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Developing a Decision Support System for Assessing Bantara Rank Promotion Eligibility among Secondary School Scouts

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A B S T R A C T

Assessing student eligibility for Bantara rank promotion requires an objective and systematic decision-making process. This study aimed to develop a technology-based decision support system to assist scout supervisors in evaluating students' eligibility for Bantara rank promotion at a secondary school. The system was developed using the Scrum framework within an Agile development approach, including product backlog preparation, sprint planning, sprint implementation, sprint review, and retrospective activities. The development process was conducted over six weeks, comprising 26 effective working days. The system applied the Weighted Scoring Model to calculate and determine students' promotion eligibility. The evaluation results showed a validity score of 0.97, a practicality score of 0.615, and an average effectiveness score of 0.93. These findings indicate that the developed system met the evaluation criteria used in the study and was considered feasible for supporting Bantara promotion assessments. The system provides a more structured basis for decision-making and may assist scout supervisors in conducting student assessments more consistently and objectively.

Abstrak

Penilaian kelayakan siswa untuk kenaikan pangkat Bantara memerlukan proses pengambilan keputusan yang objektif dan sistematis. Penelitian ini bertujuan untuk mengembangkan sistem pendukung keputusan berbasis teknologi guna membantu pembina pramuka dalam mengevaluasi kelayakan siswa untuk kenaikan pangkat Bantara di sebuah sekolah menengah. Sistem ini dikembangkan menggunakan kerangka kerja Scrum dalam pendekatan pengembangan Agile, yang mencakup persiapan product backlog, perencanaan sprint, pelaksanaan sprint, tinjauan sprint, dan kegiatan retrospektif. Proses pengembangan berlangsung selama enam minggu, yang terdiri dari 26 hari kerja efektif. Sistem ini menerapkan Model Penilaian Berbobot untuk menghitung dan menentukan kelayakan siswa dalam promosi. Hasil evaluasi menunjukkan skor validitas sebesar 0,97, skor kepraktisan sebesar 0,615, dan skor efektivitas rata-rata sebesar 0,93. Temuan ini menunjukkan bahwa sistem yang dikembangkan memenuhi kriteria evaluasi yang digunakan dalam penelitian ini dan dianggap layak untuk mendukung penilaian promosi Bantara. Sistem ini menyediakan landasan yang lebih terstruktur untuk pengambilan keputusan dan dapat membantu pembina pramuka dalam melakukan penilaian siswa secara lebih konsisten dan objektif.

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1. Introduction

Character education is an important dimension of secondary education because schools are expected to support not only students' academic development but also their personal responsibility, discipline, and social conduct. Extracurricular activities provide a structured environment in which these attributes can be developed beyond formal classroom instruction. Previous studies have shown that scouting activities can facilitate the internalization of character values, while the contribution of

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extracurricular participation to character education is influenced by school climate, teachers, and peer relationships [1], [2]. Extracurricular programs may also support students' interests, personal development, religious values, and moral formation when their implementation is aligned with students' needs and educational objectives [3].

Scouting is one of the extracurricular programs used in Indonesian schools to develop discipline, leadership, independence, cooperation, and social responsibility. In Indonesia, its implementation is institutionally supported by Regulation of the Minister of Education and Culture No. 63 of 2014, which establishes scouting as a structured educational activity and provides operational guidance for its implementation. Scouting can also be understood as a form of non-formal education that uses experiential and outdoor activities to support youth development [4]. At the secondary-school level, Scout Enforcer programs include progressive competency levels, such as Bantara and Laksana, through which members demonstrate the completion of specified requirements and competencies.

Despite this structured progression, determining students' eligibility for Bantara rank promotion may remain dependent on manual assessment and the judgment of scout supervisors. Such practices may create difficulties related to consistency, transparency, efficiency, and the proportional consideration of multiple assessment criteria. Previous research has identified obstacles in the implementation of school scouting programs, including limitations in supervisory personnel, facilities, and systematic evaluation processes [5]. These constraints indicate that improving scouting assessment requires not only adequate program resources but also an assessment mechanism that can organize criteria, scores, and decision rules consistently.

Decision support systems have been applied to various selection and evaluation problems that involve multiple criteria. Studies using weighted decision-making methods have demonstrated their potential to structure the evaluation of alternatives in achievement-related selection and educational service decisions [6], [7]. Web-based academic information systems have also been developed to improve the efficiency of student data management and facilitate educational evaluation [8]. In other contexts, weighted methods have been applied to teacher reward allocation [9], while fuzzy-logic-based decision support has been used to assist educational program selection [10]. Collectively, these studies demonstrate that computational decision support can organize multiple criteria and generate systematic recommendations for educational decision-makers.

However, previous studies have predominantly addressed academic administration, institutional selection, reward allocation, tutoring recommendations, and study-program placement [6]–[10]. They do not specifically examine eligibility assessment for rank promotion in secondary-school scouting. Moreover, the existing studies provide limited evidence regarding how a transparent weighted scoring procedure can be integrated into a technology-based system for evaluating Bantara candidates. Thus, a contextual and technological gap remains between the use of multicriteria decision support in formal educational administration and its application to competency-based assessment in scouting activities.

