

RESEARCH ARTICLE

SiKS: An Integrated Web-Based Student Counseling Information System with Automated WhatsApp Notifications

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This article contributes to:



ABSTRACT

Fragmented school counseling records can obscure case histories, disrupt follow-up, and weaken communication with families. This study developed and formatively evaluated SiKS, an integrated web-based student counseling information system that connects counseling activities through role-based access and automated WhatsApp notifications. Requirements were elicited through interviews with the Vice-Principal for Student Affairs and a School Counselor at an Indonesian vocational high school, supplemented by analysis of the existing workflow. Developed using the Waterfall model, Laravel, and MySQL, the prototype links appointment requests, scheduling, counseling records, follow-up actions, parental summons, reporting, and notification logs across six user roles. Evaluation included 50 black-box scenarios derived from the requirements and user acceptance testing with 20 role-representative respondents after a guided walkthrough. Three validators reviewed the 15-item instrument, assigning 211 out of 225 possible points (93.78%). All 50 executed functional scenarios produced the expected outputs. User acceptance scores totaled 1,336 out of 1,500 points (89.07%), with item scores ranging from 82% to 96%. Interface attractiveness, suitability for school use, menu accessibility, and perceived confidentiality under role-based access received the strongest ratings; report clarity, printing and downloading, and notification services received comparatively lower ratings. The study presents a context-specific design that links case continuity, differentiated access, and event-triggered communication within a single counseling workflow. The findings support functional conformance under the tested conditions and favorable initial user perceptions. Developer-led testing, the single-school setting, and guided exposure limit inferences about independent use, sustained adoption, privacy protection, and counseling outcomes.

KEYWORDS

School counseling; case continuity; role-based access control; WhatsApp notifications; formative evaluation

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1. INTRODUCTION

Guidance and counseling in secondary schools is an educational service that depends on continuity of information. Counselors must provide a safe channel through which students can seek help, protect confidentiality, maintain traceable records of assessments and follow-up, and coordinate with teachers and families when additional support is required. Digital tools may improve access and continuity, but research on digital mental health among young people indicates that engagement depends on perceived usefulness, privacy, trust, guidance, and implementation context rather than on the availability of technology alone [1], [2], [3]. Digitizing counseling therefore involves more than replacing paper forms: the system must support appropriate access, continuity, and communication without exposing sensitive case information.

In Indonesia, Law No. 20 of 2003 on the National Education System provides the national legal framework for education [4], and its implications for the education system are discussed in [5]. Ministry of Education and Culture Regulation No. 111 of 2014 (Permendikbud No. 111/2014) further frames guidance and counseling as support for students' personal, social, learning, and career development [6]. Indonesian scholarship also links school counseling services with student development and discipline support [7], [8]. These responsibilities make record continuity and controlled information access important operational requirements for school counseling services.

Information systems can support these requirements by organizing, controlling access to, and reporting information more consistently [9], although information-system success also depends on system quality, information quality, service quality, use, user satisfaction, and net benefits [10]. For sensitive records, access must be differentiated according to legitimate responsibilities. Role-based access control is widely used to restrict access to sensitive records, but its effectiveness depends on careful role definition and implementation [11]. Claims about communication functions also require careful qualification: digital notifications can improve appointment-related communication in other service settings [12], but those findings cannot be assumed to transfer directly to school counseling. Accordingly, this study evaluates notifications as an operational mechanism for reducing manual handoffs, while counseling outcomes remain outside the study scope.

The practical context for this study is SMKN 2 Guguak, a public vocational high school in Guguak District, Lima Puluh Kota Regency, West Sumatra, Indonesia. The school offered five vocational study programs and enrolled 622 students in the 2025/2026 academic year. At this scale, the counseling unit needs reliable mechanisms for recording case histories, coordinating appointments, monitoring follow-up, and generating summary reports for authorized school personnel.

Interviews conducted in April 2026 with the Vice-Principal for Student Affairs and the School Counselor identified four interrelated weaknesses in the existing workflow. First, daily individual and group counseling had no comprehensive longitudinal record apart from limited paper documentation, making case chronology and periodic recapitulation difficult to reconstruct. Second, appointments were requested verbally or face to face, which offered limited privacy to students seeking counseling. Third, follow-up relied on manual coordination, so missed or postponed sessions were difficult to monitor

systematically. Fourth, parental summons letters were delivered on paper through students, leaving delivery unverified and allowing communication to be delayed or withheld.

These limitations were interrelated. When requests, sessions, follow-up, and parental communication are stored or handled separately, the school cannot easily determine the progression of a case from initial contact to completion. The same fragmentation also complicates appropriate restrictions on information access: school leaders may need aggregate monitoring, whereas detailed session content should remain restricted. The design problem is therefore a case-lifecycle problem involving traceability, role-specific visibility, and event-driven communication, rather than simply a need to digitize individual forms.

Previous counseling information systems address elements of this problem but remain fragmented in several respects. Atika et al. [13] developed web-based counseling data management, monitoring, and reporting; Marisa et al. [14] digitized scheduling and record tracking; Yanti et al. [15] and Wulandari and Farell [16] focused on student violation or case-handling records; Mariati et al. [17] incorporated counseling-related communication records; and Putranto and Tambotoh [18] integrated complaint and counseling services. Other school information systems demonstrate broader digital reporting and administrative integration [19]. Collectively, these studies establish the feasibility of web-based counseling or student-service systems, but provide limited explicit evidence of an end-to-end structure that keeps a counseling request, its validation, the session record, follow-up status, parental summons, and notification history traceably connected while restricting visibility according to user roles.

This study addresses that application-level gap by asking the following question: How can SiKS, an integrated web-based student counseling information system, connect the counseling case lifecycle through role-based access and automated notifications, and to what extent does the resulting prototype meet its specified functional requirements and receive favorable initial evaluations from representative users? Accordingly, the study aims to design, implement, and formatively evaluate SiKS at SMKN 2 Guguak. The study makes three contributions: (1) a traceable data structure linking request, session, follow-up, summons, and notification events; (2) a role-based interaction design that distinguishes case-level access from leadership monitoring, while revealing a permission exception requiring correction; and (3) an evaluation that distinguishes developer-verified functional conformance from initial user acceptance. Favorable user acceptance testing (UAT) results provide initial evidence of perceived acceptability and feasibility; sustained adoption, counseling effectiveness, privacy robustness, and long-term implementation require separate evidence [20], [21].

The following sections review the relevant literature, describe the Waterfall development process and evaluation procedures, and discuss the findings, contributions, and limitations.

2. LITERATURE REVIEW

2.1. Counseling Service Principles, Privacy, and Digital Engagement

School counseling systems must reflect counseling principles in their technical requirements. Permendikbud No. 111/2014 positions guidance and counseling as a means of supporting students' personal, social, learning, and career development [6], while counseling literature emphasizes confidentiality, voluntary engagement, and supportive access [7]. In digital systems, confidentiality requires access rules that prevent unnecessary exposure of session content; voluntariness requires a discreet means for students to initiate requests without publicly approaching the counseling room. Evidence from web-based mental-health interventions for young people reinforces this design logic:

privacy, perceived usefulness, trust, guidance, and contextual fit can shape engagement, whereas unclear safety or ethical arrangements can impede uptake [1], [2], [3]. These findings do not make a school counseling information system equivalent to a mental-health intervention, but they help explain why privacy, clarity, and low-friction access are important system requirements for a service used by young people.

2.2. Case Continuity, Traceability, and Role-Based Access

Existing web-based counseling systems demonstrate the value of digitized records, but they vary in the extent to which they represent a counseling case over time. Some systems emphasize counseling data management, monitoring, and reporting [13]; others add scheduling and status tracking [14], violation handling [15], [16], communication records [17], or integrated complaint and counseling services [18]. The central design issue is therefore not the presence of a database, but whether it preserves links among requests, validation decisions, sessions, follow-up actions, and communication events. A disconnected set of digital records can reproduce the fragmentation of the paper process. The present study consequently treats chronological case linkage as a primary design requirement. Because counseling records are sensitive, traceability must also be paired with role-specific visibility: students need access to information related to their own cases, counselors require case-level data, homeroom teachers need information relevant to assigned students, and leadership access should be limited to what oversight requires. This logic is consistent with role-based access control in sensitive information systems [11], while recognizing that least-privilege access must be verified through implemented permissions rather than inferred from role labels.

