



The Role of Automation in Enhancing Efficiency and Accuracy in SEAIT's School Clinic

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ABSTRACT

This study examined the role of automation in improving workflow efficiency and record accuracy in the SEAIT School Clinic through the implementation of the SEAIT School Clinic Management System (SSCMS). Employing a mixed-method design, the research integrated quantitative and qualitative data collection through structured surveys, focus group discussions, and system evaluation. The quantitative analysis, including descriptive statistics, paired sample t-tests, and Pearson correlation, revealed a significant increase in workflow efficiency and record accuracy following automation ($p < 0.05$). The qualitative findings supported these results, highlighting improvements in documentation, report generation, and access to patient records. Participants emphasized that automation reduced manual workload, minimized human error, and enhanced overall service quality, although challenges such as limited training, data privacy, and infrastructure constraints were also noted. The study, grounded in the Technology Acceptance Model (TAM), demonstrated that perceived usefulness and ease of use significantly influenced system adoption and satisfaction among clinic staff. The findings underscore the transformative potential of automation in school healthcare environments, offering insights for future digitalization initiatives aimed at optimizing operational efficiency, accuracy, and user experience in educational health systems.

Keywords: Automation, Human-Computer Interaction (HCI), Healthcare Digitalization, Record Accuracy, Technology Acceptance Model (TAM), School Clinic Management System, Workflow Efficiency.

1. INTRODUCTION

1.1 Background and Context

Human-Computer Interaction (HCI) applies a user-centered design in developing digital interfaces and systems that made the workflow management for healthcare providers simple and efficient (Langote et al., 2024). Throughout the years, the increasing growth of HCI reshaped various sectors, mainly in healthcare, where efficiency, accuracy and user-friendliness is important. The development and integration of Electronic Health Records (EHR), data visualization, and interfaces designed for user needs, improved tasks and operational efficiency, resulting in a more effective workflow process. These digital advancements made substantial improvements to the efficiency and precision of administrative processes, making healthcare workers complete more tasks in shorter time than with traditional pen-and-paper methods (Kaihlainen et al., 2023). However, while automation offers numerous benefits, there are still challenges encountered in healthcare systems such as data duplication, system instability, and potential loss can disrupt workflow efficiency and affect the accuracy of the system.

The introduction of automation through the SEAIT School Clinic Management System (SSCMS) was designed to address existing challenges by automating tasks such as patient intake, record retrieval, and staff coordination. This study aimed to evaluate the impact of automation on the efficiency and accuracy of clinic operations by examining the effects of SSCMS. Through exploring the perceptions of the clinic staff, the research

sought to determine whether the system successfully addressed existing workflow issues or introduced new challenges that need further improvement.

1.2 Research Problem

In the present-day setting, the SEAIT school clinic heavily relies on a pen-and-paper method for the majority of the duties, that includes handling medical transactions, maintaining patient records, inventory tracking, and preparing monthly case reports. This established method has been a practice for many years; however, it is prone to error, time-consuming, at risk of document misplacement and inaccurate information input. This manual method is also inefficient in managing large amounts of data. As automation technology has advanced, enabling previously lengthy tasks to be swiftly executed, precisely, and effectively, numerous healthcare organizations have changed to digitalised systems to improve daily workflow and service delivery. This research sought to explore how automation profoundly affected work effectiveness and precision, as well as assessed whether the adoption of a digital system notably enhanced clinic operations. While previous research has demonstrated the positive effects of robotics automation on operational efficiency and patient satisfaction in large-scale healthcare settings (Khinvasara, 2024), there remains a lack of studies focusing on smaller, educational clinic environments. Specifically, there is limited understanding of how automation impacts workflow efficiency, record accuracy, and user satisfaction in school clinics like SEAIT's. Furthermore, the relationship between automation and overall clinic performance, as well as the challenges faced during implementation in such contexts, has not been thoroughly explored. This gap highlights the need for research that examines the unique dynamics of automation in educational healthcare settings.

1.3 Research Questions and Objectives

This research aimed to evaluate the role of automation in the SEAIT School Clinic in improving workflow efficiency and record accuracy in the clinic operations. Specifically, it sought to answer these questions:

1. What is the perceived impact of automation on workflow efficiency and record accuracy in SEAIT's School Clinic, based on user satisfaction and performance ratings?
2. What is the level of workflow efficiency and record accuracy in clinic operations before and after automation is introduced?
3. Is there a significant relationship between automation and the overall efficiency and accuracy of the SEAIT's School Clinic?
4. How do the clinic staff perceive the impact of automation on daily operations in SEAIT's School Clinic?
5. What challenges or improvements have been observed in the clinic's workflow and management since the introduction of automation?
6. In what ways has automation influenced the overall service quality and user satisfaction in SEAIT's School Clinic?

In relation with the research questions, this research aimed to achieve the following objectives:

1. To evaluate the perceived impact of automation on workflow efficiency and record accuracy in SEAIT's School Clinic, based on user satisfaction and performance ratings.
2. To assess the level of workflow efficiency and record accuracy in SEAIT's School Clinic before and after the implementation of automation.
3. To determine the statistical relationship between automation and the overall efficiency and accuracy of SEAIT's School Clinic.
4. To explore the perceptions and experiences of staff and students regarding the effectiveness and usability of the automated system in their daily clinic interactions.
5. To identify and understand the specific operational changes, including both benefits and difficulties, brought about by the implementation of automation in the clinic.
6. To examine how the automated system has affected the quality of healthcare service delivery and the satisfaction levels of its users.

1.4 Justification and Significance

The research was conducted to help understand the role of automation in improving operational efficiency and record accuracy in regards to school clinic workflow. The findings provided an understanding of how integration of automated systems affects overall aspects of clinical workflow while gaining insights of the advantages and challenges faced during implementation. Through an in-depth analysis of the impact of automation on record management, inventory tracking, and administrative functions, the study extends guidance for school administrators, healthcare providers, and policy makers in making informed decision-making about the implementation and adoption of technology-driven solutions in school health services. The finding can also serve as a foundation for future system improvements and the establishment of best practices for digital transformation in school clinics.

2. LITERATURE REVIEW

2.1 Overview of HCI Theories and Models

Theories and models in human-computer interaction (HCI) provide a structured framework that assesses the understanding on how users interact with technology, affecting the system design and implementation of automation. In this research, Technology Acceptance model (TAM) is the foundation model chosen which explains user adoption of technology based on Perceived Usefulness (PU) and Perceived Ease of Use (PEOU)—two factors that are crucial in determining whether a user will adopt the system successfully. TAM is significant in evaluating how well nurses and staff accept the automated system and how the adaptation correlates with workflow improvements in terms of efficiency (Davis, 1989; Marikyan & Papagiannidis, 2024).

2.2 Automation in Healthcare

Medical automation is the use of automated systems and technologies that enhance medical processes primarily to reduce manual tasks, minimize human error, and improve operational efficiency (Silveira, 2025). A similar study noted that patient care and administrative work are improved through automation while significantly reducing time, more cost-effective by reducing the use of traditional paper-based processes (Schwarz, 2025), enabling personalized care and more accurate diagnosis (Pashkovskaya, 2025).

