METHODOLOGY

## 

## This chapter presents the methodology that was used in designing and developing the system. This chapter also includes the population and locale of the study, materials, methods, data gathering techniques and sources of data that the researchers used in conducting the study.

### Population and Locale of the Study

The study was conducted at Benguet State University, La Trinidad Campus from the Second Semester of S.Y. 2021-2022 to First Semester of S.Y. 2022-2023. The data gathered was from the six (6) Benguet State University Health Services Medical Clinic Staff. The scope of the study is to store, view, and update the information of the student’s record of the enrolled student from elementary to graduate students in La Trinidad Campus during a transaction of students where their information would be needed and be viewed by the person in charge. The final diagnosis and management of the given medicine to the patient is also included in the system. The users of the system are the staff of UHSI of BSU. The BSU-SHCRMS does not cover the inventory of medicines and supplies. In addition, it will not also cover the Dental Clinic Operations.

### Materials

Different open-source software tools, programming and markup languages were used in creating BSU-SHCRMS. This includes the use of Hypertext Mark-up Language (HTML), Cascading Style Sheet (CSS), Hypertext Processor (PHP), MySQL, JavaScript, XAMPP, Sublime Text, Visual Studio Code, FPDF, Ajax, jQuery and Bootstrap.

HTML enables us to markup the structure of the interface of this project, such as the login form and registration. CSS would help in the styling and presentation of the interface, such as the background, font style, and colors. JavaScript is used in programming the functionality of the project. According to Vodnik (2020), HTML, CSS, and JavaScript make up the essential building blocks of websites worldwide, with CSS controlling a page’s appearance and JavaScript programming its functionality. You can think of the HTML document as providing the bones of a webpage, while CSS provides the skin, and JavaScript provides the brains. With Ajax and jQuery the display and behavior of the system with sending and receiving data from a server asynchronously did not encounter problems. jQuerry provides several methods for Ajax functionality in developing the system. Bootstrap helped in developing the design of the system as it is an open source CSS framework that contains HTML, CSS and JavaScript-based design templates for typography, forms, buttons, navigation and other interface opponents.

According to PHP (n.d.), PHP Hypertext Preprocessor (PHP) is a programming language that allows web developers to create dynamic content that interacts with databases. PHP is a HTML-embedded server-side scripting language that is basically used for developing web-based software applications. It was used to manage dynamic content, databases, session tracking, and even build entire e-commerce sites. It was also integrated with a number of popular databases, including MySQL, PostgreSQL, Oracle, Sybase, Informix, and Microsoft SQL Server.

MySQL is an open-source database management system that will serve as the back-end storage of all the records. According to Pelandiana & Ado (2018), MySQL was the world's most popular open-source database. With its proven performance, reliability and ease-of-use, MySQL has become the most popular database for web-based applications, with high-profile web properties such as Facebook, Twitter, YouTube, Yahoo, and many others using it.

The researchers used XAMPP to develop, test, and deploy the system on a local web server. According to Quadri (2021), XAMPP is an open-source tool for locally executing Web applications using a Web server. XAMPP is a popular and free solution for locally running applications on Windows. It is compatible with all major operating systems and is widely used by Windows users to locally develop and test Web applications.

Sublime Text and Visual Studio Code are the two source code editors that were used in developing the system. The researchers utilized two source code editors, as each researcher has distinct preferences. According to Heller (2019), Sublime Text and Visual Studio Code are two of the best multi-language, multi-operating system programming editors; Sublime Text for its speed as well as its convenient editing features, and Visual Studio Code for its superior features and nearly as good speed. Each tool is compatible with Windows, MacOS, and Linux.

In addition, any Operating System such as Windows 7 or newer, MAC OS X v10.7 or

higher, or Linux Ubuntu is required for the system to work. A server is also required to connect the personal computers, and if possible, the server to be used will be supported by BSU’s server to better handle workloads and prevent hard drive failures. Server, as defined by Posey (2021), is a computer program or device that provides a service to another computer program and its user, also known as the client. In a data center, the physical computer that a server program runs on is also frequently referred to as a server. That machine might be a dedicated server or it might be used for other purposes. Wireless Wi-Fi adapters will also be used to connect the computers to a wireless LAN (Local Area Network). Furthermore, the date of the system should be updated always as the forms, specifically the archive functions, require an updated system date time.

The study covers minimum hardware requirements such as PC/Laptop where the user accesses the system and it is strongly recommended to be fewer than 5 years old, with 2GHz processor, with a 64GB Hard Drive, and a minimum 4GB RAM.