2.3. Automated Notifications and School-Family Coordination

Automated notifications connect system status changes to communication events. WhatsApp API management systems demonstrate the feasibility of programmatic notification delivery [22]. School-based applications have used WhatsApp for attendance communication [23], while other implementations demonstrate automated notification [24] and OTP-based authentication [25]. A systematic review and meta-analysis in healthcare also indicates that text-based electronic notifications can improve appointment attendance [12]. This evidence is relevant only by analogy: a school counseling summons differs in purpose, sensitivity, and recipient relationship, and the present study did not measure attendance outcomes. Accordingly, the notification module is evaluated here as part of the workflow infrastructure. A request can alert a counselor, a validation decision can notify a student, and a follow-up summons can be sent directly to a parent or guardian. Because the prototype uses a third-party WhatsApp gateway rather than a fully controlled institutional messaging service, message content should be minimized to what the recipient needs, delivery statuses should be recorded, and failed automated delivery should trigger a documented manual follow-up process.

2.4. Evaluation Logic: Functional Conformance, Acceptance, and Implementation

Software evaluation produces different types of evidence that should be interpreted separately. Black-box testing establishes whether executed scenarios produce specified outputs [26], whereas UAT captures users' assessments of a system's acceptability and feasibility in its intended setting [27]. Implementation research further distinguishes acceptability and feasibility from adoption, fidelity, penetration, and sustainability [20], and the updated Consolidated Framework for Implementation Research emphasizes that real-world implementation depends on contextual determinants across the innovation, setting, and people involved [21]. These distinctions guide the evaluation. A 100% functional pass rate supports conformance for the tested scenarios, and a favorable UAT score supports initial acceptance after guided

exposure. Long-term use, privacy robustness, counseling effectiveness, and transferability require additional evaluation.

3. METHODS

3.1. Research Design

This study used the Waterfall system development model, comprising requirements definition, system and software design, implementation, integration and testing, and operation and maintenance (Figure 1) [28]. Waterfall was selected because the counseling workflow, organizational roles, and core regulatory constraints had been identified before implementation and were treated as relatively stable requirements. The research was therefore designed as a single-site study of software design and formative evaluation rather than as an effectiveness trial. The technical unit of analysis was the requirement-derived test scenario, whereas the UAT analysis drew on respondents' questionnaire ratings.

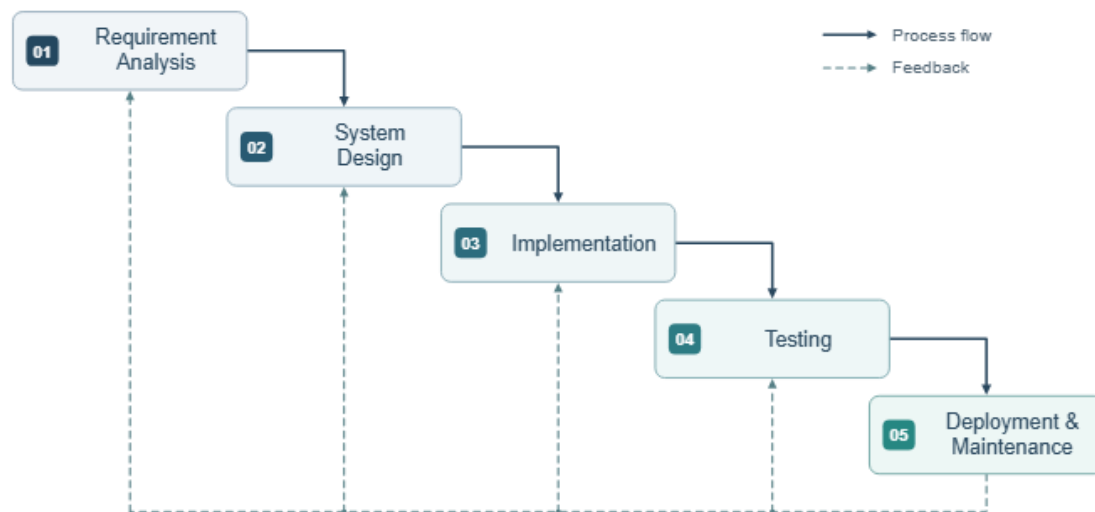


Figure 1. Waterfall development model used in the study

3.2. Study Site and Participants

The study was conducted at SMKN 2 Guguak, a public vocational high school in West Sumatra, Indonesia. Requirements data were obtained through semi-structured interviews with the Vice-Principal for Student Affairs and the School Counselor, supplemented by documentation of existing referral, scheduling, parental-summons, and visit-logging processes. UAT involved 20 purposively selected respondents representing roles responsible for using or overseeing the system: one Principal, one Administrator, one Vice-Principal for Student Affairs, two Guidance Counselors, two Homeroom Teachers, and 13 Students. The six role-specific interactions are shown in Figure 2. This purposive sample supported formative evaluation at the study site, not an estimate of population-level acceptance.

3.3. System Architecture and Development Tools

SiKS was implemented as a Laravel (PHP) web application with MySQL as the relational database management system. Laravel supported authentication, routing, and role-based application logic across the six user groups. The database schema was developed through normalization from an unnormalized

form through the first, second, and third normal forms to reduce repeating groups and partial or transitive dependencies [29], [30]. The resulting entity-relationship structure centers on the counseling request and links it to scheduling, counseling sessions, follow-up actions, parental summons, and a notification log (Figure 3) [31]. System behavior and access were modeled with Unified Modeling Language (UML) use-case and activity diagrams [32], [33]. Automated messages were sent via the Fonnte WhatsApp gateway and its application programming interface. The browser interface used HTML, CSS, and JavaScript, while Laragon and Visual Studio Code supported local development.

3.4. System Development Procedure

3.4.1. Requirements Analysis

Interviews and an analysis of the manual workflow identified four linked operational problems: incomplete counseling histories, requests made without adequate privacy or formal scheduling, paper summons letters with uncertain delivery, and the lack of a shared, role-appropriate view of case status. These problems informed four core requirements: chronological case histories with summary reporting, student self-service scheduling, event-triggered notifications and summons delivery, and role-based status monitoring. The requirements were used as the basis for the subsequent UML models and functional test scenarios.