One of the key aspects of medical automation involves automation of administrative processes, which includes management of electronic medical records, tracking inventory, and automating prescription systems. Clinical workflows have become more efficient with the advancements in human-computer interaction (HCI), machine learning and artificial intelligence (Rundo et al., 2020). In recent studies, it was shown that AI integration enhanced diagnostic accuracy transforming healthcare practices that can be used to support healthcare providers (Spatharou et al., 2020). As stated in a study of Automation in Healthcare Claims Processing: Enhancing Efficiency and Accuracy, automation increases productivity among healthcare workers (Machireddy, 2025). By automating key administrative and clinical processes, healthcare providers can dedicate their time more on delivering high-quality care to their patients. In healthcare, information technology is used for workflow automation to automate repetitive workflows bringing success to healthcare organizations (Alder, 2023)

Further research supports the impact of automation in healthcare. Digitalization and automation improve speed and accuracy of administrative tasks, leading to more efficient operations compared to traditional manual methods (Kaihlainen et al., 2023). While automation in healthcare improves patient satisfaction and workflow, it also leads to reduced operational costs (Nadeau, 2023). Moreover, the HCI plays a crucial role in designing user-centered digital interfaces as it enhances workflow management for medical professionals (Langote et al., 2024).

2.3 Workflow Efficiency

Contemporary healthcare encounters more intricate responsibilities and the difficulty of handling extensive data owing to rising population numbers (Zayas-Cabán et al., 2023). The adoption of health information technology and advanced computational tools has created opportunities for process automation, leading to more efficient and effective workflows.

Workflows play a critical role in clinical efficiency, with 60% of healthcare CIOs identifying inefficient processes and lack of automation as primary user frustrations (Ray & Larsen, 2024). Introducing systems in health care workflows deliver a high-quality, equitable care (Zayas-Cabán et al., 2021). Optimized workflows help clinicians

streamline their tasks, eliminate unnecessary steps, and enhance efficiency while ensuring a seamless experience for both healthcare professionals and patients.

Automation-driven solutions help healthcare organizations overcome ongoing operational challenges, enabling them to focus more on delivering high-quality patient care (Grisamore, 2024).

2.4 Record Accuracy

Healthcare establishments, especially sizable medical organizations, need to handle enormous quantities of patient information. Every patient possesses a detailed medical history, offering immediate insights into their health condition. Precise medical records are essential for knowledgeable decision-making and efficient treatment planning.

Handwritten record-keeping poses significant risks, as mistakes can happen when several individuals make alterations, conditions remain undetected, or records are incorrect (Skerpac, 2021). These errors can result in wrong diagnoses, unsuitable treatments, or even patient harm, possibly leading to medical malpractice lawsuits. Moreover, errors in healthcare records can erode patient confidence in providers, harming the reputation of healthcare leaders and their capacity to offer safe and dependable care (Frazier, 2024).

The implementation of electronic health record (EHR) systems offer solutions to these challenges. Compared to manual methods like traditional pen-and paper method, EHRs reduce cost, improve operational efficiency and record accuracy of patient data. Research suggests that the adaptation of EHR mitigates IT-related errors, reduces the likelihood of medical mistakes, and increases overall performance of healthcare institutions. Healthcare providers can ensure greater accuracy, improve patient care, and have more efficient clinical processes by leveraging automation in medical documentation.

2.5 Existing Solutions and Limitations

Automation was introduced through automated prescriptions (Sharaf, 2024). The research investigated the impacts of automated prescriptions on medication safety, workflow effectiveness, and healthcare quality. Findings demonstrated a beneficial effect, signifying notable advancements in prescription precision, decreased medication mistakes, and increased patient safety after introducing automation technologies. Obstacles comprised system outages and staff reluctance; however, the results indicate that prescription automation has the potential to greatly enhance the safety and efficiency of healthcare services. Nevertheless, this study focused solely on automated prescriptions and did not address other administrative duties in healthcare settings, like handling patient records.

Digital transformation is progressively evident in health and social care, influencing work arrangements, demands, responsibilities, and instruments. A qualitative investigation into digitalisation amid the COVID-19 pandemic revealed that while administrative duties became more efficient, the workload beyond these tasks rose (Kaihlainen et al., 2023). Users were required to master new systems and subsequently instruct others. Main issues encompassed computer illiteracy and insufficient training, which adversely affected overall work efficiency relative to the period prior to digitalisation. The research concentrated on users' views regarding digitalisation and did not investigate statistical impacts on accuracy and efficiency prior to and following digitalisation.

2.6 Theoretical Framework for the Research

The research was based on the Technology Acceptance Model (TAM), which accounts for user acceptance and utilization of technology through two main factors: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). Perceived Usefulness is understood as the extent to which users think the system enhances their job performance, whereas Perceived Ease of Use indicates how simple and user-friendly the system is to operate (Davis, 1989; Marikyan & Papagiannidis, 2024). TAM is widely used to evaluate the success of technology implementation in various settings, especially in healthcare and educational institutions.

In this research, TAM was used for evaluating the clinic staff's acceptance of the automated school clinic management system. By assessing perceived usefulness (PU) and perceived ease of use (PEOU), this study determined the factors influencing the system's acceptance and its impact on workflow efficiency. A higher acceptance rate was expected to correlate with improved operational efficiency and accuracy in patient management.

2.7 Conceptual Framework

This study analyzed the impact of automation on efficiency and accuracy in SEAIT's school clinic. The study was based on specific independent and dependent variables. Here were the identified variables within the conceptual framework.

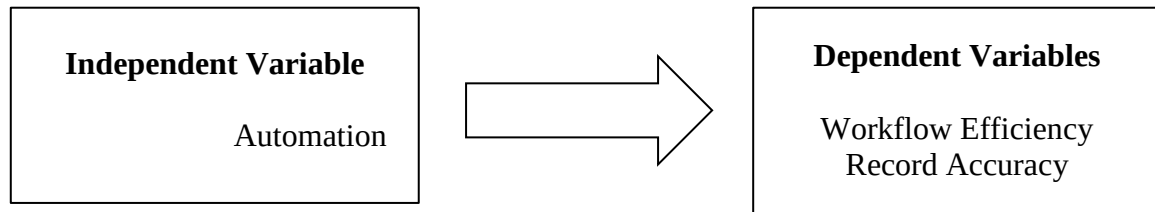


Figure 2.7.1 Conceptual Framework of the Study

In this conceptual framework, the independent variable (implementation of automation in clinic operations) directly influenced the dependent variables (workflow efficiency and record accuracy). The study aimed to examine how automation streamlines administrative processes, reduces manual errors, and enhances the accuracy of patient records. Additionally, it sought to determine whether automation optimizes clinic workflow by reducing task completion time and improving service delivery. Through a mixed-method approach, the study assessed the effectiveness of automation in improving both efficiency and accuracy in the SEAIT School Clinic.

3. METHODOLOGY

3.1 Research Design

This study employed a mixed-method design, incorporating multiple case studies and thematic analysis to evaluate the impact of automation on efficiency and accuracy in clinical operations at the SEAIT School Clinic. This design facilitated in-depth knowledge of how automation influences SEAIT school clinic workflow by consolidating measurable outcomes using statistical analysis tools with profound understanding from user experiences through a focus group discussion.

3.2 Participants

There were 10 participants in this study: two nurses, two nursing assistants, and six student volunteers who were directly taking part in the daily operational workflow of the SEAIT School Clinic. These individuals provided valuable insights into the efficiency and accuracy of clinical tasks in pre- and post-automation. To ensure familiarity with pre-automation workflows, participants had at least one month of experience working in the SEAIT School Clinic.

