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Using BOR, LOS, TOI, and BTO Data to Develop Digital Media Promoting Health Information Management Competencies in Higher Education

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ABSTRACT

Objective: *This study aims to develop digital promotional media based on hospital efficiency indicators – specifically Bed Occupancy Ratio (BOR), Length of Stay (LOS), Turn Over Interval (TOI), and Bed Turn Over (BTO) – serving as both a learning tool and a means to promote the competencies of Medical Record and Health Information Professionals (PMIK).* ***Method:*** *The study employs the Design Thinking method, comprising the stages of empathize, define, ideate, prototype, and test. Data collection involved observation, structured interviews, and usability testing with 18 respondents, consisting of two subject matter experts, one media expert, and 15 RMIK students.* ***Results:*** *Analysis results indicated that BOR (75%), LOS (4 days), and TOI (1 day) met efficiency criteria, whereas the BTO value (20 times) required optimization. Usability testing using the System Usability Scale (SUS) yielded an average score of 80.5.* ***Novelty****: Based on user needs, a mobile application prototype named FunTa (Fun Statistics) was developed, featuring a dashboard, indicator calculator, learning materials and videos, quizzes, PMIK competency information, and app settings.*

INTRODUCTION

Digital transformation is changing how health organizations manage information and deliver services. International guidance highlights the role of digital technology in strengthening health service management [1]. Indonesia's professional standard for Medical Record and Health Information Professionals (PMIK) covers ethical and legal practice, professional development, communication, data management, clinical classification and coding, health statistics, and management of health information services [2]. Higher education programs in Medical Record and Health Information (RMIK) can use digital media to show how graduates apply these competencies.

Hospitals use the bed occupancy ratio (BOR), length of stay (LOS), turnover interval (TOI), and bed turnover (BTO) to evaluate inpatient bed utilization. These indicators provide complementary information when interpreted with the same reporting period and denominator. The Barber–Johnson chart brings the indicators together to support interpretation of bed utilization [3]. An inpatient study from Udayana University Hospital provides another example of using these measures to evaluate bed efficiency [4]. For RMIK students, calculating and interpreting the indicators is a practical exercise in using hospital data to inform service improvement.

Visualizations such as graphs and diagrams can communicate patterns in data to audiences with different levels of statistical knowledge [5]. Prior instructional work has examined visual learning materials [6], Android-based infographics [7], and interactive materials for quantitative topics [8]. Digital media have also been studied as tools for

health promotion and institutional communication [9]. This study uses BOR, LOS, TOI, and BTO as the core content of an interactive promotional and learning prototype so that prospective audiences can see how PMIK professionals analyze, interpret, and communicate hospital statistics.

RESEARCH METHOD

The study used Design Thinking, a human-centered approach that develops and tests solutions around users' needs [10]. Its five stages were empathize, define, ideate, prototype, and test [11]. The design process drew on observation of existing promotional material, a review of relevant PMIK competency literature, structured interviews, and discussions with lecturers and students. Potential users included lecturers, PMIK practitioners, and RMIK students. The purposively selected evaluation sample comprised two PMIK subject-matter experts, one media expert, and 15 RMIK students.

Hospital indicators from a Type D hospital were analyzed descriptively and compared with efficiency criteria. The results were incorporated into the digital prototype to demonstrate hospital statistics, scientific communication, and digital literacy. The prototype was evaluated using the 10-item System Usability Scale (SUS) [12]. For odd-numbered items, one point is subtracted from the response. For even-numbered items, the response is subtracted from five. The adjusted item scores are summed and multiplied by 2.5 to produce a score from 0 to 100.

RESULTS AND DISCUSSION

Results

Participant characteristics

The source reports 18 participants selected for their relevance to the intended users or their expertise in evaluating the prototype. Table 1 presents the participant roles and counts.