3.4.2. System Design

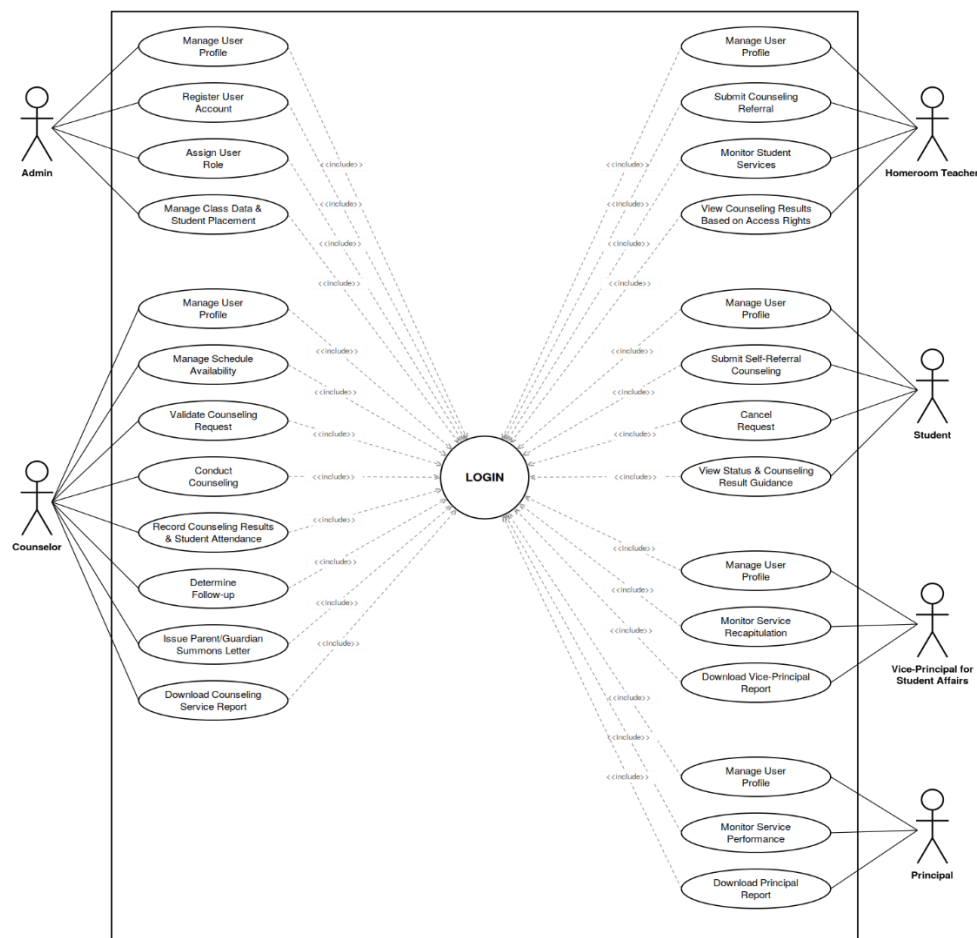


Figure 2. Use-case diagram of SiKS

The requirements described in Section 3.4.1 were modeled using UML [32], [33]. The use-case model identifies six authorized actors: Administrator, Counselor, Homeroom Teacher, Student, Vice-Principal for Student Affairs, and Principal (Figure 2). Actor-specific workflows cover account and access management, referral and monitoring, schedule validation, counseling-session recording, student self-service requests, and leadership-level review of recapitulation data. The design aimed to separate case-level work from leadership monitoring so that access permissions would reflect operational responsibilities; the implemented privilege set was subsequently examined through functional testing against that design intent.

The database design progressed from an unnormalized form through first normal form (1NF), second normal form (2NF), and third normal form (3NF). The final entity-relationship model contains 15 interconnected entities and 18 relationships (Figure 3). Counseling Request functions as the principal case entry point and is linked to Counseling Session, Follow-Up Action, Summons Letter, and Notification records, while supporting entities represent users, classes, departments, academic years, and schedule availability. This structure was designed to preserve the sequence of events in a case and to avoid storing summons or follow-up information as isolated records.

Access-control rules were incorporated into the design before implementation. Under the intended access-control design, students can access only their own case-related information; Homeroom Teachers can view information about students assigned to their classes; and Counselors manage counseling content and follow-up. Leadership interfaces were designed primarily for read-only monitoring and recapitulation. Functional testing then assessed the implemented permissions against the design.

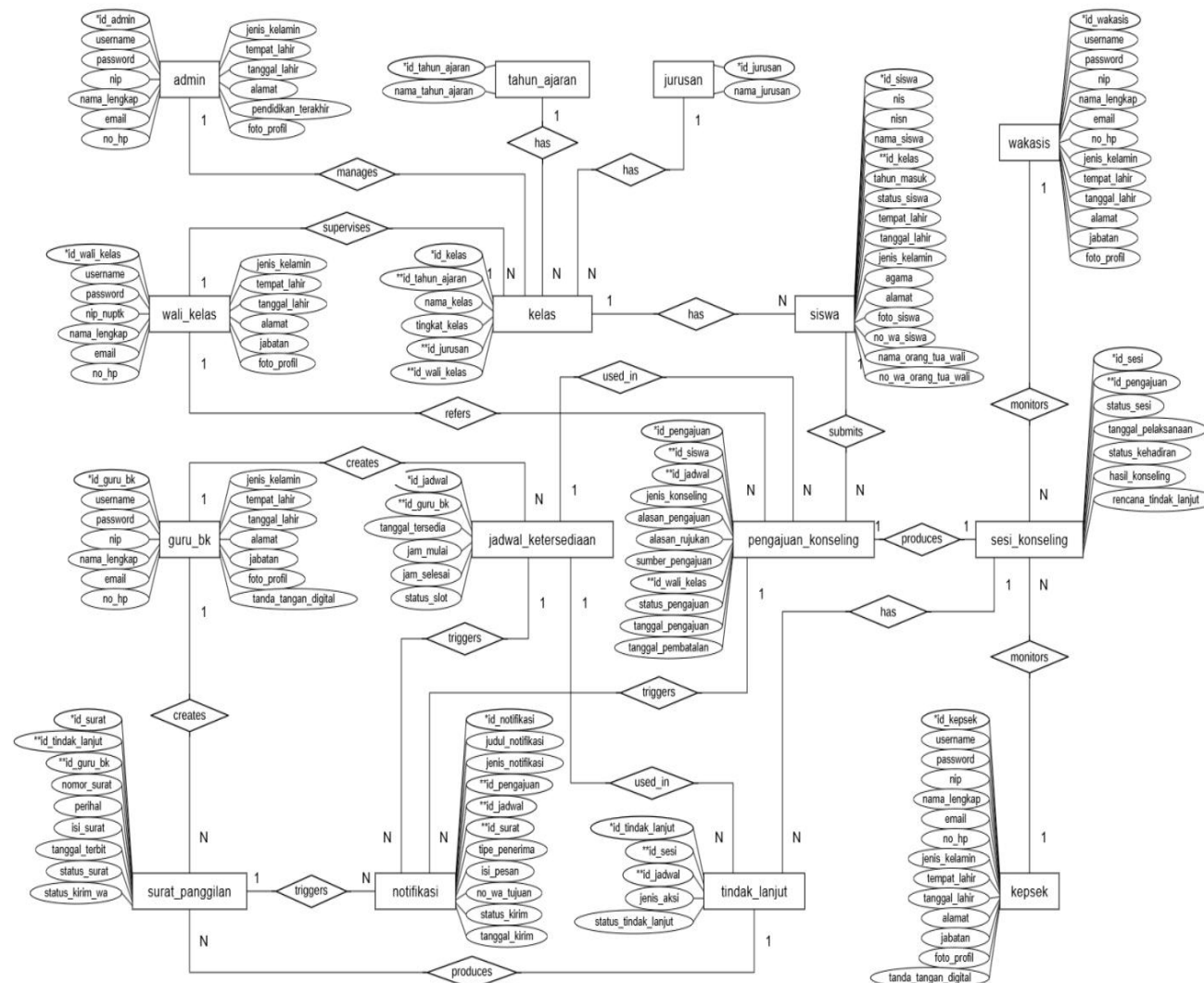


Figure 3. Entity–relationship diagram of SiKS

3.4.3. Implementation

Implementation proceeded from local verification to limited hosted use. The first stage ran the application locally with Laragon and MySQL to verify role-based authentication, account and class management, counseling requests and schedule validation, session and history recording, parental summons management, and notification delivery. In the second stage, the application was made available on a hosted web server to a limited set of users to test the main workflow and address interface issues before final evaluation.

In the final stage, the revised prototype was demonstrated and evaluated across all six system roles using trial data. This stage supported the black-box scenarios and the guided UAT described below. This was not a longitudinal production deployment; therefore, outcomes such as sustained daily use, long-term data quality, message-response behavior, or counseling effectiveness were not measured.

3.4.4. Testing and Data Analysis

Functional verification used black-box testing, which examines whether specified inputs and actions produce the expected system behavior without requiring inspection of internal code [26]. Fifty scenarios derived from the requirements covered general authentication and the six role-specific modules, including account management, schedule availability, request submission and validation, session recording, summons generation, report functions, and WhatsApp notification dispatch. Scenarios were executed by the development team and cross-checked with Selenium IDE browser automation. A scenario was classified as valid when the observed behavior matched the expected result. The complete scenario matrix is reported in Appendix A.

