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Web-Based DSS for Madrasah Teacher Performance Appraisal

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ABSTRACT

Teacher performance appraisal in Madrasah Diniyah Hidayatul Mubtadiin was previously conducted manually using spreadsheets and paper archives, resulting in slow processing, input errors, and limited traceability of historical results. This study proposes and implements a web-based Decision Support System (DSS) to automate semester appraisals and produce transparent rankings using the Profile Matching method. Profile Matching was selected because the appraisal problem is competency-gap oriented: it evaluates how close each teacher's competency profile is to an ideal target profile, supports Core Factor/Secondary Factor structuring, and yields interpretable gap-based scores. In contrast, SAW and TOPSIS mainly aggregate weighted criteria without explicitly modeling competency gaps, while AHP requires extensive pairwise comparisons that become inefficient as the number of criteria/factors increases. The system evaluates 14 teachers across five aspects (pedagogic, professional, personality, discipline, and social) with 11 measurable factors using a 1–5 rating scale and an ideal target level of 5 for each factor. The application was developed using the Laravel MVC framework with three roles (admin, teacher, principal), principal verification, and automatic generation of digitally signed PDF reports. Functional validation via black-box testing on 10 key scenarios showed a 100% pass rate. In operational use, the DSS reduced appraisal processing time from 6 hours per semester period (manual workflow) to 1 hour (system workflow), representing an 83.3% reduction, while improving auditability through stored computation results and verification status.

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1. INTRODUCTION

Teachers in madrasah diniyah play a central role in shaping learners' religious character and learning habits through Qur'anic instruction, classical Islamic texts (kitab kuning), and daily educational practice. Ensuring consistently high-quality instruction requires not only competent teachers but also a fair and accountable performance management process. Therefore, a structured teacher performance appraisal is required as a basis for professional development, promotion, reward allocation, and continuous improvement of instructional quality [1]-[2].

At Madrasah Diniyah Hidayatul Mubtadiin (Dusun Blawi, Desa Masangan), teacher performance evaluation is conducted every semester (six months). However, the current workflow is still handled manually using Microsoft Excel and paper-based forms archived in physical folders. While this practice creates operational inefficiencies (slow data processing and reporting, higher risk of data loss, and weak access control), its consequences extend further to the quality of appraisal decisions. Manual recording and recapitulation increase the likelihood of incomplete inputs, formula mistakes, and inconsistent application of weights across assessors or periods, which can lead to ranking inconsistencies and reduce decision reliability. Moreover, limited traceability makes it difficult to audit how a final score was produced, potentially opening

room for subjective bias and disputes because stakeholders cannot easily verify whether the appraisal results are computed consistently and fairly.

Decision-making in educational management involves collecting information, comparing alternatives, and selecting the most appropriate action—activities that are vulnerable to inconsistency and bias when performed manually. A decision support system (DSS) is designed to enhance (not replace) decision makers by providing structured computations, standardized rules, and transparent outputs, particularly for semi-structured decisions [3]. In the context of teacher appraisal, a DSS can strengthen decision quality by ensuring that the same inputs always produce the same results, that calculation steps are reproducible, and that historical data can be audited across appraisal periods.

This study adopts the profile matching method because the appraisal problem is competency-gap oriented: it measures the GAP between an actual competency profile and an ideal target profile; a smaller GAP yields a higher weight and indicates better suitability [4]. This approach is intuitive for stakeholders because it directly communicates "how far" a teacher's performance is from the expected standard and supports factor structuring into Core Factors and Secondary Factors. In contrast, SAW and TOPSIS primarily aggregate weighted criteria to produce a score or closeness ranking without explicitly modeling competency gaps, while AHP requires extensive pairwise comparisons that become less efficient as the number of criteria and sub-factors increases. Therefore, profile matching is suitable for periodic appraisal that emphasizes closeness to institutional competency targets while maintaining interpretable computations.