Table 1. Evaluation participant characteristics

Participant role	n
PMIK subject-matter experts	2
Media expert	1
RMIK students	15
Total	18

Empathize

The review of existing RMIK promotional media found that most material presented the program profile, facilities, and academic activities. It provided few examples of how graduates use hospital data. Discussions with lecturers and students informed the prototype requirements. The application needed to present hospital indicators, allow users to practice calculations, provide instructional content and quizzes,

and explain PMIK competencies. Its interface needed to communicate the indicators clearly and be easy to navigate.

Define

The central problem was that existing promotional material did not demonstrate how graduates calculate and interpret hospital indicators. The design team selected BOR, LOS, TOI, and BTO as the central content because they are relevant to the competencies taught in hospital statistics.

Ideate

The user flow connects sign-in with the application dashboard. Users can open formulas, videos, quizzes, PMIK competency information, and settings. The interface design includes sign-out and a return to the login page. Figure 1 shows the original workflow.

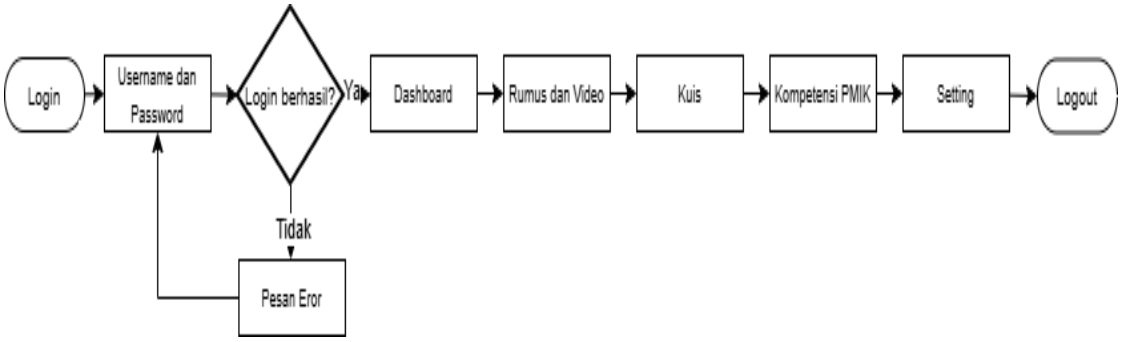

Figure 1. FunTa user flow

Prototype

FunTa (Fun Statistics) was designed as a mobile prototype for studying health facility statistics. The prototype uses consistent icons and colors and a card-based dashboard. These decisions align with the general principles of human-centered design for interactive systems [13].

The login screen is the entry point to the prototype. The proposed flow uses an email address and password. The dashboard provides access to the calculator, learning materials, videos, quizzes, and profile. The design also envisages displaying learning progress.



Figure 2. Login screen



Figure 3. Dashboard

The calculator and simulation screens allow students to enter hospital service data and view the four indicators. The proposed visualization uses a Barber–Johnson chart to connect the input data with the resulting measures of bed utilization.

