UI/UX Design of The ENC Application as Electronic Nursing Care in Clinical Practice Education for Nursing Students in Hospitals.

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ABSTRACT

The implementation of hospital information systems in the digitalization-based era, including medical records, currently shows that there is a need for nursing education to focus on information education, including developing electronic-based practical student nursing care applications. This research aimed to design the user interface and user experience of electronic nursing documentation, named "The ENC". The ENC (electronic nursing care) with a design thinking approach. Designing the user interface (UI) and user experience (UX) used a design thinking approach consisting of empathize, define, ideate, prototype and test. Data collection was carried out at the empathize stage using content questionnaires and interviews. UI/UX design using the Figma application. Application testing with nursing student users based on predetermined scenarios. The ENC (electronic nursing care) application design uses the design thinking method to produce an application prototype that adapts to the needs of nursing students. To validate the efficacy of The ENC application, testing was conducted with nursing student users through predetermined scenarios. The design thinking approach facilitated the creation of an application prototype attuned to the specific requirements of nursing students. Following this, a comprehensive survey involving 30 nursing students was conducted to assess usability, quality, and satisfaction with the application's UI/UX, thereby capturing both positive and negative feedback. The ENC application adapts to the needs of nursing students to ease the transition from paper-based to electronic-based documentation, increase acceptance of the application, and increase its use in the clinical environment.

Keywords: Digitalization, Electronic Nursing Care (ENC), Healthcare, Nursing Education, UI/UX Design

INTRODUCTION

The rapid development of new technology trends is swiftly replacing and transforming paper-based clinical documentation to electronic formats, as the process of collecting, recording, and managing patient data becomes more effective and efficient (Raghunathan, McKenna, & Peddle, 2022; Raghunathan, McKenna, & Peddle, 2021; Safariah, 2019). Medical records encompass patient identity, examinations, treatments, procedures, and other services provided to patients. Electronic medical records involve administrative and clinical documentation created using electronic systems dedicated to medical recordkeeping (Menteri Kesehatan Republik Indonesia, 2022).

Good clinical documentation is a crucial aspect of healthcare decision-making (Shafiee et al., 2022). Electronic clinical documentation plays a vital role in documenting healthcare processes (Kernebeck et al., 2022; Suganda & Hariyati, 2020; Medlock et al., 2022), offering advantages such as real-time patient data access, information sharing among healthcare professionals, and comprehensive documentation of all actions. Electronic clinical documentation has the potential to enhance the quality and efficiency of care (Kernebeck et al., 2022).

Indonesia's Minister of Health Regulation No. 24 of 2022 mandates all healthcare facilities to implement electronic patient medical history documentation systems by December 31, 2023 (Menteri Kesehatan Republik Indonesia, 2022; Redaksi Sehat Negeriku, 2022). Well-integrated nursing care relies on adequate documentation systems. Nursing documentation, structured to reflect the phases of the nursing process (assessment, diagnosis, planning, implementation, and evaluation), serves as evidence that nurses fulfill their ethical and moral responsibilities (Safariah, 2019; Shafiee et al., 2022).

Currently, almost all hospitals use electronic medical records (Media Indonesia, 2022). This reduces the burden on nurses, as previous research found that nurses spent about 37% of their working time on nursing documentation (Shafiee et al., 2022; Saraswasta & Hariyati, 2019). Nurses are the primary users of electronic documentation, and nursing students need to be adequately prepared for this core clinical technology in their curriculum (Raghunathan, McKenna, & Peddle, 2022).

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Despite the rapid digitization of healthcare, the implementation of electronic nursing documentation in Indonesian nursing education remains limited. A survey in Australia and New Zealand found that only 37.8% of institutions used academic electronic medical records, and the application is relatively new. Nursing students still predominantly compose paper-based nursing care reports, consuming time and resources. Their first exposure to electronic documentation occurs during clinical internships (Raghunathan, McKenna, & Peddle, 2022; Raghunathan, McKenna, & Peddle, 2021; Medlock et al., 2022).

