

## **PAARL** Research Journal



Volume 6: 2019

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## Editor's Introduction

This sixth issue of the PAARL Research Journal (PRJ) is a compilation of papers presented during the 2019 PAARL National Summer Conference with the theme "Repositioning Libraries in Big Data Era: New Methods, Services, and Opportunities". This national conference was held last 24th-26th April 2019, in Iloilo City, Philippines. Research papers presented in this conference have demonstrated the need for librarians to be aware of what big data is and how it may impact their libraries, now more than ever since people around the world continue to generate and contribute to the "Big data". Moreover, the papers in this issue have shown the need for librarians to recognize the need to improve all facets of their library's operations and to propose new and innovative services, collections, and facilities by exploring new opportunities and repositioning their libraries through proper planning utilizing various data analytic techniques.

We have continued our partnership with the National University - College of Education, Arts and Sciences (NU-CEAS) in the review of these research papers. Furthermore, faculty members from NU-CEAS were asked to form a panel of critiques who expressed their observations and gave recommendations to the authors for them to improve their research papers during the 5th Marina G. Dayrit Lecture Series and Research Colloquium, wherein, the top three papers in this issue were presented. Authors of these research papers received the Best Research Award for 2019 sponsored by PAARL through a grant from CE-Logic, Incorporated. Moreover, a cash incentive of P5,000.00 is offered to the author(s) whose research papers were accepted for publication in this issue of the PRJ.

This PRJ issue is a testament to the continuous efforts of the PAARL Board of Directors to help our colleagues in the profession to develop a culture of research and increase the research outputs of Filipino academic librarians.

The following articles comprise the 2019 issue of the PRJ:

1. Design and Implementation of EMRC Web-Based Portal by Geraldine G. Mallo-Eustaquio. This case study presents the design and implementation of the Manuel S. Enverga University Foundation's Educational Media Resource Center's (EMRC) web-based portal using Rapid Application Development Model.

Ms. Mallo-Eustaquio's paper won the 2019 PAARL Best Research Award.

2. OPAC Access and Usage Data Analysis using an Open Source Web Analytics Software by Ma. Celine Larracas and Dr. Fernan R. Dizon. This study presents the implementation and use of an open source, web analytics software in analyzing access and search data of an open source, integrated library system's (ILS) online public access catalog (OPAC) to guide the collection development priorities of the Asian Institute of Management's Knowledge Resource Center (AIM-KRC). Data collected from its OPAC (Koha) using a web analytic tool (Matomo) provided helpful insights necessary for informed decision making as far as library collection development is concerned.

## *Ms. Laraccas and Dr. Dizon's paper received the Second-Best Research Award.*

3. Understanding the Patterns of Library Usage and Collection Usage among undergraduate Students of N.U. – Manila. A Machine Learning Approach by Editha A. Alamodin, Mideth B. Abisado, Ramon L. Rodriguez, and Bernie S. Fabito. This study presented the library usage and collection usage among National University undergraduate students through manually collected library usage statistics, system-generated data from Follett's Destiny Library Manager (DLM) for the book collection usage, and ProQuest Usage for electronic journal databases. Based on the generated data, patterns of library usage and collection usage were identified, specifically: (1) the relationship of library collection usage vis-à-vis student degree program; (2) library usage trends in terms of academic month; and (3) sufficiency of library collection.

## Ms. Alamodin and her colleagues' paper received the Third Best Research Award.

4. Initiatives in Organizing and Managing Electronic Resources in an Academic Library in Southern Philippines by Abubakar S. Mama and Amer Hassan U. Sarangani. This research paper aims to describe, explore, and explain the various practices/initiatives of the Mindanao State University librarians and library staff in organizing and managing the e-resources. Specifically, this paper deals with the step-by-step electronic processing of the e-resources by exploring the needed software that will automate the entire process. The selection of the e-resources is restricted to support and reflect the curricular offerings of the parent institution which entails the identification of the needed e-resources, strategizing methods and tools to manage the data at hand, and finally, creating access mechanisms for the usage and dissemination of the available e-resources.

On behalf of the 2019 PAARL Board of Directors, I would like to acknowledge:

• The faculty members of the NU-CEAS, headed by their Dean, Dr. Jessie S. Barrot, for helping us in reviewing the submitted articles in this issue and for

serving as panel of critics during the presentation of selected papers for the Best Research Award;

- CE-Logic, Inc. for their continuing support to advance PAARL's research initiatives and projects.
- The members of the PAARL Editorial Team, Dr. Maria Gia G. Gamolo, Engracia S. Santos, and Ms. Judeelyn S. Bundoc for helping me evaluate and proof-read the submitted papers for this issue; and
- The members of the 2019 Board of Directors for their dedication and hard work.

Mabuhay ang PAARL!

DR. FERNAN R. DIZON Editor-in-Chief

#### DESIGN AND IMPLEMENTATION OF EMRC WEB-BASED PORTAL

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#### ABSTRACT

**Purpose/Objectives.** The library's primary purpose is to address the needs and demands of its patrons. With the sprout of information and communication technology (ICT), the demands and needs of library patrons have inflated along with the change and innovation brought by ICT. Library patron's inclination to use web search engines cannot be taken for granted by libraries as this becomes the trend in the search for knowledge. As one of the goals of a library is to provide the best library services, it is also its responsibility to take effort to handle and document data accurately for the purpose of retrieving precise information. To be able to give the best library service to the users, libraries as a repository of information must provide ways and methods on the delivery of information accurately, precisely, and effectively.

In support of the objectives, the researcher designed and implemented an EMRC webbased portal which innovates the current manual system of the EMRC. The following are the specific objectives of the project: (1) to provide a user-friendly, manageable and efficient platform for the online availment and reservation system and communication medium capacitated for the delivery/access of/to accurate information and other library services; (2) identify and realize user experience in utilizing a web-based portal; (3) obtain concrete/factual data of the processes/procedures of designing and implementation of the EMRC web-based portal.

**Significance of the study.** This research supports the use of web portal in libraries for access and retrieval of information. It specifically provides MSEUF University libraries a web portal addressing the needs of the library staff and patrons at the Educational Media Resource Center (EMRC). This also reinforces collaboration among the librarians and IT personnel with regards to the designing and implementation of the proposed web-based portal. The findings of the research can also be a basis for future developments and improvements in the library services of MSEUF.

**Design, methodology, approach.** This research is a case study which used Rapid Application Development for the design and implementation of the EMRC Webbased Portal. RAD is a team-based technique that speeds up information systems development and produces a functioning information system. RAD was the

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methodology used to describe the systematic approach of the development. The web portal was developed using programming platforms such as HTML, CSS, JavaScript, and PHP for the frontend of the system and MySQL was used for its database. The model of the web portal was designed using the Unified Modeling Language (UML) which includes use-case diagram and activity diagram. The EMRC web-based portal was tested and evaluated through a checklist type questionnaire based on the criteria of ISO 25010:2011. Purposive sampling technique was used to access a particular population who evaluated the EMRC web-based portal. Data were interpreted using the percentage analysis and weighted mean to indicate whether the proposed system complies with the software characteristic standard of ISO 25010:2011.

**Findings.** The design of the EMRC web-based portal addressed the needs of the Educational Media Resource Center as it produced a functional, capable, and effective portal promoting accurate storage, access, and retrieval of information. With the use of ISO standard 25010:2011, the result of the evaluation clearly revealed areas for improvement of the EMRC web-based portal. The result of the testing and evaluation of the system revealed the prominent category of the EMRC web-based portal was the security of the system with the weighted mean of 4.83, followed by the functional suitability with the weighted mean of 4.79, maintainability and portability with the weighted mean of 4.77, reliability ranked sixth with the weighted mean of 4.75, performance efficiency ranked seventh with the weighted mean of 4.67. Findings predicted future development and improvements of the portal necessary in upgrading and advancement of the services of the EMRC.

**Originality of the paper:** This research work is a product of the author's ideas and concepts with the help and inputs of a programmer. All references were properly cited. Methods were properly documented and had not manipulated any data.

**Keywords:** web portal, library web-based portal, audiovisual management system, library system, ICT

#### **INTRODUCTION**

The avenue of change cascading in our society and the academe is in no moderation. Rubin (2004) stressed that libraries and librarians confront destabilizing factors such as the flood of information, constant innovation in technology, economic demands, political demands, stresses, and social problems. We are living in a society where there is overlapping information and technology is progressing from time to time. The prominence of information and communication technology (ICT) has brought a lot of change in the library profession and it opened a lot of opportunities as well. As ICT thrives, it also ventures in enhancing and advancing library services. With these technologies data documentation has become easy for libraries as information systems support the advancement of library services. Librarians provide bibliographic data of books and other library materials to easily access any collection in a library management system.

Learners in today's generation involve the digital natives and digital migrants who consider search and retrieval of information more on the internet than in a manual system or a traditional library environment. Their search for knowledge is unending. Henceforth, librarians must provide services congruent to the demands of its users. A library as part of a learning community plays a vital role in a student's academic development and that it has to offer services that are up to date and crucial in this computer era. Service (De Grandbois, 2016) involves the deployment of knowledge, skills, and competencies that one person or organization does for the benefit of the other. Library services are the way to deliver information to its patrons. It is essential to revisit library services for the purpose of knowing the lapses and enhancing the services and methods of information delivery based on the needs and demands of patrons.

One of the advanced library services brought by the wave of ICT is the expediency of a library web portal. A library's collection, equipment and facilities are the ones being utilized by library patrons. Remotely, all these library features can be accessed through a library portal. Many libraries today provide library web portal to serve its patrons better. Libraries would want to help and provide library services to its patrons anywhere and anytime. This practice is a great advantage for the library patrons as it is their world today. Therefore, libraries must adapt and respond to the complexity of the information needs of the clientele and the advances of technology.

With the inevitable presence of information and communication technology (ICT), the demands and needs of library patrons have inflated along with the change and innovation ICT has brought. Everyone searches Google and web search engines generally because doing so is quick, easy, and convenient and they are good at retrieving relevant information (Markey, 2015). Library patron's inclination to use web search engines cannot be taken for granted by libraries as this becomes the trend in the search for knowledge.

#### **Research objectives**

One of the goals of the library is to provide the best library services as much as possible. The library patron's needs are always the primary concern of a library. To keep phase with the unescapable change brought by ICT and to rule out erroneous information, libraries must provide platforms where accurate information can be stored, accessed, and retrieved. In support of this, this research designed and implemented the EMRC web-based portal which innovates the current manual system of the EMRC.

The following are the specific objectives of the research/project:

- 1. Provide a user-friendly, manageable, and efficient platform for the online availment and reservation system and communication medium capacitated for the delivery/access of/to accurate information and other library services.
- 2. Identify and realize user experience in utilizing a web-based portal.
- 3. Obtain concrete/factual data of the processes/procedures of designing and implementation of the ERMC web-based portal.

#### LITERATURE REVIEW

The following are studies and literatures about library portal information system design that helped the researcher in conceptualizing the EMRC web-based portal. The challenges of the existing systems were gathered, analyzed, and considered in this project.

#### Web Portal and Libraries

Prajapati (2015) stated that the function of libraries is to acquire, organize, offer for use and preserve publicly available material irrespective of the form in which it is packaged in such a way that, when it is needed, it can be found and put in to use. Today, with the availability of ICT, libraries and information centers took advantage of its benefits. Most libraries had and created its web portal showcasing valued data and information and library services. The web portal is defined as a web page that has links and expedient information and is an entry point to the Web; it typically include a search engine, daily headlines, a subject directory, and other items of interest (Stair & Reynolds, 2016). Stakeholders have access to these web portals, and they can acquire information remotely. Web 2.0 offered new service models, methods and technologies that can be adapted to improve library services (Ankuya, 2015). The present state of library worldwide is that it has access to available "intelligent systems" that provide

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transparent, one-step searching and access to various library in-house and remote databases (Mratinkovic, Piestun, Fouda, Killings, & El Hajj, 2017). Henceforth, the web portal is indeed one of the most used advances of ICT in libraries and information centers. Library web portal has become salient in delivering information and services to patrons. The World Wide Web has become the most prominent tool for information search, but libraries are where valid data can be found. By providing an EMRC web portal in the library, the author believes that the services of the EMRC will be fully utilized supporting the teaching-learning process and that the users will become more satisfied in their quest for information.

#### **Library Portal**

A study on library portal by Letha (2006), discussed the importance of having a library portal to facilitate the use of e-resources to its maximum extent. It was stated that a well-defined mechanism is needed to organise, store, and access information. A library portal is highly beneficial for web-enabled information services. The web portal is the tool or gateway to remotely access various e-resources of a library. This study justified the value of web portal.

Konnur & Kacherki (n.d.) supports the notion of Letha in their study entitled Library Portal: Role of Librarian. This study revealed that patrons want information regardless of where they find it. They do not limit themselves to their library's collection. It was also stated that a portal offers patron's one-stop shopping that takes them from the initial need for information through its delivery without having to use several different tools. A portal if well designed provides effective navigation of complex, multiple collections. It was said that over the past decade, academic librarians have been evaluators, selectors, and organizers of information on the web, therefore, librarian's experience and expertise make them valuable players in a team approach in planning and implementing library portals. The interactive service such as "Ask a Librarian" was mentioned that can make request assistance simple and convenient by connecting web users directly to librarians.

Additionally, the historical development of library portal and the role of the librarian in developing significant library portal were highlighted in the study of Mane and Pange (2014). It was concluded that a library portal is an art and science of the usage and application of library knowledge for decisions as well as research purposes which will in turn support education system. Portal technology is very significant and is both an opportunity and a threat to the library. The use of Library card system was replaced by Online Public Access Catalogue (OPAC) which is further developed as Web-OPAC, and afterwards transformed into Library Portals. Library Portal plays significant role in the advancement of the education system. It is meant to turn a nascent mind into a well-developed, talented mind. Well-developed mind means the capability of creating

new ideas and theories and its application in the challenging world. It was emphasized that in this social networking era, to fulfil the ever increasing requirements of users in a most efficient manner, there is a need for every library to provide its services and collection through an easy interface by developing a library portal.

Mane and Pange conducted another study entitled "University Library Portal An Effective Knowledge Management Tool: A Case Study of Savitribai Phule Pune University" in 2015. This study investigated the students' perceptions of using University Library Portal as a Knowledge Management tool. This introduced the relationships between University Library portal and knowledge management practices. It was revealed that all the respondents are very much interested to use the University Library portal and quite good number of respondents are regular users. A recommendation was made which stated that the Library professional working in university libraries should create awareness about the potential of the university library portal and its use among the users by conducting programmes, such as orientation programmes, demonstrations, workshops, seminars and through notices pamphlets. The study also revealed that the respondents need personalization in the available portal to convert it into a knowledge management tool. Furthermore, it was found out that majority of the respondents are eager to create, share, store and utilize knowledge on the University library portal.