The Weighted Scoring Model offers a relatively transparent multicriteria procedure in which each assessment criterion is assigned a weight according to its importance, each alternative receives a criterion score, and the weighted values are aggregated into a total score. Although related weighted methods have been applied in previous selection studies [9], a Weighted Scoring Model has also been used to rank alternatives in decision support applications [11]. Its transparent calculation process is relevant to Bantara assessment because supervisors must consider several requirements whose contributions to the final decision may differ. Nevertheless, the method does not replace the professional judgment of scout supervisors; rather, it provides a structured basis for organizing assessment data and supporting their final decisions.

Accordingly, the research gap addressed in this study is the absence of an evaluated technology-based decision support system that applies criterion weighting to Bantara rank promotion assessment in a secondary-school scouting context. The novelty of the study does not lie in introducing a new multicriteria algorithm, but in adapting the Weighted Scoring Model to the specific assessment requirements of Bantara promotion and integrating it into a system developed for scout supervisors. This contextual adaptation is expected to connect scouting competency assessment with transparent and systematic digital decision support.

This study therefore aims to develop and evaluate a Weighted Scoring Model-based decision support system for assessing students' eligibility for Bantara rank promotion at SMA N 1 Gunuang Omeh. Practically, the system is intended to assist scout supervisors in managing assessment criteria and producing more consistent and traceable recommendations. Academically, the study contributes evidence concerning the application of a transparent multicriteria decision-support approach to assessment in school-based non-formal education.

2. Method

2.1. Research Design

This study employed a Research and Development design to develop a technology-based decision support system for assessing students' eligibility for Bantara rank promotion. Research and Development is a systematic approach used to design, develop, improve, and evaluate products, models, methods, services, or procedures intended to address identified practical needs [12]. In this study, the approach was used to guide the development of a functional decision support product rather than solely to examine an existing phenomenon.

This study employed a Research and Development design to develop and evaluate a technology-based decision support system for assessing students' eligibility for Bantara rank promotion. Research and Development is a systematic approach used to design, develop, improve, and evaluate products, models, methods, services, or procedures intended to address identified practical needs [12]. In this study, the approach was used to produce a functional decision support system rather than solely to describe or examine an existing educational phenomenon.

The research process consisted of needs analysis, system design, software development, functional testing, and product evaluation. The needs-analysis stage was conducted to identify the existing assessment process, the competency criteria used in Bantara promotion, the functions required by scout supervisors, and the expected form of the assessment results. The information obtained during this stage was subsequently used to define the system requirements and guide the software-development process.

The software product was developed using an Agile development approach. Agile development emphasizes flexibility, iterative work, incremental product development, and responsiveness to changes in system requirements [13]. Its implementation also requires continuous interaction between developers and intended users so that the resulting software remains aligned with user needs [14].



Figure 1. Scrum Agile Model

2.2. Research Context and Setting

The study was conducted in the context of Bantara rank promotion assessment at SMA N 1 Gunuang Omeh. The developed system was intended to support scout supervisors in evaluating students against the General Proficiency Requirements for Bantara Scout Enforcers.

The system-development process began on 8 April 2025 with an inception meeting to discuss the development plan and identify the functions required by the school. The main development activities were conducted from 14 April to 22 May 2025. The development period lasted approximately six weeks and was reported to comprise 26 effective working days.

The school represented the institutional user of the system, while the scout supervisors represented the intended operational users. Their requirements formed the basis for designing the system interface, assessment functions, calculation mechanism, and result-recapitulation functions.

2.3. Requirements Analysis

System requirements were identified through observation and interviews with scout supervisors. The requirements-analysis process focused on the existing Bantara assessment procedure, assessment criteria, user-access requirements, data-management needs, and the format in which final assessment results should be presented.

The assessment criteria were derived from the General Proficiency Requirements for Bantara Scout Enforcers. Five principal competency domains were incorporated into the system: spiritual, emotional, social, intellectual, and physical competencies. Each domain contained several indicators that represented the competencies expected of Bantara candidates.

The requirements-analysis stage also identified the need for the following system functions:

1. user registration and authentication;
2. role-based user management;
3. presentation of Bantara assessment criteria;
4. student assessment-data entry;
5. criterion-weighted score calculation;
6. storage of assessment results;
7. presentation of final scores and rankings; and
8. presentation of student eligibility decisions.

These requirements were documented and prioritized in the product backlog before the development process began.

2.4. Development Roles

Scrum was adapted to the scale and characteristics of the project. The school and scout supervisors acted as the product owner by communicating system needs and reviewing the resulting product. The researcher acted as the Scrum master and individual system developer.

As the Scrum master, the researcher organized the development process, monitored progress, recorded encountered constraints, and ensured that the development activities remained consistent with the sprint plan. As the developer, the researcher designed the system models and interfaces, developed the database, implemented the assessment and calculation functions, and tested the resulting software.

Because the software was developed individually, daily Scrum activities were implemented as independent work logs rather than team meetings. These logs documented completed tasks, encountered technical constraints, and planned activities for the next working day.

2.5. Scrum-Based System Development

Scrum was adopted as the operational framework within the Agile development approach. It was selected because its iterative structure supports short development cycles and allows system requirements to be reviewed and adjusted during product construction [15].

The development process comprised five main stages: product backlog preparation, sprint planning, sprint execution, sprint review, and retrospective [13]–[15].. Although the development was conducted by an individual researcher, the principal Scrum stages were retained and adapted to the project context.

2.6. Product Backlog

The development process began with the preparation of a product backlog. At this stage, the requirements obtained from observation, interviews, and discussions with the school were translated into system-development tasks.