CASE 1: Staff Perceptions of the SSCMS and its Role in Daily Operations

This case explored how clinic staff perceive the introduction and use of the SEAIT School Clinic Management System (SSCMS) in their day to day transactions. It explored their understanding of the current process involved in managing student health records and clinic operations, their familiarity with automated systems and their views on introducing automation into clinic workflows. The case examined how staff interpret the impact of the system on documentation, monitoring of student medical information and overall clinic efficiency.

CASE 2: Challenges Encountered in the Use of SSCMS

This case investigated the specific challenges clinic staff face when using the SSCMS. It considered the issues they encountered in maintaining accuracy and efficiency during clinic operations, concerns about adapting to new technologies including data privacy and security, power outages and mobile signal reception. It also covered the types of training and support they believe are necessary for using the system properly. The case aimed to outline both technical and operational challenges that arise with the introduction of automation in the clinic.

CASE 3: High Staff Satisfaction in Using the SSCMS

This case focused on the high level of satisfaction expressed by clinic staff in using the Seait School Clinic Management System (SSCMS). It highlighted how the system has positively affected their daily work, including smoother workflows, faster access to records and better time management. This case also demonstrated how automation has contributed to enhancing overall service quality and satisfaction for the clinic personnel, particularly in terms of more efficient healthcare delivery and improved user experience.

3.3 Data Collection

In order to collect the quantitative data, the researchers conducted a structured survey questionnaire where each question was rated using Likert scale (1-4) in order to measure the participant's perceptions of workflow efficiency, this includes patient satisfaction, task completion, staff coordination, and overall clinical tasks, as well as documentation quality, time management, confidentiality, and easy retrieval of records, before and after implementing automation.

In order to collect the qualitative data, the researchers conducted a focus group discussion (FGD). A semi-structured guide was used to explore the participants' experiences with the current processes, challenges in maintaining efficiency and accuracy, perceptions of automation's potential impact on workflow and care quality, training and support needs, concerns about adapting to new technologies, desired system features, and recommendations for improving clinic operations through automation. Moreover, the evaluation of 50 automated records compared to manually verified records was incorporated and discussed during the FGD session to assess participants' collective insights on the system's accuracy and performance.

3.4 Data Analysis

This study used a mixed-method approach to evaluate the impact of automation on workflow efficiency and record accuracy within the SEAIT School Clinic. Quantitative data was analyzed using descriptive statistics, paired sample t-test, and Pearson correlation analysis. Descriptive statistics was used to summarize user satisfaction and performance rating, providing insight into the perceived impact of automation on workflow efficiency and record accuracy. Paired sample t-tests determine whether a statistically significant difference exists in workflow efficiency and record accuracy before and after the implementation of the SEAIT School Clinic Management System (SSCMS). Pearson correlation analysis was applied to determine the strength of the relationship between the automation of clinic processes and the overall efficiency and accuracy of clinic operations. Qualitative data from focus group discussions were examined using thematic analysis, categorizing responses into key themes such as usability, workflow efficiency, challenges, and areas for improvement. For accuracy evaluation, a 95% confidence interval was used to estimate the precision of the system. Integrating findings from both methods ensures a comprehensive understanding of both measurable outcomes and participant perspectives.

3.5 Ethical Considerations

This study valued ethical research practices and standards by obtaining informed consent, where all participants were fully briefed on the study's purpose, procedures, and their right to withdraw at any time. To protect privacy, no personal information was collected, and all data was securely stored. The possible impact of automation on clinic staff workload were considered to foster ethical behavior in the workplace. Additionally, the accuracy and reliability of the automated system validated before implementation, and ethical authorization was acquired from the head nurse before data collection began.

4. ADVANCED HCI SYSTEM DESIGN

4.1 System Architecture

The architecture of the SEAIT School Clinic Management System (SSCMS) was designed to automate clinic operations, improve efficiency, and ensure accurate patient data handling. The system followed a multi-tiered architecture, allowing for smooth data flow and optimized performance.

Key Components and Interactions

- **User Interface (UI):** The user interface connects to the application layer and gives users a simple and accessible way to use the system.
- **Application Layer:** The application layer handles the system's main processes. It manages how information flows between the user interface and the database, making sure everything runs smoothly and correctly.
- **Database Layer:** The database layer is where all clinic data is safely stored. It keeps records organized, easy to access, and ensures the accuracy and security of the information.

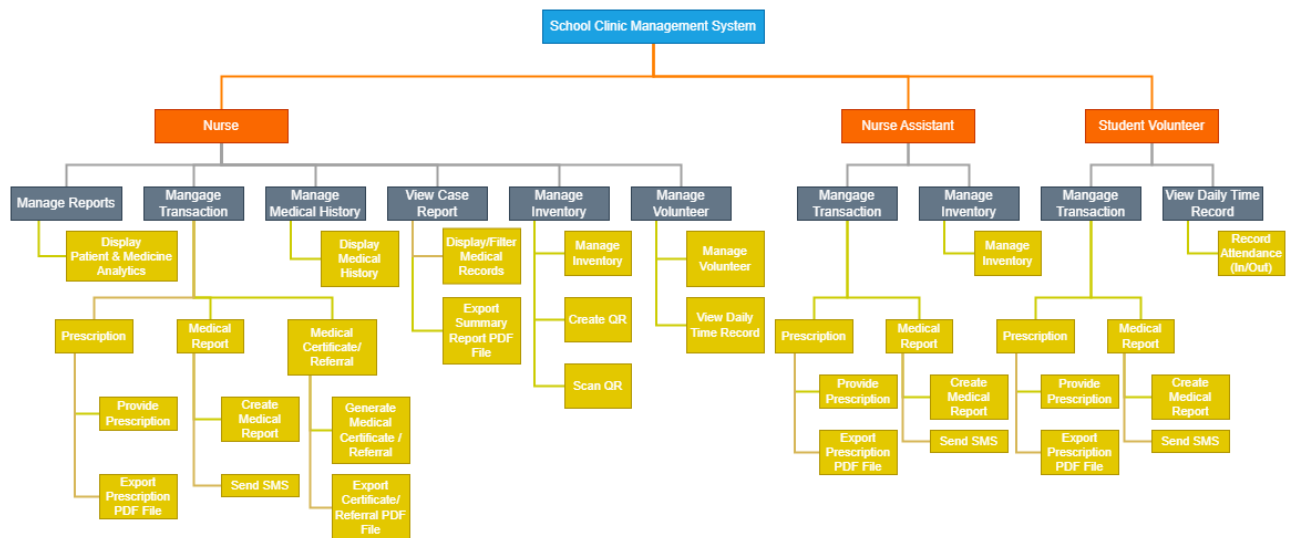


Figure 4.1.1 Functional Decomposition Diagram of SSCMS

4.2 Features and Functionalities

The features of SEAIT School Clinic Management System are the following:

- **Advanced Data Analytics:** This shows the data visualization for weekly patient visits, most dispensed medicine, and frequent health issues encountered. The system will analyze the data input by the users in order to produce analytics for each category.
- **Medical Certificate and Referral Slip Generator:** This enables the creation of digital medical certificates and referral slips for patients to get endorsed to the rural health unit or the nearest hospital. Nurses simply input the required information, and the system automatically generates a printable PDF document for issuance.
- **SMS Notification for Emergency Contacts:** This alerts the emergency contact of a student once they are brought to the clinic for consultation and/or referred to the nearest hospital. This SMS notification provides the contact brief details of what happened to the patient, ensuring that the contact is aware of the situation and can take appropriate action.
- **Medical Inventory Management with QR Code Integration:** This feature centralizes and automates inventory tracking by monitoring stock levels and notifying clinic staff when supplies are low. With integrated QR code scanning, new batches of medicines and supplies are quickly logged and categorized, improving accuracy and ensuring efficient restocking and inventory control.
- **Electronic Daily Time Record (DTR) for Student Volunteers:** This automates the time tracking process of student volunteers who render service duty in the school clinic. Once they click the button “time,” they will have a record of time in and/or time out in the system.
- **Automated Prescription Generation:** This automatically prescribes over-the-counter (OTC) medications for a predefined list of common illnesses. With this, the clinic staff will pick an illness on a dropdown list based on the patient's signs and symptoms, and the system will match it to an appropriate OTC medication. The system does not intend to diagnose or treat complex medical conditions.

- **Medical History Access:** This shows medical history of each patient, containing their check-up records at the clinic. Under this, the system displays a chronological view of all past consultations, diagnoses, medications, and procedures. This allows the clinic staff to view and update patient medical records for continuity of care.
- **Case Report Automation:** This automatically generates case reports monthly. The system will then produce a PDF file of the summary of case reports. In the said PDF file, it will show relevant data like patient name, course, findings, treatment, and the exact date they went to the clinic.

These features address the research problem by automating the clinic operations, reducing manual workload, and minimizing errors. By digitising routine tasks, improving data accuracy, and enabling faster access to patient information and resources, the system enhances both efficiency and the quality of healthcare services provided. This leads to better decision-making, improved communication, and more reliable recordkeeping, ultimately supporting a more organized and responsive school clinic environment.

4.3 User Interface Design



Figure 4.3.1 Login Page

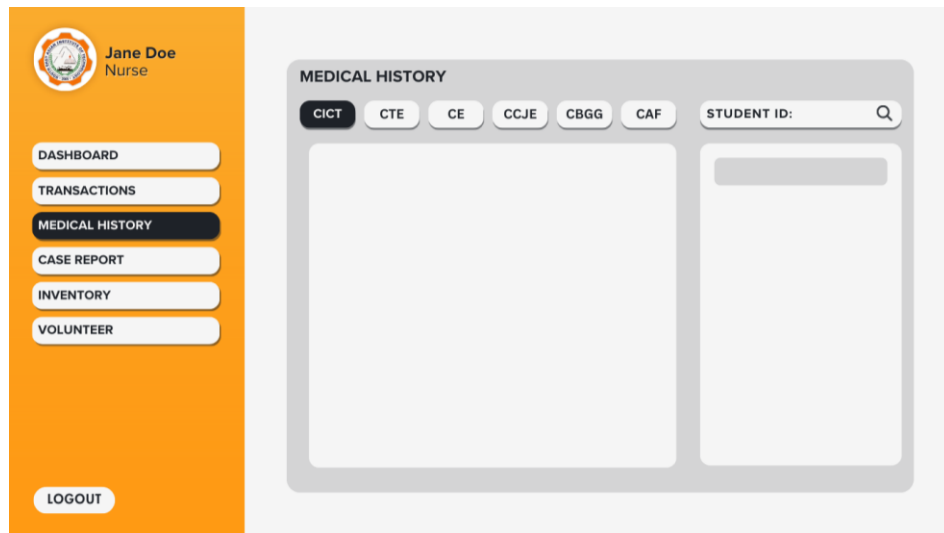


Figure 4.3.2 Data Visualization Page

Figure 4.3.3 Prescription Page

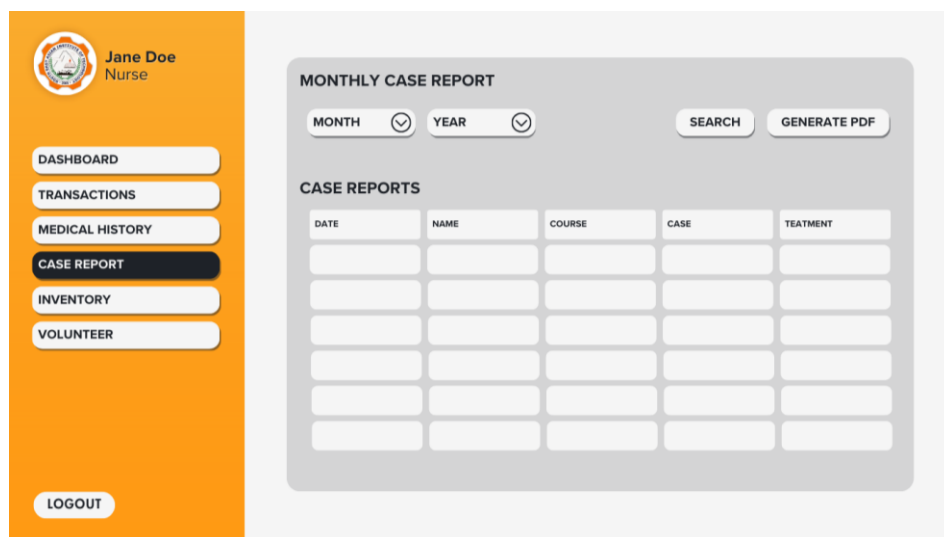
Figure 4.3.4 Medical Report

Figure 4.3.5 Medical Certificate / Referral



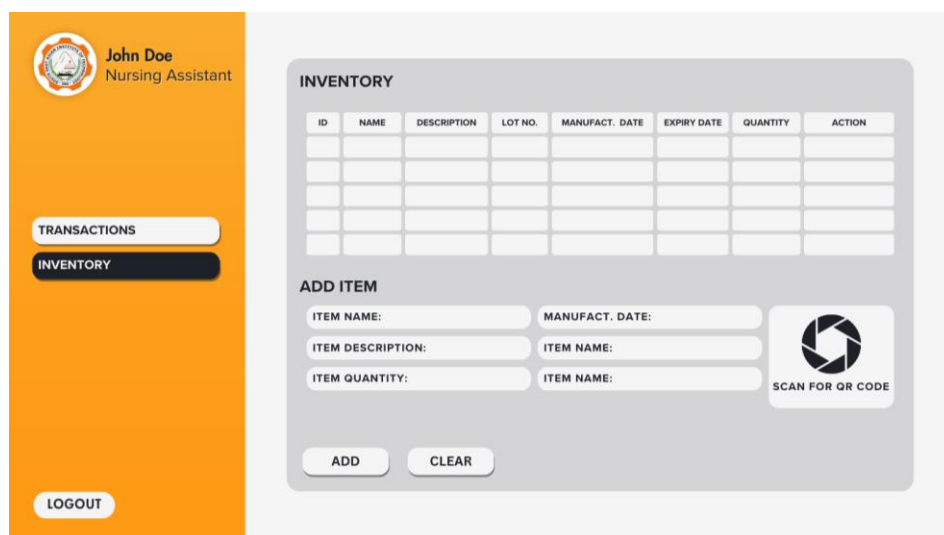
The screenshot shows the 'MEDICAL HISTORY' page for Jane Doe, a Nurse. The left sidebar contains navigation buttons: DASHBOARD, TRANSACTIONS, MEDICAL HISTORY (highlighted), CASE REPORT, INVENTORY, and VOLUNTEER, along with a LOGOUT button at the bottom. The main content area is titled 'MEDICAL HISTORY' and includes tabs for CICT, CTE, CE, CCJE, CBGG, and CAF. A search bar labeled 'STUDENT ID:' with a magnifying glass icon is present. The main area contains two large empty rectangular boxes for data entry or display.

