Analysis of Decision Support System for Character Assessment of Elementary School Students to Improve Teacher Assessment Objectivity

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Manuscript received Month date, 2023; revised Month date, 2023; accepted Month date, 2023

***Abstract*— Analyzing a decision support system related to student character assessment in elementary schools to improve the assessment objectivity becomes the aim of the study. A qualitative with a pre-test and post-test design method was implemented in this study. The research subjects, conducted with a random sample technique, were 45 people consisting of teachers and principals in 8 elementary schools in Kasihan Bantul, Indonesia. A questionnaire design was conducted to collect the data to measure the system implementation effectiveness. The data analysis was completed by analyzing the system effectiveness. The results present a fact that the decision support system can provide a more objective and consistent assessment of student character. The teachers and principals found that the system provides valuable insights in monitoring the character development of the students and identifying indicators that need more attention. Challenges in implementing the system include a lack of knowledge of the decision support systems and assistance for teacher training implementation. This research contributes to provide insights to enhance the character assessment of elementary school students. The research implication is that the system implementation should be supported by adequate teacher education and support to assure its effectiveness. It is concluded that the decision support system becomes an important system applied to improve student character education in elementary schools, and the teachers' understanding and support define the success.**

***Index Terms*— Decision Support System, Character, objective, Elementary School and random sample**

I. Introduction

Character education[1], [2] portrays a critical role in developing morals and positive values of elementary school students. Elementary schools are considered as the students' initial foundation to understand the principles of ethics, honesty, empathy, cooperation, and other positive characters shaping them into responsible individuals and ethical members of society[3]. Elementary schools have an autonomous morality[4] which can be seen from children's judgement that something is good depending on its purpose. Thus, character education is critical at this age to help children internalize good values[5]. Presidential Regulation No. 87/2017 on Character Strengthening Education to streamline the role of schools in character building was issued by the government[6] aiming to enhance student character by combining ethics, aesthetics, literacy, and kinesthetics with collaboration among schools, families, and communities[7].

Character Strengthening Education Program[8] is based on the philosophy of Ki Hajar Dewantara, while the development is spirituality; fostering thinking referred to an excellence of academic ability; fostering feelings related to moral integrity, art, and culture; and also, sports is meant to be healthy and able to actively participate as citizens. It is implemented by implementing Pancasila values to character education[9]. Religious values, honesty, tolerance, discipline, hard work, creativity, independence, democracy, curiosity, nationalism, spirit, love for the country, achievement respect, communication, peace-loving, fondness for reading, environmental care, social care, and responsibility are considered as Pancasila values[10], [11]. The eighteen values are simplified into five main character values covering religion, nationalism, independence, integrity, and mutual cooperation at the Education Assessment Center .

In this modern era, there has been an increase of efforts to improve the character education effectiveness at the elementary school level. One approach that is starting to develop is the application of decision support systems[12], [13] in assessing student character. This system[14], [15], has the potential to assist educators and schools in understanding and measuring student character more objectively and systematically. Some research that have been done including research[16] about a system to determine exemplary students using the assessment based on both academic and non-academic aspects, research[17] about a system for determining eligibility for promotion using the forward chaining method with academic and character assessment aspects, research[18] about a problematic student prediction system using the K-NN algorithm method with an assessment based on mental portrayal aspects and research[19] about a student character

Manuscript received XXX; revised XXX; accepted XXX.
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assessment system using five aspects of character using the simple additive weighting method. The four studies have different methods and aspects of assessment. The implementation is carried out at one school, but there has been no research that analyses the objectivity of teachers when inputting the value of the aspects used as the basis for assessment.

There are many methods in decision support systems[20] including simple additive weighting, analytic hierarchy process, fuzzy logic, TOPSIS, and weight product, each of which has differences in the calculations described in Table 1.

Table 1. Decision Support System Method

Numb	Description	
	Method	Calculation
1	Simple Additive Weighting	A method done to select the best choice from a set of alternatives based on a certain criterion.
2	Analytic Hierarchy Process	An implemented method to find the best alternative of all with many criteria by comparing each pair of alternatives and criteria.
3	Fuzzy Logic	A method used to deal with uncertainty in problems that have many answers.
4	TOPSIS	Multicriteria decision-making based on the principle that the chosen option is the one to be the furthest from the negative ideal solution and the one that is most distant from positive ideal solution.
5	Weight Product	A technique to relate attribute ratings involving multiplication which the rating must first be multiplied by the weight of the attribute in question

The research purpose is to analyze the decision support system of student character assessment in elementary schools to improve the assessment objectivity conducted by teachers. This system[21], [22] has applied the simple additive weighting method as the character assessment calculation basis, because this method[23] is simpler and able to find the best decision from a number of alternatives with certain criteria that match the problem, namely student character assessment to improve teacher objectivity. The analysis conducted includes an evaluation of the effectiveness of these systems[24], [25] in providing meaningful character assessment, as well as how these systems[26] can contribute to improve student character education in the elementary school curriculum. The question of how student character is measured and improved is an ever-relevant issue, hence this study is expected to provide deeper insights into the role of character assessment systems, especially with simple methods[27] to support the character education at the elementary school level. The study implications are expected to make beneficial contributions to a more effective character education development system in the future.