The researchers also used interview and survey questionnaires. The questionnaires were divided into two parts, the first part contains possible problems that the researchers may have to address depending on the degree of the problem. The second part of the questionnaire contains suggested system features that the clients may want to see in the proposed system. The interview and survey results served as a guide for the researchers as they created and designed a system that will also address the problems that the medical clinic's current system is experiencing.

### Methods

The researchers used both descriptive research and mixed methods which employed both qualitative and quantitative research design to be able to conduct this study on answering the given statement of the problem. Descriptive research, according to Johnson (2017), is a type of research design that seeks information in order to systematically describe a phenomenon, situation, or population. Descriptive research can be used to collect qualitative data through methods such as interviews, which can provide insights into the experiences, attitudes, and perceptions of individuals involved in the phenomenon being studied. Descriptive research can also collect quantitative data, such as survey responses, to provide numerical data that can be statistically analyzed. In the study, the researchers used qualitative methods to investigate end-user experiences and opinions because these are non-numerical data and qualitative methods seek to interpret meaning from them. Furthermore, qualitative methods are holistic approaches that involve discovery, which in this study is the discovery of the BSU Medical Clinic's current means of consultation and record keeping, as well as the challenges encountered and the functional/non-functional information requirements and features required for the proposed system. A semi-structured interview was used by the researchers to accomplish this. The researchers used quantitative methods such as surveys to determine the existing student health consultation record system of the BSU medical clinic, including the problems encountered, functional/non-functional information requirements and features needed for the proposed system, and the level of usability of the developed system. Mixed method is a research approach whereby researchers collect and analyze both quantitative and qualitative data within the same study (Shorten & Smith, n.d.). The mixed method analysis consisted of combining the data gathered from both qualitative and quantitative methods for an interpretation. Mixed methods studies is that the use of quantitative and qualitative approaches in combination provides a better understanding of research problems and complex phenomena than either approach alone (Creswell & Plano Clark, 2007). A study was made by Mannino (2014) where the researcher employed a mixed method and it stated that, in this approach, quantitative instruments were used to measure the relationship between the independent variable of resilience and the dependent variables of physical health, mental health, satisfaction with life, and future orientation. At the same time, the central phenomenon of resilience was explored using qualitative methods of a focus group and interview with a subset of the participants. Overall, the combination of descriptive research and mixed methods can provide a detailed and nuanced understanding of a phenomenon, which can inform decision-making.

The researchers used purposive sampling in which the inclusion criteria for the qualified participants must meet the following: the respondent must be a medical clinic staff and willing to participate without the prospect of compensation. Participants will be excluded from the study if they are on a job order or contract of service. The study will utilize self-administered closed-ended survey questionnaires and semi-structured interview with the aim of determining the existing student health consultation record system processes and problems encountered in the existing student health consultation record system processes of Benguet State University, and the information requirements and appropriate security and control measures needed for a network-based student health consultation record system. The researchers used the Post-Study System Usability Questionnaire (PSSUQ) to determine the usability of the proposed student health consultation record management system. The PSSUQ was used by the researchers because it is a standardized and reliable questionnaire that is widely used in research studies to assess system usability. Using a standardized questionnaire, such as the PSSUQ, the researchers can compare their findings to previous studies and draw accurate conclusions about the system's usability. PSSUQ's high levels of reliability and validity ensure that the questionnaire's results are consistent and accurate. PSSUQ is also a user-based questionnaire that measures user satisfaction with the system's usability, reliability, and interface. This user perspective provides valuable feedback that can assist the researchers in identifying areas for improvement and making changes to the system to better meet the needs of the users. Overall, using PSSUQ to evaluate system usability can provide a standardized, reliable, and valid approach to assessing user satisfaction, as well as assist the researchers in identifying areas for system improvement. The PSSUQ is a 16-item standardized questionnaire with seven response options for respondents; from Strongly agree to Strongly disagree and it is widely used to measure users’ perceived satisfaction of a website, software, system or product at the end of a study (Will, 2016). The questionnaires will be given to the medical clinic staff after the system is used by the users. The data gathered from this will be treated statistically and will be used to derive conclusions.

#### Software Development Methodology

Rapid application development (RAD) was chosen by the researchers over other software development methodologies because of its benefits such as rapid development, flexibility, collaboration, and testing. With the researchers' limited time to build the system, RAD is the most appropriate methodology because it allows for faster system development and prototyping. Changes and updates can be made quickly and easily with RAD, allowing researchers to adjust the system as needed. RAD also emphasizes close collaboration between developers and end users, which can aid in ensuring that the system meets the end users' needs and requirements. Lastly, the researchers selected RAD because it incorporates testing and feedback cycles throughout the development process, which can aid in identifying and addressing issues early on. This can assist in ensuring that the final system is of high quality and meets the needs of the end users.