The principal backlog items consisted of:

1. Unified Modeling Language design;
2. system-interface design;
3. login and registration pages;
4. system-introduction page;
5. Bantara assessment page;
6. score-recapitulation page; and
7. system-developer profile page.

The backlog items were arranged according to their level of priority. Core functions related to user authentication, assessment-data processing, Weighted Scoring Model calculation, and result presentation were prioritized because they were directly associated with the principal purpose of the system.

2.7. Sprint Planning

During sprint planning, high-priority product-backlog items were selected and organized into a sprint backlog. Each item was divided into specific development tasks, assigned an expected output, and allocated an estimated completion period.

The development plan was organized into five main sprint focuses. The first sprint covered user-requirement analysis and system modelling. The second focused on user-interface design. The third addressed the implementation of the core system functions, including authentication, user

management, and data processing. The fourth focused on integrating the Weighted Scoring Model into the assessment process. The final sprint involved functional testing and product evaluation.

The planned activities were estimated to require 26 working days. This estimate included the preparation of use-case and activity diagrams, interface design, database development, assessment-form development, implementation of the calculation function, and construction of the results and recapitulation pages.

2.8. Sprint Execution

The selected system components were developed incrementally during the sprint. The initial activities involved preparing the Unified Modeling Language models, including use-case and activity diagrams. These models represented the expected interactions among users and the sequence of activities within the system.

The next activities focused on designing the system interface and developing the authentication and user-management functions. The assessment page was subsequently developed based on the five Bantara competency domains. The system database was configured to store user information, student-assessment data, criterion scores, final scores, rankings, and eligibility results.

The Weighted Scoring Model was then incorporated into the system's calculation module. After its integration, the researcher developed functions for saving assessment data, processing final scores, displaying rankings, and presenting eligibility decisions.

Progress was monitored through daily work logs. These records were used to compare completed activities with the sprint backlog, identify technical obstacles, and adjust subsequent development activities where necessary.

2.9. Sprint Review

At the end of the development cycle, the completed product increment was reviewed to assess its correspondence with the previously identified system requirements. The review focused on whether the planned functions had been implemented and whether users could complete the intended assessment workflow.

The principal functions examined during the review included authentication, user management, assessment-data entry, Weighted Scoring Model calculation, result storage, ranking, and eligibility reporting. Functions that did not correspond with the initial requirements were identified for revision.

The review also examined the correspondence between the implemented assessment indicators and the General Proficiency Requirements used by scout supervisors.

2.10. Retrospective

Following the sprint review, the development process was evaluated through a retrospective. The researcher examined the implementation process, technical difficulties, completion of planned tasks, and aspects requiring improvement.

The retrospective was used to determine whether modifications were required in the subsequent development cycle. Because Scrum is iterative, the sequence from backlog preparation to review and retrospective could be repeated when system functions required correction or refinement.

In this study, retrospective activities were recorded as part of the individual development log. The retrospective focused on improving the technical development process and the correspondence between the system and user requirements, rather than evaluating the personal characteristics of the researcher.

2.11. Weighted Scoring Model Implementation

The Weighted Scoring Model was implemented as the decision-processing mechanism of the system. This model calculates the total score of each alternative by multiplying the score obtained for each criterion by the corresponding criterion weight and subsequently summing the weighted scores [11].

The general Weighted Scoring Model calculation can be expressed as:

$$S_i = \sum_{j=1}^{n} w_j x_{(ij)}$$

where :

Si represents the final score of student i;

w_j represents the weight assigned to criterion j;

x_{ij} represents the score obtained by student i on criterion j; and

n represents the total number of criteria.

The assessment module recorded candidate performance across the spiritual, emotional, social, intellectual, and physical domains. After the assessor entered the required scores, the system multiplied the criterion scores by their respective weights and aggregated the resulting values. The final scores were used to arrange the candidates' rankings and generate Bantara eligibility decisions.

The criterion weights, scoring scale, and eligibility threshold must be reported explicitly in the final manuscript. These details are necessary to ensure that the calculation procedure is transparent and reproducible.

2.12. Data Collection Procedures

Data collection was conducted in several stages. First, observation was used to examine the existing Bantara assessment procedure and identify the information required by the scout supervisors. Second, interviews with scout supervisors were conducted to identify assessment criteria, expected system functions, user-access requirements, and the desired format of assessment results.

Third, document analysis was conducted on the General Proficiency Requirements for Bantara Scout Enforcers. The identified requirements were grouped into five assessment domains and incorporated into the system's assessment form.

Fourth, functional data were collected through black-box testing after system development had been completed. Each system function was tested using predetermined input and expected-output scenarios.

Finally, product-evaluation data were collected to examine system validity, practicality, and effectiveness. Validity was assessed through expert judgment concerning the correspondence between the product and the identified requirements. Practicality was assesed through user responses regarding system usability. Effectiveness was examined based on the system's ability to process assessment data and generate decisions that corresponded with the established assessment criteria.

2.13. Research Instruments

The research used several instruments corresponding to the stages of system development and evaluation. The needs-analysis stage employed observation and interview guidelines to identify the existing assessment procedure and user requirements.

A document-analysis sheet was used to organize the Bantara competency domains and their corresponding indicators. A functional-testing sheet was used to record the test scenario, expected output, actual output, and status of each tested function.