UAT used a 15-item questionnaire adapted for this study, drawing on the UAT approach described by Wibowo and Darwati [27], with four design items, six service items, and five efficiency items. Before administration, three validators assessed the 15 items using a five-point rating scale; the item-level ratings and validator summary are reported in Appendix B. This expert-review score represents a study-specific pre-administration assessment and was not treated as a psychometric validity coefficient. The questionnaire was then administered via Google Forms to the 20 respondents described in Section 3.2 after a guided walkthrough of features relevant to each role. Responses were recorded on a five-point Likert scale (5 = strongly agree, 4 = agree, 3 = somewhat agree, 2 = disagree, 1 = strongly disagree). The feasibility percentage was calculated as the obtained score divided by the maximum possible score, multiplied by 100. Scores of 81–100% were classified as Very Feasible; 61–80%, Feasible; 41–60%, Reasonably Feasible; 21–40%, Less Feasible; and below 21%, Unfeasible. Item-level response distributions and feasibility scores are reported in Appendix C. Because UAT followed a guided walkthrough and involved a small purposive sample at one school, the analysis is descriptive and formative.

3.4.5. Operation and Maintenance Plan

Following evaluation, a proposed maintenance plan was prepared to cover corrective maintenance (resolving post-release errors), adaptive maintenance (updating academic-year, class, or category data), perfective maintenance (improving report, search, and interface performance), preventive maintenance (periodic backups), and service-availability monitoring. These activities describe a planned maintenance process; longitudinal maintenance performance was not evaluated in the present study.

4. RESULTS

4.1. System Implementation

The final SiKS prototype implemented the workflow specified in the design stage as a Laravel web application with a MySQL database. Six role-based dashboards provide functions aligned with the respective roles. The Administrator interface manages user accounts, data import and export, activation status, and supporting master data (Figure 4), while the remaining modules connect schedule requests, counseling sessions, follow-up, recapitulation, and notifications to the same underlying case structure. Functional testing revealed that the Principal role can access detailed counseling-session information (Appendix Table A1, BB-45), revealing a least-privilege concern that must be resolved before use with real counseling records.

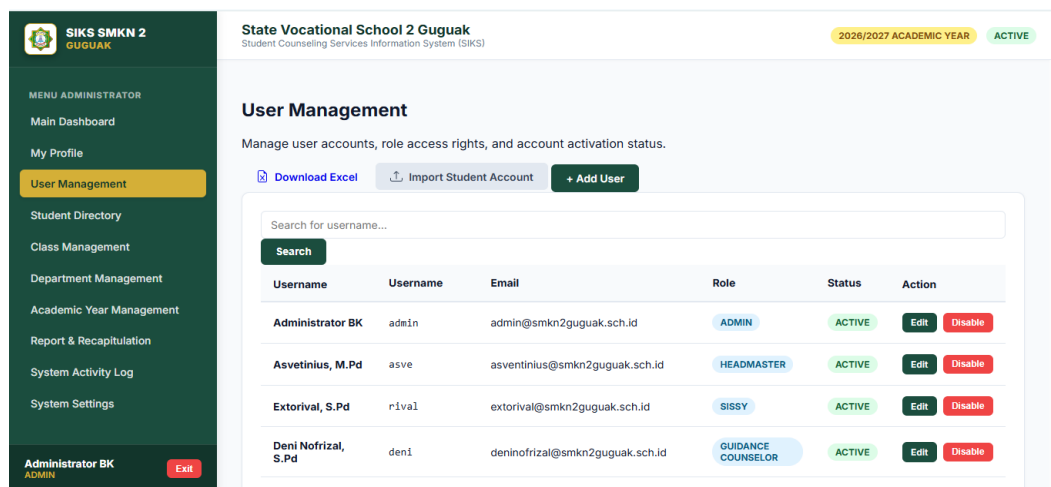


Figure 4. Administrator user-management interface

The Counselor dashboard serves as the operational center for case management (Figure 5). It summarizes active students, pending requests, sessions scheduled for the day, and completed sessions, while also providing direct access to upcoming sessions and recent requests. These dashboard counts describe recorded system activity rather than counseling outcomes; their purpose is to support case triage and continuity.

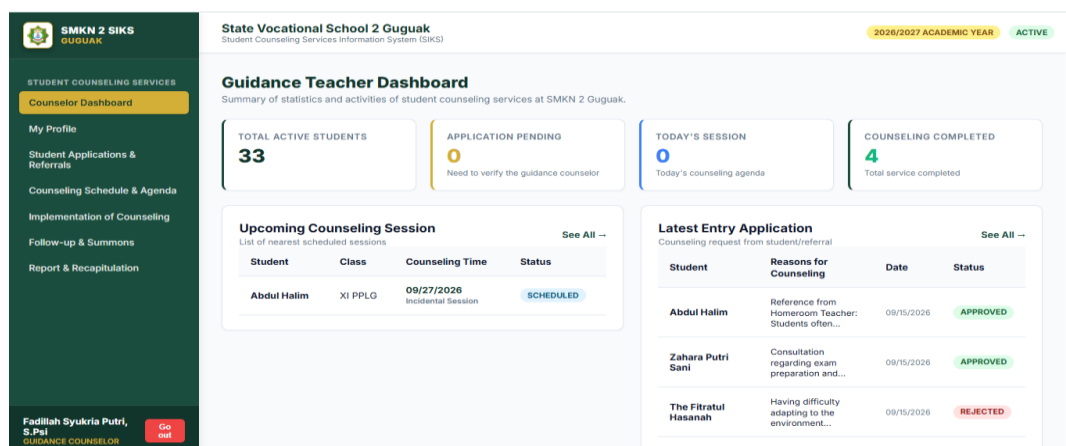


Figure 5. Counselor dashboard

Counselors record and review counseling session histories on the counseling implementation page (Figure 6). The page links a session to the corresponding student, service type, presenting problem, counseling result, and follow-up status so that subsequent actions remain linked to the originating case instead of being stored separately.

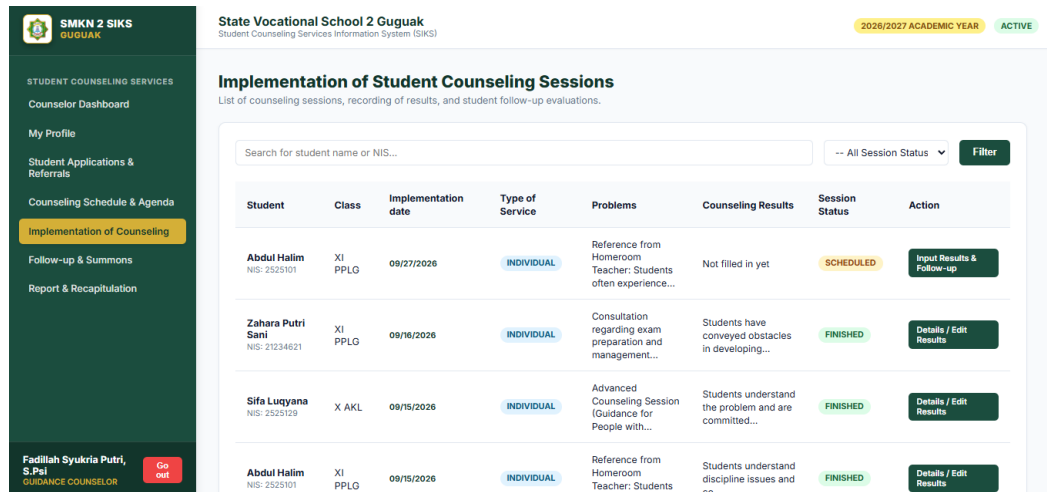


Figure 6. Counselor interface for recording counseling sessions

Students submit counseling requests and monitor their status through the scheduling page (Figure 7). For each request, the system displays the selected date and time, assigned counselor, service type, reason for the request, validation status, counselor feedback, and an option to cancel. This workflow offers a discreet digital request channel and separates request submission from counselor validation.