Figure 4.3.6 Medical History



The screenshot shows the 'MONTHLY CASE REPORT' page for Jane Doe, a Nurse. The left sidebar is identical to the previous page, with 'CASE REPORT' highlighted. The main content area is titled 'MONTHLY CASE REPORT' and features dropdown menus for 'MONTH' and 'YEAR', a 'SEARCH' button, and a 'GENERATE PDF' button. Below this is a section titled 'CASE REPORTS' containing a table with five columns: DATE, NAME, COURSE, CASE, and TEATMENT (sic). The table has six empty rows for data entry.

Figure 4.3.7 Case Report Page



The screenshot shows the 'INVENTORY' page for John Doe, a Nursing Assistant. The left sidebar has 'INVENTORY' highlighted. The main content area is titled 'INVENTORY' and contains a table with eight columns: ID, NAME, DESCRIPTION, LOT NO., MANUFACT. DATE, EXPIRY DATE, QUANTITY, and ACTION. Below the table is an 'ADD ITEM' section with input fields for ITEM NAME, ITEM DESCRIPTION, ITEM QUANTITY, MANUFACT. DATE, and ITEM NAME (repeated). There are 'ADD' and 'CLEAR' buttons at the bottom. A QR code scanner icon with the text 'SCAN FOR QR CODE' is also present.

Figure 4.3.8 Inventory Page with QR Code Scanner

Figure 4.3.9 Add Volunteer Page

ID	TIME IN (AM)	TIME OUT (AM)	TIME IN (PM)	TIME OUT (PM)

Figure 4.3.10 Electronic Daily Time Record

5. EVALUATION AND RESULTS

5.1.1 Survey

This study used a pre-automation and post-automation survey to evaluate the impact of automation on workflow efficiency and record accuracy in the SEAIT School Clinic. The same structured questionnaire was used for both phases. It was first conducted one week before the system was introduced and then given again after the participants had used the system for a period of time. To make sure that the survey was accessible and easy to complete, printed copies were manually distributed to participants. Participants were also informed about the survey's purpose, assured that their answers would remain confidential and given enough time to complete their answers carefully.

The completed survey questionnaires were manually collected and encoded into a spreadsheet for an organized data analysis. After encoding, the data was reviewed carefully to correct any errors and maintain consistency. The researchers used the descriptive statistics to summarize how the clinic performed in terms of workflow efficiency and record accuracy after the automation was introduced. To measure how effective the system was, a paired sample t-test was used to compare the workflow efficiency and the record accuracy before and after the introduction of automation. The Pearson correlation coefficient was also applied to determine the relationship between workflow efficiency and record accuracy after automation. These methods helped the researchers assess the impact of the system and identify possible areas for improvement.

5.1.2 Focus Group Discussion

A focus group discussion (FGD) was conducted with the same participants who answered the survey in order to gain a deeper understanding of how the participants experienced the SEAIT School Clinic (SSCMS). The discussion was focused on areas such as usability, workflow efficiency, challenges encountered and areas for improvement. Participants were highly encouraged to speak openly, especially when comparing the old manual process with the new automated system. The discussion was recorded and then transcribed to accurately capture what the participants said. After reviewing the transcripts, responses were organized into common themes. These insights helped explain the survey results with a more clear and complete view of the overall impact of the system on clinic operations.

5.2 Performance Metrics

The performance metrics used to evaluate the SSCMS were based entirely on user feedback, focusing on workflow efficiency and record accuracy. To understand workflow efficiency, participants were asked about how quickly they could complete a task, how easy it was to move through the system, and how smoothly patients were handled. When it came to record accuracy, the feedback centered on how clear and dependable the records were, how well private information was protected and how simple it was to manage patient data. Overall user satisfaction was a key factor in both areas, showing how well the system helped staff provide reliable and effective care. These matrices provide a structured and user-focused way to look at how the system performed and how dependable it was in real use.

5.3 Comparative Analysis

The SEAIT School Clinic Management System (SSCMS) was compared to the clinic's previous manual system to assess improvements and limitations introduced by automation. Survey results showed a notable improvement in perceived efficiency and satisfaction after the introduction of automation, particularly in areas of record accuracy, task completion speed, and reduced manual workload. The system's interface contributed to improved user satisfaction by simplifying navigation and standardizing procedures. However, while automation greatly enhances clinic operations and staff performance, continuous system optimization, user feedback integration, and support remain essential to ensure SSCMS fully aligns with the users' needs for workload efficiency and record accuracy.

5.4.1 Results and Findings of Survey

Quantitative RQ 1: What is the perceived impact of automation on workflow efficiency and record accuracy in SEAIT's School Clinic, based on user satisfaction and performance ratings?

The table below presents the descriptive statistics for post-automation workflow efficiency in the SEAIT School Clinic, based on user satisfaction and performance ratings. Data was collected from 10 respondents, with efficiency scores ranging from a minimum of 3.3 to a maximum of 4.0, resulting in a range of 0.7. The mean score is 3.79, indicating a generally high perceived efficiency after automation. The low standard deviation and variance suggest that the scores are closely clustered around the mean, reflecting consistent and stable workflow efficiency following the introduction of automation.

Table 5.4.1.1 Presentation of descriptive statistics for the post-automation workflow efficiency of the SEAIT School Clinic

N	Minimum	Maximum	Range	Mean ($\bar{x}$)	Standard Deviation (S)	Variance (S^2)
10	3.3	4.0	0.7	3.79	0.2132	0.04544

The table below shows that the post-automation record accuracy in the SEAIT School Clinic has a high mean score of 3.8, with values ranging from 3.0 to 4.0, resulting in a range of 1. The standard deviation of 0.3055 and variance of 0.09333 indicate that the responses are relatively consistent and closely clustered around the mean. This reflects a generally positive prescription of improved record accuracy following the introduction of automation.

Table 5.4.1.2: Presentation of descriptive statistics for the post-automation record accuracy of the SEAIT School Clinic

N	Minimum	Maximum	Range	Mean ($\bar{x}$)	Standard Deviation (S)	Variance (S^2)
10	3.0	4.0	1	3.8	0.3055	0.09333

Quantitative RQ 2: What is the level of workflow efficiency and record accuracy in clinic operations before and after automation is introduced?

The table below presents the results of a paired sample t-test conducted to assess the level of workflow efficiency before and after the automation at the SEAIT School Clinic. Since the p-value is less than 0.05, this indicates a statistically significant improvement in workflow efficiency after automation. The mean difference of 0.54 suggests a moderate increase in efficiency, while the standard deviation of the differences (0.4115) reflects some variability in the levels of improvement. Additionally, the normality p-value of 0.9899 confirms that the data meets the assumption of normality, thereby supporting the validity of the test results.