Prior studies have shown that DSS implementations using profile matching can improve objectivity and transparency in selection and ranking tasks, including assessment contexts, because the computational steps are explicit and easier to justify to stakeholders [5]–[7]. However, many implementations focus mainly on calculation outputs and do not integrate end-to-end appraisal governance (centralized data storage, verification authority, and official reporting), which limits traceability and weakens accountability. This study aims to design, implement, and evaluate a centralized web-based DSS for semester teacher performance appraisal in a madrasah diniyah context using profile matching. Specifically, the system evaluates teachers across five aspects—pedagogic, professional, personality, discipline, and social—using a 1–5 rating scale with an ideal target profile to enable consistent GAP-based scoring. The study evaluates (i) functional correctness of the main modules (data management, scoring input, computation, verification, ranking, and reporting) through black-box testing, and (ii) operational effectiveness by comparing appraisal processing time before and after system adoption. By integrating standardized scoring indicators, automated ranking, verification by the principal, and digitally signed PDF reports, the proposed DSS strengthens traceability and reduces ranking inconsistency risks compared to spreadsheet-and-paper workflows, thereby supporting more reliable and accountable appraisal decisions [8].

2. METHOD

2.1. Research Procedure and Data Collection

Data were collected through (1) direct observation of learning activities and the madrasah environment, (2) interviews with the principal and teachers to elicit requirements and appraisal indicators, and (3) literature study and document review to strengthen the theoretical basis and examine previous appraisal forms. The application was developed using a prototyping approach: an initial prototype was built, evaluated by users, and iteratively refined until it met operational needs. The implementation uses a web stack with the Laravel framework and a relational database, and supports three roles (admin, teacher, and principal).

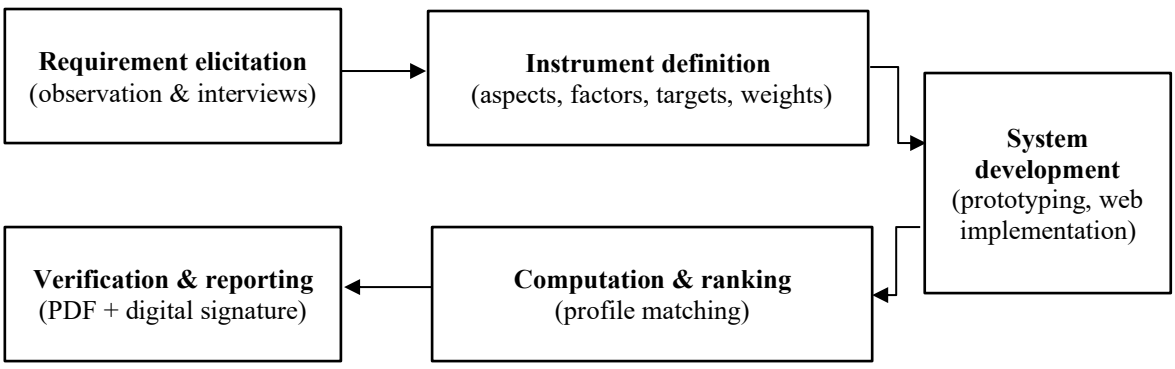

Figure 1. Workflow of the study

As illustrated in Figure 1, the research and system development process follows a structured flow starting with requirement elicitation through observations and interviews. This step gathers the necessary

insights to define key aspects, factors, targets, and weights for the teacher performance appraisal. The second step is instrument definition, where the appraisal criteria are formulated. Next, the system goes through the development phase, which involves prototyping, testing, and refining the application to meet the operational needs. The process continues with computation and ranking, utilizing the Profile Matching method to assess teacher performance. Finally, the process concludes with verification and reporting, where the principal verifies the results, and the system generates digitally signed PDF reports for official documentation.

2.2. Appraisal Instrument and Rating Scale

The appraisal instrument is organized into five aspects (pedagogic, professional, personality, discipline, and social). Each aspect is represented by one or more measurable factors (Table 3). Factors are scored using a five-point rating scale, where higher scores represent better performance. Table 5 provides the scale definition used in the system.