II. METHODS

The quantitative method has been implemented with a before and after decision support system design to assess the student character assessment in elementary school. The research subjects[28] were teachers and principals at eight elementary schools in Kasihan, Bantul, Yogyakarta. There were 45 people as the sample based on random sampling[29] techniques conducted in March 2023.

The decision support system[30], [31] was developed by applying a simple additive weighting method[32] because it is easier for teachers and principals to use this system. The simple additive weighting calculation uses the following calculation procedure:

1. Alternative determination (A_i).
2. Determining the criteria as reference material (C_j).
3. Giving a suitability rating value to each alternative and criteria.
4. Giving weight (W) to each criterion
   $W = [W_1\ W_2\ W_3\ W_4]$
5. Creating a decision matrix (X) from the match rating table (each alternative (A_i) and each criterion (C_j)) that has been determined, where i = 1,2m and j = 1,2 ….n, in Eq. (1).
   $$X = \begin{Bmatrix} C11 & C12 & \ldots\ldots & C1j \\ Ci1 & Ci2 & \ldots\ldots\ldots & Cij \end{Bmatrix} \quad (1)$$
   Information:
   X: matrix
   C: Criteria
6. Doing normalization process by doing a calculation of the normalized performance rating value (r_{ij}) of alternative Ai on criteria C_j, with the following formula:
   If j is a benefit as in Eq. (2), then
   $$R_{ij} = (X_{ij}\,(\max s\ \{X_{ij}\}) \quad (2)$$
   Information:
   R_{ij}: normalized matrix
   X_{ij}: matrix

   If j is a cost as in Eq. (3), then
   $$R_{ij} = (\min\ \{X_{ij}\}/X_{ij}) \quad (3)$$
   R_{ij}: normalized matrix
   X_{ij}: matrix
   With: R_{ij}= normalized performance rating value
   The results of the above calculations will form a normalized matrix (R)
7. Normalized matrix in Eq. (4).
   $$R = \begin{Bmatrix} C11 & C12 & \ldots\ldots & C1j \\ Ci1 & Ci2 & \ldots\ldots\ldots & Cij \end{Bmatrix} \quad (4)$$
   Information:
   R: normalized matrix
   C: Criteria
8. The preference result (Vi) was obtained from the sum of the multiplication of the rows of the normalized matrix (R) with the preference weights (W) according to the matrix column (W) in Eq. (5).
   $$V_i = \sum nj = i\ W_j R_{ij} \quad (5)$$
   Information:
   V_i: ranking for each alternative
   W_j: weight value of each criterion
   R_{ij}: normalized performance rating value
   If in ranking V_i the value is greater, then it will be selected as an alternative.

The data analyses used in the study include:

1. Review of the system to media experts, material experts and teachers as users.
2. Product Effectiveness Analysis
   It is determining the character education assessment decision support system effectiveness using inferential statistical quantitative analysis techniques which a prerequisite test is carried out before hypothesis testing.
   (1) Prerequisite tests are carried out to determine whether the research data are statistically parametric

or non-parametric by means of both tests namely tests of normality and homogeneity.

A normality test is conducted to determine if a data distribution is normal.

A homogeneity test is carried out to determine if the sample data obtained in the study has a homogeneous variance, carried out by means of the Test of Homogeneity of Variance.

Based on the test criterion, if the significance value shown is > 0.05, Ho is rejected. It can be infered that the data has a homogeneous variance.

(2) Statistical tests are carried out after the prerequisite test. Then, the type of statistical test used to determine the difference can be determined. If the data has a normal distribution and homogeneous variance, a parametric statistical test can be carried out. While, a non-parametric statistical test is carried out if the data is not normally distributed. Before conducting statistical testing, the hypothesis is formulated first:

Hypothesis 1.

Ho: There is no difference in character assessment using the Decision Support System

Ha: There is a difference in character assessment using the Decision Support System

Hypothesis 2:

Ho: There is no difference in increasing the objectivity of character assessment using a Decision Support System for teachers.

Ha: There is a difference in increasing the objectivity of character assessment using a Decision Support System for teachers

A. Research Design

The case diagram[24], [33] presents four actors, namely teachers, administrators, principals, and student parents who will use and have their respective access rights in the system. Five use cases (processes), are presented namely to sign-in, to input sub-criteria weights, to view class character assessment reports, to input student, teacher, principal, and class data, and to view student character assessments. The further explanation of the use case diagram of the character assessment system presented in Fig 1.