Pertaining with the use of web portal, a short paper entitled Computer Self-Efficacy and Its Relationship with Web Portal Usage: Evidence from the University of the East (Bringula, Sarmiento, & Basa, 2017) was studied. It revealed that there is a low usage of the faculty web portal and that it is quite surprising considering that the portal shows its functionality, availability, and accessibility of its services and digital library resources. The author stated that the reasons behind could be that they got used to the same materials that they have been using every semester. Hence, their attitude towards the use of the web portal may not be favorable. These findings are attributed to the nature of the web portal services. Thus, it is concluded that the use of one element of the web portal can be influenced by one set of distinct factors.

Brantley, Armstrong, & Lewis (2006) conducted a study entitled Usability Testing of a Customizable Library Web Portal which provides this study of what to offer in the EMRC Web-Portal to become usable to its users. It was concluded that Librarians must label resources using common language, even at the risk of incomplete or slightly inaccurate descriptions. It was also mentioned in this study that users frequently misunderstand how libraries organize information if they have not had library instruction. It was emphasized that the My Chicago Library navigation needs to conform to common Web features by including shorter pages or making page sections easily accessible using anchors. The authors suggested that designers should value clarity of visual layout and minimize textual explanations in future iterations of the portal.

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Further study on the on web portal entitled LibPortal Project: Access to Library Provided Resources: A Survey and Review of Library-orientated Portals in Higher and Further Education (LISU, 2004) was also considered as support in this project. It was stated that both Higher Education (HE) and Further Education (FE) saw the main benefits of a 'portal' as promoting the library's resources more effectively, offering a single point of access and delivering library services more efficiently. The most popular services to which the library portals provide access were the library catalogue, electronic databases, and electronic journals, with 97% of HE providing this facility. Links to websites providing information relevant to the curriculum rated highly for both HE and FE.

#### Information System Design

A research project entitled a Web Portal Architectural Design and Implementation for Private Universities in Nigeria by Ofoegbu, Fayemiwo, Omisore & Olanrewaju (2014) was considered as a guide for the researcher's project. The project used the waterfall model as its methodology. MySQL is the database used while PHP is its scripting language. To design the portal, the UML Modeling tool such as Data Flow Diagram and Use Case Diagram was used. The portal was implemented to achieve specific objectives such as controlling educational processes, providing access to educational resources, storing user details and information, ensuring security and data integrity, providing a user-friendly environment for users and confidentiality.

Another project study conducted entitled Development of Southern Luzon University Digital Library of Thesis and Dissertation (Danganan, 2016) was utilized as reference to make this project. This study used the ISO standard 25010:2011 for testing and evaluation of the system. It used the UML Modeling to document the system's design specification while MySQL was used as its database and PHP for scripting language.

Additionally, a project study entitled Design and Development of an E-Learning Portal (Salvatierra, 2010) which become salient in the design and implementation of the EMRC Web-Based Portal. This study also used the ISO standard 25010:2011 to test and evaluate the system. The research project showed that the e-learning portal is very valuable for educators as an alternative supplementary teaching-learning medium. It was stated that through the e-learning portal, difficulties of teachers and learners who were not in the same geographic location was resolved. The idea of the research project can also predict the value of web portals in libraries as a supplementary in providing information remotely.

#### METHODOLOGY

The research focused on the design and implementation of an EMRC web-based portal. According to Satzinger (2016), systems analysis describes in detail what a system must do to satisfy the need or solve the problem while systems design describes in detail how information system will actually be implemented to provide the needed solution.

Case study method was used which involves quantitative and qualitative method and used Rapid Application Development for the design and implementation of the EMRC Web-based Portal. RAD model as shown in figure 1, is a team-based technique that speeds up information systems development and produces a functioning information system. It is utilized to help manage large predictive projects with less formality and requires less documentation and fewer status and review meetings (Satzinger, Jackson, & Burd, 2016). RAD focuses on gathering customer requirements through workshops or focus groups, early testing of the prototypes by the customer using iterative concept, reuse of the existing prototypes (components), continuous integration and rapid delivery (SDLC RAD Model, 2018).



Figure 1. Project framework based on RAD.

It is a part of the iterative environment of the RAD model that the system will be tested which then can address issues that affect the system before it will be shown or utilized by the clients. Web testing as defined is the name given to software testing that focuses on testing web application (Web Application Testing, 2012).

The EMRC web-based portal was tested and evaluated through a checklist type questionnaire based on the criteria of ISO 25010:2011. The eight quality characteristics of ISO 25010:2011 used are as follows:

*Functional suitability.* This characteristic represents the degree to which a product or system provides functions that meet stated and implied needs when used under specified conditions.

*Performance efficiency.* This characteristic represents the performance relative to the number of resources used under stated conditions.

*Compatibility.* The degree to which a product, system or component can exchange information with other products, systems, or components, and or perform its required functions while sharing the same hardware or software environment.

*Usability.* The degree to which a product or system can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use.

*Reliability.* The degree to which a system, product or component performs specific functions under specified conditions for a specified period.

*Security.* The degree to which a product or system protects information and data so that persons or other products or systems have the degree of data access appropriate to their types and levels of authorization.

*Maintainability.* This characteristic represents the degree of effectiveness and efficiency with which a product or system can be modified to improve it, correct it, or adapt it to changes in the environment, and in requirements.

*Portability.* The degree of effectiveness and efficiency with which a system, product or component can be transferred from one hardware, software or other operational or usage environment to another (ISO/IEC 25010, 2011).

The purposive sampling technique was used to access a population who evaluated the EMRC web-based portal. The statistical treatments used in this project are the percentage and weighted mean to indicate whether the proposed system complies with the software characteristic standard of ISO 25010:2011.

#### FINDINGS AND DISCUSSION

The author studied and analyzed the existing procedure of the EMRC to find the most effective solution in creating the EMRC web portal. It first determined the needs or conditions, data, variables, and conditions of the EMRC to create the web portal. The author investigated the status of the EMRC services of the University Libraries

of MSEUF through observation and ocular inspection. From the investigation the researcher defined the problems in the unit as well as the opportunities that served as baseline data that was used in this research/project. Analysis of the current system was made for the purpose of uncovering the strength and weaknesses of the EMRC and so to identify the variables needed in the new system to meet the needs of the patrons and the EMRC. From this, the project researcher defined the system requirements that determined how the new system must work for the benefit of both the user and the EMRC personnel.

#### I. Requirement Analysis

The following details are gathered by the author on how the current services and procedure are being held and delivered to library patrons at the EMRC.

#### Overview of the Educational Media Resource Center

Manuel S. Enverga University Foundation has its Educational Media Resource Center (EMRC) a unit of the University Libraries which houses the audio-visual collection and equipment and manages the reservation and use of function rooms. There are five staff in the EMRC who simultaneously manage and supervise the function rooms and address the needs of the utilizing patrons.

#### EMRC Services:

Audio-Visual Services. The Center houses a great number of audio-visual materials, including CDs, VCDs, and DVDs pertaining to different subject areas that act as supporting aid in the teaching-learning process in the University. These are the collection of purchased and donated materials exclusively for the use of administrators, faculty, non-teaching employees and students for a better and holistic learning process. The EMRC function rooms are built with equipment used to view and listen all kinds of audio-visual materials. The audio-visual collection of the EMRC is arranged and organized according to an in-house scheme. These AV collections are kept and recorded in the Follett CirCat library system which is not web-based and can be searched on the OPAC stations provided inside the library.

Photo and Video Services. EMRC acts as the support unit of the University in the documentation of various activities that are happening throughout the school year. It has equipment for photo and video coverage to document the annual events, seminars, and functions held in the University. Some of these activities include the Faculty-Employees Congress, baccalaureate services, commencement exercises and the annual MSEUF Foundation Celebration. Multimedia Services. The Center with its various function rooms is equipped with multimedia projectors, LCD, TVs and laptops and sound system to be used for PowerPoint presentations, reports, discussions, and seminars held within its premises. The Center continues to develop the rooms and purchase equipment to greatly support and create a more interactive teaching-learning environment.

Function Room Services. The EMRC has six (6) function rooms with one big multifunction hall convertible to three classroom-type and one (1) little theatre. The function rooms are fully air-conditioned with 30-80 seating capacity equipped with multimedia equipment, LCD TV, and sound system. It is a function room used for seminars, and technology-aided learning process enhancing and creating a better interactive class.

Viewing and Listening Services. Aside from the different function rooms, the Center has its own mini viewing and listening area located at the EMRC Office. The viewing area is used for film viewing and audio listening of students for a maximum of six students.

Dubbing Services. The Dubbing services are available for audio recording and narration of video presentations, movie making and promotional video editing.

#### EMRC Procedure:

Availment and Reservation of Services

All bona fide students currently enrolled at the University, academic, academic support and non-academic personnel and administrators, and accredited organizations can use the EMRC function rooms.

Manual reservation of collection and services are fully implemented at the EMRC. Function rooms' availability can be viewed/observed/known, only by visiting and checking of the facility at the EMRC office's record calendar.

As of the moment, MSEUF has a population of eight thousand students in the college and graduate program. The current services of the EMRC are operational, but with the presence and application of ICT, these services can become more advanced and efficient to its patrons.

#### II. Design of the System

One of the salient factors in this project is the design. The following are the aspects of the design of the EMRC web-based portal.

System Environment and Description

The EMRC Web-Based Portal would serve as an information tool that provides users access to EMRC information and services remotely. This portal as web application, took advantage of the web technologies which offers pervasive and ubiquitous system to EMRC library users. The system was developed in PHP (Hypertext Preprocessor) and MySQL was its database. This system is designed to run in different web browsers (Internet Explorer, Google Chrome etc.).

The EMRC Web-Based Portal has two user modules: (1) Modules for the administrator: EMRC components, circulation, reservation, inquiries and setting; and (2) Web Portal Dashboard for Library Patrons: OPAC, Reservation and Inquiries. It has the following functionalities:

- In visualizing the design of this project, the proponent used the Unified Modeling Language (UML) for constructing the following: use-case diagram and activity diagrams illustrated the functions and routines of the system.
- EMRC web-based portal's functional descriptions were: (a) web OPAC, (b) online reservation of collection, (c) facility and equipment, (d) and the online inquiry and assistance.
- Frontend and backend were coded based from the programming platforms and coding standards: PHP, JavaScript, CSS, and HTML.
- Database schema includes data collected: patron's information, audiovisual collection information, and the EMRC services information.
- Physical design provisioned the specifications for hardware requirements such as: a storage or server for data, web host for the remote access, internet provider, a local area network as well as wide area network to support the online and offline systems and information technology equipment like desktop computers.
- It was deployed using a cutover method where manual pen and paper system was replaced by the web-based portal. Data encoding were done to facilitate data entry.
- The web-based portal was tested and evaluated through a checklist type questionnaire based on the criteria of ISO 25010:2011.

#### Design Models

To visualize the design of this project, the proponent used the UML in the creation of the EMRC web-based portal. Among the UML diagrams used were usecase diagram and activity diagram which illustrated the functions and routines of the system.

#### 1. Use Case Diagram



Figure 2. Use case diagram of the EMRC Web-Based Portal

Figure 2 illustrates the use case diagram of the EMRC Web-Based Portal of MSEUF Libraries. As shown in the use case diagram, the system is composed of twenty-five (25) use cases. The web portal used two actors: the first actor is represented by EMRC staff or librarian and the second actor is represented either by a student, faculty, or researcher. The login use case for the EMRC Staff or librarian determines and validates the authorized administrator of the system while the logout use case enables the administrator to log out of the system so the session will stop. In dashboard/module's use case, the administrator can access the EMRC components which include cataloging, editing and deleting of AV collection, equipment, patron and MARC tag; circulation which has the check-in and check-out process of AV material; reservation that can process the approval and rejection of reservation of EMRC facility and equipment; inquiries where administrator can respond to user's inquiry and the setting where administrator can add, edit and delete additional administrator as well as edit its

access and function to the system. Login and logout use cases was also provided for the access of student/faculty/researcher to the web portal's dashboard. The user can view and search information in the OPAC, reserve collection, facility and equipment in the reservation and inquire and ask for assistance in the inquiries.

#### 2. Activity Diagram

To further describe the use case diagram of the web portal, the activity diagrams were provided to illustrate each use case activity. An activity diagram describes dynamic aspects of the system showing the procedural flow of control between classes while processing an activity. It is basically a flowchart to represent the flow from one activity to another activity. An activity diagram is best used to model high-level processes because activity diagrams are less technical in appearance to sequence diagrams (Bell, 2003). The following are some of the activity diagrams drawn for this research.

#### Database Design

A relational database was designed to store and document all the data required in the audiovisual management system and the online availment and reservation of EMRC services. Data collected are the patron's information, audiovisual collection information, and the EMRC services information.

- 1. Library Patron Information/Data: wherein the EMRC personnel can do addition/updating/deletion of a patron. Data includes patron's last name, first name, middle name, gender, birth date, address, email, course, department, student no., telephone number and photo. The system's admin provides the username and password of the patron.
- 2. Audiovisual Collection Information/Data: wherein the EMRC personnel can do addition/updating/deletion of a collection. Data includes the bibliographic data such as barcode no., date encoded, LCCN, ISBN, cataloguing source, main entry, title, subtitle, responsibility, publication, physical description, subject and others. A table for marc tags is provided which is assigned by the librarian.
- 3. EMRC Services Information/Data: wherein the EMRC personnel can do addition/updating/deletion of EMRC services. All input data made from the patron's online reservation will be recorded in this component. Table for equipment includes data such as equipment photo, name, type, price, quantity, availability, date acquired and specification.

All tables included in the database are shown in Figure 4.



Figure 3. Activity diagrams of the EMRC Web-Based Portal.





Figure 4. Database of the EMRC web-based portal

#### **III. Functional Description**

The EMRC web-based portal offers library patrons access to the EMRC's catalog of the collection, online reservation of function room and equipment as well as online inquiry with the EMRC personnel. Library patrons can already view the availability of a function room and equipment wherever they are. The availability of Online Public Access Catalog benefited library patrons as they can see EMRC collection anytime, whenever their need arises. Also, there was created a medium to communicate with the EMRC personnel. The functionalities of the EMRC web-based portal are divided into two, the dashboard for the EMRC staff and the dashboard for the library patrons. Both have log-in and log-out structure to ensure the authenticity of the user. Search box for finding an audiovisual collection is offered which is accessible by library patrons and outside users. Web pages are services page which includes equipment viewing page and function room viewing page, about page, inquiry page and contact page. EMRC staff and library patron can have their conversation on the inquiry page. The EMRC staff as admin of the system can add/edit/update/delete a library patron, AV material and equipment in his dashboard. He can also approve/revise/disapprove a reservation and process the transaction for circulating an AV material.

1. Online Public Access Catalog (OPAC)

The EMRC web-based portal provides a web OPAC (Online Public Access Catalog) which is defined as an online bibliography of a library collection that is available to the public (Rouse, 2011). The library patron can view the collection's call number, barcode, accession number, title, author, publisher, copyright date, status (available/not available), description (whether a collection is a CD, VCD or a DVD), subjects and shelf number. These records will provide library patrons the information on the collection of the

EMRC. In this way, the library patrons are more informed with the available collections in the EMRC anywhere they are and anytime. There is an ease on the retrieval of the collection on the part of the EMRC personnel. A search box was provided to do a basic search and advanced search on subject, title, author, and call number. Upon searching for a subject, title, author or call number, materials can already be viewed in list and a selected AV material is displayed with its full MARC record.