Table 5. Five-point rating scale

Score	Description
5	Excellent / exceeds expectations
4	Good / meets expectations consistently
3	Fair / meets expectations with minor issues
2	Poor / below expectations
1	Very poor / does not meet expectations

2.3. Profile Matching Computation

The profile matching method is employed to evaluate teacher performance by comparing the actual scores against an ideal target profile. Figure 2 illustrates the overall workflow of the DSS operation. The process consists of several sequential steps, beginning with input scores per factor, followed by the gap computation step to determine the difference between the actual and target scores. The next step is the aspect weighting and ranking procedure, where the system calculates the final ranking (S) based on the weighted aspects. The gap values are aggregated into Core Factors (CF) and Secondary Factors (SF), and the results are then used for final computation and ranking.

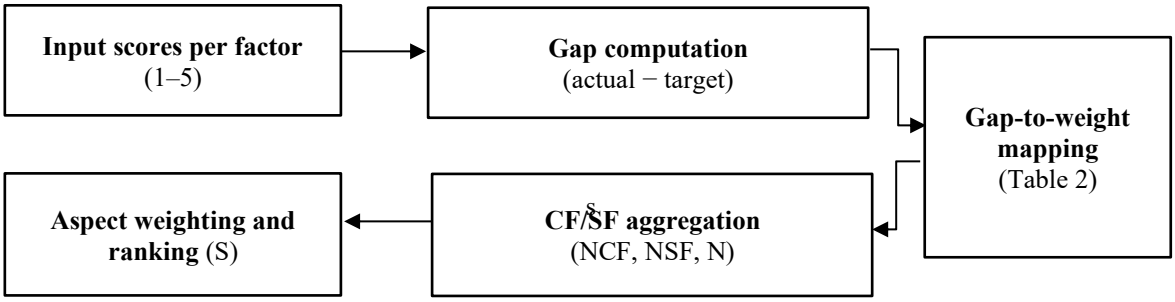

Figure 2. Workflow of the DSS operation

The DSS uses a 1–5 Likert scale for each appraisal factor, where 5 indicates the best performance. The ideal profile (target) is set to 5 for all factors. For each factor, the gap between the teacher's actual score and the target is calculated as:

$$gap\_i = a\_i - t\_i \quad (1)$$

Where a_i is the actual score and t_i is the target score for factor i. The gap value is then converted to a weight using the mapping in Table 2 (smaller gaps receive higher weights).

For each aspect, factors are grouped into core factors (CF) and secondary factors (SF). The average CF and SF scores are computed as:

$$NCF = (\Sigma\, w\_CF) \,/\, n\_CF \quad (2)$$
$$NSF = (\Sigma\, w\_SF) \,/\, n\_SF \quad (3)$$

The aspect score is calculated using a 60%:40% composition between CF and SF:

$$N = 0.60 \times NCF + 0.40 \times NSF \quad (4)$$

Finally, the total score for ranking is obtained by weighting each aspect using WA (Table 1):

$$S = \Sigma (WA\_j \times N\_j) \quad (5)$$

Table 1. Inter-aspect weights (WA)

Aspect	Weight (WA)
Pedagogic	25%
Professional	25%
Personality	20%
Discipline	15%
Social	15%
Total	100%

Table 2. Gap-to-weight conversion

Gap	Weight	Gap	Weight
0	5	+3	2.5
+1	4.5	-3	2.0
-1	4.0	+4	1.5
+2	3.5	-4	1.0
-2	3.0		

Table 3. Appraisal factors and CF/SF grouping

Aspect	Core Factor (60%)	Secondary Factor (40%)
Personality	Role-model attitude/behavior	-
Professional	Mastery of subject matter	Creativity of teaching methods
Social	Interaction with teachers/students/parents	Honesty; cooperation
Discipline	Compliance with rules	Punctuality
Pedagogic	Classroom leadership	Decision-making responsibility; learning outcome evaluation

2.4. System Modules and Data Model

The DSS is organized using the Model–View–Controller (MVC) pattern provided by the Laravel framework. MVC separates data management (models), user interface (views), and control logic (controllers) to improve maintainability and reduce coupling between modules. To support traceability, the database stores appraisal inputs, computed results, verification status, and report metadata per appraisal period. Table 6 summarizes the main entities managed by the system.