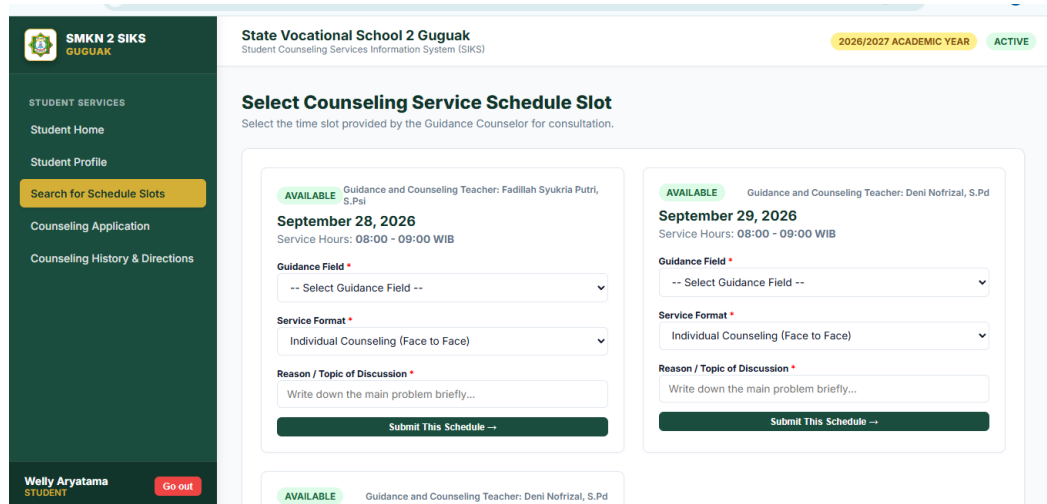


Figure 7. Student interface for submitting counseling requests

SiKS implements three event-triggered WhatsApp notifications (Figure 8): a new request or a referral from a homeroom teacher alerts the counselor; an approval or rejection is communicated to the student; and a follow-up summons can be sent directly to the student's parent or guardian. The prototype records notification events, linking communications to the corresponding case. Names, telephone numbers, and other identifying details shown in the interface figures are fictitious test data.

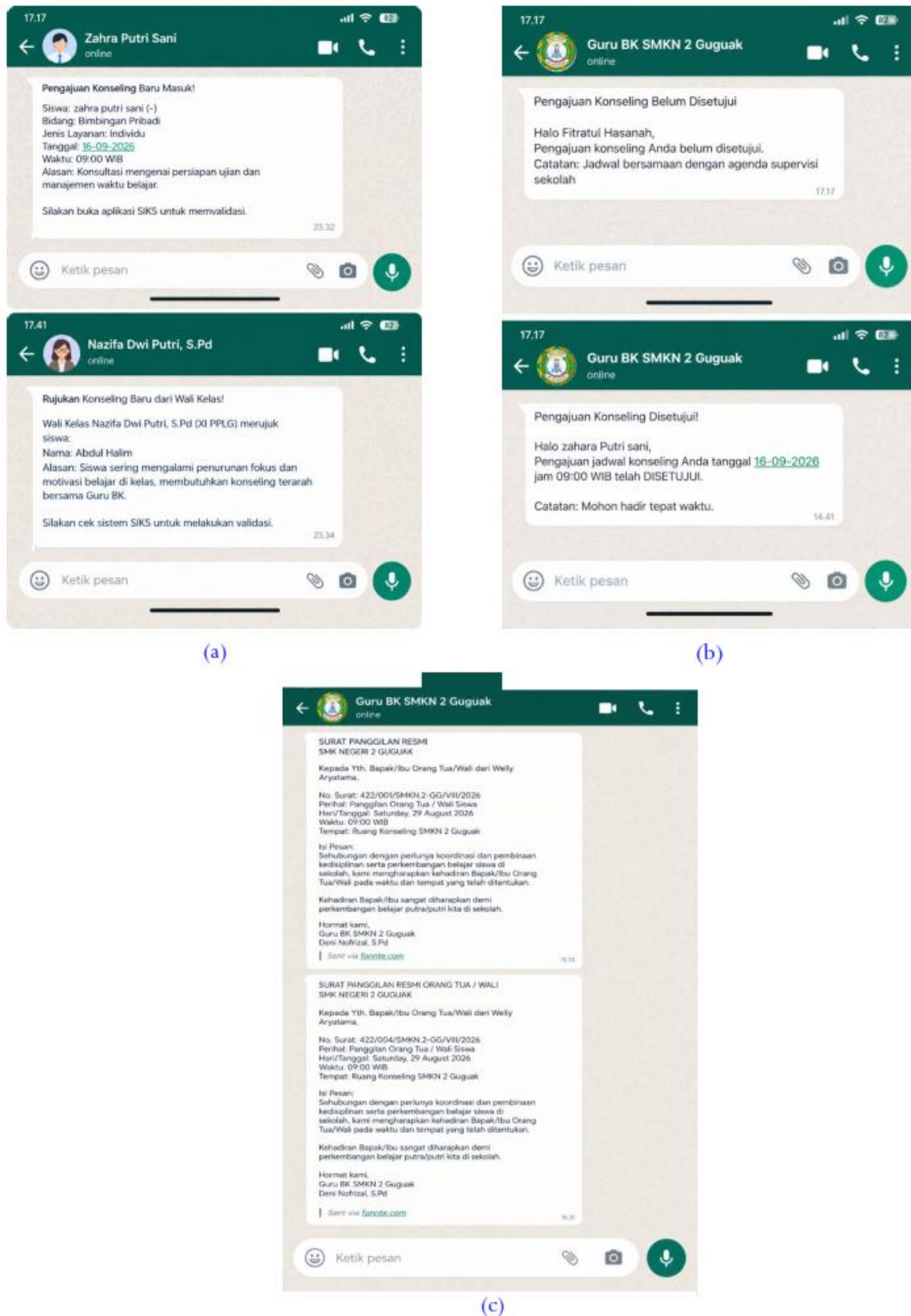


Figure 8. Automated WhatsApp notifications: (a) request or referral sent to the counselor; (b) validation result sent to the student; and (c) parental summons sent to a parent or guardian.

4.2. Functional Testing Results

Fifty black-box scenarios evaluated general authentication and the six role-specific modules [26]. The scenarios covered standard workflows and error cases for account access, master-data management, schedule availability, counseling request submission and validation, session recording, follow-up, generation of summons letters, report functions, and notification dispatch. Figure 9 summarizes the scenario count by module, and Appendix Table A1 provides the complete scenario matrix.