2. Online Reservation of Collection, Facility, and Equipment

An online reservation of collection, facility and equipment is one of the features of the EMRC web-based portal. An EMRC Reservation page was provided. It is a page wherein library patron can view the calendar of reserved function rooms of the EMRC. Upon viewing of the calendar, the library patron can fill-up an online form to reserve a facility and provide the list of requested equipment. It can be approved online by the EMRC personnel within the day from 8:00 in the morning until 8:00 in the evening. For immediate response, the library patron can message the EMRC personnel with the provided medium for online communication.

3. EMRC Online Inquiry and Assistance

The EMRC web-based portal offers online inquiry and assistance. The medium of communication is an online chat with the EMRC personnel. Synchronous messaging happens within the EMRC's office hours. Library patrons can still message the EMRC personnel even offline. Messages can be viewed by the EMRC personnel the following during office hours.

#### **IV.** Physical Design

1. Network Topology

The EMRC web-based portal used a computer server for the storage of data which is found at the server-room of the University Libraries. The web portal is accessible inside the network infrastructure of the University. The University Libraries should acquire a web hosting technology for the remote access of the EMRC web-based portal. For information technology equipment, computers are available at the library to access the system. Personal computers of library patrons can also be used for remote access of the web portal.





Figure 5. EMRC Web-Based Portal Network Map

2. Hardware Requirements

The database will be installed in the server of the University Libraries. The computer server has the following specifications:

- 8 gigabytes of memory
- 2 terabytes hard disk drive
- Intel Core i3 Processor
- Monitor
- Keyboard
- Mouse
- Windows 10 (Operating System)

To access the EMRC web-based portal, the library user's device must at least have the following specifications for their personal computer:

- 2 gigabytes of memory
- 500 gigabytes hard disk drive
- Core i3 Processor or other equivalent processor
- Operating system with installed web browser of any kind
- Monitor
- Keyboard
- Mouse
- 3. User Interface

With the design of the EMRC web-based portal, it was able to

1. Provide a user-friendly and easy to manage system to view the

information/data of the EMRC collection through the web-based online public access catalog

- 2. Provide an efficient online availment and reservation system for EMRC services that helps EMRC personnel in delivering its services specifically through an AV management system and,
- 3. Utilize a manageable web-based portal that serves as a communication medium for both the patrons and EMRC personnel.

The following are some of the user interface pages of the EMRC Web-Based Portal.

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Figure 6. User interface of the EMRC Web-based portal

#### V. Testing and Evaluation

After the EMRC web-based portal was developed, a software evaluation tested the system's effectiveness and capability through the checklist type questionnaire based on the criteria of ISO 25010:2011 with eight quality characteristics such as functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability and portability. The library and EMC staff, faculty and students were the respondents in answering the acceptability and evaluation of the web portal.

Purposive sampling was used in selecting the respondents of the evaluation of the web portal. There were 80 respondents who helped the project researcher determine the acceptability, effectiveness and capability of the web portal based on the standards of ISO 25010:2011. Fifteen (15) or 18.75% of the respondents were library staff, fifteen (15) or 18.75% were faculty and fifty (50) or 62.5% were students. The average results were presented in graphs on each sub-characteristic of the eight categories.

	Statement		Interpretation	Weighted Mean	Rank
1. The EMR in addressing to get the rec reserve a faci a medium to personnel in	C Web-Based Portal is s g the needs of library use cord of EMRC collectio lity and equipment as w communicate with EM an online environment	suitable ers on, vell as IRC	Strongly agree	4.88	1
2. The EMRC Web-Based Portal gives correct/accurate data or information.		Strongly agree	4.74	3	
3. The EMR appropriate	3. The EMRC Web-Based Portal is appropriate for its use/purpose.		Strongly agree	4.75	2
Total Weighted Mean		Strongly agree	4.79		
Legend:	4.20 - 5.00 $3.40 - 4.19$ $2.60 - 3.39$ $1.80 - 2.59$ $1.00 - 1.79$	Strongly Agree Fairly A Agree Strongly	y Agree gree y Disagree		

Table 1. Respondents' evaluation on the functional suitability of the EMRC webbased portal

Table 1 displays the level of acceptability of the EMRC web-based portal in terms of functional suitability. It is indicated that statement number 1 which states the suitability of the system has the highest weighted mean of 4.88, third statement which state the appropriateness of the web portal ranked number 2 with the weighted mean of

4.75 and the lowest ranked was statement number 2 which states the appropriateness of the system with the weighted mean of 4.74. All the criteria in the functional suitability of the system were interpreted as "strongly agree" with the section mean of 4.79, which means that the EMRC web-based portal was evaluated favorably by the respondents in this category.

Table 2	2. Respondents'	evaluation	on the	performance	efficiency	of the	EMRC	web-
based j	oortal			-				

Statement	Interpretation	Weighted Mean	Rank
1. The EMRC Web-Based Portal displays data in real time.	Strongly agree	4.71	3
2. The EMRC Web-Based Portal displays data/information efficiently.	Strongly agree	4.78	1.5
3. The EMRC Web-Based Portal ably does the online reservation of facilities and equipment as well as the promising online inquiry and assistance with EMRC personnel.	Strongly agree	4.69	4
4. The EMRC Web-Based Portal's parameter meets requirements and does not hang or crash.	Strongly agree	4.78	1.5
Total Weighted Mean	Strongly agree	4.74	
Legend: 4.20 - 5.00 Strong 3.40 - 4.19 Agree 2.60 - 3.39 Fairly 1.80 - 2.59 Agree 1.00 - 1.79 Strong	yly Agree Agree rly Disagree		

Table 2 shows the performance efficiency of the EMRC web-based portal according to the respondents' evaluation. Statement number 2 which says that the web portal displays data in real time and statement number 4 which states the efficiency of the web portal in displaying information ranked first with the weighted mean of 4.78, followed by statement number 1 with the weighted mean of 4.71 and statement number 4 ranked least with the weighted mean of 4.69. As shown in the table, it can be depicted that the respondents strongly agreed to the performance efficiency of the EMRC web-based portal.

	Statement		Interpretation	Weighted Mean	Rank
1. The EMRC Web-Based Portal runs in different devices/operating systems.		Strongly agree	4.73	1	
2. The EMP operates wit	2. The EMRC Web-Based Portal interacts/ operates with different devices well enough.		Strongly agree	4.61	2
Total Weig	hted Mean		Strongly agree	4.67	
Legend:	4.20 - 5.00	Strongly	y Agree		
	3.40 - 4.19	Agree			
	2.60 - 3.39	Fairly A	gree		
	1.80 - 2.59	Agree	-		
	1.00 – 1.79	Strongly	y Disagree		

Table 3. Respondents' evaluation on the compatibility of the EMRC web-based portal

Table 3 indicates the compatibility of the EMRC web-based portal according to the respondents' evaluation. Statement number 1 has the weighted mean of 4.73 which ranked first while statement number 2 was ranked 2nd with the weighted mean of 4.61. As for the compatibility of the portal, it described that the respondents strongly agreed to the compatibility of the system with the section mean of 4.67.

Table 4. Respondents'	evaluation on the usabilit	y of the EMRC web-based	portal
		/	

Statement	Interpretation	Weighted Mean	Rank
1. The EMRC Web-Based Portal is suitable to the needs of library users.	Strongly agree	4.74	5
2. The EMRC Web-Based Portal is easy to use and operate in a simple manner and can be learned even without technical expertise.	Strongly agree	4.63	6
3. The EMRC Web-Based Portal's features can be easily understood and operated.	Strongly agree	4.79	3.5
4. The EMRC Web-Based Portal has selection and suggestion features/button to avoid errors from library users.	Strongly agree	4.79	3.5
5. The EMRC Web-Based Portal's user interface is pleasing and enables satisfying interaction for library users.	Strongly agree	4.83	2

	Statement		Interpretation	Weighted Mean	Rank
6. The EMRC friendly and co	Web-Based Portal is provenient to use.	s user	Strongly agree	4.86	1
Total Weight	ed Mean		Strongly agree	<b>4.</b> 77	
Legend:	4.20 - 5.00 $3.40 - 4.19$ $2.60 - 3.39$ $1.80 - 2.59$ $1.00 - 1.79$	Strongly Agree Fairly A Agree Strongly	y Agree gree y Disagree		

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Table 4 displays the usability of the EMRC web-based portal according to the respondents' evaluation. The statement which states "the EMRC Web-Based Portal is user friendly and convenient to use" has gained rank 1 with the weighted mean of 4.86, it was followed by statement number 5 which states the pleasing interface of the web portal with the weighted mean of 4.83. Statement number 3 and number 4 ranked placed on the same rank (3.5) with the weighted mean of 4.74 is statement number 2 was on the last rank with weighted mean of 4.63. All criteria under the usability of the EMRC web-based portal was interpreted as "strongly agreed" with the section mean of 4.77. This possibly means that the system's usability was manageable to the users.

	Statement		Interpretation	Weighted Mean	Rank
1. The EMRC Web-Based Portal functions according to the needs of the library users and provides reliable information.		Strongly agree	4.84	1	
2. The EMRC available in the	2. The EMRC Web-Based Portal is available in the web anywhere, anytime.		Strongly agree	4.65	2
Total Weight	ted Mean		Strongly agree	4.75	
Legend:	$\begin{array}{r} 4.20-5.00\\ 3.40-4.19\\ 2.60-3.39\\ 1.80-2.59\\ 1.00-1.79\end{array}$	Strongl Agree Fairly A Agree Strongl	y Agree Agree y Disagree		

Table 5. Respondents' evaluation on the reliability of the EMRC web-based portal

Table 5 indicates the reliability of the EMRC web-based portal according to the respondents' evaluation. Statement number 1 which states the reliability and functionality of the system according to the needs of the users ranked 1 with the weighted mean of 4.84 while statement number that states the availability of the portal ranked 2 with the weighted mean of 4.65. The section mean for the reliability category of evaluating the system was 4.75 and was interpreted as "strongly agree".

	Statement	Interpretation	Weighted Mean	Rank
1. The EMRC can be accessed personnel.	C Web-Based Portal Admin d only by authorized	Strongly agree	4.86	1.5
2. The EMRC Web-Based Portal can only be modified by the system's programmer and the authorized library staff and not by anyone who has account to access the portal (ex. Library patron) nor any other individual outside the system		Strongly agree	4.86	1.5
3. The EMRC Web-Based Portal can be proven original and authentic.		Strongly agree	4.76	3
Total Weighted Mean		Strongly agree	4.83	
Legend:	4.20 - 5.00         Stron           3.40 - 4.19         Agree           2.60 - 3.39         Fairly           1.80 - 2.59         Agree           1.00 - 1.79         Stron	gly Agree Agree gly Disagree		

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Table 6. Respondents	evaluation	on the security	of the EMRC	web-based	portal

Table 6 shows the security of the EMRC web-based portal according to the respondents' evaluation. Statements number 1 and 2 which state the security of the web portal in terms of admin accessibility and the system's modification by the system's programmer and authorized library staff only both ranked first with the weighted mean of 4.86 and the least in rank was statement number 3 which states the originality and authenticity of the system got the weighted mean of 4.76. This category gained a section mean of 4.83 which was interpreted as strongly agreed by the respondents.

Table 7. Respondents' evaluation on the maintainability of the EMRC web-based portal

Statement	Interpretation	Weighted Mean	Rank
1. The EMRC Web-Based Portal is adaptable to the user.	Strongly agree	4.83	2

Statement	Interpretation	Weighted Mean	Rank
2. The EMRC Web-Based Portal can be updated when needs arise.	Strongly agree	4.75	4
3. The profile of the patrons and the record of collection, equipment, and function rooms can be updated/edited.	Strongly agree	4.85	1
4. The defects/conflicts of the EMRC Web-Based Portal can be easily identified and reconfigured.	Strongly agree	4.74	5
5. The full functionality of the EMRC Web-Based Portal is stable, even updates or changes in configuration are set.	Strongly agree	4.79	3
6. The EMRC Web-Based Portal performs well, effective, and can be used efficiently in full testing.	Strongly agree	4.71	6
Total Weighted Mean	Strongly agree	4.78	
Legend: 4.20 – 5.00 Strongl 3.40 – 4.19 Agree 2.60 – 3.39 Fairly A 1.80 – 2.59 Agree 1.00 – 1.79 Strongl	y Agree Agree y Disagree	<u>.</u>	

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Table 7 shows the maintainability of the EMRC web-based portal according to the respondents' evaluation. As shown in the table, statement number 3 ranked first, which states the maintainability of the portal in terms of updating the record of collection, equipment and function room with a weighted mean of 4.85, it was followed by statement number 1 which states the adaptability of the portal to the user with the weighted mean of 4.83, 3rd in rank was statement number 5 which state the maintainability of the portal in terms of performance, effectiveness and efficiency with the weighted mean of 4.79, statement number 2 which states the maintainability of the system when needs arise with the weighted mean of 4.75, and statement number 4 which states the maintainability of the system in terms of identifying and reconfiguring defects and conflicts with the weighted mean of 4.74 got the 4th and 5th rank respectively, and the least in rank was statement number 6 which state the maintainability of the system in terms of its function in full testing with the weighted mean of 4.71. All the criteria for the category of the system's maintainability came with the interpretation of "strongly agree" which gathered the section mean of 4.78.

· · · · ·		1			
	Statement		Interpretation	Weighted Mean	Rank
1. The EMRC Web-Based Portal can run in any web browser.		Strongly agree	4.76	2.5	
2. The EMRC Web-Based Portal can be replaced with more advanced system.		Strongly agree	4.81	1	
3. The EMRC Web-Based Portal can be easily accessed in the web with any form of device.		Strongly agree	4.76	2.5	
Total Weig	hted Mean		Strongly agree	4.78	
Legend:	4.20 - 5.00 $3.40 - 4.19$ $2.60 - 3.39$ $1.80 - 2.59$ $1.00 - 1.79$	Strongl Agree Fairly A Agree Strongl	y Agree Agree y Disagree		

Table 8. Respondents' evaluation on the portability of the EMRC web-based portal

Table 8 indicates the maintainability of the EMRC web-based portal according to the respondents' evaluation. It is shown in the table that the statement number 2 which states that the EMRC web-based portal can be replaced with more advanced system ranked 1 with the weighted mean of 4.81. It was followed by the 1st and 3rd statement on the same rank 2.5 with the weighted mean of 4.76. In this category of the web portal's portability, the section mean was 4.78 and interpreted as "strongly agree".