Table 6. Main data entities in the DSS

Entity	Description
User	Authentication and role (admin/teacher/principal)
Teacher	Teacher profile data (ID, name, position, etc.)
Aspect	Appraisal aspect definition and WA weight
Criterion/Factor	Appraisal factors within each aspect and CF/SF label
Assessment	Per-teacher scores per factor for a given period
Computation Result	Computed NCF/NSF, aspect scores, final score, and ranking
Verification	Principal verification status, timestamp, and notes
Report & Signature	PDF report metadata and embedded digital signature

3. RESULTS AND DISCUSSION

3.1. System Output and Workflow

The proposed decision support system (DSS) was implemented as a web-based application to support semester teacher performance appraisal at Madrasah Diniyah Hidayatul Mubtadiin. The operational workflow begins with assessment preparation (criteria and aspects), followed by score input, automatic computation using profile matching, ranking generation, verification by the principal, and report issuance in PDF format.

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In the system, role-based access is applied to ensure controlled appraisal activities. The admin manages teacher data and appraisal instruments, and inputs assessment scores based on the appraisal process. Teachers can view the appraisal results and download the report. The principal has access to the appraisal list, can review results, and performs verification to confirm the official status of the appraisal outcome. The appraisal list view including teacher identity, computed score, reward information, and verification status is presented in Figure 3.

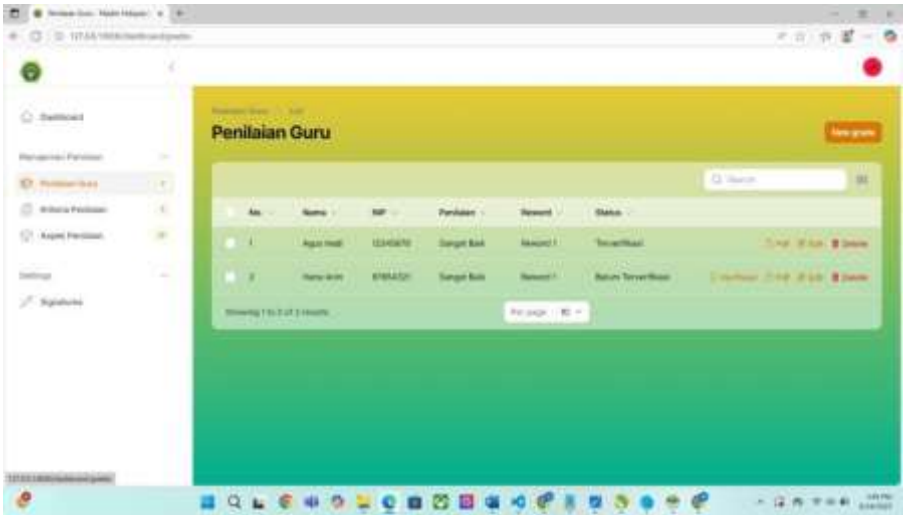

Figure 3. Teacher Assessments

3.2. Profile Matching Computation Results

The DSS applies the profile matching procedure to transform raw appraisal scores into standardized performance scores. Each teacher is evaluated using five aspects (personality, professional, social, discipline, and pedagogical competence) on a 1–5 scale. For each factor, the system calculates the GAP between the teacher's actual score and the ideal target profile. The GAP values are then converted to weighted scores using a predefined GAP-to-weight mapping. This mechanism ensures that teachers whose competencies are closer to the expected standard receive higher weighted values.