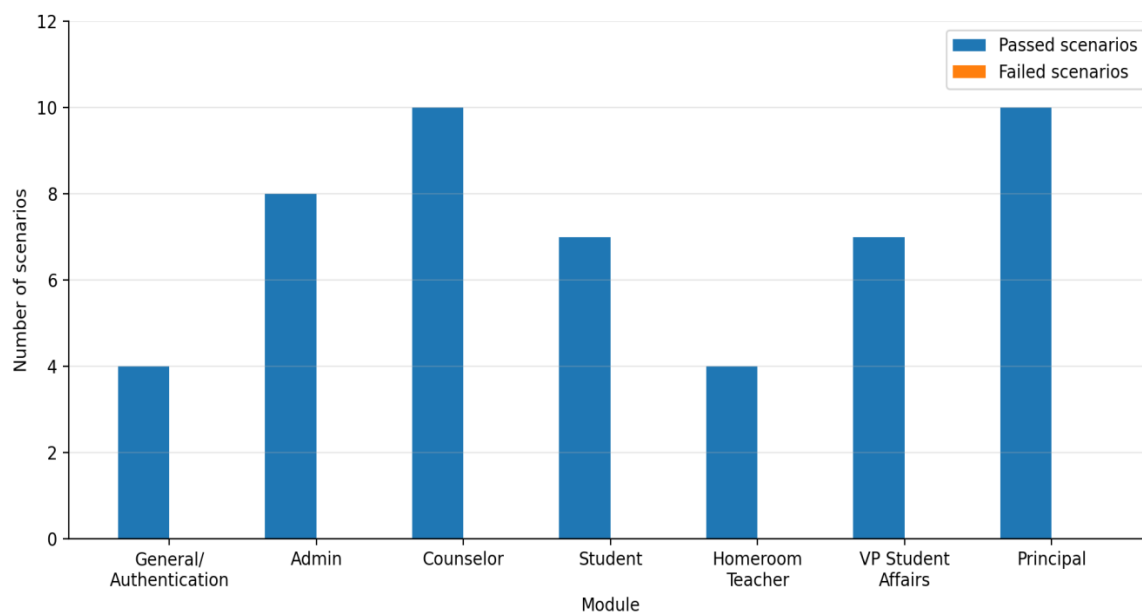


Figure 9. Black-box testing results by system module

All 50 executed scenarios matched their specified expected outputs and were recorded as valid. This result supports functional conformance for the executed requirements, including the notification pathway used in the test environment. These findings apply only to the scenarios executed; independent security and penetration testing, stress testing, and long-term reliability testing were outside the present evaluation.

4.3. User Acceptance Testing Results

4.3.1. Instrument Validation

Three validators reviewed the 15-item UAT instrument. Their respective scores were 70, 71, and 70 out of 75 points each, for a combined score of 211 out of 225 (93.78%). The study's scoring rubric classified this result as Very Valid. Appendix Tables B1 and B2 provide the item-level ratings and validator summary, and requested revisions were incorporated before administration. As an expert-rating exercise, the 93.78% value reflects a favorable assessment before administration and is not a psychometric coefficient of construct validity, reliability, or measurement invariance.

4.3.2. User Acceptance Results

After the guided walkthrough, 20 respondents completed the reviewed questionnaire. Among the 300 item responses, 149 were Strongly Agree, 138 Agree, and 13 Somewhat Agree; none were rated Disagree

or Strongly Disagree. The total score was 1,336 out of 1,500 (89.07%), classified as Very Feasible. Item-level feasibility ranged from 82% to 96% (Appendix Tables C1 and C2). The highest scores were for interface attractiveness (96%), suitability for school use (94%), ease of menu and feature access (93%), and the item concerning access-based security and confidentiality (92%). Relatively lower scores concerned printing and downloading functions (82%), clarity of summaries and reports (84%), automated notification services (86%), and perceived advantages over other methods or applications (86%). These responses indicate favorable initial acceptance while identifying functions that warrant refinement.

5. DISCUSSION

5.1. Integrated Case Continuity and Role-Based Confidentiality

SiKS chiefly contributes an explicit connection among counseling activities that were previously fragmented. A request initiates a connected sequence of validation, scheduling, session recording, follow-up, summons, and notification history. This architecture addresses the gap identified in the local workflow and clarifies the difference between storing records and preserving the progression of a case. Earlier counseling systems demonstrate useful components such as counseling data management, scheduling, reporting, violation handling, or complaint management [13], [14], [15], [16], [17], [18], but the present design makes the interdependence among those stages visible in one case structure. Operationally, recapitulation and follow-up can be derived from connected records instead of reconstructed from recollection or disconnected documents.

The role-based access model combines a private student request channel with differentiated permissions, in line with counseling principles and evidence indicating that privacy, trust, and low-friction access can shape young people's engagement with digital support [1], [2], [3]. Role-based authorization is likewise an established mechanism for limiting access to sensitive information systems [11]. Appendix Table A1 (BB-45) shows one important exception: the implemented Principal role can open detailed counseling-session information. The current configuration therefore does not satisfy least-privilege access for counseling-session details and must be corrected before production deployment. The 92% UAT rating for access-based security and confidentiality reflects favorable user perception after guided exposure, although independent security validation is still needed. Stigma reduction, help-seeking behavior, and willingness to disclose concerns were not measured.

5.2. Notifications as Workflow Infrastructure

The WhatsApp workflow addresses a specific weakness in the previous process: a paper summons given to a student for delivery could be delayed or never reach the parent. In the prototype, a status change can trigger a direct message and create a notification record linked to the case. Evidence from healthcare indicates that electronic text notifications can improve appointment attendance [12]. School-based systems have used WhatsApp for attendance communication [23], while other implementations demonstrate automated notification [24] and OTP-based authentication [25]. Because these settings differ from school counseling, this study evaluated the notification pathway as part of the workflow infrastructure. Message generation and gateway dispatch were verified in the test workflow; confirmed receipt, parental responses, appointment attendance, time to follow-up, and counseling completion remain to be evaluated. The evidence therefore supports an implemented mechanism for traceable communication and fewer manual handoffs, not confirmed message receipt.

This distinction also has governance implications. Counseling messages may contain sensitive contextual information, and the prototype relies on a third-party gateway. Safe operation would require minimizing message content, use a dedicated institutional sender, retain only necessary delivery metadata, maintain role-restricted access to case details, and provide a manual fallback when automated delivery fails. Future evaluation should test delivery reliability and privacy controls directly instead of inferring security from successful functional execution.

5.3. What the Functional and UAT Results Establish

The 50/50 functional-test result and the 89.07% UAT score describe different aspects of the prototype. Black-box testing establishes conformance of the executed requirements, whereas UAT captures users' assessments after a guided walkthrough. Together, these findings provide formative evidence of functional conformance and favorable initial acceptance. Unaided learnability, routine adoption, and effectiveness require separate evaluation. Proctor et al. distinguish acceptability and feasibility from adoption, fidelity, penetration, and sustainability [20], while CFIR emphasizes contextual determinants across the innovation, setting, and people involved [21].

Item-level results add detail to the overall percentage. Respondents rated interface attractiveness, school appropriateness, menu access, and perceived access-based confidentiality most favorably, suggesting that the basic interaction model was understandable and contextually plausible. Lower ratings for printing and downloading, report clarity, and notifications identify specific usability concerns that can be addressed without characterizing them as failures. In particular, an 82% score for printing and downloading remains within the study's Very Feasible category, but it signals that document-generation workflows deserve priority in the next design cycle. Similarly, the 86% notification score suggests that successful dispatch in functional testing did not translate into uniformly high user ratings, reinforcing the value of combining technical and user-centered evidence.

5.4. Practical Implications, Limitations, and Future Evaluation

For schools with similar counseling workflows, this design suggests a practical sequence: define the case lifecycle first; map each role to the minimum information required; connect every follow-up and communication event to the originating case; and then automate notifications and reporting. This sequence keeps the system centered on counseling continuity. Leadership dashboards should present aggregate information to support decisions, whereas session content should remain accessible only to those with a legitimate need. The item-level UAT findings further indicate that report readability and export functions should be refined before broader use because administrative value depends on both data collection and clear presentation.

Several limitations qualify these findings. The study was conducted at one vocational school, requirements were elicited from a small number of staff, functional testing was led by the development team, and UAT used a 20-person purposive sample after a guided walkthrough. The evaluation did not include unguided task-based usability testing, longitudinal adoption measures, comparison with the prior workflow, message-delivery and parent-response measures, independent security or penetration testing, stress testing, or direct counseling outcomes. Future multisite studies should pair independent functional and security testing with longitudinal usage logs, task-based usability measures, delivery and response metrics, and implementation outcomes such as adoption and sustainability [20], [21]. When systems are used by minors, future studies should document in advance the ethics and consent procedures required by the relevant institution and journal.