Category	Interpretation	Weighted Mean	Rank
A. Functional Suitability	Strongly agree	4.79	2
B. Performance Efficiency	Strongly agree	4.74	7
C. Compatibility	Strongly agree	4.67	8
D. Usability	Strongly agree	4.77	5
E. Reliability	Strongly agree	4.75	6
F. Security	Strongly agree	4.83	1
G. Maintainability	Strongly agree	4.78	3.5
H. Portability	Strongly agree	4.78	3.5
Total Weighted Mean	Strongly agree	4.76	

Table 9. Summary of respondents' evaluation of the EMRC web-based portal

4.20 - 5.00	Strongly Agree
3.40 - 4.19	Agree
2.60 - 3.39	Fairly Agree
1.80 - 2.59	Agree
1.00 – 1.79	Strongly Disagree
	4.20 - 5.00 3.40 - 4.19 2.60 - 3.39 1.80 - 2.59 1.00 - 1.79

Table 9 shows the summary of evaluation of the EMRC web-based portal. The table indicates that as a whole, the interpretation of the evaluation of the system was "strongly agree" with the average weighted mean of 4.76. The prominent category of the web-based portal which ranked 1 was the security of the system with the weighted mean of 4.83, followed by the functional suitability with the weighted mean of 4.79, maintainability and portability ranked third with the weighted mean of 4.78, fifth in rank was usability with the weighted mean of 4.77, reliability ranked sixth with the weighted mean of 4.74 and the least was the system's compatibility with the weighted mean of 4.67.

#### Summary of the Findings

Based on the data gathered, the following findings were derived:

- 1. The design of the EMRC web-based portal addressed the needs of the Educational Media Resource Center as it produced a functional, capable, and effective portal promoting accurate storage and retrieval of information.
- 2. With the use of ISO standard 25010:2011, the result of the evaluation clearly revealed areas for improvement of the EMRC web-based portal. The result of the testing and evaluation of the system revealed the prominent category of the EMRC web-based portal, this was the security of the system with the weighted mean of 4.83, followed by the functional suitability with the weighted mean of 4.79, maintainability and portability with the weighted mean of 4.78, usability with the weighted mean of 4.75, performance efficiency ranked seventh with the weighted mean of 4.74 and the least was the system's compatibility with the weighted mean of 4.67.
- 3. Findings predicted future development and improvements of the portal necessary in upgrading and advancement of the services of the EMRC.

#### RECOMMENDATIONS

With the results of the evaluation of the EMRC web-based portal the following recommendations were emanated:

- 1. For the University's management and the library director, they must keep on supporting the needs in maintaining and upgrading the EMRC web-based portal as the system offers great value in managing, organizing, processing, and retrieving AV collection.
- 2. For the Library Director and librarians, it is suggested that the EMRC webbased portal can be fully utilized if the portal is promoted among its users by creating instructions in the handling and use of the system in the library instruction program.
- 3. For the Library Director, Librarian and IT personnel, as mobile technology has been one of the advances of information technology, it is highly recommended to create or upgrade the EMRC web-based portal with version that could run on mobile devices.
- 4. For the University Managers and Library Director, they must keep sending EMRC staff and librarians in trainings, workshops and seminars to be able to gain knowledge and skills that will help in upgrading and advancing the EMRC web-based portal.

#### CONCLUSIONS

The following conclusions are derived from the result of this study on the evaluation of the EMRC web-based portal:

- 1. The EMRC web-based portal has provided the EMRC staff an advanced technological tool, specifically the AV management system for the data documentation, administration, and organization of the AV collection.
- 2. The EMRC web-based portal has delivered students, faculty and researcher advanced technological tool to avail and reserve EMRC functions and services and that it has provided a remote access to information with the provision of OPAC and online schedule and availment of EMRC functions and services.
- 3. The EMRC web-based portal has bridged the gap of communication between the library patron and the EMRC staff.

- 4. The EMRC web-based portal is open for future updates and development necessary for the enhancement of the EMRC services.
- 5. Updated and advanced method of delivering library services like the provision of a web portal is an advantage both for today's generation of library patrons and the library staff as this helps in fast retrieval of accurate information.

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## APPENDIX A

## **Evaluation Questionnaire**

Dear Respondents:

I am Geraldine G. Mallo-Eustaquio, conducting a research project entitled "Designing and Implementation of EMRC Web-Based Portal".

In view of this, may I request a spare of your time to test and evaluate the proposed EMRC Web-Based Portal. Your participation is highly appreciated in the accomplishment of this undertaking. Rest assured that your data will only be used for the purpose of this research project and will be dealt with confidentiality. Thank you very much.

Yours,

Geraldine G. Mallo-Eustaquio Researcher

Name (Optional):			
Affiliation to MSEUF:	<b>Student</b>	Faculty	Library Staff

Please rate the following Criteria and Description of the EMRC Web-Based Portal by placing a check ( $\checkmark$ ) on the space provided using the following scale:

# (5) Strongly Agree (4) Agree (3) Fairly Agree (2) Disagree (1) Highly Disagree

CRITERIA AND DESCRIPTION	5	4	3	2	1
A. Functional Suitability					
1. The EMRC Web-Based Portal is suitable in addressing the needs of library users to get the record of EMRC collection, reserve a facility and equipment as well as a medium to communicate with EMRC personnel in an online environment.					
2. The EMRC Web-Based Portal gives correct/accurate data or information.					

3. The EMRC Web-Based Portal is appropriate for its use/ purpose.					
B. Performance Efficiency			3	2	1
1. The EMRC Web-Based Portal displays data in real time.					
2. The EMRC Web-Based Portal displays data/information efficiently.					
3. The EMRC Web-Based Portal ably does the online reservation of facilities and equipment as well as the promising online inquiry and assistance with EMRC personnel.					
4. The EMRC Web-Based Portal's parameter meets requirements and does not hang or crash.					
C. Compatibility	5	4	3	2	1
1. The EMRC Web-Based Portal runs in different devices/ operating systems.					
2. The EMRC Web-Based Portal interacts/operates with different devices well enough.					
D. Usability	5	4	3	2	1
1. The EMRC Web-Based Portal is suitable to the needs of library users.					
2. The EMRC Web-Based Portal is easy to use and operate in a simple manner and can be learned even without technical expertise.					
3. The EMRC Web-Based Portal's features can be easily understood and operated.					
4. The EMRC Web-Based Portal has selection and suggestion features/button to avoid errors from library users.					
5. The EMRC Web-Based Portal's user interface is pleasing and enables satisfying interaction for library users.					
6. The EMRC Web-Based Portal is user friendly and convenient to use.					
E. Reliability	5	4	3	2	1
1. The EMRC Web-Based Portal functions according to the needs of the library users and provides reliable information.					

2. The EMRC Web-Based Portal is available in the web anywhere, anytime.					
F. Security	5	4	3	2	1
1. The EMRC Web-Based Portal Admin can be accessed only by authorized personnel.					
2. The EMRC Web-Based Portal can only be modified by the system's programmer and the authorized library staff and not by anyone who has account to access the portal (ex. Library patron) nor any other individual outside the system.					
3. The EMRC Web-Based Portal can be proven original and authentic.					
G. Maintainability	5	4	3	2	1
1. The EMRC Web-Based Portal is adaptable to the user.					
2. The EMRC Web-Based Portal can be updated when needs arise.					
3. The profile of the patrons and the record of collection, equipment, and function rooms can be updated/edited.					
4. The defects/conflicts of the EMRC Web-Based Portal can be easily identified and reconfigured.					
5. The full functionality of the EMRC Web-Based Portal is stable, even updates or changes in configuration are set.					
6. The EMRC Web-Based Portal performs well, effective, and can be used efficiently in full testing.					
H. Portability	5	4	3	2	1
1. The EMRC Web-Based Portal can run in any web browser.					
2. The EMRC Web-Based Portal can be replaced with more advanced system.					
3. The EMRC Web-Based Portal can be easily accessed in the web with any form of device.					

#### Geraldine G. Mallo-Eustaquio / PAARL Research Journal (2019); Vol. 6: 1-34

# OPAC ACCESS AND USAGE DATA ANALYSIS USING AN OPEN SOURCE WEB ANALYTICS SOFTWARE

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**Purpose/objectives.** This paper examines and presents a single case study of an implementation and use of an open source, web analytics software in analyzing access and search data of an open source, integrated library system's (ILS) online public access catalog (OPAC) to guide the collection development priorities of the Asian Institute of Management's Knowledge Resource Center (AIM-KRC). Data collected from its OPAC (Koha) using a web analytic tool (Matomo) provided helpful insights necessary for informed decision making as far as library collection development is concerned.

**Significance of the study.** This paper contributes to the study of open source library management systems and web analytics software as applied and used in a Philippine academic library setting. Currently, very few studies in this area have been conducted in Philippine libraries. In times when libraries' budgets are cut, libraries must find more cost-effective ways of building its collection, by using open-source software and systems. This would result in savings for libraries; savings which could be used in acquiring more library materials.

**Design, methodology, approach.** This study utilized a descriptive, research design, using case study as its main research methodology. After presenting detailed information about the case, the researchers presented the OPAC usage data collected using Matomo, an open source web analytics software, as installed and used in the case's cloud-based, Koha ILS's web server. Data extracted, presented, and analyzed covered the period September 2018 to July 2019.

**Findings.** The data collected is presented and analyzed using matrices, graphs, and infographics. To ensure alignment of the research questions, data gathering methodology, and data analysis framework, a justification matrix is provided. Aside from the justification matrix, a consistency matrix of the research findings, interpretations, conclusions, and recommendations is also presented for clarity and transparency.

**Research limitations and implication.** Since this is a single case study, the research findings of this study are limited/applicable to this case only.

**Originality of the paper:** This study is one of the very few studies conducted by a Philippine academic library on the use of an open-source web analytics software installed in an open source ILS. This study and its findings may be used as a reference and guide by academic librarians planning to embark on using open source web analytic tools in analyzing their users' OPAC access and use.

**Keywords:** OPAC Access, Usage Data Analysis, Open Source Web Analytics Software, Integrated Library Management System

### INTRODUCTION

The study of web analytics has received considerable attention due to the massive data generated over the years. These data, if mined and analyzed, could provide helpful insights for effective decision making. This prompted and picked the interest of the researchers, since very few local studies on this topic are available. This may be the first local study conducted in a Philippine academic library setting. While it is generally known that libraries have acknowledged the need to progress along with the advancement of technology, most actions taken were poured towards the improvement of library facilities and websites. Moreover, research delving on web analytics have focused on the improvement on user experience of the library website, content, design, or its effectiveness (Wei Fang, 2007; Paul, 2009; and Turner, 2010), rather than for collection development purposes. Moreover, very few local studies on either open source web analytics software and its implementation or the utilization of search keywords geared towards collection development remain elusive. Hence, the need to explore how web analytics data can be utilized and analyzed for collection development.

This study examined how the AIM-KRC integrated an open source web analytics software to an open source, integrated library management system (ILS), specifically, the analyses of collected data on OPAC access and search terms used. Specifically, this study attempted to answer the following questions: (1) How did the AIM-KRC integrate and use an open source web analytics software in its open source integrated library management system (ILS)?; and (2) What were the commonly used search terms in the Koha OPAC?

Aside from seeking answers to the above research questions, this paper also presented the features available in the open source web analytics software, Matomo, and the reports that could be generated, a necessity to libraries pursuing their objective improve collection development and user services without the shackle of budget constraints. The Site Search Keywords report generated the commonly used search terms and bore relevance to observe what users usually search in the OPAC. Through web analytics, its reports provided evidence to support library decisions such as library collection development.

### About the Case

The Asian Institute of Management (AIM) is an Asian pioneer in management education. Through a consortium of prominent business leaders, Philippine academic institutions, and the Harvard Business School, it has become the alma mater to 43,000 alumni from 80 countries and to a majority of directors to the 25 most valuable listed companies in the country ever since it was founded in 1968. The primary teaching methodology used at AIM is case method which is reflective of the Harvard Business School influence on the Institute. In case method teaching, students are given sets of business cases which they would need to study and analyze in advance. These cases will then be discussed in class and students will be expected to present their analyses and solutions of identified issues and problems.

The Knowledge Resource Center (KRC) is the official repository of AIM for teaching, learning and research materials, as well as institutional records, aside from being the intellectual hub of the Institute that provides services to meet the educational, research, information, and recreational needs of its stakeholders.

In December 2015 with the assistance of a local service provider, OnStrike Library Solutions, KRC selected Koha as its integrated library system, replacing a proprietary, locally developed ILS. In February 2018, the KRC integrated an open source web analytics software, Matomo, formerly known as Piwik into its ILS. This software tracks online visits, displays reports on these visits for analyses and report runs on a PHP/MySQL webserver. This software was developed in June 2007 by Aubry and his team (About Matomo Analytics, 2020). Currently, it has 100,000 active users, 50 translations, and used by more than 1.4 million websites in over 190 countries. The tools available for the KRC's Matomo installation include the Dashboard, Visitors, Behavior, Acquisition, Goals, and UI Framework. With their guidance, widgets for the usage reports were incorporated into the dashboard for easy access.

## **REVIEW OF RELATED LITERATURE**

#### Web Analytics

According to the Web Analytics Association (2011), "Web analytics is the measurement, collection, analysis and reporting of Internet data for the purposes of understanding and optimizing Web usage." The advantage of using web analytics is lack of need to conduct surveys or accede to inaccurate information, and the collected data is automatically accurate. Using web server logs, reports are generated from these web analytic tools to make information easier to access and use. Although web analytic tools lack the feature to predict user needs, it can still surmise their behavior that can

generate analyses to anticipate user needs. These data are essential in making decisions since it pivots the improvement of library performance. Biswas and Marchesoni (2016) have also mentioned that data analysis serves an important role in identifying collections that receive many visits, and through data usage evaluation, one can make better informed decisions taken, attracting users and serving their needs. It prevents making blind decisions, and in its stead, through using analytics, provides educated decisions. As Pesch (2004) noted, "Statistics are a measurement of users' actions that we try to correlate to their intentions", that is why web analytics interconnects with transaction log analysis, especially conducted on an Online Public Access Catalog (OPAC), since as Blecic, Bangalore, Dorsch, Henderson, Koenig, &Weller (1998) pointed out in their paper "OPAC users behind them a trail of searchers and results that provides evidence of how well they understand and use a system."

### **OPAC** Access and Usage Data Analysis

It is evident that web analytics can be used to analyze data collected with a library's OPAC. Aside from this, another source of usage data is through transaction logs of the OPAC, which collects data in an unobtrusive and anonymous manner, but still documents the text of searches and records information such as the number of results retrieved by a search or the number of database hits. Through transactional log analysis, a method that allows librarians to collect user search terms using the log files registered in the library's OPAC, it creates opportunities to reconstruct how the patron interacts with the catalog (Villén-Rueda, Senso, & Moya-Anegón, 2007). This can be conducted in an indirect way to observe the patron's actions and interaction with the system; this also provides the search results inputted by the patrons during their search process that may also determine web searcher trends (Jansen & Pooch, 2001). In reviewing OPAC transaction logs, identification of issues in the library's collection, online catalogue's interface design, etc. can be analyzed and addressed for improvements. Another vantage point to consider is using data from the analyses of OPAC transaction logs to guide the library's collection development policies and activities.