To obtain aspect-level performance values, the system separates factors into Core Factors (CF) and Secondary Factors (SF). The CF and SF averages are computed and combined to produce the aspect score using a 60% (CF) and 40% (SF) composition. The final performance score is obtained by aggregating aspect scores using the institution's aspect weighting configuration, producing a numeric score that is subsequently used to generate the ranking list and reward assignment. This computation is executed automatically for each semester period, ensuring consistent scoring across teachers and reducing manual calculation errors.

3.3. Ranking Result per Period

After computation, the system generates a ranking list for the active semester appraisal period. The ranking output is displayed in the principal's appraisal dashboard and can be used as the basis for managerial decisions such as reward distribution and follow-up development programs. In addition to on-screen ranking, the system generates a formal PDF report for each teacher after verification. The report contains aspect scores, total score, final score, and the assigned reward, and it becomes an official document once the principal verifies it. The process of entering the principal's signature is shown in Figure 4.

Figure 4. Principal's signature input process

A key advantage of this approach is traceability: the ranking and final score are reproducible because they follow fixed computational rules (GAP conversion, CF/SF composition, and aspect aggregation). Moreover, the verification status provides a clear distinction between preliminary results and officially approved results, improving accountability in the appraisal process.

3.4. Testing and Discussion

Functional testing was conducted using black-box scenarios to validate the main features and user flows. Table 4 summarizes 10 key test cases across roles and modules. All test cases passed, indicating that the implemented functions meet the specified requirements.

Table 4. Black-box testing summary

No	Feature	Test scenario	Expected result	Outcome
1	Login	Enter email and password according to role (admin/teacher/principal)	Access the dashboard with correct permissions	Pass
2	User management	Add a new teacher record	Data saved and displayed in the list	Pass
3	Appraisal criteria	Add a new criterion	Criterion saved and listed	Pass
4	Appraisal aspects	Add a new aspect	Aspect saved and linked to criteria	Pass
5	Teacher appraisal	Input appraisal scores	Scores saved and shown in appraisal list	Pass
6	Edit/delete appraisal	Update or delete appraisal data	Data updated/deleted according to action	Pass
7	Verification	Principal verifies the appraisal result	Status changes to Verified	Pass
8	Report export	Export appraisal report to PDF	PDF generated and downloadable	Pass
9	Digital signature	Verify appraisal	Principal’s signature appears in the PDF	Pass
10	Logout	Click logout	Return to login page	Pass

From an operational perspective, the DSS improves efficiency compared to spreadsheet-and-paper workflows by centralizing appraisal data, automating the profile matching computation, and reducing repetitive manual checks. In addition, the presence of verification and digitally signed PDF reporting strengthens document legitimacy and supports auditability. Overall, the system enables faster semester evaluations, more consistent scoring, and clearer accountability through verification and traceable computation outputs.

4. CONCLUSION

This study developed and implemented a web-based Decision Support System (DSS) for semester teacher performance appraisal at Madrasah Diniyah Hidayatul Mubtadiin, utilizing the Profile Matching method. The system evaluates teachers across five aspects—personality, professional, social, discipline, and pedagogical competence—on a 1–5 scale and automates key processes such as GAP analysis, GAP-to-weight conversion, factor aggregation, and final ranking computation. This innovation enhances the efficiency,

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consistency, and transparency of the teacher evaluation process, compared to traditional spreadsheet-and-paper workflows.

Functional validation through black-box testing confirmed that the system's modules (data management, assessment input, computation, verification, ranking, and reporting) operate correctly. The DSS successfully reduces manual workload, accelerates semester evaluation activities, and ensures more consistent decision-making. However, further research is required to evaluate the decision quality and user acceptance of the system. Understanding how the system influences decision outcomes, particularly in terms of fairness and consistency, is crucial for improving its design and effectiveness.

While this study focuses on technical implementation, future work can expand the scope by incorporating broader evaluation evidence, such as classroom observations, attendance logs, and learner feedback. Additionally, sensitivity analysis on aspect weighting and comparisons with other multi-criteria decision-making methods (e.g., AHP, TOPSIS, or SAW) can further strengthen decision robustness and promote broader institutional acceptance.

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