Relying solely on clinical internship experiences to acquire digital technology proficiency does not adequately prepare nursing students for competent electronic documentation use. Access to hospital electronic documentation systems during clinical internships is usually restricted, raising privacy and security concerns (Raghunathan, McKenna, & Peddle, 2022; Everett-Thomas et al., 2022). Academic environments must facilitate the use of electronic documentation in the curriculum, providing relevant learning opportunities for technology-integrated practice (Raghunathan, McKenna, & Peddle, 2022).

A critical concept in the electronic documentation development curriculum is effective and secure technology and information systems across various practice settings. This research aims to build electronic nursing documentation software named "the ENC" to provide a platform for nursing students to practice digital nursing documentation in both classroom and clinical internship settings. The ENC employs a nursing process approach, comprising assessment (subjective data, objective data, and laboratory data), diagnosis, intervention, implementation, and evaluation of nursing care (PPNI, 2022).

The ENC will implement an automated workflow to reduce manual tasks such as data input and nursing interventions, thereby optimizing nursing student service time to patients. It uses a combination of narrative documentation, checklists, and graphs to illustrate the nursing care process. The ENC's nursing care process refers to the Indonesian Nursing Diagnosis Standard (SDKI), Indonesian Nursing Outcome Standard (SLKI), Indonesian Nursing Intervention Standard (SIKI), and Nursing Standard Operational Procedure Guidelines (Akhrian Syahidi & Tolle, 2022; Herfandi et al., 2022; Karlina & Indah, 2022). The initial year of ENC design will focus on UI and UX design, crucial aspects as previous studies have shown that smartphone users tend to leave web pages if the display is not well-optimized, and 79% of users will exit a website if the content is uninteresting (Top & Gider, 2012; Amar et al., 2019)

In the realm of student practice, with a specific focus on nursing education, the research endeavors to address a dual-fold problem. Firstly, it delves into the inquiry of how the UI/UX design of the Electronic Nursing Care (ENC) application contributes to the clinical internship education of nursing students in hospitals. Secondly, it aims to explore the user experience pertaining to the initial prototype design of ENC as electronic nursing care documentation. These investigations are crucial steps in creating a framework tailored to student needs, emphasizing the significance of user interface and experience in the clinical learning environment.

GAP AND NOVELTY
Referring to the previous review, this research successfully identified critical shortcomings and introduced new aspects as follows:
1. Absence of Electronic Nursing Documentation System for Nursing Education:
   Currently, there is a conspicuous void in the availability of an electronic nursing documentation system specifically developed for nursing education and its implementation in clinical practices. The initial design of the ENC platform is considered an innovative solution to address this deficiency and strengthen the integration of technology in the context of nursing education and practice.
2. Structured in Accordance with Nursing Standards:
   The ENC platform stands out with a structured design aligned with established nursing processes, including SDKI, SLKI, SIKI, and nursing SOP. The aim is to enhance the standardization of nursing documentation in both healthcare and educational environments.
3. Focus on User Interface and User Experience:
   The initial design of ENC places significant emphasis on user interface (UI) and user experience (UX), with the goal of providing visually appealing and user-friendly layouts. This aligns with the specific needs of users in the nursing field, offering a solution that is not only effective but also accommodates a positive user experience.
4. Automated Workflow Approach:
   A distinctive feature of the ENC development lies in the adoption of an automated workflow approach. This approach streamlines the documentation process for students, eliminating the need for manual paper-based writing

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and making a significant contribution to efficiency in nursing practice. The development of the ENC will involve an automated workflow approach, facilitating students in documentation without the need for manual writing on paper.

These findings not only highlight critical gaps in the current landscape but also affirm the innovative contributions of the ENC platform, paving the way for the development of an electronic nursing documentation application that is effective in meeting the unique needs of nursing education and clinical practice

METHOD

A. Research Design

The problem-solving approach in this study adopts the design thinking process, with a focus on designing the user interface (UI) and user experience (UX) to obtain a prototype of the ENC that is visually appealing and aligns with user needs. The design thinking method comprises stages such as empathize, define, ideate, prototype, and test (Herfandi et al., 2022; Karlina & Indah, 2022). The software used for designing the user interface (UI) and user experience (UX) is Figma.