#### **Collection Development and Web Analytics**

Evans (2004) described collection development as a process that allows libraries to respond to patrons' information needs and service requirements through developing its collection. Evans and Saponaro (2005) argued that user-centered collection development can be depicted as a library's understanding of its patrons and depends on how the library's collection is used by its patrons. Several models for library acquisitions are available for adoption by librarians. Solomon and Gray (2018), presented two models of library acquisitions: the patron-driven acquisition (PDA) model, also known as demand-driven acquisition (DDA), and the evidence-based acquisitions (EBA) or evidence-based

selection (EBS) model. Given the increased attention given to evidenced-based selection, the use of web analytic tool can greatly help librarians in this regard since the tool will be able to collect and analyze data generated by the library's patron while using their OPAC.

# METHODOLOGY

This study utilized a descriptive research design. Furthermore, this is a single case study about the implementation of an open source web analytic software, Piwik (now known as Matomo), as installed and used in the AIM-KRC's Koha ILS's web server. Data were extracted, analyzed, and presented came from search terms that the patrons have inputted into the OPAC. By using Matomo, the researchers harvested data covering the period of September 2018-July 2019. The study did not include data using other features and reports of Matomo, i.e. "Search Keywords with No Results," which was yet to be installed by the service provider. To ensure that the research question, methodology, justification, and analyses matrix was used (see Appendix A). A research questions, analyses, and conclusion matrix was also used to demonstrate alignment and consistency (see Appendix B).

Prior to the actual collection and analyses of web data, the researchers found it necessary to consult its ILS service provider so that data could be properly collected using Matomo. There were several questions that researchers had in mind that they scheduled an interview with the service provider in April 2019. Follow-up interviews were done through phone calls and online chats to better understand the various reports of the web analytic software and its interpretations and clarifications (see Table 1), since personal interviews deter the service provider and the researchers' schedules, the service provider had Matomo installed remotely for both parties' convenience. The researchers then took notes of those interviews. According to the service provider, Matomo reports could be generated and exported in its Dashboard page, specifically: site search keywords and search keywords with no results, which can be found under the Engagement page, alternatively.

Personal Interview	Phone Call Interview	Chat Interview
March 27, 2019	April 8, 2019	April 8, 2019
April 1, 2019		April 20, 2019

Table 1. Interview Logs

Navigation on an unfamiliar platform later yielded an unexpected setback to data collection. The service provider and researchers later learned that that the widget for the data collection of search terms keyed into KRC's OPAC should have been enabled, which is why the study's data consists only from September 2018-July 2019, despite

its integration to the library management system on February 2018. The software also has a feature that enables specific dates for the reports to be generated, which the researchers needed to input the exact start date that the Site Search Keywords report was activated, otherwise it won't generate the report. In addition, the matter with the Visitor Profile that provides a summary of activities the patron had done, it did not accurately specify the country from where the patron had accessed AIM-KRC's OPAC. The service providers explained that the patrons' access data were stored in US servers which is why in one of the reports of Matomo, it reflected that patrons accessing AIM-KRC's OPAC are mostly from US. This report cannot be utilized, despite promising prospects, due to its inaccurate location identification feature, hence it was excluded in the analyses.

Despite these setbacks, the data harvested from the limited months in the Site Search Keyword reports have reflected the commonly used search terms used by the KRC OPAC's patrons. The site search keywords, and their frequency are displayed from highest to lowest. The compiled results were examined through frequency count from September 2018-July 2019. The integration of Matomo was made possible through the aid of a service provider.

## RESULTS

During the interview with the service provider, OnStrike Library Solutions Inc., remotely installed the web analytics software, Matomo, into AIM-KRC's Koha's web server in February 2018. Through its integration, valuable data was gathered during the months of September 2018-July 2019, which was then interpreted through the aid of the service provider by conducting interviews and the researchers taking down interview notes for reference. The data harvested from the limited months in the Site Search Keyword reports have reflected the commonly used search terms that patrons inputted to the AIM-KRC's OPAC. Since the open source software has a user-friendly platform, the frequency and the site search keywords are displayed from highest to lowest.

Matomo provides highly informative dashboard, useful to decision-makers (see Fig. 1). Some of the information provided (using widgets) include visitors in real-time, visitors' map, visitor logs, referrer types, etc. This page is customizable for convenience and immediate access to needed information. Other reports which could be viewed using various tabs or links in this page include Visitors, Engagement, Acquisition, and Goals.

matomo					Dashboard All Websites 💠 💿 🕞		
Q	ASIAN INSTITUTE OF MANAGE	TROM 2018-09-01 T	2019-07-31	ALL VISITS	NEW UPDATE: MATOMO 3.11.0		
III Dashboard	Visits in Real-time		Visits Log		Visitor Map		
Dashboard	DATE	VISITS ACTIONS	Wednesday, July 31, 2019	1 Action	11,015 visits		
Dashboard of aimkrc	Last 24 hours	38 123	23:58:15 IP: 112.207.0.0	AIM Knowledge Resourc krc.aim.edu/			
celine	Last 30 minutes	1 2	States		and the second		
Tisitors	Monday, August 5, - 11:54:51 (17s)		🌣 // 🖷				
Behaviour	lipicet Entry		Direct Entry Wednesday,	Direct Entry Wednesday,	Direct Entry Wednesday, 3 Actions - 17s		O WoodsWide Y Visite Y
Acquisition	Actions: 💼 💼		22:22:23	AIM Knowledge Resourc			
◎ Goals	Monday, August 5, + 10:44:37 💩 😰 Direct Entry	<b>9 4 9</b>	United States	krc.aim.edu/ AIM Knowledge Resourc krc.aim.edu/cgi-bin/koha	Channel Types		
	Actions:		Direct Entry	krcdiscussionrooms.sked			
	Monday, August 5, - 10:29:55 (7 m	in 29s)	Wednesday, July 31, 2019 22:13:34	6 Actions - 1 min 10s I AIM Knowledge Resourc	Direct Entry -		

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Figure 1. Matomo Dashboard

Figure 2 illustrates the visits to the KRC's OPAC from September 2018-July 2019. This figure also shows other unique information regarding visits to the site such as unique views, average visit duration etc. These data are helpful in determining the frequency of visits, how users access the OPAC (through search engines, direct URL, using social media sites like Facebook, etc.)



Figure 2. Visits and Entries into Koha's OPAC

Figure 3, meanwhile, indicates a more detailed activity log individual patrons that have utilized Koha's OPAC. It lists down the number of times they have visited over a span of time and logs the activities they have done per visit. The profile also provides details of where, when, and how the visitors accessed the website.

Figure 4 shows the various keywords used in searching materials in the KRC's OPAC. It also indicates the number of search results page as well search exits or the rate of moving outside of the search results page. This might mean opening a new window for an entry in the search results page that the user might want to see more information on.



Figure 3. Visitor Profile

Site Search Keywords				
KEYWORD	▼ 5	EARCHES	SEARCH RESULTS PAGES	% SEARCH EXITS
Search?query-1=AND;{}		54	1.6	11%
negotiation skills		34	2.4	68%
venture		29	1.1	3%
communications		25	1.7	16%
Search?query-1=AND;{philippines}		18	1	0%
Search?query-1=AND;{effectivity of gamification in employee engagement}		15	1.6	40%
Search?query-1=AND;{disaster}		14	1.8	21%
Search?query-1=AND;/(macaranas)		13	1.2	38%
Search?query-1=AND;/(data science)		11	1.8	27%
damodaran on valuation		10	1.2	0%
marketing		9	4.1	22%
Search?query-1=AND;(marketing management)		9	1.6	0%
social enterprise		9	2.9	11%
economics		8	4.8	25%

Figure 4. Site key word search

Gathered data from September 2018-July 2019 using the report generator for Site Search Keywords reflected a small number that may be attributed to the fact that AIM as an organization has a very small population. Looking at Table 2, one can notice that most of the search terms were business and management related terms. This comes to no surprise since AIM is a business school offering specialized graduate degree programs. AIM is also a case-method business school, which usually means that reading materials are prepared in advance for the students. Most of the results may also be attributed to complementary readings to the students' classes or supplementary readings for their Management Research Reports (MRR)/theses.

	LABEL	SEARCHES
1	Venture	27
2	Communications	24
3	Negotiation skills	22
4	Philippines	17
5	Effectivity of gamification in employee engagement	15
6	Data Science	14
7	Disaster	14
8	Macaranas	13
9	Economics	10
10	Damodaran on valuation	10

Table 2. 10 Frequently Used Search Words/Terms in Matomo from September 2018 to July 2019

# DISCUSSION

This study has clearly shown how an open source web analytic tool could be integrated into a library's OPAC. Moreover, this study has shown what data can be collected and used for making management decisions in this case, library collection development directions and decisions as Day and Davis (2010) clearly pointed out. This is supported by Mercer's (2019) claim that web analytics is very important business tool since it could provide a wealth of information for any business. The researchers used web analytics for its functionalities as demonstrated of figure 4. Such data is not available in ordinary installation of Koha, however by the integration of Matomo into AIM-KRC's ILS, opportunities to explore its generated reports were opened. This is supported by the study of Keil, Böhm, and Rittberger (2015) wherein they used the same method of delegating data capturing and analysis with their service providers.

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They also pointed out Matomo to be a self-hosting open source software, which is more suited towards data privacy issues since it denotes control over the captured data. They mentioned that access to the raw data allows more detailed analyses, which is what the researchers' study seek for future improvements in other aspects of the library.

Development of an unbiased collection may be effectively avoided by using web analytics software thereby helping acquisitions librarians make informed decisions based on evidence (Biswas & Marchesoni, 2016). Moreover, by taking such actions, the library will acquire library materials based on the actual interests and needs of users, instead of maintaining a collection-centered approach. Solomon and Gray (2018) presented two models for collection development: the patron-driven acquisition (PDA) model, also known as demand-driven acquisition, and the evidence-based acquisition or evidence-based selection. The study veered from the mentality of just-incase acquisition towards evidence-based acquisitions to make data supported collection development decisions. Based on the implementation of Matomo, in the case of the AIM-KRC, the web analytics software safeguarded user privacy and discretion while patrons use the OPAC. It gathered data which only the library personnel, with assigned authority, could access. By using Matomo, the AIM-KRC was able to generate reports on the search terms from the KRC's patrons web usage of OPAC, particularly the search terms used and its frequency.

Like the web analytics is the transaction log analyses by Blecic, Bangalore, Dorsch, Henderson, Koenig, and Weller (1998) and Villén-Rueda and Moya-Anegón (2007). Studies like these, including the present study, help librarians, better understand their users' conduct, thereby creating opportunities to reconstruct how the patrons interact with the catalog, leading to a more evidence-based collection development in libraries.

While data from web analytics software have proved to be very helpful in understanding the research interest of users, it is very important to carefully consider the issue of user privacy. As Keil, Böhm, and Rittberger (2015) stated, web analytics software may be used to monitor and analyze user behaviors in an unobtrusive manner, while still maintaining user privacy that the library should implement for data privacy (Chandler & Wallace, 2016).They optimized the reports to their advantage for the improvement of their library website. On the other hand, the AIM-KRC pursued gathering data that is aimed to improve collection development. Instead of analyzing user behavior and patterns, AIM-KRC harvested search terms the patrons inputted into the OPAC that practice user privacy, an issue the International Federation of Library Associations and Institutions (IFLA) stresses since the advancement of technology.

Collected data, using web analytics, can also help us identify and understand the strengths and weaknesses of a library's collection in relation to the needs of its users. Unlike before, when librarians were the sole architect or designer of their libraries' collection,

today's library patrons are more demanding and discerning. As a result, they are more involved in the library's operations now, more than ever. By identifying their commonly used search terms, we would have a better understanding of what they are looking for in our collection and check it against items in our respective collections. Once we have identified weaknesses and gaps in our collections, we can then focus our fiscal resources in acquiring materials that will fill the gaps and address the identified weaknesses.

### CONCLUSIONS

The findings of this study clearly prove that academic libraries need not allocate large sums of their depleting fiscal resources in using various computer systems and technologies for their libraries for the purpose of analyzing their users' interactions with their OPAC. By using an open source web analytic software and through transaction log analysis for improving their library's collection development efforts, which could be done through data harvesting. User privacy is also a crucial factor that Matomo assures, considering that only the assigned library personnel is allowed access to the data. In fact, librarians may use free or open source software in their respective libraries, and still be capable of generating valuable data. Moreover, collection development decisions must be based on evidence or data. Consequently, collection development librarians must veer away from the traditional collection-centered approach in developing their libraries' collection. The case of the AIM-KRC is a very good example of how an academic library used and integrated an open source, web analytic tool in their open-source ILS OPAC.

#### RECOMMENDATIONS

This study has clearly shown the benefits of using a web analytics software in collecting data as basis for a more targeted collection development activity for libraries. Hence, collection development librarians must veer away from the traditional collection-centered approach in developing their libraries' collection.

It is also important to note that collection development decisions must be based on evidences or actual data. Using an open source web analytics software, this study has shown that we can strengthen the collection of our libraries using data to support a shift in the acquisition of library materials from being collection-centered to user-centered. This paper also has potential to examine what the patrons have used in the physical and/or digital collections of the library. Retracing the users' entries to the pages and observing their behavior when using the OPAC may also prove beneficial to improve library services and/or collection. Capture settings may also prove advantageous to learning the exact location when users access the OPAC. The increase in usability of the OPAC or website can also be recommended since there were patrons who left the page after briefly opening the page. Search patterns can also be considered based on the results of the reports such as the bounce rate, type of search, and their most used/least used search limiters.