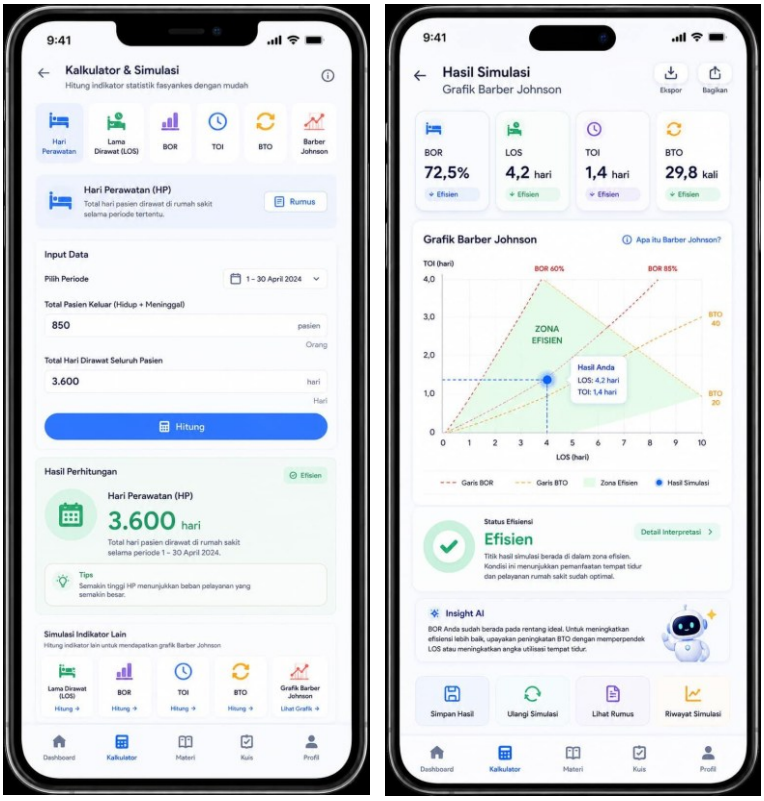

Figure 4. Calculator and simulation screens

The learning materials present concepts, formulas, and videos on inpatient days, BOR, LOS, TOI, BTO, and the Barber–Johnson chart. The quizzes provide a way for learners to check their understanding. The profile introduces PMIK competencies in health data management, facility statistics, disease classification and coding, information systems, communication, and ethics. The settings screen presents account, notification, display, help, and application information options.