Fig 1. The stages of the design thinking method

1. Empathize

In this stage, the research team aims to understand users in the context of the designed product. Surveys are conducted with participants, including lecturers, practicing nurses, and practical nursing students. The focus is on exploring relevant elements of nursing assessment. Participants are asked to assess the importance of items in the initial data list provided by the research team. The importance is gauged using a three-point Likert scale with options "YES," "NO," and "NOT SURE." The scale reflects whether an element is deemed highly important ("YES") or of low importance ("NO") for inclusion. The information gathered is then subjected to descriptive statistical tests to analyze the software needs, with agreement on an element considered if the value is ≥70% of participants who agree (Akhrian Syahidi & Tolle, 2022).

2. Define

In the Define stage, the findings from the Empathize stage, defined as problems, are summarized in personas. Personas contain information derived from the surveys and represent the intentions, goals, needs, and desires of users. Additionally, the research team employs the "how might we" (HMW) approach. This involves defining the problem based on the representation of user documents (personas), aiming to capture the essence of user requirements. The Define stage sets the groundwork for framing the identified issues and needs in a way that informs the subsequent stages of the design thinking process.

3. Ideate

This stage will undertake the process of developing solution ideas based on the analysis results in the define stage. The solution ideas generated will then be implemented into the design of the user interface and prototype.

4. Prototype

In the prototype stage, the research team will begin designing the recommended solutions into a prototype form to create the UI/UX design of the ENC as academic clinical nursing documentation.

5. Test

The final stage will involve testing the completed prototype design with selected users and collecting feedback. The instrument used is a questionnaire created by Top, M (2011), consisting of 35 items to measure three constructs: system usability, system quality, and user satisfaction (Karlina & Indah, 2022). The 35 questionnaire items are as follows: 12 items assess 'system usability,' defined as the frequency of system use in completing tasks related to patient care; 12 items assess 'system quality,' defined as the evaluation of system quality, its output, and responsiveness; 11 items assess 'user satisfaction with the ENC,' defined as the extent to which nursing students believe that the system is essential in improving their work.

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Response options range from 1 to 5 ('never/almost never/not at all' to 'always/almost always/very great') for each item. Before using the questionnaire, its validity and reliability are tested (Karlina & Indah, 2022).

B. Participants
   Participants in this study include practicing nurses at the Regional General Hospital of Subang District and Hamori Subang Hospital, as well as lecturers and students undergoing clinical practice at the State Polytechnic of Subang in August-September 2023, using purposive sampling.
C. Analysis Method
   The data is analyzed using SPSS 23.0 with descriptive statistics, employing percentages for all interval scale variables. Mean and standard deviation values are used in both the design and evaluation phases.
D. Research Ethics
   This research has obtained ethical clearance with number 263/II.I.AU/ETHICS/ VII/2023. All participants are required to sign consent forms and review the participation agreement form before becoming respondents. They are made aware of the research objectives and informed that their participation is voluntary, with the freedom to withdraw from the study at any time.

RESULT AND DISCUSSIONS

The design of the UI/UX for the ENC is presented to address the challenges faced by nursing students in compiling nursing care during clinical practice in hospitals. The results of the research using the design thinking method are in the form of a prototype.

A. Empathize

This stage consists of observation and data collection from potential users, namely nursing students, and stakeholders, including lecturers and hospital nurses, to gain insights and understanding about the focus of designing "The ENC" application. Data collection is done through brief interviews and questionnaires in three locations: Subang District General Hospital (RSUD Kabupaten Subang), Hamori Hospital (RS Hamori), and State Polytechnic of Subang. The total respondents are 62 people, comprising 21 nurses from RSUD Kab. Subang, 4 nurses from RS Hamori, 6 nursing lecturers from State Polytechnic of Subang, and 31 nursing students from State Polytechnic of Subang. The description of respondent data in this study is presented in Table 1.