Table 5.4.1.3: Presentation of paired sample t-test comparing workflow efficiency before and after automation of the SEAIT School Clinic

p-value	t	Sample Size (n)	Average of differences ($\bar{x}_d$)	SD of differences (Sd)	Normality p-value
0.002485	4.1498	10	0.54	0.4115	0.9899

The table below presents the results of a paired sample t-test comparing record accuracy before and after automation of the SEAIT School Clinic. The p-value of 0.001097 indicates a statistically significant improvement in record accuracy ($p < 0.05$). The mean difference of 0.85 suggests a notable increase in accuracy following automation. The standard deviation of the differences (0.5701) reflects moderate variability in the levels of improvement. Additionally, the normality p-value of 0.9317 confirms that the assumption of normality is satisfied, further supporting the reliability of test results.

Table 5.4.1.4: Presentation of paired sample t-test comparing record accuracy before and after automation of the SEAIT School Clinic

p-value	t	Sample Size (n)	Average of differences ($\bar{x}_d$)	SD of differences (Sd)	Normality p-value
0.001097	4.715	10	0.85	0.5701	0.9317

Quantitative RQ 3: Is there a significant relationship between automation and the overall efficiency and accuracy of the SEAIT's School Clinic?

The table below presents the results of the Pearson correlation analysis between post-automation workflow efficiency and post-automation record accuracy in the SEAIT School Clinic. The correlation coefficient (r) is 0.5971, indicating a moderate positive relationship between the two variables. The coefficient of determination (r^2) is 0.3566, suggesting that approximately 35.66% of the variation in one variable can be explained by the other. However, the p-value of 0.06835, which is slightly above the 0.05 significance level, indicates that the relationship is not statistically significant at the conventional threshold.

Table 5.4.1.5: Presentation of Pearson correlation coefficient on the post-automation work efficiency and post-automation record accuracy of the SEAIT School Clinic

X	Y	Sample Size (n)	Correlation Coefficient (r)	r ²	p-value
Post-Automation Work Efficiency	Post-Automation Record Accuracy	10	0.5971	0.3566	0.06835

5.4.2 Results and Findings of Focus Group Discussion

FGD-Q1. Can you describe the current processes involved in managing student health records and clinic operations at SEAIT?

The first respondent shared that all processes were done manually, including the recording of names and data, such as the patient's year level and program, which had to be written by hand. Their assessment was mostly subjective, based on the patient's reported symptoms, although they also considered objective signs. However, the evaluation primarily relied on subjective input. The second respondent added that documentation as limited to handwritten records, which mainly included nursing diagnosis, assessment, and when necessary, collaboration with other offices.

FGD-Q2. What challenges do you face in ensuring efficiency and accuracy in these processes?

The fourth respondent shared that during urgent situations, such as a *code blue*, they sometimes fail to record the patient's detail because their full attention is on providing immediate care. They noted that manual documentation is time-consuming, and if the process were automated, they could simply click to record, making the system much faster and more efficient. The sixth respondent also shared that they often face challenges such as a lack of basic supplies like pens, and when patients arrive consecutively, it becomes difficult to document immediately. Documentation tends to be inefficient unless there is only one or two patients at a time. Additionally, issues arise when a patient is brought in without a watcher or proper identification, leaving the staff unsure of the patient's details or the circumstances that led to their condition—that is when the patient is unconscious.

FGD-Q3. Have you had any experience with automated systems in the clinic?

All of the respondents stated that they had no prior experience with automated systems in the school clinic.

FGD-Q4. What are your thoughts on introducing more automation into the clinic's operations?

The eighth respondent emphasized that an automated system helps streamline the tracking of medical records, especially for repeat patients, as it eliminates the need to repeatedly input information and allows easy access to their medical history. They also pointed out that records management becomes more efficient, with easier archiving and quicker data retrieval, even in cases of accidental deletion due to human error—thereby helping maintain data integrity. Meanwhile, the third respondent shared that the system is helpful and makes patient documentation more manageable. They noted that generating monthly or weekly reports is much simpler, and tasks such as scanning the medical products for inventory and issuing medical certificates takes less time, making the overall process more efficient.

FGD-Q5. How do you think automation could affect the workflow in the clinic?

The first respondent stated that the system could make their work easier and more efficient, particularly in searching for and accessing necessary information. The second respondent added that workflow in the clinic would be more manageable, especially during times when only one or two staff members are available, and student volunteers are not always present to assist with patient care.

FGD-Q6. In what ways might automation influence the quality of care provided to students?

The seventh respondent mentioned that automating patient management would allow the staff to focus on patient care and assessment, thereby improving the efficiency of their time and efforts. The third respondent emphasized that while empathetic care remains essential to the quality of care, automation would assist in documentation and provide better help to the clinic. However, they also noted that in the absence of cases requiring specific interventions, the overall care provided to the patient could still be lacking. When asked about the consideration of extraneous variables, the third respondent acknowledged their potential presence but affirmed that automation would still offer valuable support.

FGD-Q7. What kind of training or support would be necessary for staff to effectively use automated systems?

The fifth respondent suggested providing basic human-computer interaction training, particularly on navigating the system and managing tasks such as the automated prescription, emphasizing the importance of making the process simple and easy to understand. The second respondent added that it is crucial not only to learn how to use the system but also how to troubleshoot technical problems and offer proper guidance in case issues arise. Meanwhile, the fourth respondent highlighted the importance of being familiar with the overall use of the system.

FGD-Q8. Are there any concerns about adapting to new technologies in the clinic?

The second respondent pointed out the importance of considering data privacy and raised concerns about what would happen during a power outage. The seventh respondent added that there are no major issues unless internet access is required, noting that there are times when the internet connection is unavailable. Additionally, the first respondent raised concerns about the reliability of SMS-based features since mobile signal reception can be weak throughout the clinic.

FGD-Q9. What features would you like to see in an automated system for the clinic?

The first respondent suggested incorporating a QR code scanner so that a patient's details would automatically appear in the system with just one click, eliminating the need to manually search or input information—saving both time and effort. The second respondent emphasized the importance of having an easy-to-use assessment section that includes nursing diagnoses, necessary medications with their dosages and side effects, as well as a direct contact feature to the school physician in critical cases. They also highlighted the need for an organized process for referring patients directly to the guidance office in cases involving mental health concerns.

FGD-Q10. Do you have any recommendations for implementing automation to enhance efficiency and accuracy?

The sixth respondent stressed the importance of identifying students with special needs, such as those who are deaf or mute, as assessing them can be difficult without proper background information. Additionally, the first respondent suggested implementing an online registration system where students could fill out a form—similar to a Google Form—to indicate their medical conditions. This would allow clinic staff to easily search for and access relevant information within the system, resulting in more accurate and efficient patient care.