Product-evaluation instruments were used to examine validity, practicality, and effectiveness. However, the number of items, assessment indicators, response scales, and scoring procedures for these instruments must be specified by the authors in the final manuscript.

At minimum, the instrument description should report:

- the dimensions measured by each instrument;
- the number of items;
- the response scale;
- the identity and number of evaluators;
- the scoring formula; and
- the criteria used to interpret the resulting scores.

2.14. Functional Testing

Black-box testing was used to evaluate the correspondence between the system's functional requirements and its observable outputs. This testing method examined the system from the user's perspective without evaluating the internal structure of the program code.

Twelve test scenarios were prepared. These scenarios covered:

1. access to the login page;
2. access to the registration page;
3. access to the user-management page;
4. access to the home page;
5. access to the system-introduction page;
6. access to the assessment page;
7. display of the assessment form;
8. storage and continuation of assessment data;
9. calculation and display of assessment results;
10. storage of calculation results in the database;
11. access to the score-recapitulation page; and
12. access to the system-profile page.

For each scenario, the actual system response was compared with the expected output. A function was classified as passed when the actual output corresponded with the output specified in the testing scenario.

2.15. Product Evaluation

The developed system was evaluated in terms of validity, practicality, and effectiveness.

Validity evaluation focused on the correspondence between the system functions, assessment criteria, calculation procedure, and identified user requirements. The validity assessment was conducted through expert judgment.

Practicality evaluation focused on the extent to which the intended users could operate the system, enter assessment data, access system functions, and interpret the resulting information. User responses were collected after interacting with the developed system.

Effectiveness evaluation focused on the system's ability to process criterion scores, calculate final results, generate rankings, and produce eligibility decisions according to the rules implemented in the system.

The manuscript reports validity, practicality, and effectiveness scores. However, the evaluation procedures must be supplemented with the number and expertise of evaluators, participant-selection procedures, instrument indicators, scoring scales, formulas, and category thresholds.

2.16. Data Analysis

Requirements-analysis data obtained through observation, interviews, and document analysis were analyzed descriptively. The information was organized into functional requirements, user roles, assessment domains, system features, and expected outputs.

Black-box testing data were analyzed by comparing the expected and actual outputs of each test scenario. The results were classified as passed when the system produced the expected response and failed when the actual output differed from the predetermined requirement.

The Weighted Scoring Model results were obtained by multiplying the student score on each criterion by the corresponding criterion weight and summing all weighted criterion scores. The resulting scores were used to rank students and determine their eligibility status.

Product-evaluation data were analyzed quantitatively to produce validity, practicality, and effectiveness scores. The final manuscript should present the precise formulas used to calculate the reported validity score of 0.97, practicality score of 0.615, and effectiveness score of 0.93. The interpretation intervals for each score must also be reported.

2.17. Ethical Considerations

The research was conducted with the knowledge and approval of the school. Data obtained during system development and testing were used solely for research and academic purposes.

Although the study did not directly report sensitive personal student information, confidentiality should be maintained by limiting access to student identities and assessment records. Any student information presented in system screenshots, tables, or figures should be anonymized before publication.

The final manuscript should clarify whether informed consent was obtained from scout supervisors, students, or other participants involved in system evaluation. It should also state whether institutional ethical approval was obtained or whether the study received an exemption from formal ethical review.

3. Result and Discussion

3.1. Result

3.1.1. Bantara Eligibility Assessment Criteria

The developed decision support system used five assessment domains derived from the General Proficiency Requirements for Bantara Scout Enforcers: spiritual, emotional, social, intellectual, and physical competencies. Each domain consisted of specific indicators used by scout supervisors to record the candidates' demonstrated competencies.

The spiritual domain covered religious knowledge and practices, including the pillars of faith and Islam, prayer, fasting, funeral arrangements, zakat fitrah, and selected hadiths. The emotional domain assessed students' ability to communicate appropriately, provide constructive criticism, recognize peers' feelings, and participate in discussions. The social domain included religious tolerance, participation in Ambalan activities, financial responsibility, appropriate language use, community service, and cultural participation.

The intellectual domain assessed knowledge of scouting regulations and history, navigation and mapping skills, civic knowledge, international organizations, entrepreneurship, recycling, and

the application of knots and lashings. The physical domain included regular exercise, swimming, team sports, adolescent health knowledge, drill activities, disease awareness, and participation in camping activities. The complete domains and their respective indicators are presented in Table 1.

