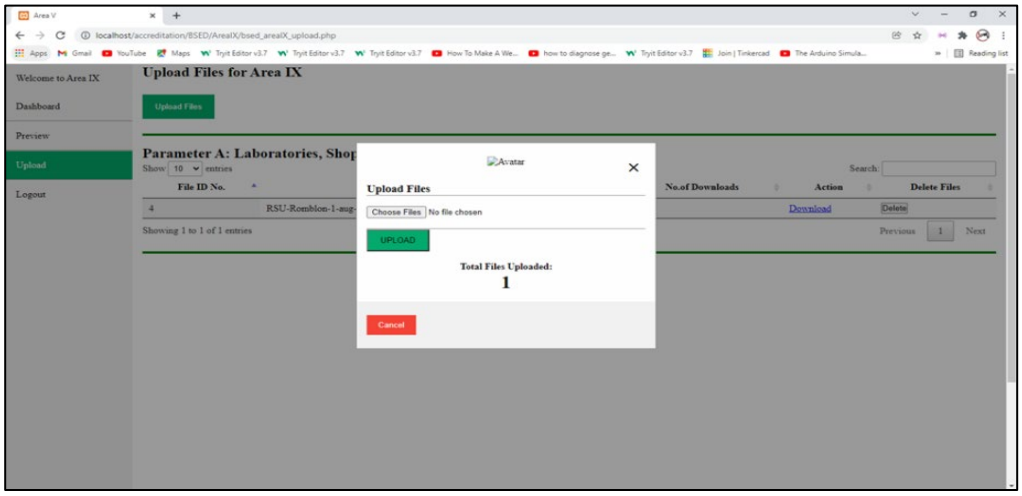

Figure 6. Area Chairman Preview Area

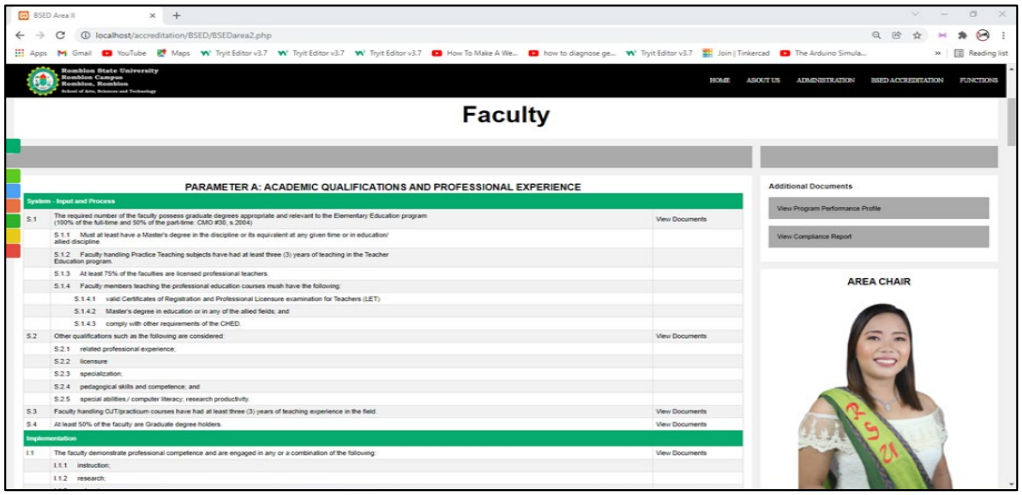

Figure 7. Internal/External Accreditors View

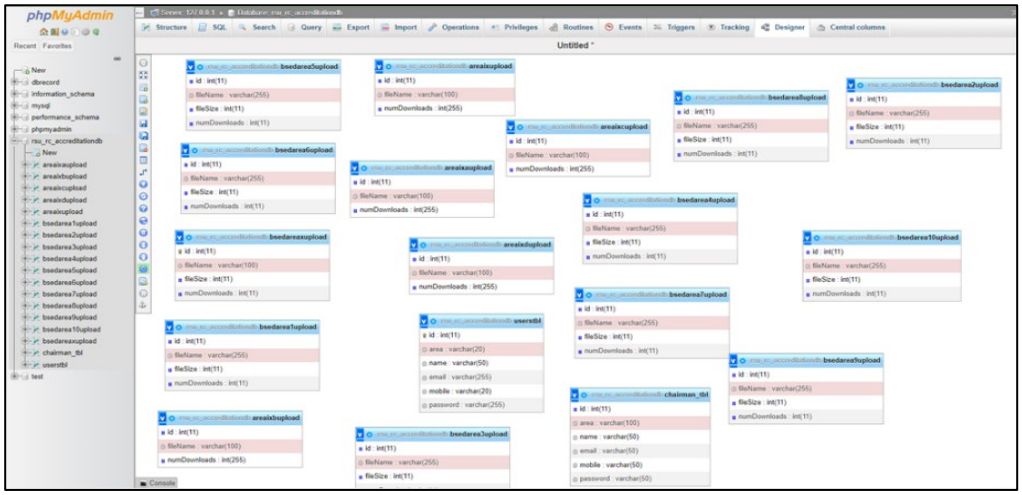

Figure 8. Database Design

Table 5. Result on the Software Evaluation for the Acceptability of the System using ISO/IEC 25010:2011