The table below shows that automation has influenced the SEAIT School Clinic in several areas based on the emerging themes. Under the Operational Efficiency, R1 shared that, *“Having records easily accessible through the system helps us respond more quickly to patient needs,”* which would save time and simplify the recording process especially during emergencies. For Workflow Improvement, R2 emphasized that automation would be helpful. *“Automation would help reduce the number of steps involved in routine tasks like checking medical history and updating records,”* highlighted how automation could ease workloads. Regarding Access to Patient Information, R8

noted that, “Tracking of medical records becomes easier and more accurate, especially for repeat visits,”. In terms of Enhanced Quality Care, R7 said that, “Automation would allow the team to focus more on patient care and assessment,” while R3 added that, “Empathetic care is better supported when administrative tasks are minimized” to support clinical care. Under Improved Responsiveness and Coordination, R2 explained that, “It would help reduce the number of steps involved in routine tasks like updating records and coordinating with other departments,” which improves response time. For Positive Attitude toward Automation, R3 expressed, “It’s a helpful system, especially when generating monthly reports and issuing medical certificates,” reflecting their openness to adopting technology. Lastly, under Need for Training and Support, R4 emphasized the importance of “basic human-computer interaction training” and learning how to navigate the system, while R2 mentioned the need to know “how to handle technical problems”. However, some concerns were also raised, “Mobile signal reception can be weak, which affects some features like SMS-based notification” - R1. These statements showed that while respondents are hopeful and positive about automation’s benefits, they also recognized the importance of adequate training and technical support to fully maximize its impact.

Table 5.4.2.1: Thematic Analysis Presentation of the impact on Workflow Efficiency, Record Accuracy, Overall Service Quality, and User Satisfaction of SSCMS

Themes	Core Ideas
Operational Efficiency	Automation is perceived as a way to enhance efficiency and make routine tasks in clinical operations more manageable.
	Supports both data handling and real time patient management such as immediate access to records during emergencies.
	Helpful during emergencies and high patient volume for quicker response.
Workflow Improvement	Workflow becomes more organized with fewer manual steps.
	Task completion becomes more organized and less time-consuming through automated processes.
	Reduces the burden of multitasking, especially during peak hours.
Access to Patient Information	Information is better organized and easier to access across multiple visits or consultation.
	Automation minimizes the risk of data loss , incompleteness or misplacement ensuring reliable patient information.
	Digital records reduce manual errors and support easier archiving and retrieval, improving both data accuracy and long term accessibility.
Enhanced Quality Care	Empathetic care is better supported when administrative tasks are minimized, allowing more meaningful patient interactions.
	More time is allocated to patient care instead of administrative duties.
	Patient interaction becomes more focused and uninterrupted.
Improved Responsiveness and Coordination	Faster generation and sharing of reports and medical documents improve clinic responsiveness.
	Repeated visits are easier to handle due to accessible patient history.

	Automation supports smoother coordination among clinic staff and other departments like the guidance office.
Positive Attitude toward Automation	Automation is accepted as a beneficial shift from manual processes.
	Confidence in adopting digital systems increases with proper support.
	Automation is associated with improvements in accuracy and speed.
Need for Training and Support	Effective system navigation and troubleshooting skills are essential.
	Basic understanding of system functions increases task confidence.
	Continuous training and support help maintain competency and resolve errors promptly.

The table below shows the comparative analysis of SSCMS Impact on Workflow Efficiency , Overall Service Quality and User Satisfaction. It reveals that the SSCMS has significantly enhanced operational efficiency, workflow and service quality in SEAIT School Clinic, particularly in Cases 1 and 3 where staff demonstrated strong familiarity with the system and expressed high satisfaction. Automation facilitated faster access to patient information, improved documentation consistency and enabled more responsive and coordinated care, underscoring its positive impact on clinic operations. In contrast, Case 2 illustrates that these benefits are not consistently experienced across all settings. Technical challenges such as power outages, poor mobile signal reception, data privacy concerns and insufficient training significantly hindered the system's effectiveness. All cases underscored the necessity of continuous training and support, emphasizing that the success of automation is closely tied to reliable infrastructure and user preparedness.

Table 5.4.2.2: Comparative Case Analysis of the impact on Workflow Efficiency, Record Accuracy, Overall Service Quality, and User Satisfaction of SSCMS

Themes	Case Unit		Remarks
	Similar	Different	
Operational Efficiency	Case 1 & 3		Case 1 shows that automation helps staff manage tasks more efficiently, while Case 3 highlights faster access to information and better service speed.
		Case 2	Case 2 reveals that power outages and poor mobile signal receptions disrupt clinic operations.
Workflow Improvement	Case 1 & 3		Case 1 anticipates easier daily tasks with SSCMS, while Case 3 demonstrates that workflow has improved based on the user feedback.
		Case 2	Case 2 shows that limited training affects the staff's ability to navigate the system properly.
Access to Patient Information	Case 1 & 3		Case 1 mentions that SSCMS helps manage student records, implying improved access and Case 3 implies faster information retrieval.
		Case 2	Case 2 emphasizes worries regarding data privacy and security.
Enhanced Quality Care	Case 1 & 3		Case 1 indicates that service delivery improved as administrative burdens lessened. Case 3 shows improved and focused healthcare delivery.

		Case 2	Case 2 suggests that quality of care was affected by technical challenges.
Improved Responsiveness and Coordination	Case 1 & 3		Case 1 highlights faster coordination and response, while Case 3 shows improved task flow and service speed.
		Case 2	Case 2 highlights that power outages cause delays in accessing information and responding quickly to clinic needs.
Positive Attitude towards Automation	Case 1 & 3		Case 1 expresses positivity toward automation's role in the clinic. Case 2 shows acceptance and appreciation of the system's benefits.
		Case 2	Case 2 reveals concern about data privacy, limited training, power outages and mobile signal receptions.
Need for Training and Support	Case 1-3		All respondents recognized the importance of training and support in effectively use the system.

Qualitative RQ 4: How do the clinic staff perceive the impact of automation on daily operations in SEAIT's school clinic?

The impact of automation on daily operations in the SEAIT school clinic is perceived by the staff as beneficial as shown in the table 5.4.2.1 and 5.4.2.2, it helps staff manage routine tasks efficiently especially in data handling and real time patient management such as retrieving patient records in case of an emergency. However, case 2 in operational efficiency, factors such as power outage and poor mobile signal reception may affect clinical operation negatively.

Qualitative RQ 5: What challenges or improvements have been observed in the clinic's workflow and management since the introduction of automation?

Since the introduction of automation, improvements have been observed within the clinic's workflow and management as shown in table 5.4.2.1 and table 5.4.2.2, automation helps reduce manual steps such as in documenting a patient. During peak hours, patient assessment is done quickly reducing the burden of multitasking. However, in case 2 under workflow improvement, it was stated that limited training affects the staff's ability to navigate the system, disrupting clinical workflow.

Qualitative RQ 6: In what ways has the automation system influenced the overall service quality and user satisfaction in SEAIT's school clinic?

Looking at the influence of automation on service quality and satisfaction allows the researchers to see whether the system has improved the clinic experience for both staff and users. Based on the table 5.4.2.1 and table 5.4.2.2, it is evident that automation has made a positive impact on overall service quality and user satisfaction. The system enhanced accuracy, reduced delays and allowed for faster and more efficient service delivery. In cases 1 and 3, user satisfaction was high due to improved service delivery and easier access to records. However, in Case 2 satisfaction was low because of technical issues and the lack of proper training. This indicates that while automation positively influences service quality and satisfaction, these outcomes depend on proper training and system support.

6. DISCUSSION

6.1 Interpretation of Findings

The findings revealed that workflow efficiency and record accuracy in SEAIT's School Clinic effectively enhanced through the implementation of automation. Using mix-methods, quantitative and qualitative approaches, the study examined how system automation affected daily operations, user satisfaction, and quality of service.