Table 1. Bantara Eligibility Assessment Criteria

Domain	Assessment Indicators
Spiritual	Explaining the principles contained in the pillars of faith and Islam; demonstrating an understanding of the pillars of faith; interpreting the meaning of the pillars of Islam; explaining the importance of congregational prayer; consistently performing obligatory and supplementary prayers; identifying at least five supplementary prayers and their procedures; explaining the purposes of fasting; distinguishing obligatory and supplementary fasting; explaining the obligatory conditions of fasting; explaining the conditions for valid fasting; identifying the essential elements of fasting; explaining the rules for caring for a deceased person; describing the procedures for funeral preparation; memorizing the prayer used in the payment and receipt of zakat fitrah; and presenting and explaining the meaning of selected hadiths.
Emotional	Providing suggestions politely without offending peers; presenting reasons clearly; selecting appropriate expressions; recognizing an appropriate time to offer criticism; recognizing peers' feelings; understanding discussion procedures; and participating actively in discussions.
Social	Encouraging others to fulfil religious obligations; demonstrating appropriate conduct when others perform religious activities; attending Ambalan meetings at least twice per month; paying weekly scout-unit dues using independently earned money; using appropriate Indonesian in daily communication; participating actively in Ambalan working groups; participating in community service activities at least twice; and presenting a form of regional art individually or in a group.
Intellectual	Identifying the Presidential Decree related to the Scout Movement; identifying the National Scout Council decision concerning the Scout Movement bylaws; explaining provisions concerning the objectives, principal duties, basic principles, and methods of scouting; explaining the founder and international development of scouting and the work of Baden-Powell; explaining the early history of scouting in Indonesia; describing the development of Indonesian scouting; estimating time without using a clock during an expedition; explaining compass components, azimuth, back azimuth, resection, and intersection; reading and creating trail or natural signs and preparing a route map; explaining the principles of Pancasila and their application; presenting information about the Association of Southeast Asian Nations; presenting general information about the United Nations; explaining and implementing an entrepreneurial activity; explaining and demonstrating the result of a recycling activity; and applying knots and lashings in daily situations.
Physical	Participating in regular exercise at least once per week; demonstrating an appropriate freestyle swimming technique; explaining the procedures and basic regulations of a team sport; presenting information about the physical and psychological development of male and female adolescents; demonstrating 15 drill movements; leading a drill activity; identifying at least three infectious diseases and their causes; identifying at least three degenerative diseases and their causes; explaining at least three diseases associated with unhealthy behavior; and participating in a camping activity for at least three consecutive days.

The five-domain structure was incorporated into the assessment interface so that the assessor could record student performance systematically across all requirements. However, the manuscript should also specify the score range, weight, and minimum eligibility standard assigned to each domain.

3.1.2. Developed Decision Support System

The system-development process produced a web-based decision support system consisting of authentication, user management, student assessment, score calculation, result storage, ranking, and eligibility-reporting functions. The use-case diagram in Figure 2 represents interactions between the principal system actors, including scout supervisors, students, and school representatives.

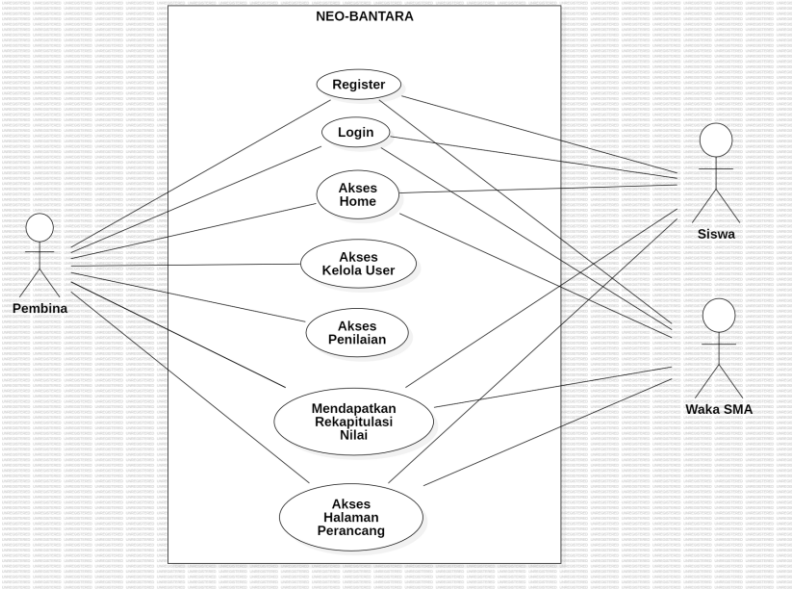


Figure 2. Use-Case Diagram

The authentication component provided login and registration functions for system users. As illustrated in Figure 3, registered users were required to enter their credentials before accessing the system functions associated with their assigned roles.

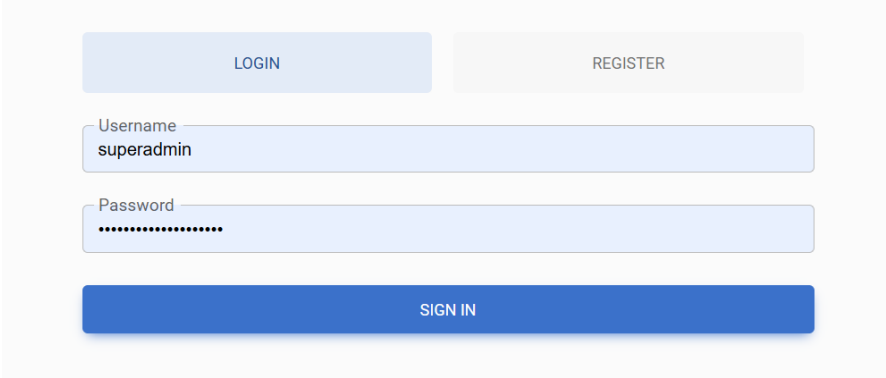


Figure 3. Login Page

The principal assessment interface presented the five Bantara competency domains, as shown in Figure 4. Each domain directed the assessor to the corresponding assessment form. This structure allowed the indicators to be grouped according to their competency domains rather than presented as a single undifferentiated list.