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# APPENDIX A

# Research Questions, Methodology, Justifications, Analyses Matrix

RESEARCH QUESTIONS	METHODOLOGY	JUSTIFICATIONS	ANALYSES
How did the AIM- KRC integrate and use an open source web analytics software in its open source, integrated library management system (ILS)?	Case Study	Chandler and Wallace (2016) Keil, S., Böhm, P. and	Interview notes
What were the commonly used search terms in the Koha OPAC?		Rittberger, M. (2015)	<ul> <li>Generated reports</li> <li>Codes (Frequency Count)</li> </ul>

# **APPENDIX B**

# Research Questions, Analyses, Conclusion Matrix

RESEARCH QUESTIONS	ANALYSES	CONCLUSION	RECOMMENDATIONS
How did the AIM-KRC integrate and use an open source web analytics software in its open source, integrated library management system (ILS)?	Interview notes	Third party vendor was tapped to integrate and use a free, open source, web analytic software (Matomo) to the case's open source library management system (Koha)	<ul> <li>Accurate account on collection development using data gathered as a concrete evidence to support shift in the acquisition of library materials</li> <li>Capture settings to learn the exact locations users access the OPAC</li> <li>Search patterns</li> <li>User behaviour when using the OPAC for the improvement of library services and/or collection</li> <li>Targeted collection development activity</li> </ul>
What were the commonly used search terms in the Koha OPAC?	Generated reports Codes (Frequency Count)	<ul> <li>Collected and identified search terms using the open source web analytic software may be used as basis for a more targeted collection development activity</li> <li>Collection development decisions must be based on evidence or data. Collection development librarians must veer away from the traditional collection-centered approach in developing their libraries' collection.</li> </ul>	<ul> <li>Usability of the OPAC or website</li> <li>Observation of patrons' usage of physical and/or digital library</li> </ul>

# UNDERSTANDING THE PATTERNS OF LIBRARY USAGE AND COLLECTION USAGE AMONG UNDERGRADUATE STUDENTS OF N.U.-MANILA: A MACHINE LEARNING APPROACH

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**Purpose/Objectives:** This study aimed to explore and understand library usage and collection usage among National University undergraduate students, per discipline, in the last two academic years (AY 2015-2016 and AY2016-2017), through manual library usage statistics, system-generated data from Follett's Destiny Library Manager (DLM) for the book collection usage, and ProQuest Usage for electronic journal databases. Based on the generated data, patterns of library usage and collection usage were identified, specifically: (1) the relationship of library collection usage vis-à-vis student degree program; (2) library usage trends in terms of academic month; and (3) sufficiency of library collection.

**Significance of the study:** This study provides valid statistics and research data useful to the NU Administrative body and NU-LRC as basis for planning and improvement of library collection and services. Identification of appropriate book collection titles and electronic journal databases will increase student library usage. Knowing the relationship between student degree program and student usage can help in identifying which library collection per program has sufficient collection. The user patterns will also determine if the current collection addresses the actual LRC information resource needs of each student; and can therefore serve as justification for purchase requests for current, new, and relevant additional books and other electronic journal databases for

subscription. Library user patterns can also inform planning for a more effective or better utilization of library sources and services in the NU community.

**Design, methodology, and approach:** The study used simple machine learning and statistical techniques to achieve its goals. The data were obtained from library usage statistics, NU-LRC library system, Follett's Destiny Library Manager for book usage, and ProQuest usage for e journal databases from AY 2015-2016 to AY 2016-2017.

Statistical analysis was employed to show the pattern of library usage at National University-Manila. The cleaned data were processed using data tools in MS Excel to understand the usage of library resources from AY 2015-2016 to AY 2016-2017. Pattern analysis was based on the results of the statistical analysis. Visualization techniques were used to understand the usage pattern of the students.

**Findings:** The results of the study are presented and discussed with reference to the goal of the study, which is to understand the library usage and collection usage patterns of the students of National University-Manila. Students were found to utilize books related to their field of specialization, for instance, 90% of nursing students as well as architecture and dentistry students were using resources related to their respective fields of study. The result shows consistency of book collection usage per college for both academic years.

No consistency was noted in the growth or decline in the number of library users for the two academic years. The highest number of library users was found in the College of Business and Accountancy in AY 2015-2016, and in the College of Tourism and Hospitality Management in AY 2016-2017.

In terms of library usage per month, most students borrowed/used library collections or visited the library for their academic needs during the middle of the semester, which was the period of examinations at the university. In June, October, April, and May, the number of library users was expectedly low across colleges, since these months were either the start or the end of the semester.

The library user behavior notably changed because of the students' access to technology. Some of them opted to use online materials or resources rather than library book collections.

The visualized data in graph form indicate that the students mostly used 2003-2012 editions of books, since these editions were greater in number than the recent ones.

**Research limitations and implications:** The study initially intended to use machine-learning techniques to develop a model for understanding library usage at the university, but data from the library were not enough for building the model. Since the covered period was limited only to two academic years (AY 2015-2016, AY

2016-2017), the results could not be generalized and could not provide any correlation between library usage and collection usage pattern.

**Originality of the paper:** Related literature in the local setting was limited. The data gathered were analyzed and machine learning and statistical techniques were employed to determine the significance between library usage and collection usage.

Keywords: Pattern of Use, Library Collection, Collection Development, Clients/Library users

## INTRODUCTION

National University-Manila, a higher-education institution, is a rapidly growing university with the vision of making quality education accessible to Filipinos. The National University Learning Resource Center (NU-LRC), the primary learning haven of students, has collections of books, journals, magazines, non-print materials, and electronic databases that students can access freely. The library is the most widely used source of information in literate societies, but the broadening choices of information sources have become an emerging challenge to the survival of libraries (Kaushik, A 2013).

Librarians must be aware of the kinds of information being sought and how these can be obtained. Because of the rapidly escalating cost of purchasing and archiving print journals and electronic media, the library has the duty to provide and maintain efficient services (Rana & Madan, 2013). The NU-LRC statistics show that an average of 400 students visit the library and 70 books are borrowed daily as recorded, increasing by almost 20% per academic year. Existing literature supports the notion that understanding the information needs and information-seeking behavior of students helps in planning and implementing the information systems and services of libraries (Kataria, Bennett University, Institute of Electrical and Electronics Engineers. Uttar Pradesh Section, & Institute of Electrical and Electronics Engineers, n.d.) (Kan & Ping, 2008) (Silipigni & Connaway, 2015). This information, however, does not suffice as valuable data to serve as basis for planning and improvement of the library collection.

## **Research Objectives**

This study sought to discover patterns of library usage and collection usage among students, specifically identifying the following:

- 1. Relationship of library collection usage vis-à-vis student degree program.
- 2. Library usage trends in terms of academic month.
- 3. Sufficiency of library collection.

#### Scope and Limitations

The study used as dataset the generated data from library usage statistics for library usage, Follett's Destiny Library Manager (DLM) for book collection usage, and ProQuest usage for e journal databases. The analysis of library usage and collection usage focused on NU-Manila students only. Collection usage covered books and the e-journal database subscription, ProQuest. This study performed an analysis of library usage of NU-Manila students only in the last two academic years (AY 2015-2016, AY 2016-2017)

#### Significance of the Study

This study is significant to the NU Administrative body and NU-LRC. The availability of valid statistics and research data to support planning and improvement is imperative to enhance library collection and services. Identifying the appropriate book collection titles and electronic journal databases can increase student library usage. Knowing the relationship between student degree program and student usage can help determine which library collection per program has sufficient collection. User patterns can also tell if the current collection addresses the actual LRC information resource needs of each student; and, therefore, can serve to justify purchase requests for current, new, and relevant additional books and other electronic journal databases for subscription. Library user patterns can also form a basis for effective or better utilization of library sources and services in the NU community.

#### LITERATURE REVIEW

Research studies on university libraries usage have been done extensively to aid in library decision-making (Bucknell, 2008). Academic libraries play an important role in helping students with their school requirements, including research initiatives. With the changing times and the evolving needs of students, academic libraries have taken efforts to revolutionize their services to meet user demands (Sheikh, 2015). One way is to study the habits of users to provide better data-related services by helping analyze which books need to be added to their collection (Bollen & Luce, 2002) (Federer, 2016) (Collins & Stone, 2014).

There is ample literature focusing on borrowers' pattern for printed books and e-books consumption. Statistical techniques have been utilized to understand their clients better. Recommendations for research in academic libraries include encouraging librarians to promote the use of electronic resources among undergraduate students (Wang & Bai, 2016), changing the academic library landscape for the use of other nationals studying in the institution (Bladek, 2019), using social media to help increase library use (Winn, Rivosecchi, Bjerke, & Groenendyk, 2017), promoting coauthorship of librarians with faculty members engaged in research to help improve librarians' skills in providing research support services (Borrego, Ardanuy, & Urbano, 2018), and improving the services of academic libraries based on the needs of each academic department (e.g., students enrolled in science programs prefer bigger tables) (Hall & Kapa, 2015).

Studies of data mining applications in academic libraries from 1998 to 2015 revealed that collection and usage behavior are the topmost topics in which data mining functions were employed (Siguenza-Guzman et al., 2015). Moreover, classification and regression models are the most common types of data mining functions used in an academic library setting. This study, on the other hand, adds novelty to the existing literature by using machine learning that could possibly provide book recommendations to NU-LRC clients.

#### Visualizations used for library

Dealing with big data usually involves finding relevant information from it, modeling the elements composing it, and transforming it into useful information and knowledge. With data getting bigger and more differentiated every day, visualizing and analyzing data to extract patterns is necessary. Visualization can add value to raw library and allow the discovery of insights from the data. Aisch, G. (n.d.) stresses that visualization is critical to data analysis. Moreover, the author describes the process of transforming, visualizing, analyzing and interpreting data to cull the insights. The same visualization techniques can be applied to further get insights on data usage in the library, which can then be used to improve the services of the university library. Finch, J.L., & Flenner, A.R. (2016) employed data visualization in examining academic library collection. For them, this revealed the relationship among subject areas for users, illuminating circulation patterns and other useful insight. On the other hand, there are researchers analyzing the physical collection that focus on usage statistics and collection analysis. Lima further explained how student Syed Reza Ali mapped transaction data from Seattle Public Library to shed light on circulation movements.

Statistical analysis is a starting point of machine learning. This research is in progress and needs more data to develop a machine learning model that can be used by the library. The visualization technique was used to discover insight on the data gathered.

### METHODOLOGY

The study is composed of four major phases: data collection, data processing, statistical and visualization and pattern analysis (see Figure 1).

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Figure 1. Overview of the methodology

The data collection focused on library usage, book collection usage, and ProQuest usage in two academic years (AY 2015-2016 and AY 2016-2017). For library usage, the number of users per program per month for the two academic years was extracted. For library collection usage, the number of transactions with the title of the books, publication year, and program of the students, as well as the circulation types of the borrowed library materials, were extracted, using the library system of the university, specifically Follet's Destiny Library Manager. ProQuest usage consisted of types of databases visited and the classification of library patron as students. The frequency of the students' use per month was included to further analyze the data.

The data processing phase involved cleaning and formatting of the gathered data. Data on library usage, which were stored in the logbook of the library, were converted in spreadsheet for processing. Library usage data were extracted from library usage statistics, book collection usage data were extracted from Follett's Destiny Library Manager, and ProQuest usage data were extracted using the ProQuest system. Some of the extracted data that were no longer needed were removed to fit the requirements for data processing. The output of this phase was a dataset ready for processing using machine learning techniques.

The study used statistical analysis to show the pattern of library usage at National University. The cleaned data were processed using data tools in MS Excel to understand the usage of library resources from AY 2015-2016 to AY 2016-2017. The initial plan was to use machine learning techniques to develop a model for understanding library usage at the university, but the data from the library were not enough for building the model. Pattern analysis was based on the results of the statistical analysis. Visualization techniques were used to understand the pattern of the library users.

To uphold data privacy, student names were not included in the data acquisition. A letter of permission was sent to the Senior Director to request the needed data.

## **RESULTS AND DISCUSSION**

In this section, the results of the study are presented and discussed with reference to the goal of the study, which is to understand library usage and collection usage patterns among students of National University-Manila. The discussion is divided into three subsections. Simple statistical analysis of data in two academic years (AY 2015-2016 and AY 2016-2017) was used to understand library usage at National University. The results were based on extracted data from various sources in the library. Permission to

gather data was sought, and some information is intentionally concealed in compliance with the Data Privacy Act of 2012.

## Relationship of library collection usage vis-à-vis student degree program

The university library has a considerable library collection, ranging from fiction to program-specific books and other library resources. Figures 2 and 3 show the comparison of book usage across the colleges or programs. These indicate that students from various colleges used or borrowed library resources across programs. The borrowed books were mostly aligned to their programs. Almost 90% of nursing students utilized books related to their field of specialization. The same could be said for most architecture and dentistry students. Most of the business and accountancy students accessed the Filipiniana collections. This implies that books in CBA were mostly written by local authors and published in the Philippines or in the local setting. The results show consistency of book collection usage per college for both academic years.



Figure 2. Book usage per college vs library collection for AY 2015-2016



Figure 3. Book usage per college vs library collection for AY 2016-2017

Students from the College of Allied Health were consistent in using books intended for the college. For AY 2015-2016, those from the College of Engineering (COE), College of Tourism and Hospitality Management (CTHM), and College of Education, Arts and Science (CEAS) borrowed books across all colleges. For AY 2016-2017, COE and CTHM borrowed books outside their field. Almost across all programs, there were instances in which COE and CTHM students were borrowers.



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Figure 4. Library usage per college for two academic years (AY 2015-2016, AY 2016-2017)

There was no consistency in the growth or decline in the number of library users for the two consecutive academic years. The College of Business and Accountancy accounted for the highest number of library users for AY 2015-2016, while the College of Tourism and Hospitality Management took over the top rank in AY 2016-2017.

# Library usage trends in terms of academic month

Figures 5 and 6 show the trends of library users per month at National University. It appears that most students borrowed/used library collections or visited the library for their academic requirements in the middle of the semester, which was the period of examinations at the university. In the months of June, October, April and May, the number of library users was small across colleges, since these months were either the start or end of the semester. It was expected that the turnout of library users would be low.



Figure 5. Summary month utilization per college for AY 2015-2016



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Figure 6. Summary month utilization per college for AY 2016-2017

For AY 2016-2017, CTHM had the highest numbers of library users in the months of January to March, even if it does not account for the most number of enrollees in the university. The number of library users in AY 2016-2017 was notably small compared with the previous academic year.



Figure 7. ProQuest Usage for two academic years (AY 2015-2016, AY 2016-2017)

Library user behavior practically changed because of the students' access to technology. Some students opted to use online materials or resources rather than using library book collections (see Figure 7).

#### Sufficiency of Library Collection

The visualized data offer a starting point for discussing library resources in support of the existing curriculum for different programs of the university. The results offer comprehension compared with flat file, from which important insights can be drawn. The given graphs are easy to understand by the stakeholders in the university and can serve as the springboard for policy creation, especially on the usage and improvement of library collection.

Figure 8 shows that the students used mostly 2003–2012 editions of books because the library had more of these than recent editions.



Figure 8. Summary of borrowed library resources per publication year

Relying on book usage statistics generated from DLM, the researchers investigated the specific book titles that were mostly borrowed by the students or used in multiple numbers (e.g., 40 times or more). For the College of Business and Accountancy, the books "Cost Accounting," "A Comprehensive and Practical Approach in Practical Accounting 2," "Financial Management Principles: Principles and Applications," and "Fundamentals of Accounting" were in demand. Engineering books like "Electronic Devices and Circuit Theory," "Engineering Mechanics," and "National Structural Code of the Philippines 2010" were frequently borrowed. For the College of Allied Health, the books "Fundamentals of Maternal and Child Nursing Care" and "Maternal and Child Health Nursing" had the highest number of usage. Books that could be used across all programs, such as "College of Algebra," "College Physics," "Analytic Geometry," and "Komunikasyon sa Akademikong Filipino" were also noticeably the most borrowed. It is worthy to note that these book titles were either textbooks or references as part of the curriculum or as cited in the syllabus. In AY 2016-2017, fiction series books of "Harry Potter" and the reference book "Guinness World Record" were the top borrowed books.