RAD is a methodology that focuses on, as the name indicates, developing rapidly through frequent iterations and continuous feedback (Chien, 2020). According to Deshpande (n.d.), RAD helps to rapidly develop prototypes for testing functions and features without having to worry about any effects on the end product. RAD ensures the high quality of the product by regularly involving users in the whole lifecycle. Each prototype was reviewed by the user, which helped in identifying any major issues (Rana, 2021).

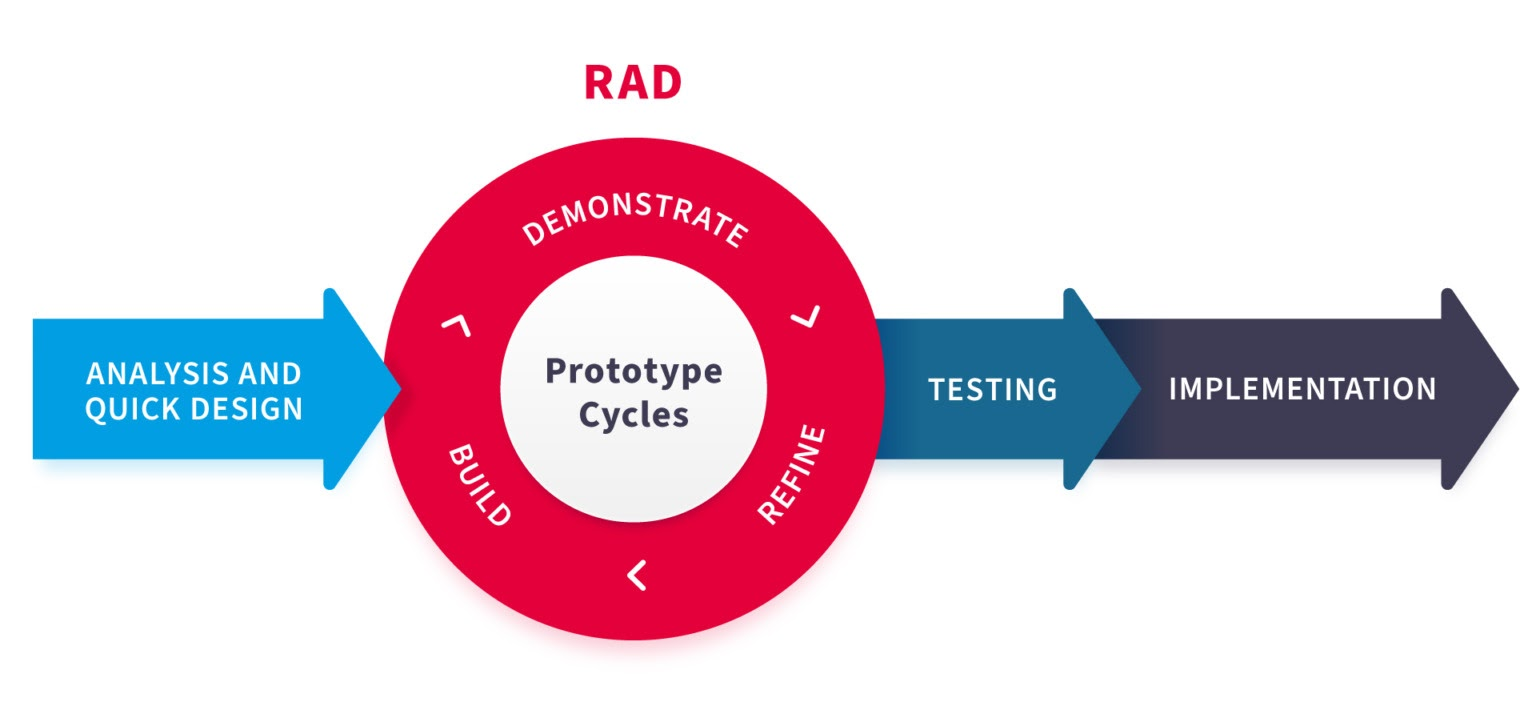


Figure 2.1: Phases of RAD Model

Adapted from Cox (2019), figure 2.1 is the RAD model that illustrates the phases involved in creating the BSU-SHCRMS. The following are the processes on how the researchers developed the Student Health Consultation Record Management System based on RAD methodology.