Characteristics		**Mean**	**Verbal Interpretation**
Functional Suitability	Functional Completeness	4.44	Agree (Very Satisfactory)
	Functional Correctness	4.41	Agree (Very Satisfactory)
Performance Efficiency	Time behavior	4.16	Agree (Very Satisfactory)
	Resource utilization	4.25	Agree (Very Satisfactory)
	Capacity	4.84	Strongly Agree (Outstanding)
Compatibility	Coexistence	4.50	Strongly Agree (Outstanding)
	Interoperability	4.53	Strongly Agree (Outstanding)
Usability	Appropriateness/ recognizability	4.88	Strongly Agree (Outstanding)
	Learnability	4.56	Strongly Agree (Outstanding)
	Operability	4.63	Strongly Agree (Outstanding)
	User error protection	4.47	Agree (Very Satisfactory)
	User interface aesthetics	4.69	Strongly Agree (Outstanding)
	Accessibility	4.78	Strongly Agree (Outstanding)
Reliability	Availability	4.41	Agree (Very Satisfactory)
	Fault tolerance	4.16	Agree (Very Satisfactory)
	Recoverability	4.22	Agree (Very Satisfactory)
Security	Confidentiality	4.31	Agree (Very Satisfactory)
	Integrity	4.34	Agree (Very Satisfactory)
	Non-repudiation	4.38	Agree (Very Satisfactory)
	Accountability	4.38	Agree (Very Satisfactory)
	Authenticity	4.34	Agree (Very Satisfactory)
Maintainability	Modularity	4.41	Strongly Agree (Outstanding)
	Reusability	4.53	Agree (Very Satisfactory)
	Analyzability	4.47	Agree (Very Satisfactory)
	Modifiability	4.47	Agree (Very Satisfactory)
	Testability	4.47	Strongly Agree (Outstanding)
	Overall Mean	**4.4**	**Agree (Very Satisfactory)**

Shown in Figure 4 is the list of total uploaded files by the members and chairman of each area. Figure 5 shows the upload function, in which the member or chairman of each area can upload a document related to the parameters. Figure 6 shows the preview window, in which they can view, edit, download and print the uploaded document. Figure 7 is the window in which an internal/external accreditor can view. Figure 8 shows the design of the databases for the areas in the accreditation. The database name is rsu_rc_accreditationdb, which composed 18 tables, one (1) table for users, one (1) table for Academic Chairpersons, while the remaining tables is intended for uploading of documents in each area.

As presented in Table 5, most respondents agreed that the entire system was acceptable and ready to use for the level 3 accreditation of the Bachelor of Science in Secondary Education (BSED) (M = 4.4).

Figure 9 shows the overall system evaluation using ISO/IEC 25010:2011 (International Organization for Standardization, 2011). Based on the results, the system is usable because it enables the user to perform

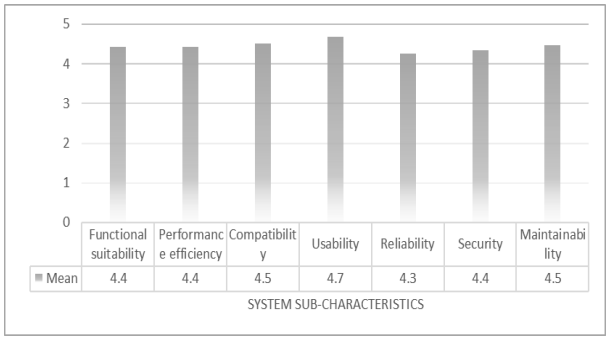

Figure 9. Overall System Evaluation - ISO/IEC 25010:2011

their task effectively, efficiently, and satisfactorily in the specified context of use (M = 4.7). On the other hand, the reliability of the system must be given an attention. Although the result got "very satisfactory" (M = 4.3) score, the users revealed that reliability is important factor that the developed system should possess. Security makes a unique contribution to the reliability of the system. A trusted system is one that is reliable and

has been tested to the end-user's laptop and desktop devices. Furthermore, based on the result of the overall system evaluation using ISO/IEC 25010:2011, the developed system ensures that the end-user needs security. All components must be consistent for the system to be reliable, that is, clear and secure. Overall, the respondents are very satisfied with the developed system (M = 4.4).

CONCLUSION

This paper presents the design and development of a data warehouse system for accreditation purposes using a conceptual framework which serves as a matrix when building a data warehouse system. The logical design focuses on the accuracy and integrity of the desired data warehouse so that the accreditation requirements and user environment can be accurately mapped. The physical design must take into account cost, data security, data relationships, naming standards for data types, tables, indexes, and so on. The proponents have successfully developed and tested the system to the end-user's laptop and desktop devices. Furthermore, based on the result of the overall system evaluation using ISO/IEC 25010:2011, the developed system ensures that the end-user needs were met and the system maintenance was successfully done by the system by the administrator.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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