## CONCLUSION AND RECOMMENDATIONS

Since the covered period was limited only to two academic years (AY 2015-2016, AY 2016-2017), the results could not be generalized and could not provide any correlation between library usage and collection usage pattern.

Based on the results, students utilized books related to their fields of specialization. For instance, 90% of nursing students as well as architecture and dentistry students were using resources related to their fields of study. Book collection usage per college was consistent for both academic years.

No consistency was noted in the growth or decline in the number of library users for the two academic years. The highest number of library users came from the College of Business and Accountancy in AY 2015-2016, and from the College of Tourism and Hospitality Management in AY 2016-2017.

It was during the middle of the semester, which was the period of examinations at the university, that most students borrowed/used library collections or visited the library for their academic requirements. The months of June, October, April, and May expectedly showed low usage across colleges since these were either the start or end of the semester.

Library user behavior practically changed because of the students' access to technology. Some opted to use online materials or resources rather than library book collections.

The visualized data in graph form reveal that the students used mostly 2003-2012 editions of books, but only because their actual number was greater than the recent editions of books.

Library shareholders should carefully examine the policy on collection and make sure their collections are compliant with the requirements of the Commission on Higher Education or any accrediting body.

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# INITIATIVES IN ORGANIZING AND MANAGING ELECTRONIC RESOURCES IN AN ACADEMIC LIBRARY IN SOUTHERN PHILIPPINES: A CASE STUDY

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This research paper aims to describe, explore, and explain the various practices/ initiatives of the Mindanao State University librarians and library staff in organizing and managing the e-resources. Specifically, this paper deals with the step-by-step electronic processing of the e-resources by exploring the needed software that will automate the entire process. The selection of the e-resources is restricted to support and reflect the curricular offerings of the parent institution which entails the identification of the needed e-resources, strategizing methods and tools to manage the data at hand, and finally, creating access mechanisms for the usage and dissemination of the available e-resources. With this, the study purposively aims to answer the following problem statement: (1) to know what are the available e-resources in the university library and how many of these are already organized; (2) to identify what tools and software that are necessary needed to organize the e-resources; (3) to explore the step-by-step processes involved in the electronic processing of the e-resources; (4) to know the accessibility and visibility of the e-resources for the library clienteles; and finally (5) to assess the utilization and usage of the collection. From the findings, it was found out that there were 5,539 ebooks processed out of 12, 457. On the other hand, there were a total of 6, 865 theses and dissertation collections of the library, out of this numbers only 1,384 were successfully processed as E-resources. Moreover, there were five (5) identified software and hardware which are needed to the processes namely: Server-Client Computers, Microsoft Office, PDF Merger, KOHA ILS, and the Calibre Ebook Management System v2.77. The steps involve in the process of organizing E-resources were also included in this paper as well as the assessment of the usage of the E-resources by the library users. Finally, this paper is ought to be beneficial to LIS students and practitioners who are having difficulties in organizing and managing their E-resources and managing the data that are produced by the procedures and processes within the process. This paper might also serve as a model for other academic libraries to pattern the way they organize their electronic resources. This study is based on a case study approach, using descriptive, exploratory, and explanatory design to present the
situation in the library. Moreover, a feedback-survey questionnaire was also distributed to fifty (50) students using purposive sampling to augment the obtained findings.

**Keywords:** managing electronic resources, electronic technical processing, e-book and e-thesis and dissertation, academic libraries

#### INTRODUCTION

In today's information-driven society, accessing information over the internet becomes a daily habit of people from all walks. They use the internet to access relevant information regarding local and global societal issues, trends, and development in their own field of profession and specialization, and to be informed also of the things that might affect their lives. Having said that, anyone, including professionals, can download and store information in electronic media storage such as computer hard discs, external hard drives, CDs and DVDs, and even in flash drives to name a few (Herrington & Herrington, 2006). Because of the advent of the internet and the sophisticated ways of sharing information across several mediums, professionals such as faculty, administrative staff, librarians, and even students has numerous collection of e-books, e-journals articles, and e-thesis and dissertations downloaded over the internet. When these downloaded resources are not organized it usually store as files in their computers or storage devices, and when collection grows, retrieval and classification become terrible. Therefore, managing these types of resources, whether personal or in a library, is not an easy task.

Librarians, on the other hand, are one those professionals in the information industry who are tasked to collect, store, and organize information resources, in print and/or electronic format, for their library clienteles. Librarians should frequently assess and evaluate their roles in the academic community and re-position their identity as an information-provider to remain relevant and responsive in today's technology-driven societal changes (Singh, 2001). To be more effective, librarians must collaborate with other professionals such as faculty and staff from other departments of the institutions to collect e-resources and do the necessary initiatives to organize and make the resources accessible to the wider reading public (Kumari & Narasimhaiah, 2016).

Organizing e-resources, such as e-books and e-thesis, from a scratch is not an easy mission. Librarians should consider the computer programming and networking aspects of the task to properly organize the manage these resources. However, not all librarians possess skills i.e. to create a database(s) that will hold the resources and to design an assembly-line or process on how to do it. Librarians have relatively average level skills in various ICT related tasks in the library (Seena & Sudhier Pillai, 2014). Therefore, some librarians initiate by means of either outsourcing Information Technology (IT) professionals/experts to do the task, hire IT people into their library, or do their own initiatives to learn and acquire the necessary skills to understand the processes in doing so (P T & V, 2018).

The management of electronic resources demands expertise in handling systems which are more complex than the traditional library management system (Pinfield, 2001). This requires an expertise in the software and hardware when handling and organizing e-resources. However, librarians who are entering in the field of computer systems, hardware, and databases and the like are filing the gap. These newly emerge librarians are referred to as system librarians. They are responsible for managing the information technology used in the library.

This case study will focus on the various practices of the Mindanao State University librarians in organizing and managing e-books and e-thesis and dissertation in the library and how these resources becomes visible and accessible to the academic community. Most of the e-books in this institution were downloaded from open-access publishers over the internet and others were donated by some faculty members as a reference to their assigned courses. The e-thesis and dissertation, on the other hand, were collected from the graduating students every after the semestral commencement exercise, all in pdf format.

Therefore, this research paper seeks to describe, explore, and explain the various practices of the Mindanao State University-Marawi Campus librarians in their pursuit towards organizing their own accumulated collection of e-resources and making it available as part of the library's new innovative services in order to satisfy the university researchers, students, faculty and staff, and other library users.

#### **Research** objectives

The overall purpose of this case study is to describe, explore, and explain the various practices of a university librarians in organizing and managing their e-resources in such a way that will benefit the institution they served. Therefore, this study aims to answer the following problem statement:

- to know what are the available e-resources in the university library and how many of these are already organized;
- to identify what tools and software that are necessarily needed to organize the E-resources;
- to explore the step-by-step processes involved in the electronic processing of the E-resources;
- to know the accessibility and visibility of the e-resources for the library clienteles; and finally
- to assess the utilization and usage of the collection.

#### LITERATURE REVIEW

This research paper was shaped by a limited number of published researches which are available over the internet the deals with organizing and managing e-resources. Most of the literatures written in this subject were mainly focused on the users' utilization of the e-resources using a descriptive-correlation type of research designs and methodologies. However, the researchers continue to dig to find a substantive numbers of research studies to state their findings to further support the assertion of the intention of this research paper.

To understand the concept of an e-resources, Bavakenthy et al., (2003) as cited by Sajane (2017) in her doctorate dissertation about the accessing and using electronic resources in academic libraries describes the concept of e-resources, she noted that:

e-resources are resources in which information is stored electronically and is a broad term that includes a variety of publishing models, including OPACs, CD-ROMs, online databases, e-journals, e-books, internet resources, Print-On-Demand (POD), e-mail publishing, wireless publishing, electronic link and web publishing, and so forth (p.10).

In this context, e-resources are any information stored and distributed using electronic medium such as CDs, DVDs, internet format, and pdf, chm, epub, and the like. These resources were called electronic because of the format by which they are stored, distributed, and presented to the public consumer.

Further, Sajane (2017) also explained that management of Information and Communication Technologies (ICTs) in organization is not easy as it involves two levels of considerations: first strategic level which includes review and putting in place the most appropriate existing ICTs and second is the operation level which involve the provision of ICT services to the organization through capacity-building, development, implementation, application and monitoring of the usage and effectiveness of the system. However, lack of a fulltime ICT experienced librarian or ICT expert professionals in the library and changing technologies and obsolesces in software and hardware requirement becomes barriers of a proper management of e-resources libraries.

Moreover, Gunjal & Dhamdhere (2013) studied the application of ICTs in academic libraries. Accroding to their study, among the ict-related problems facing by the libraries is lack of ict-oriented library staff to handle the overall management of the library's ICTs. They also found out that the contributory factors to this problem is the inadequate provision and integration of ICT-related course in most LIS education in Africa and other developing countries which produces library professionals that lacks the neccesary skills that the workplace requires. They also indicated that without ICTs it has been impossible for a library to provide wider access to thesis and dissertations from their remote location. The only way to have access to these resources is by visiting the libraries where the collections are housed. As a result, thesis and dissertations in most developing countries have largely been closed collections accessed mainly by students and researchers residing nearby.

Similarly, Nwosu, Okeke, and Ejedafiru (2013) in their study that surveyed and interviewed two system administrators reported similar findings. They found that even academic libraries with substantial budgets are having difficulty in handling the incessant changes in electronic information. More technologies and methods are needed to manage, filter, organize and summarize electronic information sources. Electronic information services are gradually becoming the most likely use services in libraries. According to the two system librarians, some of the problems in managing the electronic information in their workplaces was there was no written policy on management of e-resources, poor funding and its serious effects on management and acquisition of electronic information, difficulty in coping with the frequent changes in electronic information, insufficient computers, financial constraints, poor capacity building for librarians, poor technological infrastructures, and a little awareness of the value of e- resources.

Islam and Islam (2006) also reported that the frequent changes in our society, largely brought by the Information and Communication Technologies (ICTs), has affected the libraries and librarians in the way they serve their users. Today's library users are expecting that the library should adapts and reacts to the ecological changes that are happening within its environment. Librarians now needs to possess additional skills and expertise such as programming, computer networking, database management, and metadata records administration, more so in the use and application of modern ICT tools, digital information services and knowledge management. With the use of these tools and the skills and expertise, librarians are expected to handle and develop information storage and retrieval systems of specialized and local data and materials like thesis and dissertation, managing different types of housekeeping operations, and exchanging local databases and sharing of resources across wider local area network. More so, handling the complex systems of interrelated and interconnected resources through various means, qualified personnel should provide access to the resources, databases, and databanks to work in the exploitation of resources in the libraries.

However, dream will remain a dream unless one will take the first step towards the realization and putting into reality that dream. Islam and Islam (2006) also argued that the various challenges facing by the libraries in terms of embracing ICT tools in their services, among others, is the copyright management. E-resources and local thesis and dissertation are just some of the resources that are subject to copyright issues which limits the initiatives of the libraries in organizing these resources and making them available via computer terminals.

Information and Communication Technology, as we naturally understood, acts as a catalyst in all spheres of science and technology. In the future it becomes a building block of modern society. According to Mishra (2014), ICT is very important nowadays to a library to achieve its goals of managing information sources and providing efficient and effective library services because it offers access to information of several subject areas. ICT also offers advances in telecommunications and has opened new ways of collecting, organizing, and disseminating scientific and technical information to the wider reading public.

Nevertheless, access to information is very crucial to learning and knowledge acquisition. Habiba and Chowdhurry (2012) in their study regarding the use of electronic resources in Dhaka University reported that library users use electronic resources purposively for learning and acquire new information. It was also found out that e-books and e-journal articles were among the mostly used type of electronic resources in the university library because these type of resources offers up-to-date information and mostly are freely accessible. Averagely, the library users are satisfied with the provisions of electronic resources in Dhaka Library and majority of them benefited to the e-resources.

Finally, in order to organize such e-resources in the library, M.U. (2011) suggest that a Knowledge Management (KM) in library is necessary because it facilitates the acquisition, storing and retrieval, dissemination, and management of such e-resources. Knowledge Management is "a process, which deals with the knowledge creation, acquisition, packaging and application or reuse of knowledge". KM consist of knowledge creation, organization, data protection and preservation, and dissemination of knowledge information. Among the objectives of the KM is the is the protection of intellectual property right in information technology era, and to create knowledge management is also difficult as it relates to the organization and management of e-resources. The author cited that skills are necessarily needed by the Library and Information professionals. Most of the notable skills are:

- IT literacy, which means knowing how to use the appropriate technologies to capture catalogue records and disseminate information and knowledge to the target audience and knowing how to translate that knowledge into a central database for library users to access;
- Innovation and acquiring;
- Enable knowledge creation, flow, and communication within the organization and between staff and the public.

Therefore, it is imperative for the Library and Information professionals to constantly update their skills and competencies in this ever changing technologicaldriven society.

#### METHODOLOGY

A case study approach was used in this study since the main purpose is to present the initiative of the Mindanao State University library in organizing their electronic resources. A case study approach is suitable in this study because the objectives was focused on describing, exploring, and explaining the entire processes of organizing the e-resources of the said library. A case study is "a strategy for doing research which involves empirical investigation of a particular contemporary phenomenon within real life context using multiple sources of evidence" (Robson, 1993). Case study as mentioned (Sturman, 1999) and as cited by (Cohen, Manion, & Morrison, 2007) claims that "a distinguishing feature of case studies is that human systems have a wholeness or integrity to them rather than being a loose connection of traits, necessitating in-depth investigation". In this study, the human systems are referring to the library employees who are directly involved in the processing of the e-resources from the start to the end. Therefore, this study investigated and reported the human interactions/relationships in managing the entire procedures in processing of the e-resources. Additionally, the researchers also explored the ICT aspect of the process such as computer software and hardware to explore and explain the smooth and continuous process itself.

Additionally, to address the objectives of the study, the researchers also combined a descriptive-exploratory-explanatory case study design. With this design, the researchers can describe the types of e-resources of the library, explore and document the stepby-step procedures that encompasses the entire process, and explain the outcome of such processes. Using a purposive sampling, a feedback-survey questionnaire was distributed to the fifty (50) actual users of the Calibre EMS, i.e. the students, who used e-resources of the library during the 2nd semester of the A.Y. 2019-2020.

#### **FINDINGS (1000-1500)**

Since this research is a case study by approach, the researchers will intently present the findings in a tabular and sequential format. Based on the research problems number one (1) and five (5), the researchers will present the findings or data in a tabular format with Tableau representation. The findings of the problem statement number three (3) was presented in a sequential order to shed light and understanding of the different steps, process, and procedures involved in managing the e-resources of the library. Descriptively, the problem statement number two (2) and four (4), the findings will be presented by describing the needed software and how this software facilitate the accessibility and visibility of the resources to the intended library clienteles.