Analysis and Quick Design: System analysis and quick design involves analyzing the current system's performance and quality of its output. It is a process that is used to evaluate particular problems and develop ways to improve them through more optimal methods. Moreover, it typically emphasizes how systems act, their relationship to other subsystems, and the ability of both to meet a specific goal (Indeed Editorial Team, 2022). According to Cox (2022), this is the phase in which project requirements such as project goals, expectations, timelines, scope, and budget are defined and finalized.

The researchers gathered information about the current problems of the existing system at Benguet State University La Trinidad Campus Medical Clinic only. With the information gathered, the researchers then defined the necessary requirements for the proposed system.

Prototype Cycle: It is a repetition of the prototype development phase, namely build, demonstrate, and refine. Designers and developers will work closely with clients to create and improve upon working prototypes until the final product is ready. Following that, developers collect user feedback in order to tune and improve prototypes and create the best possible product (Cox, 2022). Each prototype develops into a part of the future system. Thus, more complete and useful information is transmitted to the next phase. This is the development stage for the prototype where the researchers can test each prototype at each stage to try and meet the expected output.

The researchers started the development of the prototype which allowed the clients to give comments, suggestions and possible changes for the system. From the clients’ suggestion, the researchers were able to modify and refine the prototype. This phase allowed iteration of the system to fulfill the client’s expectations/suggestions.

Testing:The purpose of the testing phase is to put the system's functionalities to the test. The BSU-SHCRMS was subjected to three tests: unit testing, integration testing, and user interface (UI) testing. In general, the rapid application development testing phase includes unit testing, integration testing, and user interface testing (Shah, 2022).

Unit testing is a type of software testing in which individual software units or components are tested. The goal is to ensure that each component of the system works as intended (Software Testing Fundamentals, 2022). This testing technique was used by the researchers to ensure that each functional component of the system complied with the requirements specification.

The BSU-SHCRMS components were tested collectively using integration testing. Integration testing is a type of testing in which one or two unit-tested modules are combined and verified to see if the integrated modules work as expected (Software Testing Help, 2023). Integration testing is performed by researchers to identify defects in interactions between system components that may not have been detected during unit testing.

User interface (UI) testing was also performed to ensure the functionality and usability of the system's graphical user interface. This type of testing is essentially a mechanism for testing the aspects of any system with which a user will come into contact. This usually entails testing the visual elements to ensure that they are functioning properly in terms of functionality and performance. UI testing ensures that UI functions are free of bugs (Bose, 2022). The researchers performed manual UI testing, in which they interacted with the system's user interface to ensure that it functioned as intended. This contributes to the system's user interface being intuitive and simple to use, which can improve the user experience and, as a result, lead to higher user satisfaction.

When performing the three types of testing on the BSU-SHCRMS, the researcher used black-box testing, which is one of the functional testing techniques. According to Hamilton (2023), black-box testing is a software testing method in which the functionalities of software applications are tested without having knowledge of internal code structure, implementation details and internal paths. Black-box testing mainly focuses on input and output of software applications and it is entirely based on software requirements and specifications. Also, the researchers used manual testing during each type of testing. According to Bartlett (2016), manual testing is the process of using an application's functions and features as an end user would to verify the system's behavior. When testing software, the tester runs tests against predefined test cases and records the results. Manual testing, according to Adekanmi (2019), can be an effective test approach because it can be performed on every component of the software system and it is simple to document test results and provide feedback.

Implementation:The researchers in this phase implemented the system after all system functionalities have been validated.

In this phase, the researchers launched the proposed system and handed out a Post-Study System Usability Questionnaire (PSSUQ) to the client to gather data regarding the usability and benefits of the new system. The BSU-SHCRMS is deployed and implemented at the BSU Clinic. The researchers installed the system on the three PCs at the medical clinic including the server. The connection to the primary server was accomplished through the use of network-based applications. Only the BSU medical clinic staff were given demonstrations since they are the only ones that have access to the BSU-SHCRMS. Moreover, it is only accessible on the BSU clinic computers and BSU-SHCRMS is a project that is only accessible within the university’s communication network.

### Treatment of Data

Descriptive statistical analysis is used in this study. The data will be summarized in tabular form of charts and graphs for summing up data, assuming it for the whole population.