From the quantitative data, it was observed that users perceived a notable improvement in clinic operations after the automated system was introduced. Users reported better performance and smoother task completion after the system was automated. Survey responses showed a significant level of satisfaction, suggesting that the automated system helped improve workflow, reduce time spent on documentation, and increase consistency in data management. The statistical analysis confirmed that automation had a meaningful impact on the clinic's operational outcomes.

The qualitative findings from focus group discussions supported these observations. Before automation, staff described the manual process as time-consuming, especially during emergencies or when managing multiple patients. After automation, respondents expressed that clinic operations became more efficient and manageable. Automation was seen as a helpful solution, making tasks such as recordkeeping, report generation, and patient tracking faster and easier. Respondents also highlighted the benefits of easier access to patient information, reduced duplication of work, and improved focus on patient care. However, they also expressed concerns related to system training, data privacy, and the need for basic infrastructure to fully support the automated process.

The results highlighted that both quantitative and qualitative findings point to the conclusion that automation positively impacted the clinic's operations in terms of both efficiency and accuracy. While the quantitative data demonstrated measurable improvements, the qualitative insights provided context and a deeper understanding of how these changes affected daily tasks and overall service quality. Together, these results highlight that automation, when supported with proper training and infrastructure, can significantly enhance clinic performance and user satisfaction in a school clinic setting.

6.2 Contributions and Innovation

By showing and proving how automation can greatly improve healthcare processes in a school clinic setting, the study contributed to the body of knowledge of HCI. Grounded in the principles of user-centered design and the TAM framework, the research emphasized the significance of integrating automated technology into healthcare workflows in a manner that respects users' environments, roles, and goals. By assessing the impact of an automated clinic management system on both workflow efficiency and record accuracy, the study provides verifiable data on how digital tools influence user performance, satisfaction, and decision-making in a healthcare context. It also reinforces the role of usability, ease of navigation, and a minimal learning curve in increasing adoption and improving user experiences—key pillars in HCI design. Moreover, the study adds to the growing body of HCI research that underscores the importance of contextual understanding in developing systems to specific domains such as school-based health centers, where critical and immediate decisions, confidentiality, and user cooperation are essential.

The key innovations in the systems are the automated generation of prescriptions, medical certificates, and referral slips, allowing nurses to produce standardized and printable PDF documents swiftly, thereby minimizing errors and saving time. Real-time access to patient medical history improves clinical decision-making and supports more accurate assessments, while the automated timekeeping system simplifies volunteer attendance tracking. Additionally, the integration of a QR code scanner supports quick and accurate data and inventory management. Collectively, these innovations demonstrate how automation and thoughtful system design can transform traditional clinic workflows into a more efficient, accurate, and user-friendly experiences, in line with the principles of HCI.

6.3 Limitations and Future Work

The generalizability of this study's findings may be limited due to the relatively small sample size due to the small number of clinic staff and student volunteers on SEAIT school clinic. The study was concentrated solely on the perceptions of clinic staff and excluded feedback from patients, which could have provided an in-depth understanding of the system's impact on service delivery and overall workflow efficiency.

Future system enhancements could incorporate functionalities such as integration with school-wide health monitoring systems, AI-assisted diagnostics, and mobile compatibility. These advancements would strengthen the system's usability, scalability, and responsiveness, while boosting its readiness in handling diverse student health needs and its overall impact on healthcare service delivery within a school setting.

7. CONCLUSION

7.1 Summary of Key Findings

In summary, the inclusion of automation in the SEAIT's School Clinic resulted in a significant enhancement in workflow efficiency, task coordination, and the precision of recorded data. The system simplified important tasks like keeping patient records, producing reports, and retrieving data, allowing clinic staff to focus more on patient care. By reducing repetitive tasks and cutting down on documentation delays, automation contributes to creating a more organized and effective clinic environment. The study highlights that in spite of encountering challenges like poor mobile connectivity, the requirements for user training, and data protection concerns, with sufficient infrastructure and user assistance automation can greatly enhance the management and service quality of school clinics. These results align with earlier research showing improved prescription accuracy, a reduction in medication-related mistakes, and increased patient safety after implementing automated systems. Despite challenges such as technical outages and some employee pushback, the evidence shows that prescription automation has significant potential to enhance both safety and efficiency in healthcare services. In the end, this research highlights the significance of ongoing system updates and thorough user training in addressing implementation challenges and enhancing advantages. These insights hold significance for healthcare leaders and policymakers looking to implement or enhance automation technologies in medical environments (Sharaf, 2024).

7.2 Final Remarks

Automation ranged from minimal levels to complete, shaped by task specifications, frequency, human participation, and technological advancement. Setting automation objectives and assessing their fulfilment were important, with continuing oversight suggested for success. Observation from different sectors about workflow automation emphasize the important role of individual, processes and technology in both design and execution, steering the office of the National Coordinator for Health Information Technology's readiness to improve health care workflow automation (Zayas-Cabán et al., 2023).

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APPENDICES

Survey Questionnaire Statements for Pre- and Post-Automation

The survey questionnaire statements were adapted from the *Level of Automation and Performance of Hospitals in Nairobi County* (Wambugu, 2023) and were subsequently modified to suit the scope and delimitation of this study. The survey was grouped into two variables: workflow efficiency and record accuracy to ensure targeted evaluation of the system’s impact.

Workflow Efficiency

1. Patients were satisfied with the services and support they received in the clinic.

2. Manual processes in the clinic were efficient and manageable.
3. Tasks were completed accurately and in a timely manner.
4. Patient flow through the clinic was smooth and convenient.
5. Daily operations followed standardized procedures.
6. Staff performance was well monitored and evaluated.
7. The system or method used was easy to use and required minimal training.
8. Patients were attended to without unnecessary delay.
9. Coordination among clinic staff was smooth and consistent.
10. Overall operations in the clinic were efficient.

Record Accuracy

1. Paperwork was manageable and did not affect service delivery.
2. Clinical documentation was accurate and free of human error.
3. The process for scheduling and time management was effective.
4. Clinic performance supported by existing processes was consistent and reliable.
5. All patient visits were properly and completely documented.
6. The system used promoted transparency and accountability in clinic operations.
7. Timekeeping and attendance tracking for clinic volunteers was easy to manage.
8. Patient records were well protected and confidential.
9. Retrieving patient records was quick and hassle-free.
10. Overall, I was satisfied with the system/process used in the clinic.

Focus Group Discussion Questionnaire

The FGD questions were adapted from *Nurses' Perspectives on the Adoption of New Smart Technologies for Patient Care: Focus Group Interviews* (Choi et al., 2025) and were subsequently modified to suit the scope and delimitation of this study. The questions aimed to explore the participants' current workflows, challenges with manual processes, perceptions of automation, and suggestions for improving clinic operations through technology.

1. Can you describe the current processes involved in managing student health records and clinic operations at SEAIT?
2. What challenges do you face in ensuring efficiency and accuracy in these processes?
3. Have you had any experience with automated systems in the clinic? If so, how have they impacted your work?
4. What are your thoughts on introducing more automation into the clinic's operations?
5. How do you think automation could affect the workflow in the clinic?
6. In what ways might automation influence the quality of care provided to students?
7. What kind of training or support would be necessary for staff to effectively use automated systems?
8. Are there any concerns about adapting to new technologies in the clinic?
9. What features would you like to see in an automated system for the clinic?
10. Do you have any recommendations for implementing automation to enhance efficiency and accuracy? Can you describe the current processes involved in managing student health records and clinic operations at SEAIT?