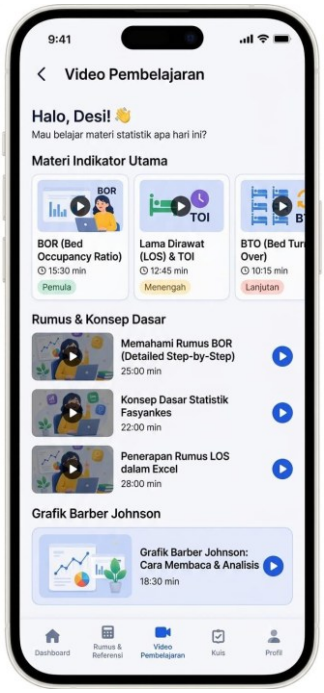

Figure 5. Learning materials and videos



Figure 6. Quiz screen

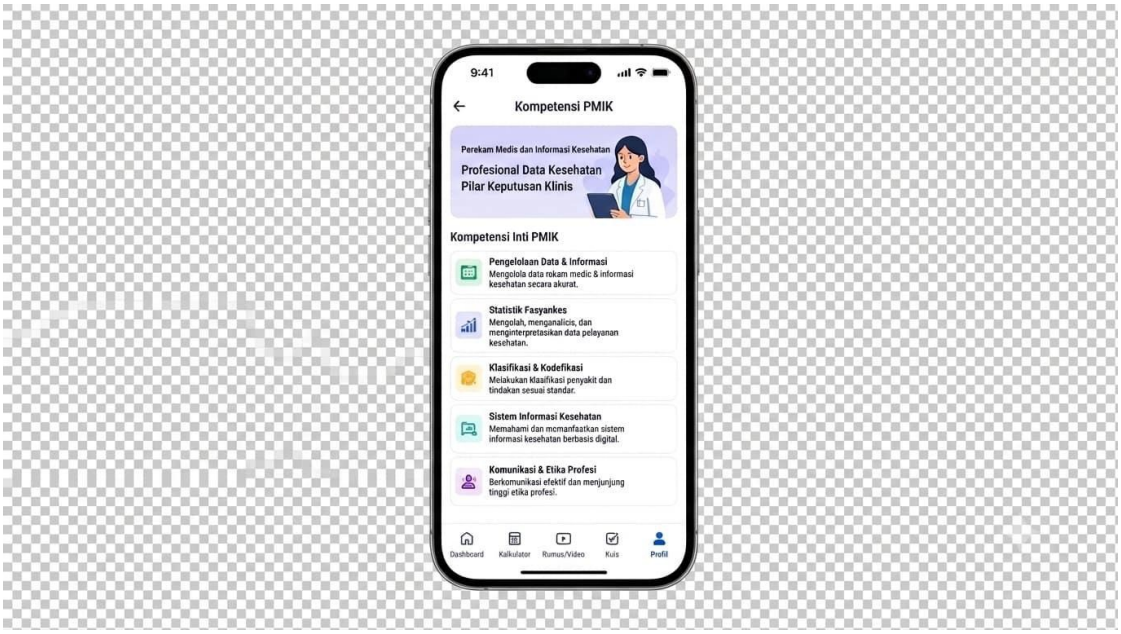

Figure 7. Profile and PMIK competencies

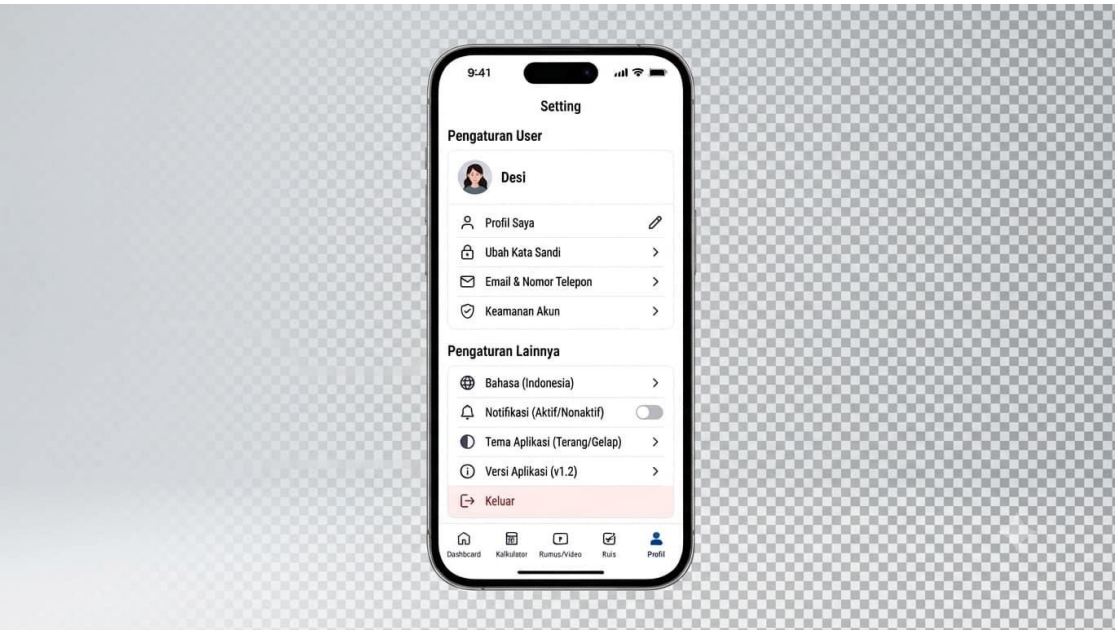

Figure 8. Settings screen

Test

The source reports a mean SUS score of 80.5 for 18 respondents. The source table contains five participant-level records (R1–R4 and R18), so the overall mean cannot be independently reproduced from the available records. Table 2 reproduces the observed responses and scores. SUS adjective labels and acceptability ranges provide reference points for interpreting perceived usability [14]. Published grading systems differ. On the curved grading scale published by Lewis and Sauro, a score of 80.5 corresponds to A− [15]. Figure 9 reproduces the interpretation graphic from the source manuscript. An SUS score does not directly measure recommendation behavior.