## What are the available e-resources in the university library and how many of these are already organized?

Table 1. Frequency and Percentage Distribution of the E-Resources of the Minadanao State University Library

Electronic Resources	Total Library	Total Processe	d E-resources
	Holdings	Frequency	Percentage
ebooks	12,457	5,539	44.46%
eTheses and Dissertation	6,865	1,384	20.16%

Table 1 show the eBooks, eTheses and eDissertation collections of the library as well the frequency and percentage distribution of the total processed eResources as of October 2019. As shown, there were twelve thousand four hundred fifty-seven (12,457) total numbers of ebooks from the inventory file of the head librarian of the eLibrary. Out of these numbers, there were only five thousand five hundred thirtynine (5,539) or forty-four-point forty six percent (44.46%) processed using the designed procedures or processes. Moreover, from the online Public Access Catalog of the university library, there were six thousand eight hundred sixty five (6, 865) total eTheses and eDissertation holdings, however only one thousand three hundred eighty four (1384) or twenty point sixteen percent (20.16%) were processed.

#### What tools and software are necessarily needed to organize the E-resources?

- Server-Client Computers according to (Oluwatosin, 2014), a Clientserver is a system or model that performs both the functions of client and server to promote the sharing of information between them. It allows many users to have access to the same database at the same time, and the database will store much information. In this study, a server-client computer refers to the set of computers used by the library to install the necessary software for the organization of the E-resources. Server computer is a Personal computer used to install the Calibre EMS, MS Office, and PDF Merger. On the other hand, the Client computers are computers used to access the E-resources, which were stored on the Server computer.
- **Microsoft Office** MS Office is a suite of desktop productivity applications that is designed specifically for office or business use (www.techopedia.com). In this study, the researchers specifically used the MS Publisher and MS Word to create covers for the eTheses and Dissertation.
- PDF Merger is an online and stand-alone software used to merge a

dedicated color-coded eTheses and eDissertation cover and merge it to the entire full text of the E-resources.

- Koha Integrated Library System is the world's first free and opens source *library system. Koha* is a fully featured, scalable *library* management *system.* In this study, Koha is used to provide access to the various E-resources of the library (*www.koha.org*). The researchers created an item type eBooks, eTheses, and eDissertation in the Koha Settings to provide distinction between electronic resources and printed resources. Moreover, the researchers also created a physical section for the above-mentioned E-resources i.e. eBooks Section and eTheses and eDissertation Section.
- Calibre Ebook Management System v2.77 is a free cross-platform and open-source suite e-book software. Calibre supports organizing existing e-books into virtual libraries, displaying, editing, creating and converting e-books, as well as syncing e-books with a variety of e-readers (*https://calibreebook.com*). In this paper, the library used this software to organize the existing electronic collections of the library such as eBooks and eTheses and Dissertation.

# What are the step-by-step processes involved in the electronic processing of the E-resources?

#### For organizing the eBooks collections, the following steps are required:

**Step 1** – the librarian-in charge will download the Calibre EMS from *https:// calibre-ebook.com* and install it to the server computer. The librarian will then upload the eBooks to the software/database by clicking the *Add Books* button located at the upper-left portion of the screen. Figure 1 shows the screenshot of the Calibre EMS. On top right of the screen shows the several options/settings to properly configure and integrate the local needs of the library. On the center is the list of titles uploaded to the system, on the left side panel is the filtering options, and on the right are the book details. As shown, there are two ways to edit the data, one is by manually supplying the need data, and two is by downloading the metadata directly from the online metadata providers such as Amazon, Google, etc.

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Figure 1. Screenshot of the Calibre eBook Management System

**Step 2** – The next step is to provide the client computer an access to the server by turning ON the Content Server. Figure 2 shows the Content Server is already turned ON. The Calibre (*by default*) automatically assigns a specific IP Address and Port Number however you can also modify the IP Address and Port Number from the computer's network setting. The example below shows 192.168.5.6:8080, this means that to access the server from the other computers (connected to the same network), the librarian must type 192.168.5.2:8080 to the web browser of the client computer. The library users can search the entire ebook collections in the Main Server of the Calibre EMS. The users can also filter the searching process by clicking the given choices such as "Newest uploaded books, Authors, Languages, and Tags, etc". These filtering options are very helpful in browsing and categorizing the eBooks.



Figure 2. Turning on/off of the Content Server to permit access to the client computers

	$\rightarrow$ home $\leftarrow$	SUPPORT CALIBRE
Choose a category to browse by	:	Search
Newest	All books	Random book
Authors	Languages	Tags

Figure 3. Content Server from the client computer's browser

**Step 3** – System Backup. Figure 4 below shows how to create backup of the system's data. To create a backup the librarian should click the *New Folder* and click *Export all Calibre Data*. Accordingly, it is very important to regularly create a backup of the system's data to prevent database failure, data lose, and computer viruses. After the backup process, the data will be saved as *.calibre-data*.

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Figure 4. System Backup

#### For eTheses & eDissertations:

**Step 1** – figure 5 shows the sample customized covers of the eTheses & eDissertation. The librarian-in-charge using the Microsoft Publisher manually and locally creates these covers. As shown below, the covers are color-coded for categorization and for easy recognition purposes.

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Figure 5. Sample of a customized covers

**Step 2** – This step requires the merging of the covers and the eTheses & eDissertation (*both in pdf format*). The file must be saved as pdf format. This step requires the use of any stand-alone or online *file* merging software.

**Step 3** – the figure below displays the uploaded eTheses & eDissertation to the Calibre EMS. This step requires the librarian to click the *add book* button to the upper right portion of the screen to successfully upload the files in a pdf format.



Figure 6. Uploaded eThesis & Dissertation in Calibre EMS

**Step 4** – this step requires the manual encoding of the needed data because the data are not available on the internet. The data such the title, author, date, and the abstract are the important data that must be encoded in the required tags. The figure below shows

the screenshot of the cover as well the tags that need to fill in.



Figure 7. Metadata for eTheses and Dissertation

**Step 5** – Turning on of the Content Server. To make the etheses & eDissertation accessible to the client computers, the content server must be turned ON. The figure below shows how to turn ON the Content Server. The client computers can have access to server using a specific IP Address and Port Number given by the server itself.



Figure 8. Turning ON the Content Server

**Step 6** – Backup the Calibre Data. As prescribed by most of the IT practitioners, there is a need to frequently back up the data in case of computer virus or system's failure. The figure below shows how to back up the Calibre EMS.

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Figure 9. Data Backup

#### What is the accessibility and visibility of the e-resources for the library clienteles?

The university library is using the KOHA integrated library system to make the E-resources visible and accessible to all library users. The system administration of KOHA created a specific item types for eTheses and eDissertation to distinguish from printed resources. In this case, all the processed E-resources will be part of the result page whenever a library user search the Online Public Access Catalog (OPAC) of the library.



Figure 10. Accessibility and Visibility of the E-resources

#### What is the Utilization and Usage of the Collection?



Table 2. Percentage Distribution of Responses on the Utilization and Usage of E-Resources

Table 1 shows the distribution of the responses from the participants of the study as to their disagreement or agreement to the given questions above. Fifty (50) respondents were given survey questionnaires during the conduct of this study to assess the utilization and usage of the Calibre EMS and the E-resources as well. As shown in the table above, majority of the library users were demonstrated a positive ease of use when using the Calibre EMS, and they also show agreed that the system is user-friendly. Moreover, the library users were also satisfied to the organization of the E-resources within the system because it works the way they wanted it to be. Finally, all the respondents stated that they would recommend to the friends the Calibre EMS whenever they are browsing resources in the library.

#### CONCLUSIONS AND RECOMMENDATIONS

Much has been said that libraries in general are experiencing a paradigm shift, from traditional to technological, because of the massive production and use of ICT and the continuous demand of ICT tools to solve technological problems. This shift had brought some problems in libraries, especially in organizing and managing electronic information. Therefore, this paper was aimed to document the initiatives of the Mindanao State University Library in organizing and managing their own collections of E-resources, particularly eBooks and eTheses & eDissertation. The needed software which contributed to the entire process were also examined as well as the detailed step-by-step which leads to the completion the whole procedures. Moreover, questionnaires were also distributed to fifty (50) library users to assess the utilization and usage of the E-resources. Overwhelmingly, majority of the respondents demonstrated a positive ease of use of the system, and they learn how to use the system easily and finally, they

are satisfied using the Calibre EMS.

However, this study is limited only to the Calibre EMS, Koha library system, Microsoft Publisher, PDF Merging software as the contributory software to address the difficulty of the librarians in organizing and managing E-resources nowadays. Therefore, the researchers are recommending a further study on the same topic to be conducted, and to explore other software also to ease the problems of most librarians in this ever-changing technological society.

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#### APPENDIX A

#### **Research Questionnaire**

Name(optional): Gender: _							
Age: College: Course: _							
Instructions: Kindly put a check mark to the to the corresponding box as your response to the questions below         Legend:         1- Strongly Disagree       2- Disagree       3-Neutral/undecided         4- Agree       5- Strongly Agree							
QESTIONS		1	2	3	4	5	
EASE OF USE							
Accessing e-resources in the library is easy							
The software that holds the e-resources is user friendly							
It requires the fewest steps possible to accomplish what I war to research	nt						
I can access and use the e-resources without written instructions							
I don't notice any inconsistencies as I use it.							
EASE OF LEARNING							
I learned to access the e-resources quickly							
I easily remember how to use it.							
I quickly became skilful in seeking information with it.							
SATISFACTION							
I am satisfied with the organization of the e-resources in this database							
I would recommend it to a friend							
It works the way I want it to work							

# Contributors

**MIDETH B. ABISADO** has twenty years of experience in education and research in Information Technology. She is an experienced Outcomes-Based Education (OBE) practitioner and trainer. She teaches both in graduate and undergraduate computing courses at the National University, Manila – College of Computing and Information Technologies. She has research presentations both in the local and international conferences. She contributed to two textbooks published in January 2016: Basic C++ for Engineers and Scientists and Advanced C++ for Engineers and Scientists, whose principal author is Gary S. Bronson. She received her BS in Industrial Education from the Technological University of the Philippines, graduated cum laude. Also, in the same university, her Master's in Information Technology. She completed her Master of Science in Computer Science, major in Software Development from the Mapua University. A 2016 and 2017 Mapua Cardinal Excellence Awardee, her passion is to prepare and mold the next generation of Filipino IT professionals and leaders in the country.

**EDITHA A. ALAMODIN** is the Director of Learning Resource Center of National University-Manila since 2010. She took up B.S.E. Major in Library Science and M.A. Major in Library Science at the University of Santo Tomas. She is now pursuing her Doctor of Education Major in Educational Management at National University-Manila. She is an active member and became an officer of various librarians' associations such as University of Santo Tomas Library Science Alumni Association (USTLSAA) from 2010-2011 and 2011-2013; Philippine Association of Academic/Research Librarians, Inc. (PAARL) from 2016-2018; and she also served as Philippine Librarians Association, Inc. (PLAI) NOMELEC in 2016.

**DR. FERNAN R. DIZON** is currently the Executive Managing Director of the Knowledge Resource Center of the Asian Institute of Management (AIM). Prior to joining AIM, he held various positions at the Rizal Library, Ateneo de Manila University for almost fifteen years, as librarian, section head, and as assistant director. He earned his Bachelor in Secondary Education from the University of Santo Tomas, Manila, and his Master in Library and Information Science (MLIS), as well as his Doctor of Philosophy in Education, from the University of the Philippines, Diliman.

He has presented papers in various local and international conferences and has published in an international, peer-reviewed journal. He also taught library and information science courses at the University of the East-Graduate School and at the Jose Rizal University-Graduate School for the Baliuag University's MLIS program. He was Secretary of the Philippine Association of Teachers of Library and Information Science (PATLS), Auditor (2017), Vice President (2018), President (2019), and Exofficio member of the Philippine Association of Academic/Research Librarians (PAARL).

He was also Editor-in-Chief of the PAARL Research Journal in 2017 and 2019 and peer-reviewer for the University of the Visayas Research Journal.

**MA. CELINE LARRACAS** is currently the Faculty LRC reference librarian in the Basic Education Department of the Assumption College, Makati. Prior to joining Assumption, she handled the access services of the Knowledge Resource Center of the Asian Institute of Management (AIM). She handled reference service, library promotions, literacy programs, and library events. Her specialization is applied media arts that she utilizes for the creation of marketing collaterals and promotional materials. She dealt with local and international professors, students, and staff at AIM. She holds a bachelor's degree in Library and Information Science from the University of Santo Tomas, Manila.

**GERALDINE G. MALLO-EUSTAQUIO** is a registered librarian and a teacher. She is a junior librarian at the University Libraries of Manuel S. Enverga University Foundation, Lucena City. She teaches information and communication technology (ICT) subjects in the program of Bachelor of Library and Information Science under the College of Education oat the same university. She has also conducted some research work for her institution. She earned her Masters' Degree in Library and Information Science at the University of the Philippines – Diliman. She is also a member of member of PLAI, PLAI-STRLC, PAARL, LAQuePL Inc, and PATLS.

**ABUBAKAR S. MAMA** is the head of the Information Technology Services Division of the Mindanao State University Library in Marawi City. He is also designated as the Head of the eLibrary, a separate building that collects, organize, and manage electronic resources for the students and other researchers to use. Additionally, he is a professorial lecturer in the Master of Public Administration Degree and a candidate for Doctor in Public Administration from the same university. Mr. Mama was a graduate of Bachelor of Library and Information Science at the Mindanao State University-Main Campus, Marawi City on April of 2010 and a holder of Master of Library and Information Science at Lourdes College, Cagayan De Oro City on March of 2016.

The author's specializations are on library systems, information sources, Google, and online information retrieval. He was also the former vice-president of the Philippine Librarian Association – Autonomous Region in Muslim Mindanao (PLAI-ARMM) and currently the chairman of the committee on network and linkages of the Mindanao Association of State Tertiary Schools Library Network +1 in Mindanao, Philippines. Lastly, he was a paper presenter and speaker in two international conferences, national and local seminars, and judge in some research colloquium in the said university.

**RAMON L. RODRIGUEZ** is a Ph.D. student in Computer Science from De La Salle University. He is currently the Program Chair of the BSCS/BSCS-DF program of the College of Computing in Information Technologies (CCIT) – National University. Bernie S. Fabito is currently a University Research Coordinator (URC) under the National University – Center for Entrepreneurship (CenTREP). He also serves as a faculty member of the College of Computing and Information Technologies (CCIT) handling IT related courses. Mr. Fabito has had the opportunity to present research works in the field of social computing, mobile computing, and HCI to various research conferences in ASIA and the USA. He is currently pursuing his Doctorate degree in Information Technology at De La Salle University – Taft.

**AMERHASSAN U. SARANGANI** is currently the Head of the Archives and Special Collection Unit of the University Library at Mindanao State University, Marawi City. He is a graduate of Bachelor of Library and Information Science of the same institution in 2015. His specialization is on Library Management System, Filing Systems, Archives and Special Collection organization and management, and also a speaker in many occasions in the University. He is currently occupying Librarian 1 position in the Mindanao State University.



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