6. CONCLUSION

This study designed and formatively evaluated SiKS, an integrated web-based student counseling information system that links student requests, scheduling, session records, follow-up actions, parental summons, and automated WhatsApp notifications within a single case-centered workflow. All 50 requirement-derived black-box scenarios produced the expected outputs, and the 15-item UAT yielded 89.07% across 20 respondents, with item-level scores ranging from 82% to 96%. These findings support functional conformance for the executed scenarios and favorable initial acceptance at SMKN 2 Guguak. The main design contribution is a traceable case workflow connecting role-based access with event-triggered communication. The evidence is formative, reflecting developer-led testing at one school and a single UAT administration after a guided walkthrough. The Principal session-detail permission documented in BB-45 remains an access-control issue requiring resolution before production use. Future work should examine independent usability, least-privilege access, delivery reliability, privacy and security, longitudinal implementation, and counseling-service outcomes across broader school contexts.

DECLARATIONS

Author Contributions

Welly Aryatama: Conceptualization; Methodology; Software; Investigation; Data Curation; Writing – Original Draft. **Syukhri:** Conceptualization; Supervision; Validation; Writing – Review & Editing. **Khairi Budayawan:** Validation; Writing – review & editing. **Delvi Asmara:** Validation; Writing – review & editing. **Dean Collin Langeveldt:** Writing – review & editing. All authors have read and approved the final version of the manuscript.

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Ethical Approval

This study was conducted as an undergraduate software development and formative usability project at SMKN 2 Guguak with formal authorization from the school and the Principal's approval. The study involved no clinical or therapeutic intervention and used trial data only, and did not access or process real student counseling records or identifiable sensitive case information.

Informed Consent

Participation was voluntary, and all participants were informed of the purpose and procedures of the evaluation before taking part. The school-based evaluation was conducted with written authorization from SMKN 2 Guguak and approval from the Principal. Verbal informed consent was obtained from each participant. For student participants who were minors, written parental or guardian consent was obtained, along with the students' voluntary agreement to participate. The evaluation used trial data only and did not involve real counseling records or identifiable sensitive case information. All names, telephone numbers, addresses, and other personal details shown in the manuscript figures are fictitious.

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Data Availability Statement

Aggregated functional-testing and UAT results are reported in the manuscript and appendices. Additional de-identified supporting records may be available from the corresponding author upon reasonable request, subject to institutional and confidentiality requirements.

Competing Interests

The authors declare that there are no competing interests related to this article.

Generative AI and AI-Assisted Technologies Statement

During manuscript preparation and revision, the authors used generative AI tools, including ChatGPT, Claude, and Gemini, solely to edit language and improve clarity. These tools were not used to generate, fabricate, or modify empirical data, analyses, or reported results. The authors reviewed and verified all AI-assisted content against the original research records and cited sources. The authors retain full responsibility for the accuracy, integrity, and final content of the manuscript.

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APPENDIX A. COMPLETE BLACK-BOX FUNCTIONAL TEST MATRIX

Appendix A reports the 50 retained requirement-derived functional test scenarios used in the developer-led black-box evaluation. The matrix covers general authentication and all six role-specific modules. Expected results were defined from the implemented requirements, and each observed result was compared with its corresponding expectation. All scenarios were recorded as valid; the matrix documents conformance only for the executed scenarios and does not constitute independent security testing, stress testing, or an exhaustive search for defects.

Appendix Table A1. Complete black-box functional test matrix.

ID	User role	Test scenario	Expected result	Observed result	Status
BB-01	General	Access the website's main page (landing page)	The system displays the SiKS SMKN 2 Guguak homepage	The landing page loaded successfully	Valid
BB-02	General	Leave the login form blank and click the login button	The system validates required fields on the login form	Required-field validation prevented form submission	Valid
BB-03	General	Log in with a valid username and incorrect password	The system rejects the login and displays a credential error message	An "invalid credentials" error message appears	Valid
BB-04	General	Log in using an inactive account	The system denies access and displays a rejection message	An "inactive account access denied" message is displayed	Valid
BB-05	Admin	Log in with valid Administrator credentials	The system redirects the user to the Administrator Dashboard	The Administrator Dashboard was successfully accessed	Valid
BB-06	Admin	Access the User Management menu page	The system displays a table listing all system user accounts	The user management table was displayed correctly	Valid
BB-07	Admin	Add a new user account with valid data	The system saves the new account and displays a success notification	The account was saved successfully with a success notification	Valid
BB-08	Admin	Add a new user with a duplicate username	The system rejects the duplication and displays a validation error message	A "duplicate username" error message appears	Valid
BB-09	Admin	Edit and reset a user account's password	The system updates the password and displays a success notification	The new password was saved successfully	Valid
BB-10	Admin	Change a user account's active/inactive status	The system updates the account status with a confirmation dialog	The account status was updated successfully	Valid
BB-11	Admin	Access the student data import page via Excel	The system displays a template download link and a file upload form	The import form and Excel template are ready to use	Valid

ID	User role	Test scenario	Expected result	Observed result	Status
BB-12	Admin	Test the WhatsApp Gateway connection	The system sends a test message and displays a successful response status	The WhatsApp delivery-response status was verified	Valid
BB-13	Counselor	Log in using valid Counselor credentials	The system redirects the user to the Counselor Dashboard	The Counselor dashboard was accessed successfully	Valid
BB-14	Counselor	Add a new counseling schedule availability slot	The system saves the schedule slot and displays a success notification	The counseling time slot was added successfully	Valid
BB-15	Counselor	Access the counseling request and referral list page	The system displays a queue table of student service requests	The counseling request queue was displayed correctly	Valid
BB-16	Counselor	Approve a student's counseling request in the queue	The system approves the request and displays a success notification	The request was approved successfully	Valid
BB-17	Counselor	Reject a counseling request by entering a reason for rejection	The system records the rejection reason and displays a success notification	The request was rejected with the reason recorded	Valid
BB-18	Counselor	Input the results of a student's counseling session	The system saves the counseling results, attendance, and follow-up	The counseling results were saved successfully	Valid
BB-19	Counselor	Display a preview of the official summons letter	The system displays a letter preview and a PDF download button	The official summons letter preview was displayed correctly	Valid
BB-20	Counselor	Download the summons letter file in PDF format	The system processes and downloads the summons letter PDF file	The PDF file was downloaded successfully	Valid
BB-21	Counselor	Send a summons notification via WhatsApp	The system sends a WhatsApp message to the parent and shows success	The WhatsApp notification was sent successfully	Valid
BB-22	Counselor	Print and export the counseling service report to Excel	The system downloads the service report summary in Excel format	The report was exported to Excel successfully	Valid
BB-23	Student	Log in using valid Student credentials	The system redirects the student to the student homepage/dashboard	The student dashboard was accessed successfully	Valid
BB-24	Student	Update profile information and a parent's contact number	The system saves the profile changes and displays a success notification	The profile and parent's contact number were updated successfully	Valid
BB-25	Student	Search for available counseling schedule slots	The system displays available counseling schedule slots provided by the Counselor	The list of available counseling schedule slots is displayed	Valid