Table 2. Participant-level SUS responses available in the source

ID	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Item sum	SUS score
R1	4	2	5	3	4	2	4	2	5	3	30	75
R2	4	2	5	3	5	2	4	2	5	2	32	80
R3	5	2	5	3	4	2	4	2	4	3	30	75
R4	5	2	5	3	4	2	4	2	5	2	32	80
R18	5	2	5	3	4	3	5	1	5	2	33	82.5

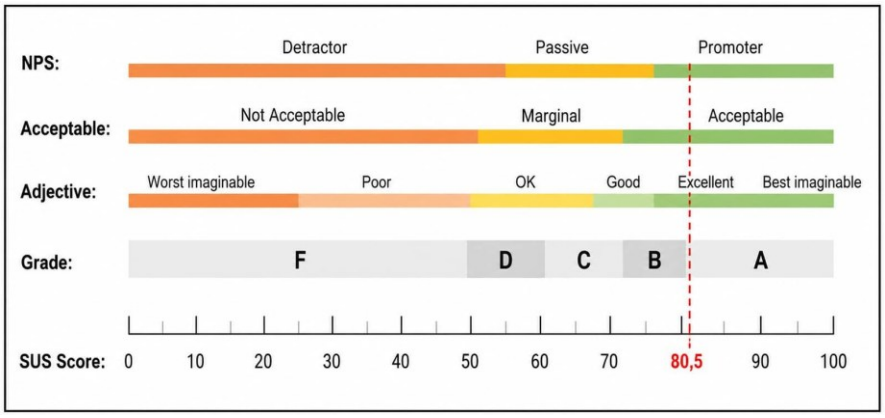

Figure 9. SUS interpretation graphic included in the source manuscript

The source also reports a separate media feasibility average of 94.25%, comprising content suitability (95%), visual clarity (92%), ease of understanding (94%), and media appeal (96%). The available manuscript does not provide the underlying item-level records or scoring instrument for those figures.

Discussion

The Type D hospital case yielded a reported BOR of 75%, LOS of four days, TOI of one day, and BTO of 20. The original analysis classified BOR, LOS, and TOI as efficient and identified BTO as requiring optimization. The reporting period and the raw values used in these calculations were not included. The numerical results therefore support illustration of the prototype, with confirmation of the efficiency classifications and alignment of the indicator inputs still required [3].

The case gives RMIK lecturers a way to teach how hospital statistics are calculated and communicated. Students can compare inputs and outputs in the calculator, review contextual learning materials, and check their understanding with a quiz. For prospective students, the same features give a concrete example of the work performed by PMIK professionals. Earlier work on audiovisual health education supports the relevance of multimedia for communicating health information [16]. Research on hospital social media promotion also provides context for digital outreach [9]. In the present study, the

reported testing focused on prototype usability and media feasibility. Changes in learning or in prospective students' perceptions were not measured.

The design stages connected the observed gap in conventional promotional media with specific features. Dashboard displays and the Barber–Johnson chart help users see how indicators relate to one another, while simulations support independent practice and case-based teaching. Green and yellow indicators communicate efficiency classifications in the original design. A concise text label alongside each color would make the classification easier to interpret across users. Confirmation of calculation accuracy and response times would require benchmark cases and test records.

The study connects hospital-statistics instruction with professional competencies described in the national standard [2]. The reported usability and feasibility results support further evaluation with the intended audiences. The available SUS rows and scoring documentation limit verification, and the prototype's contribution to learning and recruitment remains a question for future evaluation.

CONCLUSION

Fundamental Finding: This study shows that statistics from a Type D hospital were successfully converted into data-driven digital promotional media, with BOR, LOS, and TOI in the efficient category, while BTO still requires optimization. Applying Design Thinking produced the FunTa (Fun Statistics) prototype, integrating a dashboard, a calculator and simulation, learning materials, instructional videos, quizzes, and PMIK competencies as an interactive learning medium. **Implication:** Thus, this application has the potential to support the teaching of health facility statistics while strengthening the digital promotion of the RMIK Study Program in the era of digital transformation. **Limitation:** The evaluation was limited to one hospital case and a purposively selected sample. Only five participant-level SUS records were available to verify the reported mean of 80.5. **Future Research:** Future research could evaluate FunTa across several RMIK programs and measure whether the prototype improves students' interpretation of bed-use indicators and prospective students' understanding of PMIK competencies.

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