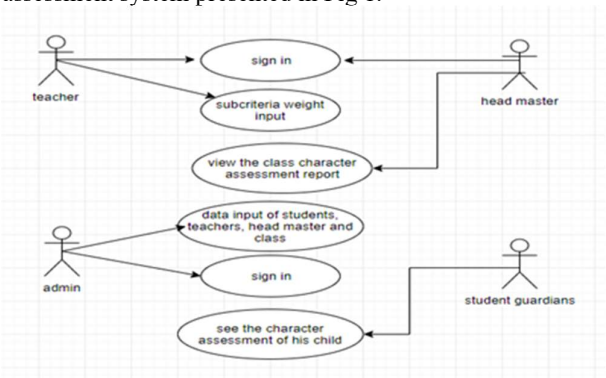

Fig. 1. Use case Diagram of Character Assessment System.

In Fig. 1, it is stated that instructors, principals, and administrators have different access levels. Administrators have the ability to enter student data, homeroom teacher data, and principal data. Teachers have the ability to input student character score weighting factors, whilst principals may examine the reports of student character score in every class. Only the character score of their child is accessible to parents.

B. Criteria

According to the findings of interviews between the research team and the school, as well as references from the Education Assessment Center, there are five assessment criteria to determine the character and elementary school students' attitude assessment of presented in Table 2.

Table 2. Assessment Criteria

Numb	Description		
	Criteria	Attribute	Information
1	Nationalism	Advantage	Thinking process, acting, and caring demonstrating devotion to care for, and high regard for the nation language, environments of physical, social, cultural, economic, and political that prioritizes the nation and state interests over one's own and the group's.
2	Religion	Advantage	Attitudes and actions that uphold their religion's principles, are accepting of other religions' practices, and coexist peacefully with those who practice them
3	Integrity	Advantage	Acting in a way that demonstrates his best attempts to establish his reliability in all of his words, deeds, and labor
4	Independent	advantage	Attitudes and actions that don't rely on others as much and put effort, thinking, and time into realizing goals and ideals
5	Mutual cooperation	advantage	attitudes that are representative of behaviours that cherish the cooperative spirit and collaborate to solve challenges

The criterion attributes are beneficial. It can be inferred that when the value is higher, the outcomes is better. The five criteria in this study are independence, religion, nationality, integrity, and mutual cooperation in which each criterion includes a sub-criterion.

C. Weighting

By assigning a certain amount of weight to each of the numerous aspects involved in a process, weighting is a technique for making decisions. The process of allocating weights can be done either scientifically using statistical calculations or subjectively by doing so.

Table 3. Weighting Indicator

Numb	Description	
	Scale	Weighting
1	Priority	5
2	Less Priority	4
3	Not a Priority	3

Table 3 shows that the sub-criteria include the weighting of behavioral indicators. The provisions that are deemed as priority weighting 5, less priority weighting 4, and the not a priority weighting 3.

The modified criteria as the behavior indicator with a preset value are assigned a value, which is the behavior indicator value.

Table 4. Scores of Behavioral Indicator

Numb	Description	
	Scale	*Weighting*
1	Cultured	4
2	Developing	3
3	Starting to Develop	2
4	Needs Guidance	1

The indicator value explained in Table 4 presents being cultured is 4, developing is 3, beginning to develop is 2, and needing assistance is 1.

Table 5. Behavioral Indicators

Numb	Description	
	Behavioral Indicators	Weighting
1	Religious event participation done at school or another place.	5
2	Loving every God creation.	4
3	Attending school flag ceremony	5
4	Singing the national anthem	4
5	Always going alone	4
6	Doing own homework	5
7	Cleaning the classroom	5
8	Throwing garbage in the trash	3
9	Applying honesty in every activity	5
10	Always being disciplined at school/home	4

The behavioural indicators of five criteria are described in Table 5, which includes the following: religious criteria is 1 and 2, nationalism criteria is 3 and 4, integrity criteria is 5 and 6, independent criteria is 7 and 8, and criteria for mutual cooperation guidelines is 9 and 10.

III. Results and Discussion

A. Results

To obtain a system that is in accordance with user requests, before implementation, a review is carried out by the experts of system, media, material and teachers. The system expert/media expert who reviewed this assessment system was Muhammad Fairuzabadi, M.Kom., who is an expert on media, information systems, and software.

Table 6. Results of system expert review

Numb	Description		
	Aspect	Indicator	Criteria
1	Display Design and Visual Communication Product Display	Product Display	Good
		Facilities to the User	Good
		Sound effects, text and images	Good
		Design, shape and layout	Good
		Interactivity and ease of understanding	Good
2	Software Engineering	Reliability	Good
		Manageability	Good
		Usability	Good
		Appropriateness of application selection	Good
		Compatibility	Good
		Programmed packaging	Good
		Completeness of documents in the programmed	Good
		Reusability	Good

Table 6 explains that there are two aspects used to assess the system: appearance design, visual communication and software engineering with each indicator having good criteria.