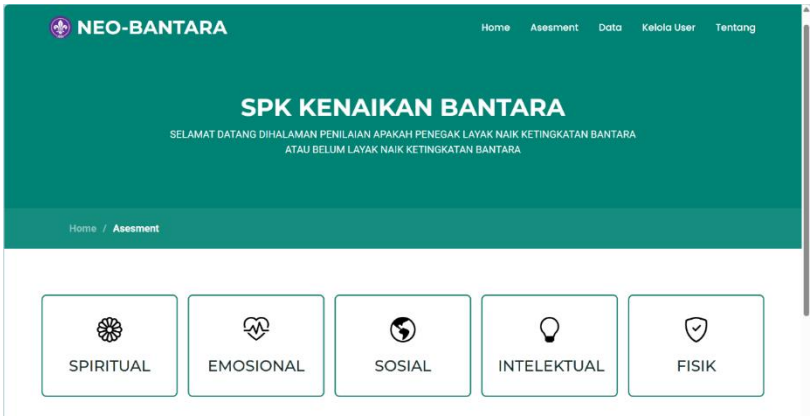


Figure 4. Bantara Assessment Page

The assessment form shown in Figure 5 recorded the student's identity, class, and scores for the individual indicators. The entered values were subsequently stored and processed through the Weighted Scoring Model.

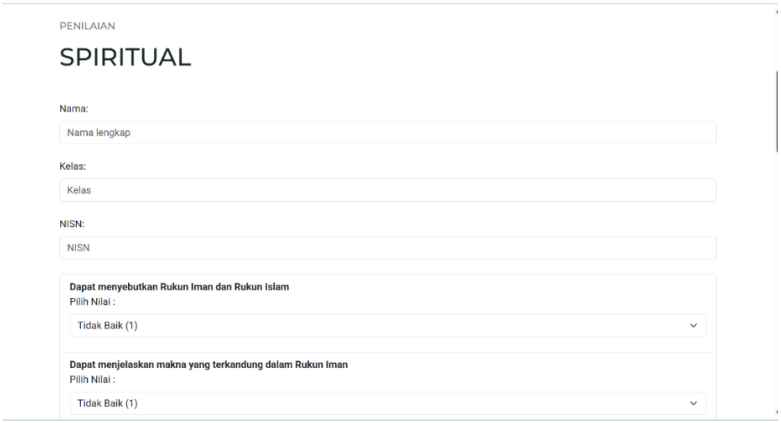
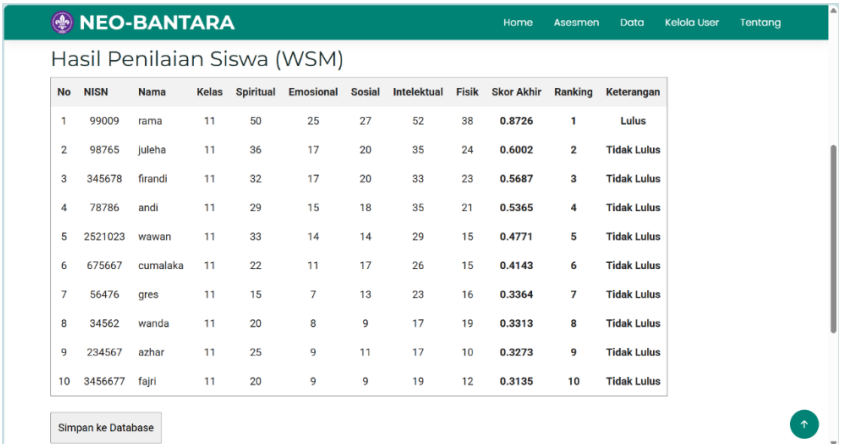


Figure 5. Assessment Form

3.1.3. Weighted Scoring Model Output

The system processed the scores entered for the spiritual, emotional, social, intellectual, and physical domains. The Weighted Scoring Model aggregated the criterion scores to generate a final score for each student. The results interface displayed student identification data, scores for each domain, final scores, rankings, and Bantara promotion decisions.

Figure 6 demonstrates the system output after the assessment data had been processed. The interface presents the candidates in ranked order and assigns an eligibility status based on the decision rule implemented in the system.



No	NISN	Nama	Kelas	Spiritual	Emosional	Sosial	Intelektual	Fisik	Skor Akhir	Ranking	Keterangan
1	99009	rama	11	50	25	27	52	38	0.8726	1	Lulus
2	98765	juleha	11	36	17	20	35	24	0.6002	2	Tidak Lulus
3	345678	firandi	11	32	17	20	33	23	0.5687	3	Tidak Lulus
4	78786	andi	11	29	15	18	35	21	0.5365	4	Tidak Lulus
5	2521023	wawan	11	33	14	14	29	15	0.4771	5	Tidak Lulus
6	675667	cumalaka	11	22	11	17	26	15	0.4143	6	Tidak Lulus
7	56476	gres	11	15	7	13	23	16	0.3364	7	Tidak Lulus
8	34562	wanda	11	20	8	9	17	19	0.3313	8	Tidak Lulus
9	234567	azhar	11	25	9	11	17	10	0.3273	9	Tidak Lulus
10	3456677	fajri	11	20	9	9	19	12	0.3135	10	Tidak Lulus

Figure 6. Weighted Scoring Model Assessment Results

The result demonstrates that the system completed the intended workflow from data entry to score aggregation, ranking, and the presentation of eligibility decisions. Nevertheless, the article must provide the criterion weights, normalization procedure, final-score formula, and eligibility threshold so that the calculation can be independently reproduced.