ID	User role	Test scenario	Expected result	Observed result	Status
BB-26	Student	Submit a counseling request while leaving the reason field blank	The system rejects the submission and triggers required-field validation	Required-field validation prevented submission of the incomplete form	Valid
BB-27	Student	Submit a complete and valid counseling schedule request	The system saves the request and displays a success message	The counseling request was submitted successfully	Valid
BB-28	Student	Cancel a counseling request in the "My Requests" menu	The system changes the status to canceled and shows success	The request was canceled successfully	Valid
BB-29	Student	View counseling history and outcomes/guidance	The system displays counseling history with a "completed" status	The counseling history and results were displayed successfully	Valid
BB-30	Homeroom Teacher	Log in using valid Homeroom Teacher credentials	The system redirects the user to the Homeroom Teacher Dashboard	The Homeroom Teacher Dashboard was successfully accessed	Valid
BB-31	Homeroom Teacher	Access the class roster/student directory menu	The system displays a table of homeroom student data and a search form	The homeroom student directory was displayed correctly	Valid
BB-32	Homeroom Teacher	Submit a counseling referral for a student in the homeroom class to the Counselor	The system sends the referral and displays a success notification	The student referral was sent to the Counselor successfully	Valid
BB-33	Homeroom Teacher	Monitor the counseling status of a student in the homeroom class	The system displays a monitoring table for handling status	The handling status monitoring table displays properly	Valid
BB-34	Vice-Principal for Student Affairs	Log in using valid Vice-Principal for Student Affairs credentials	The system redirects to the Student Affairs Dashboard	The Student Affairs Dashboard was successfully accessed	Valid
BB-35	Vice-Principal for Student Affairs	Monitor student affairs statistical metrics and analytics charts	The system displays total active students and monthly charts	The student affairs analytics dashboard displays accurately	Valid
BB-36	Vice-Principal for Student Affairs	Access the school's student directory with read-only access rights	The system displays a student data table with a read-only label	Read-only access was enforced, and the student data loaded successfully	Valid
BB-37	Vice-Principal for Student Affairs	Search and filter student data in the directory	The system filters the data table according to the search keyword	The student data search and filter function worked as expected	Valid
BB-38	Vice-Principal for Student Affairs	Access the student affairs service recap and report menu	The system displays the recap page and filter options	The report recap page was successfully accessed	Valid

ID	User role	Test scenario	Expected result	Observed result	Status
BB-39	Vice-Principal for Student Affairs	Download the report recap in PDF format	The system processes and downloads the PDF report file	The PDF recap was downloaded successfully	Valid
BB-40	Vice-Principal for Student Affairs	Download the report recap in Excel format	The system processes and downloads the Excel spreadsheet file	The Excel recap was downloaded successfully	Valid
BB-41	Principal	Log in using valid Principal credentials	The system redirects to the Principal Dashboard	The Principal Dashboard was successfully accessed	Valid
BB-42	Principal	Monitor key performance indicators on the dashboard	The system displays student reach metrics and completion ratios	The KPI metrics were loaded correctly	Valid
BB-43	Principal	Monitor the workload and performance evaluation of the counseling team	The system displays a recap of the counselor team's performance effectiveness	The counseling team's performance evaluation was displayed successfully	Valid
BB-44	Principal	Access the school counseling session monitoring menu	The system displays a counseling session monitoring overview	The counseling session monitoring menu opened successfully	Valid
BB-45	Principal	View detailed information on a counseling session	The system opens a detailed counseling information page	The detailed counseling session information was displayed successfully	Valid
BB-46	Principal	Access the school's student directory with read-only status	The system displays the read-only executive student directory	The school's student directory was displayed correctly	Valid
BB-47	Principal	Access the report and evaluation center	The system displays the report center with filter options	The report and evaluation center was successfully accessed	Valid
BB-48	Principal	Print and download the report in PDF format	The system downloads the official report in PDF format	The PDF report download completed successfully	Valid
BB-49	Principal	Export the report in Excel format	The system downloads the report in Excel format	The Excel report was downloaded successfully	Valid
BB-50	Principal	Log out of the system	The system ends the session and returns to the login page	Logout was successful and the login form reappeared	Valid

APPENDIX B. UAT INSTRUMENT VALIDATION

Before user acceptance testing, three validators reviewed the 15-item UAT questionnaire. The instrument comprises four design items, six service items, and five efficiency items. Validators used a five-point scale. The combined validator score was 211 out of 225 (93.78%) and was classified as Very Valid. Tables B1 and B2 preserve the item-level ratings and validator summary used in the study.

Appendix Table B1. Item-level UAT instrument validation ratings.

No.	Aspect	Statement	Validator 1	Validator 2	Validator 3
1	Design	Interface (visual appearance) is attractive	5	5	5
2	Design	Menus/features are easy to understand and access	5	5	5
3	Design	Color combination and background are comfortable to view	5	5	5
4	Design	Font style and size are easy to read	5	5	5
5	Service	Simplifies submitting and managing counseling schedules	4	5	5
6	Service	Counseling record, follow-up, and referral features function well	5	5	5
7	Service	WhatsApp notification integration is automatic and prompt	4	5	5
8	Service	Can accurately print/download reports and letters	5	5	5
9	Service	Maintains data security and confidentiality per access rights	4	4	4
10	Service	Overall service is satisfactory	5	5	5
11	Efficiency	System use is appropriate and effective	5	4	4
12	Efficiency	More time-efficient than the manual method	4	4	4
13	Efficiency	Reduces processing workload and operational costs	5	5	4
14	Efficiency	Makes it easier for users to understand reports	4	5	4
15	Efficiency	Has advantages over other methods/applications	5	4	5
Total			70	71	70

Appendix Table B2. Validator score summary and overall instrument validity.

No.	Validator	Score	Maximum	Percentage (%)
1	Validator 1	70	75	93.33
2	Validator 2	71	75	94.67
3	Validator 3	70	75	93.33
	Combined	211	225	93.78

Combined validity: $211/225 = 93.78\%$ (Very Valid).

APPENDIX C. USER ACCEPTANCE TEST RESULTS

UAT involved 20 respondents: one Principal, one Administrator, one Vice-Principal for Student Affairs, two Guidance Counselors, two Homeroom Teachers, and 13 Students. Each respondent rated 15 statements on a five-point scale (5 = Strongly Agree, 4 = Agree, 3 = Somewhat Agree, 2 = Disagree, 1 = Strongly Disagree). To improve readability in the portrait layout, response distributions and item-level feasibility scores are reported in separate tables while preserving the same dataset.

Appendix Table C1. Item-level UAT response distribution.

No.	Aspect	Statement	SA	A	SWA	D	SD
1	Design	The system interface is attractive.	16	4	0	0	0
2	Design	Menus and features are easy to access.	13	7	0	0	0
3	Design	Text color and background are comfortable to view.	8	11	1	0	0
4	Design	Font style and size are easy to read on mobile and computer devices.	9	11	0	0	0
5	Service	The system simplifies counseling schedule and availability submission.	12	6	2	0	0
6	Service	Counseling records, follow-up, and referral functions support the service process.	11	8	1	0	0
7	Service	WhatsApp notifications are delivered automatically and promptly within the tested workflow.	8	10	2	0	0
8	Service	The system supports printing or downloading relevant summons and reports.	5	12	3	0	0
9	Service	Access rights support the security and confidentiality expected for counseling data.	12	8	0	0	0
10	Service	Overall system services are satisfactory.	11	9	0	0	0
11	Efficiency	The system is appropriate and effective for use at the school.	14	6	0	0	0
12	Efficiency	The system is more time-efficient than the prior manual process.	9	10	1	0	0
13	Efficiency	The system can reduce workload and related administrative effort.	9	10	1	0	0
14	Efficiency	Recapitulation and reports are easier to understand through the system.	5	14	1	0	0
15	Efficiency	The system offers advantages over the previous method or comparable applications.	7	12	1	0	0
Total			149	138	13	0	0

Abbreviations: SA = Strongly Agree; A = Agree; SWA = Somewhat Agree; D = Disagree; SD = Strongly Disagree.

Appendix Table C2. Item-level UAT feasibility scores.

No.	Obtained score	Maximum score	Percentage (%)	Category
1	96	100	96.00	Very Feasible
2	93	100	93.00	Very Feasible
3	87	100	87.00	Very Feasible
4	89	100	89.00	Very Feasible
5	90	100	90.00	Very Feasible
6	90	100	90.00	Very Feasible
7	86	100	86.00	Very Feasible
8	82	100	82.00	Very Feasible
9	92	100	92.00	Very Feasible
10	91	100	91.00	Very Feasible
11	94	100	94.00	Very Feasible
12	88	100	88.00	Very Feasible
13	88	100	88.00	Very Feasible
14	84	100	84.00	Very Feasible
15	86	100	86.00	Very Feasible
Total	1336	1500	89.07	Very Feasible

Overall feasibility: $1,336 / 1,500 \times 100 = 89.07\%$ (Very Feasible). Item-level feasibility ranged from 82% to 96%.