Table 1. Characteristics of Respondents

Karakteristik	Std. deviasi	Min-max	Rata-rata	Distribusi	Persentasi
Jenis Kelamin					
Laki-laki				16	26%
Perempuan				46	74%
Umur	9,40	19 - 52	28,19		
Pendidikan terakhir					
Mahasiswa				31	50%
D3Keperawatan				6	10%
D4/S1/Ners				18	29%
S2/spesialis				7	11%
Pekerjaan					
Mahasiswa				30	48%
Perawat				26	42%
Dosen				6	10%
Pengalaman kerja	9,09	1 - 30	9,95		

The data obtained includes the content data of the application and the problems that users perceive in manually compiling nursing care. All content items, including patient administrative data, assessment data, diagnosis data, and intervention data, received an average acceptance rate of 90%, where the agreement to include elements in the ENC application is if the value is ≥70%. To view the data related to the content of the ENC application, it can be accessed through the following link:
https://drive.google.com/file/d/1dc0N1g4wR1LeYPiwTJ89SaZT6vrnSQn_/view?usp=sharing

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B. Define

Findings defined as problems are summarized in personas containing information in Table 3. In this stage, the researcher also uses the "How Might We" (HMW) approach, which is a stage of defining problems from user representation documents (personas) to capture the intentions, goals, needs, and desires of users. This process transforms problems into questions to obtain a mindset that all problems surely have solutions and can be resolved.

Table 2. User Representation Documents (Persona)

	Biography A third-year nursing student at Polsub, has completed clinical practice three times at RSUD Kab. Subang and RSD Gunung Jati Cirebon. Has been writing nursing care plans manually until now.
Name Participant 1	**Challenges** 1. In terms of writing, it takes a long time because it's manual 2. Less effective as it requires flipping through three books; every time I want to move from diagnosis to intervention, I have to open another book. 3. The writing process is very time-consuming because it has to be done one by one
Age 20 years	**Expectations** Creating an application like The ENC that is capable of: 1. Faster time efficiency for creating nursing care plans. 2. More practical and flexible to work on anywhere. 3. Effectiveness for various diagnoses and interventions.
Occupation Student	

C. Ideate

Ideas formed from the empathize and define phases revolve around designing a mobile application that can address the issues of compiling nursing care plans during clinical practice in healthcare facilities. The goal of the two previous stages is to design a mobile application that will tackle efficiency and effectiveness issues concerning users' time and effort in creating nursing care plans during clinical practice. The output is that users can focus on serving patients and providing nursing care as optimally as possible.

The user flow shown in the diagram in Figure 9 represents the user journey to achieve the goal of a specific activity. The detailed explanation is as follows: 1) First, the user encounters the onboarding screen after being instructed to register and complete personal information and a password if they don't have an account. If they already have one, they can log in directly. 2) After the application displays the main menu, users can search and choose the desired menu, such as nursing care, duty schedules, logbooks, and required skills. 3) After choosing the "add patient" menu, users will be prompted to fill in and complete the patient registration form. 4) They will proceed to conduct and fill in both medical history and physical assessment forms. 5) If the forms are completed, the user is directed to the nursing diagnosis view, where recommended diagnoses are displayed, and they are asked to choose the appropriate diagnosis. 6) Next is the intervention part, corresponding to the chosen diagnosis, followed by implementation and evaluation. The application procedure is completed. However, if users want to manage their schedules, they can click on the "schedule" menu, where they will be prompted to fill in their duty schedules during practice, including the stage name, practice location, room, and reminder settings.
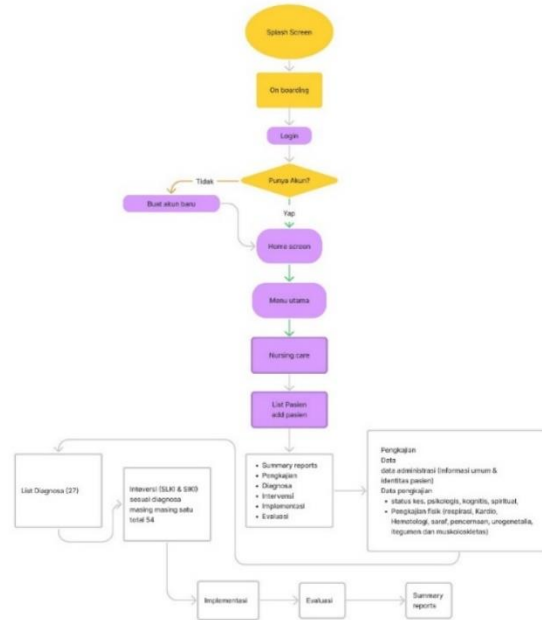
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Fig 2. User Flow of the ENC Application