3.1.4. Functional Testing Results

Black-box testing was conducted to determine whether the principal system functions generated the expected outputs. The testing covered authentication, page navigation, user management, assessment-data entry, score processing, database storage, result presentation, and access to the recapitulation and profile pages.

Table 2. Black-Box Testing Results

No.	Test Scenario	Expected Output	Actual Result	Status
1	Accessing the login page	The login page is displayed	The login page was displayed	Passed
2	Accessing the registration page	The registration page is displayed	The registration page was displayed	Passed
3	Accessing the user-management page	The user-management page is displayed	The user-management page was displayed	Passed
4	Accessing the home page	The main page is displayed	The main page was displayed	Passed
5	Accessing the system-introduction page	The system-introduction page is displayed	The page was displayed	Passed
6	Accessing the assessment page	The assessment page is displayed	The assessment page was displayed	Passed
7	Opening the assessment form	The assessment form is displayed	The assessment form was displayed	Passed
8	Saving assessment data	The data are stored and forwarded to the next process	The data were stored and processed	Passed
9	Processing assessment scores	The calculated scores are displayed	The calculated scores were displayed	Passed
10	Saving results to the database	The results are stored in the database	The results were stored	Passed
11	Accessing the recapitulation page	The recapitulation page is displayed	The page was displayed	Passed
12	Accessing the profile page	The system profile is displayed	The profile page was displayed	Passed

All 12 tested scenarios generated outputs that corresponded to their expected results. The authentication, navigation, data-entry, calculation, storage, and reporting functions therefore operated successfully under the conditions represented by the test scenarios. No functional failure was reported during these tests.

3.1.5. Product Evaluation Results

In addition to functional testing, the manuscript reports three product-evaluation scores: validity, practicality, and effectiveness. The validity evaluation produced a score of 0.97, the practicality evaluation produced a score of 0.615, and the effectiveness evaluation produced an average score of 0.93.

Table 3. Summary of Product Evaluation Results

Evaluation Aspect	Reported Score
Validity	0.97
Practicality	0.615
Effectiveness	0.93

These values should be accompanied by information on the number of evaluators, instrument indicators, scoring scale, calculation formula, category intervals, and interpretation criteria. Without this information, the categorical meaning of each score cannot be independently verified.

3.2. Discussion

3.2.1. Principal Findings

This study produced a decision support system that integrates five Bantara competency domains into a structured digital assessment process. The system enables scout supervisors to record assessment data, process scores, rank candidates, and display eligibility decisions in a single workflow. The successful completion of all 12 black-box testing scenarios indicates that the main functional requirements were implemented as intended.

The use of multidimensional criteria is consistent with the educational purpose of scouting, which involves the development of personal, social, intellectual, physical, and value-oriented competencies rather than the assessment of a single academic outcome. This finding is relevant to previous studies emphasizing the role of scouting and extracurricular participation in character formation and personal development [1]–[5]. The present system extends this educational context by providing a digital structure for documenting and aggregating competency evidence.

3.2.2. Contribution of the Weighted Scoring Model

The Weighted Scoring Model was used to transform multiple criterion scores into a final numerical result. This approach is appropriate for a decision problem in which candidates must be evaluated against several criteria with potentially different levels of importance. Weighted additive models provide a relatively understandable and auditable calculation because each criterion score is multiplied by its assigned weight before the results are aggregated [11], [16].

The results are consistent with the broader use of multicriteria decision-making approaches to structure decisions that involve multiple quantitative and qualitative considerations [17], [18]. In education, multicriteria decision-support systems have been applied to student selection, learning recommendations, project assessment, and other decisions involving combinations of academic and non-academic attributes [19], [20]. The present study extends this application to eligibility assessment in a school-based scouting program.

Compared with the Weighted Product and fuzzy decision-support applications reported in previous studies [6], [7], [9], [10], the Weighted Scoring Model provides a direct additive calculation that may be easier for school users to inspect. However, this advantage depends on the transparency of the criterion weights and scoring rules. Because the current manuscript does not report the numerical weights, their source, or a sensitivity analysis, it cannot yet demonstrate whether small changes in criterion weights would alter the student rankings. Weighted models may also permit a high score in one domain to compensate for a low score in another; therefore, the authors should clarify whether every Bantara domain also has a compulsory minimum score [16], [17].

3.2.3. Contribution of the Scrum-Based Development Process

The system was developed iteratively through requirement analysis, interface design, implementation of the principal functions, integration of the Weighted Scoring Model, and system

testing. This staged development is consistent with the adaptive and incremental characteristics of Agile software development [13], [14], [21]. Scrum can facilitate frequent examination of system requirements and incremental product improvement, particularly when user needs may be refined during development.

The adaptation of Scrum to this project should nevertheless be described carefully. The system was developed by an individual researcher, meaning that the conventional separation among the product owner, Scrum master, and development team was only partially implemented. Research has shown that Scrum is frequently adapted to project size, organizational context, and available personnel rather than implemented in an entirely standardized form [22]. Thus, the methodological contribution of this study lies in the contextual use of an iterative development process, not in demonstrating the effectiveness of a complete Scrum team structure.