The material expert review was conducted by Dr. Ari Wibowo, M.Pd., who is a material expert in the field of character education and civic education.

Table 7. Results of Material Expert Review

Numb	Description	
	Indicator	Criteria
1	The characters assessed in the developed system are appropriate for character strengthening assessment.	very suitable
2	The attitude/behavior indicators to be assessed in the developed system are theoretically appropriate for assessing the characters to be assessed.	very suitable
3	The attitudes/behavior to be assessed in the developed system support the overall system development objectives.	very suitable
4	The statements of attitudes/behavior to be assessed, are easy to understand and unambiguous.	appropriate
5	The attitudes/behavior of the characters to be assessed are attitudes or behavior that can be encountered/observed during learning.	appropriate

Table 7 explains that there are five indicators used to review the education material character contained in the character of education assessment guidelines. The results of the review by the material experts are three indicators that have very suitable criteria, while the other two indicators have suitable criteria.

In order for the system to be built in accordance with the character education guidelines and in accordance with the user, it is necessary to have a review from the user (the teacher) to find out the interaction of humans and computers. The teacher who gave the review was one of the teachers who served at Brajan public elementary school, Suti Harni, S.Pd.

Table 8. Results Review of material and system usage

Numb	Description	
	Indicator	Criteria
1	The menu of the system for determining the character values of elementary school students according to the teachers' need in conducting character assessments.	Very Good
2	Appropriateness of button placement and usage	Good
3	Ease of system operation for teachers	Good
4	The time required when this system is running	Good
5	This system has a function for teachers in conducting character assessments	Very Good

Table 8 explains that there are five indicators used to review material on character education contained in the system. Two of the five indicators have very good criteria, while the other three indicators have good criteria.

The sample used was 45 people based on random sampling techniques carried out at 8 primary schools in Kasihan, Bantul, Indonesia. The demographics of respondents are described in Table 9 which the variables are age, latest education and position.

Table 9. Respondent Demographics

Variable	Description	
	Category	Frequency
Age	20-35 years old	15
	36-50 years old	20
	51-65 years old	10
Education	Bachelor	43
	Master	2
	Doctorate	0
Position	Class Teacher	30
	School Principal/head master	8
	Teachers of specific subjects	7

Table 9 explains that the 45 respondents consisted of 8 principals/head masters, 7 teachers of certain subjects and 30 homeroom teachers, where the last education was 43 undergraduates and 2 masters with an age range of 30 years to 60 years.

Based on Kolmogorov-Smirnov and Shapiro-Wilk, a normality test is conducted to determine if the data utilized in this investigation is regularly distributed. The difference between the two is in the number of samples used. If the sample is greater than 50, Kolmogorov-Smirnov is used. If the sample is smaller than 50, it is better to use Shapiro-Wilk, as shown in Table 10.

Table 10. Results of Normality Test

Normality Tests						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
Pre-test	.144	45	.020	.964	45	.169
Post-test	.162	45	.004	.961	45	.139

a. Lilliefors Significance Correction

Table 10 explains that in Shapiro-Wilk, the significance value for the pre-test is 0.169 and the post-test significance value is 0.139. It states that the significance value is greater than 0.05 which means that the research is normally distributed. While, in Kolmogorov-Smirnov, the pre-test significance value is 0.020 and the post-test significance value is 0.004. It shows that the research is not normally distributed. In this study, because the sample (df) is 45, it is advisable to implement the Shapiro-Wilk normalization test. Meanwhile, the results of the pretest scores of 45 samples are described in Fig. 2.

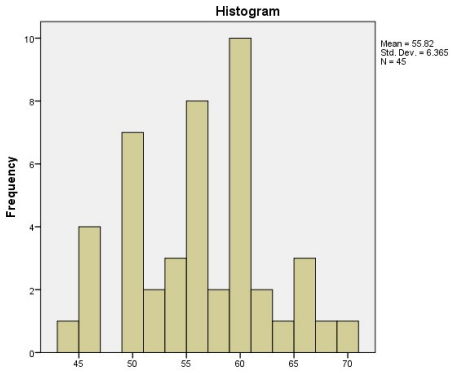

Fig. 2. Result Pre-test.

In Fig. 2, it is explained that of the 45 samples used in the pretest, the lowest score was 45 with 1 respondent; the highest score was 60 with 10 respondents; and the average was 55.82 with a standard deviation of 6.365.

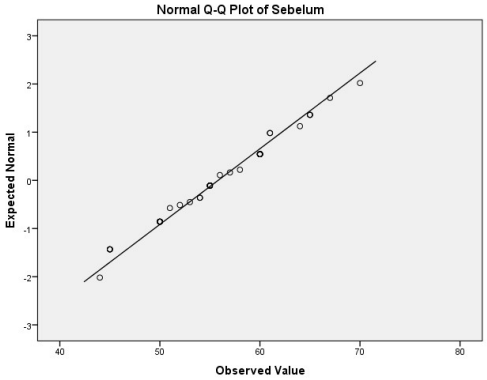

Fig. 3. Graphics normal Q-Q Plot Pre-test

In Fig. 3, it is explained that there are some values above and below the straight line but not too far from the straight line. It states that the pretest values are not too far apart.