D. Prototype

The process, starting from the empathy stage, concluded that nursing students face difficulties in creating nursing care during clinical practice, especially in terms of efficiency and the effectiveness of practice hours. Then, it progressed to the ideate stage, forming the workflow of the application to overcome the difficulties faced by nursing students in compiling nursing care. In this stage, the Figma application is utilized as a tool for creating the prototype. The features of The ENC application will be displayed in the design results below:

1) Splash Screen

This page is the introduction page of The ENC application, which will display the logo of The ENC application. The logo used features a sketch/vector of a flame. This choice is inspired by the historical aspect of nursing, where nursing pioneer Florence Nightingale used a candle for illumination while caring for patients.

Fig. 3 Splash screen of The ENC application

2) On Boarding

Users will see a description of the functions and benefits of The ENC application, as an electronic nursing care application that is more effective and efficient for use in clinical practice at the hospital.

Fig. 4 Splash screen of The ENC application

3) Register and Login

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To register an account, users must fill in personal information, including name, email, and set up a password, or users can register with a Google or Facebook account. The next step is for users to log into their account by entering their name and password.
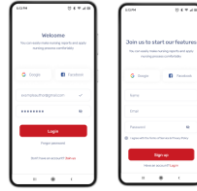

Fig. 5 Login and Register of The ENC application

4) Main Page

On the main page, there are several main features, including searching, top reports containing patient cards, top features such as nursing care, competency skills, logbook, duty schedule, and next schedule. At the bottom, there is a bottom navigation bar consisting of home, patients, add patient, actions, and profile.
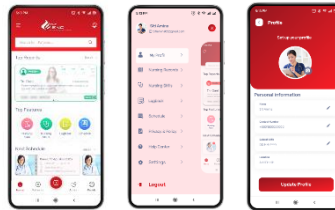

Fig. 6 Main Page of The ENC application

5) Nursing Care

For users who want to view the list of patients, they can enter the nursing care menu. Next, a list of patients will appear. If users want to compile the care for a new patient, they can click the add menu, then fill in the registration form, assessment form, choose a diagnosis, choose an intervention, implementation, and evaluation. All choices will be saved in the patient's care summary.
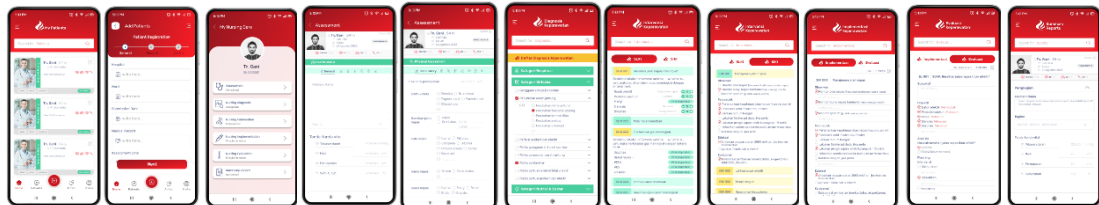

Fig. 7 List of patients, assessment, diagnosis, intervention, implementation, evaluation, and summary report in the ENC application

6) Nursing Skill

For users who have performed nursing procedures or actions assigned during the clinical practice, they can check and note how many times the action has been performed, then save it.

Fig. 8 Student skills in the ENC application.