3.2.4. Functional Performance and Product Quality

The black-box testing results demonstrate that the tested system functions produced their expected outputs. In particular, the results confirm that assessment data could be entered, stored, processed using the Weighted Scoring Model, and presented in the result and recapitulation interfaces. These findings provide evidence of functional conformance for the tested scenarios.

However, successful black-box testing alone does not demonstrate overall system quality, user acceptance, or educational effectiveness. Evaluations of educational information systems commonly consider multiple dimensions, including system quality, information quality, ease of use, user satisfaction, actual use, and perceived benefits [23], [24]. Therefore, the claim that the system is reliable or ready for broad implementation should be supported by usability testing, user-acceptance data, repeated trials, and evidence that the system's decisions correspond with validated assessments made by qualified scout supervisors.

The reported validity score of 0.97, practicality score of 0.615, and effectiveness score of 0.93 suggest that the product received generally positive evaluation results. Nevertheless, their interpretation remains uncertain because the manuscript does not provide the instrument items, number of respondents, measurement scale, calculation procedures, or category thresholds. In particular, the practicality score of 0.615 should not be labelled "practical" until its classification interval has been explicitly reported.

3.2.5. Practical and Scholarly Contributions

Practically, the developed system provides a centralized mechanism for recording Bantara assessment data and presenting the resulting decisions. This structure can improve the traceability of the assessment process because supervisors can examine the recorded criterion scores and final calculation rather than relying solely on an undocumented overall judgment. The system may also reduce repetitive manual calculation and simplify the preparation of assessment recapitulations.

Scholarly, the study demonstrates a contextual application of multicriteria decision support in non-formal education conducted within a school environment. Previous educational decision-support studies have primarily addressed academic achievement, program selection, tutoring recommendations, teacher rewards, student mobility, and learning recommendations [6]–[10], [19], [20]. The present study therefore contributes by applying a weighted assessment mechanism to competency-based scout advancement.

The novelty should be stated as a contextual and system-development contribution, rather than as the introduction of a new decision-making method. The Weighted Scoring Model and Agile development are established approaches. The distinctive contribution is their integration into a system tailored to the requirements of Bantara promotion assessment.

3.2.6. Study Limitations

Several limitations should be considered when interpreting the findings. First, the development and testing were conducted within a single school context, limiting the generalizability of the assessment criteria and system configuration. Second, the manuscript does not report the number or characteristics of student candidates, scout supervisors, validators, or practicality-test participants.

Third, the criterion weights, scoring scale, eligibility threshold, and calculation examples are not presented. These omissions prevent independent verification of the ranking and eligibility decisions. Fourth, functional testing was limited to 12 black-box scenarios and did not examine usability, security, processing performance, calculation accuracy under boundary conditions, or long-term system use.

Finally, the study did not compare system-generated decisions with assessments produced using the previous procedure. Consequently, the available evidence supports the conclusion that the system provides a structured and functional assessment mechanism, but it does not yet establish that the system is more objective, accurate, fair, or efficient than the conventional assessment process.

4. Conclusion

This study achieved its objective of developing a web-based decision support system for assessing students' eligibility for Bantara rank promotion at SMA N 1 Gunuang Omeh. The system integrates assessment indicators derived from the General Proficiency Requirements for Bantara Scout Enforcers and applies the Weighted Scoring Model to organize criterion scores, calculate final results, rank candidates, and present eligibility decisions. The system was developed iteratively using the Scrum framework, covering requirement identification, planning, implementation, review, and process evaluation.

The functional testing results showed that the principal system features, including user authentication, assessment-data entry, score calculation, database storage, and result presentation, operated according to the expected outputs. These findings indicate that the developed system provides scout supervisors with a structured and traceable mechanism for managing Bantara promotion assessments. However, the available evidence supports the system's functional suitability rather than a definitive claim that it is more accurate or objective than conventional assessment procedures.

The main contribution of this study is the contextual integration of a multicriteria decision-support method into competency-based assessment within school scouting. Practically, the system can assist scout supervisors in organizing assessment data and documenting promotion decisions more systematically. Overall, the study demonstrates the potential of a web-based decision support system to strengthen the consistency and transparency of Bantara eligibility assessment within the specific educational setting examined.

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Declarations

Author Contribution Statement

Author 1 : Conceptualization, Methodology, Investigation, Data Curation, Formal Analysis, Writing – Original Draft.

Author 2,3,4 : Validation, Methodology, Writing – Review & Editing.

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Data Availability Statement

The data generated and analyzed during this study are **not publicly available** due to privacy and confidentiality considerations involving the research participants. However, the data are available from the **corresponding author** upon reasonable request for academic and research purposes, subject to applicable ethical and institutional requirements.

Declaration of Interests Statement

The authors declare that they have **no known competing financial or non-financial interests** or personal relationships that could have appeared to influence the work reported in this paper. The authors have no financial, professional, or institutional affiliations that could be perceived as a conflict of interest regarding the publication of this manuscript.

AI Use Statement

[1] During the preparation of this manuscript, the authors used **DeepL** for **language editing (grammar, clarity, and readability)**. The authors **reviewed, revised, and verified** the final text and **take full responsibility** for the content of the publication.

[2] The authors used Grammarly Premium to support initial drafting and/or structuring of parts of the manuscript. All AI-assisted outputs were critically reviewed, rewritten where necessary, and verified against the study data and cited sources. The authors remain fully accountable for the accuracy, originality, and integrity of the manuscript.

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