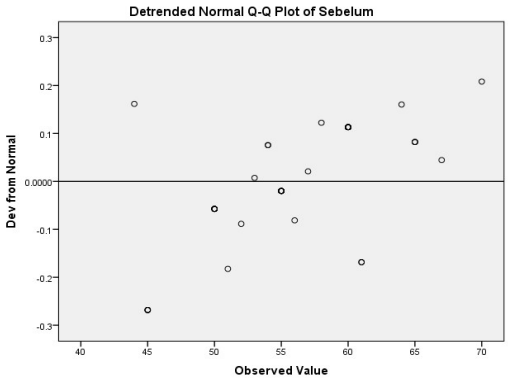

Fig. 4. Graphics Detrended Normal Q-Q Plot Pre-test

Fig. 4 explains the pre-test score distribution from a range of 40 to a range of 70, which has the same range between the bottom and the top. During the system implementation, another questionnaire was distributed to 45 respondents who were assigned to do the pretest, with the results shown in Fig. 5.

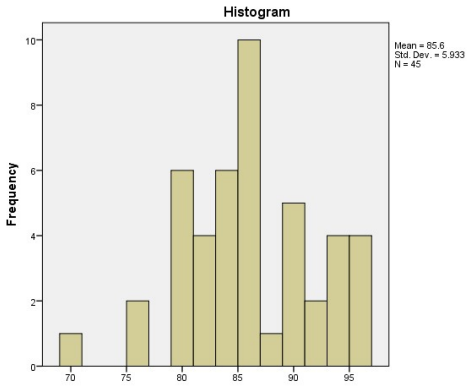

Fig. 5. Result Post-test

Fig. 5 explains that out of 45 respondents, 70 was the lowest post-test score, as many as 1 respondent. The highest post-test score was 95 (4 respondents). The average value was 85.6 with a standard deviation of 5.933.

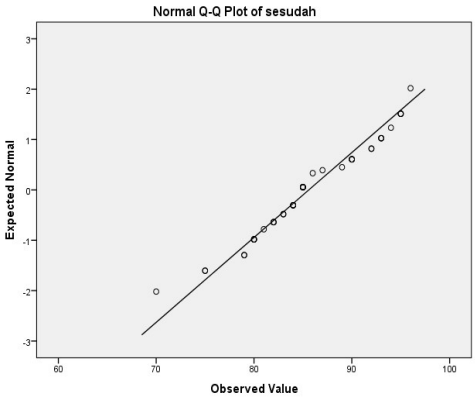

Fig. 6. Graphics normal Q-Q Plot Prot-test

Fig. 6 explains that there are some values above and below the straight line but not too far from it. It means that the post-test values are not too far apart.

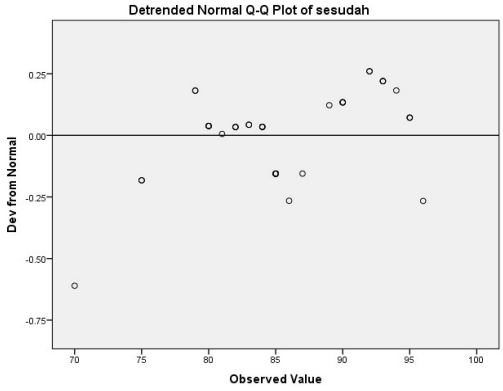

Fig. 7. Graphics Detrended Normal Q-Q Plot Post-test

Fig. 7 explains the post-test score distribution from range 70 to 95, which has a different range between the bottom and the top. A homogeneity test is to find out if the variation of some data from the population has the same variance and to determine the next statistical test.

Table 11. Homogeneity Test Result

Test of Homogeneity of Variances			
Result			
Levene Statistic	df1	df2	Sig.
.487	1	88	.487

Table 11 presents the homogeneity test result. It is explained that the signification (sig) value is 0.487 which means that the sig value is greater than 0.05. It shows that the variants of two or more population data (the results of the pre-test and post-test) are the same (homogeneous).

The T-Test was to find out the average difference from two samples or related samples.

Table 12. T-Test Result

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre-test	55.82	45	6.365	.949
	Post-test	85.60	45	5.933	.884

From the results, the pre-test mean score was 55.82 with a standard deviation of 6.365, according to the paired samples statistic data, whereas the post-test mean score was 85.60 with a standard deviation of 5.933.

Paired Samples Correlations				
		N	Correlation	Sig.
Pair 1	Pre-test & Post-test	45	.500	.000

Testing the link between the pre-test and post-test variables is the goal of the paired sample correlations table. The correlation value is 0.500 and the significance value is 0.000 based on the test findings. It is possible to conclude that there is a link between variables of the pre-test and post- because the significance value is less than 0.05.