7) Logbook

On this page, users fill in all the actions or activities carried out during their duty in one day.

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Fig. 9 Student logbook in the ENC application.

8) Schedule

This page consists of the user's duty schedule during the nursing clinical practice internship, and within it, reminders can be set.
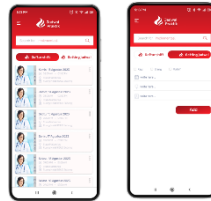

Fig. 10 Student duty schedule in the ENC application.

E. Test

Testing the prototype of the ENC application is carried out in three ways, namely by the faculty, the nursing staff, and student users who participate in the testing, involving respondents. The testing is conducted to determine the extent to which the features can function correctly and identify issues faced by users. Developers will add or improve features that are not working to align with user needs based on the feedback received. Three respondents are selected for each scenario in order to assess how well they can use the prototype to complete tasks.

Table 3. Scenario and *Goals*

No.	Skenario	*Goals*
1	The user selects the top menu	From the main page, users can choose the provided top menu
2	The user updates their new profile	On the main page, there is a profile menu for users to change their phone number for registration
3	The user creates a nursing care plan	From the main page, then the navigation bar ➔ click +, users can create nursing care plans along with tracking the progress of the process.
4	The user creates a practice logbook	From the main page, then Top features ➔ click logbook, users can make notes related to activities conducted during a day of duty
5	The user records the skills and actions they have performed.	From the main page, then Top features ➔ click Nursing skill, users can record nursing actions performed during their duty
6	The user schedules their duty roster	From the main page, then Top features ➔ click Schedule, users can manage their duty schedule during clinical practice in that rotation
7	The user navigates through all pages of the ENC application	From the main page, users obtain information about the application by following directions on the navigation bar and other menus

Table 4. The testing results from the Respondents

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Responden	1	2	3
Skenario 1	√	√	√
Skenario 2	√	×	√
Skenario 3	√	√	√
Skenario 4	√	√	×
Skenario 5	√	√	×
Skenario 6	×	√	√
Skenario 7	√	√	√

Table 4 shows the results of testing the prototype of the ENC application based on the seven scenarios in Table 3. The data obtained indicate that three respondents successfully completed three scenarios: scenario 1, scenario 3, and scenario 7. Respondent 1 encountered failure in scenario 6, while respondent 2 experienced failure in scenario 2, and respondent 3 faced failure in scenarios 4 and 5.

F. Evaluation Summary

After the prototype is ready, a survey was conducted involving 30 nursing students to assess the usability, quality, and satisfaction with the application (UI/UX). The results indicate both positive and negative impacts. The ENC application is expected to enhance the quality of nursing care among students (74%). The application functions well, and students are satisfied with the design (93%). It also helps reduce the burden of manual nursing care documentation (98%) and saves time, allowing students to focus more on patient care (100%). The ease of access to the application is reported to be high (93%), and it helps reduce documentation errors (97%). Students find it convenient for use anywhere (93%).

However, there are some negative aspects to consider. Some respondents reported that the application's speed is slow (80%). Some are uncertain about using it in the near future (68%), indicating a need for ongoing socialization about the application's features and functionalities (98%). Concerns about patient and user data leakage were also noted (86%).

CONCLUSION

The research outcome using the design thinking method is manifested in the form of the ENC prototype. The primary goal of the ENC is to reduce the manual collection and documentation of nursing care reports by students during patient care processes and to enhance the accessibility of nursing care by alleviating documentation burdens. The ENC application caters to the needs of nursing students, facilitating the transition from paper-based to electronic documentation, increasing the acceptance of the application, and promoting its utilization in the clinical environment.

The description of the application output includes details on how the ENC prototype brings efficiency to the collection and documentation of nursing care information. The sustainability of this application is evident in efforts to reduce manual workload, increase productivity, and enhance the quality of patient care. By minimizing paper usage and improving electronic accessibility, ENC not only provides an innovative solution in the context of nursing education but also supports sustainability through the implementation of environmentally friendly technology.

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