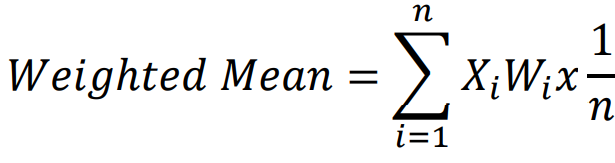
The data to be gathered in this study will be subjected to the following statistical

treatment:

Mean **-** the researchers utilized this because it is one of the easiest and simplest ways of evaluating the proposed system where: x̄ = Average of the total respondents rating in each criterion; x = average of respondents’ responses and n = total number of respondents (Pelandiana & Ado, 2018). This would be represented by x̄ = x/n where x is the average of respondents' responses and n is the total number of respondents who attended the data gathering procedure. The mean was applied to the data collected from the PSSUQ survey to assess the system's usability.

Weighted mean **-** The data collected from the survey were treated using weighted means to assess the level of problems encountered with Benguet State University Medical Clinic present approach in student health consultation. This was also utilized to determine the level of the required data and features for the proposed system, as well as the level of its usefulness and benefits.

Formula:



Xi  = Frequency of Answers in **n** respondents

Wi = Weight Factors

n = Total Respondents

For the interpretation of the computed weighted mean, the researchers used the following scales:

The table below shows the five-point likert scale in which responders specify their level of agreement to a statement typically in five points: (1) No problem; (2) Minor Problem; (3) Moderate Problem; (4) Serious Problem; (5) Severe Problem. This will be the basis to determine the security and control measures needed in the student health consultation record management system with the level of problems encountered with the current system.

#### Table 2: Five- Point Likert Scale Range and their Descriptive Equivalence for Problems Encountered

|  |  |  |
| --- | --- | --- |
| SCALE | RANGE | VERBAL INTERPRETATION |
| 1 | 1.00 - 1.80 | Not a Problem |
| 2 | 1.81 - 2.60 | Minor Problem |
| 3 | 2.61 - 3.40 | Moderate Problem |
| 4 | 3.41 - 4.20 | Serious Problem |
| 5 | 4.21 - 5.00 | Severe Problem |

Table 2.1 also shows the five-point likert scale in which responders specify their level of agreement to a statement typically in five points: (1) Strongly disagree; (2) Disagree; (3) Neither agree nor disagree; (4) Agree; (5) Strongly agree (Manuel, n.d.). This will be the basis to determine the features to include in the student health consultation record management system.

Table 2.1: Five- Point Likert Scale Range and their Descriptive Equivalence for Features Needed

|  |  |  |
| --- | --- | --- |
| SCALE | RANGE | VERBAL INTERPRETATION |
| 1 | 1.00 - 1.80 | Strongly Disagree (SD) |
| 2 | 1.81 - 2.60 | Disagree(D) |
| 3 | 2.61 - 3.40 | Neutral / Uncertain (N/U) |
| 4 | 3.41 - 4.20 | Agree(A) |
| 5 | 4.21 - 5.00 | Strongly Agree (SA) |

#### 

PSSUQ - The PSSUQ survey was used to assess the usability and benefits of the BSU-SHCRMS. Lower PSSUQ scores for health technologies indicate higher/better usability. The PSSUQ is a questionnaire to assess the perceived usability and benefits of the technology, which has been demonstrated to be valid and reliable even for small sample sizes (Tahsin et al., 2021). This questionnaire includes 16 items on a 7-point Likert scale (+ NA option), yielding an overall score as well as three subscales: system usefulness (six items), information quality (six items), and interface quality (three items). The overall result is calculated by averaging the scores of questions 1 to 16. System Usefulness (SYSUSE) is calculated by getting the average scores of questions 1 to 6. Information Quality (INFOQUAL) is calculated by getting the average scores of questions 7 to 12. While Interface Quality (INTERQUAL) is calculated by getting the average scores of questions 13 to 15.

The table below shows the seven-point likert scale in which the respondents specify their level of agreement to a statement typically in seven points: (1) Strongly agree; (2) Agree; (3) Somewhat agree; (4) Neutral; (5) Somewhat disagree; (6) Disagree; and (7) Strongly Disagree. It was utilized to treat the response scale on the PSSUQ.

Table 2.2: PSSUQ Seven- Point Likert Scale Range and their Descriptive Equivalence

|  |  |  |
| --- | --- | --- |
| SCALE | RANGE = 0.8571428571 | VERBAL INTERPRETATION |
| 1 | 1.00 - 1.85 | Strongly Agree |
| 2 | 1.86 - 2.71 | Agree |
| 3 | 2.72 - 3.57 | Somewhat Agree |
| 4 | 3.58 - 4.24 | Neutral |
| 5 | 4.25 - 5.28 | Somewhat Disagree |
| 6 | 5.29 - 6.14 | Disagree |
| 7 | 6.15 - 7.00 | Strongly Disagree |
| N/A |  |  |