Paired Samples Test									
		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		T	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	Pre-test – Post-test	-29.778	6.160	.918	-31.629	-27.927	-32.426	44	.000

Based on the paired sample test result, the t value is -32.426; the df value is 44; and the significance value (2-tailed) is 0.000. If the significance value (2-tailed) is smaller than 0.05, Ho is rejected and Ha is accepted. It means that there is a difference in increasing the objectivity of character assessment using a decision support system for teachers.

B. Discussion

By assigning weights (W) to each criterion for each character, creating a decision matrix based on criteria (Ci), normalizing the matrix depending on the kind of attribute, and generating a normalized matrix (R), testing is done using normalization to demonstrate the system. A normalization table of religious criteria and calculation results is also shown to the choices that the two students entered during implementation, as seen in the accompanying

picture. Fig. 8 displays the data on the religious criteria of two students as well as the normalization findings.

Initial Data

	Criterion	
Student Name	Loving Fellow creatures of God	Celebrating religious days at school/outside of school
Jennie Rumbie	4	3
Andi	2	3

Normalization Matrix

	Criterion	
Student Name	Loving Fellow creatures of God	Celebrating religious days at school/outside of school
Jennie Rumbie	1	1
Andi	0.5	1

Fig. 8. Normalization Matrix.

As shown in Fig. 8, the input results of the value of the behavioral indicators of the religious criteria:
The decision matrix is X, as in Eq. (1).

The decision matrix in Fig. 8. is $X=\begin{Bmatrix}4 & 3\\ 2 & 3\end{Bmatrix}$

Normalization process
The normalizing procedure is performed by computing the normalized performance rating the alternative value based on the criteria using the formula:
If the benefit attribute as in Eq. (2), then

$$R_{ij} = (X_{ij} (\max s \{X_{ij}\}) \quad (2)$$

In religion criteria, the normalisation matrix calculation uses the benefit attribute as follows:

$$R_{11}=\frac{4}{\max\{4,2\}}=\frac{4}{4}=1 \qquad R_{12}=\frac{3}{\max\{3,3\}}=\frac{3}{3}=1$$

$$R_{21}=\frac{2}{\max\{4,2\}}=\frac{2}{3}=0{,}5 \qquad R_{22}=\frac{3}{\max\{2,3\}}=\frac{3}{3}=1$$

Normalized matrix $R_{ij}=\begin{Bmatrix}1 & 1\\ 0{,}5 & 1\end{Bmatrix}$

After acquiring the normalization matrix, the next step is to compute the religion indicator values. Figure 9 shows the results of the accumulation of religious criterion values.

The calculation results

	Criteria		
Student's name	Loving fellow creatures of God	Celebrating religious days at school/outside school	Results
Jennie Rumbie	5	4	9
Andi	2.5	4	6.5

Jennie Rumbie memiliki nilai terbaik dengan nilai 9

Fig. 9. Calculation of Religious Criteria.

In Fig. 9, the results of each student's religious criteria are automatically derived from the number of behavioral indicator values in the system, while the manual calculation is weight, as in Eq. (6)

$$\text{The sum of the weights} = C1+C2 \quad (6)$$

Information:
C: criteria
The result:
Student 1 = (4+1) + (3+1) = 9
Student 2 = (2+0.5) + (3+1) = 6.5

To calculate the total of all criteria, a comparable examination is performed using the indications on the criterion. The value of each criteria that has been inputted and normalized according to the behavioral indications for each criterion is shown in Fig. 10.

Character	Score
Religious	9
Nationalist	5.25
Self-sufficient	9
Mutual aid	8
Integrity	6.418

Fig. 10. Results Report.

In Fig. 10 demonstrates that the results of all criteria (religious, nationalist, independent, mutual cooperation and integrity) are obtained by summing the values of the each criterion behaviour indicators.

In Fig. 11, the following illustrates how student achievement is assessed using daily behavioral markers. These findings can be utilized as a reference and decision assistance for teachers when making action recommendation in class.

Achievement Category	Explanation
Need Guidance	Students have not displayed the behavior stated in the behavior rubric.
Starting to Develop	Students display the behavior stated in the behavior rubric but are not consistent.
Develop	Students begin to consistently display the behavior stated in the behavior rubric.
Civilize	Students always consistently display the behavior stated in the behavior rubric.

Fig. 11. Achievement Category Results.

Fig. 11 presents the conclusion of each student achievement. This system explains the achievement category starting from guidance needs, starting to grow, growing and cultivation as well as an explanation of each category for student character development categories.

IV. Conclusion

The results mention that the decision support system can provide a more objective and consistent assessment of student character. Teachers and principals found that the system provides valuable insights in monitoring students' character development and identifying indicators that need more attention. Challenges in implementing the system include a lack of understanding of the use of decision support systems and support for teacher training. The contribution is that it provides insights in improving student character assessment in primary schools. The implication of this research is that the implementation of the system should be accompanied by adequate teacher education and support to ensure its effectiveness. In conclusion, the decision support system is an important system in improving students character education in elementary schools, and its success depends on teachers understanding and support.

Conflict of Interest

There is no conflict of interest declared by the author.

Author Contributions

Setia Wardani found the main topic, drafted the proposal, conducted the research and drew conclusions from the research findings. Rianto Rianto developed the decision support system to assess elementary student character. Arita Witanti verified the data, reviewed the manuscript. Selly Rahmawati analyzed data obtained from the field.

ACKNOWLEDGMENT

The authors would like to acknowledge their gratitude to Direktorat Riset, Teknologi, dan Pengabdian kepada Masyarakat Kemdikbudristek for the training and assistance in writing the article, Principals and Classroom Teachers in Elementary Schools in Kasihan District Bantul, Indonesia who have provided input and suggestions and Universitas PGRI Yogyakarta for supporting the implementation of this research.

REFERENCES

[1] E. S. Cahyaningrum, S. Sudaryanti, and N. A. Purwanto, "Pengembangan Nilai-Nilai Karakter Anak Usia Dini Melalui Pembiasaan Dan Keteladanan," *Jurnal Pendidikan Anak*, vol. 6, no. 2, pp. 203–213, 2017, doi: 10.21831/jpa.v6i2.17707.

[2] F. Jannah, "Urgensi Pendidikan Karakter Di Sekolah," *Journal.Stitaf.Ac.Id*, vol. 05, no. 01, pp. 167–184, 2014, [Online]. Available: https://journal.stitaf.ac.id/index.php/cendekia/article/view/19

[3] Pusat Penilaian Pendidikan Kementerian Pendidikan dan Kebudayaan, "Model Penilaian Karakter," pp. 1–59, 2019.

[4] N. K. Sari and L. D. Puspita, "Implementasi Pendidikan Karakter Di Sekolah Dasar," *Jurnal Dikdas Bantara*, vol. 2, no. 1, pp. 257–266, 2019, doi: 10.32585/jdb.v2i1.182.

[5] N. K. Sari and L. D. Puspita, "Implementasi Pendidikan Karakter Di Sekolah Dasar," *Jurnal Dikdas Bantara*, vol. 2, no. 1, pp. 257–266, 2019, doi: 10.32585/jdb.v2i1.182.

[6] Hanung Cahyono, "Perpres no. 87 Tahun 2017," *6 September 2017*, 2017.

[7] D. Desyandri, "EDUCATIONAL VALUES FOR STUDENT CHARACTER BUILDING (A HERMENEUTIC ANALYSIS)," *Pedagogi: Jurnal Ilmu Pendidikan*, vol. 16, no. 1, pp. 29–38, Apr. 2016, doi: 10.24036/PEDAGOGI.V16I1.202.

[8] Pusat Penilaian Pendidikan Kementerian Pendidikan dan Kebudayaan, "Model Penilaian Karakter," pp. 1–59, 2019.

[9] F. Wajdi and Z. Putra, "The Implementation of Elementary Student Character Values Among the Bajo Tribe through Pancasila Values as Character Building," *Social, Humanities, and Educational Studies (SHEs): Conference Series*, vol. 4, no. 4, p. 95, Apr. 2021, doi: 10.20961/SHES.V4I4.50591.

[10] N. Rahmadini and T. A. Rasyid, "Student Character Building Methods on Distance Education," *International Journal of Ethno-Sciences and Education Research*, vol. 1, no. 4, pp. 88–92, Oct. 2021, doi: 10.46336/IJEER.V1I4.243.

[11] A. Khilmiyah and G. Wiyono, "Emotional and social intelligence assessment model for student character reinforcement," *International Journal of Educational Management*, vol. 35, no. 4, pp. 789–802, 2021, doi: 10.1108/IJEM-02-2020-0046.

[12] S. P. Jakkaladiki, M. Janečková, J. A. N. Krunčík, F. Malý, and T. OtčenÁšková, "DEEP LEARNING-BASED EDUCATION DECISION SUPPORT SYSTEM FOR STUDENT E-LEARNING PERFORMANCE PREDICTION," *Scalable Computing*, vol. 24, no. 3, pp. 327–338, 2023, doi: 10.12694/scpe.v24i3.2188.

[13] M. M. Alam Bhuiyan and A. Hammad, "A Hybrid Multi-Criteria Decision Support System for Selecting the Most Sustainable Structural Material for a Multistory Building Construction," *Sustainability (Switzerland)*, vol. 15, no. 4, Feb. 2023, doi: 10.3390/su15043128.

[14] E. Turban, J. E. Aronson, and T. Liang, "Decision Support Systems and Intelligent Systems," 2007.

[15] A. Ponomarev, N. Mustafin, A. Ponomarev, and N. Mustafin, "Decision support systems configuration based on Decision support systems configuration based on knowledge-driven automated service composition : requirements knowledge-driven automated service composition : requir," *Procedia Comput Sci*, vol. 186, pp. 654–660, 2021, doi: 10.1016/j.procs.2021.04.213.

[16] T. Wiharko and M. A. Helmiawan, "Web-Based Decision Support System Determination of Exemplary Students using The Weighted Product Method," *J-Tin's - Jurnal Teknik Informatika; Vol. 2 No. 2 (2018): J-Tin's*, Jan. 2018, [Online]. Available: https://ejournal.stmik-sumedang.ac.id/index.php/jtin/article/view/356

[17] I. Utomo, W. Mulyono, N. K. Ningrum, Z. Umami, and K. Widyatmoko, "E-Report System to Help Monitor Student Academic Progress Using Forward Chaining for Grade Promotion According to Student Development Level," 2021.

[18] D. Kurniadi, A. Mulyani, and I. Muliana, "Prediction System for Problem Students using k-Nearest Neighbor and Strength and Difficulties Questionnaire," *Jurnal Online Informatika*, vol. 6, no. 1, p. 53, Jun. 2021, doi: 10.15575/join.v6i1.701.

[19] W. P. Lestari, P. H. Putri, and S. Wardani, "Decision Support System for Determining Character Education Values," *Journal of Intelligent Software Systems*, vol. 2, no. 2, p. 16, Dec. 2023, doi: 10.26798/jiss.v2i2.1142.

[20] A. Yusupa, J. Manullang, N. Marbun, S. Bill, and F. Ginting, "Decision Support System for Determining the Best PAUD Teacher Using the MOORA Method", doi: 10.58905/SAGA.vol1i2.101.

[21] H. Silva and J. Bernardino, "Machine Learning Algorithms: An Experimental Evaluation for Decision Support Systems," *Algorithms*, vol. 15, no. 4, Apr. 2022, doi: 10.3390/a15040130.

[22] F. R. Da Silva Oliveira and F. B. De Lima Neto, "Method to Produce More Reasonable Candidate Solutions With Explanations in Intelligent Decision Support Systems," *IEEE Access*, vol. 11, pp. 20861–20876, 2023, doi: 10.1109/ACCESS.2023.3250262.

[23] R. Layona and B. Yulianto, "Application for Providing the Food Menu Based on Available Food Raw Materials, Cost, and Avoidance for Certain Diseases," *Procedia Comput Sci*, vol. 179, no. 2019, pp. 878–885, 2021, doi: 10.1016/j.procs.2021.01.077.

[24] Y. Miyachi, O. Ishii, and K. Torigoe, "Design, implementation, and evaluation of the computer-aided clinical decision support system based on learning-to-rank: collaboration between physicians and machine learning in the differential diagnosis process," *BMC Med Inform Decis Mak*, vol. 23, no. 1, Dec. 2023, doi: 10.1186/s12911-023-02123-5.

[25] B. B. Gupta and P. K. Panigrahi, "Analysis of the Role of Global Information Management in Advanced Decision Support Systems (DSS) for Sustainable Development," *Journal of Global Information Management*, vol. 31, no. 2, 2023, doi: 10.4018/JGIM.320185.

[26] S. Gupta, P. Kumar, and R. Tekchandani, "A machine learning-based decision support system for temporal human cognitive state estimation during online education using wearable physiological monitoring devices," *Decision Analytics Journal*, vol. 8, Sep. 2023, doi: 10.1016/j.dajour.2023.100280.

[27] A. Rikki, M. Marbun, and J. R. Siregar, "Sistem Pendukung Keputusan Penerimaan Karyawan Dengan Metode SAW Pada PT. Karya Sahata Medan," *Journal of Informatics Pelita Nusantara*, vol. 1, no. 1, pp. 38–46, 2016.

[28] W. Saptatiningsih, Rosalia; Wardani, Setia; Sari Marti, "Applying information and communication technology on learning model innovation of character education Applying information and communication technology on learning model innovation of character education," *International Proceeding*, 2021, doi: 10.1088/1742-6596/1823/1/012057.

[29] M. Trstenjak, T. Opetuk, G. Đukić, and H. Cajner, "Logistics 5.0 Implementation Model Based on Decision Support Systems," *Sustainability (Switzerland)*, vol. 14, no. 11, Jun. 2022, doi: 10.3390/su14116514.

[30] L. Pumplun, F. Peters, J. F. Gawlitza, and P. Buxmann, "Bringing Machine Learning Systems into Clinical Practice: A Design Science Approach to Explainable Machine Learning-Based Clinical Decision Support Systems," *J Assoc Inf Syst*, vol. 24, no. 4, pp. 953–979, 2023, doi: 10.17705/1jais.00820.

[31] I. S. Nasir, A. H. Mousa, S. M. Ali Alkhafaji, W. S. A. Hussein, Z. R. Jasim, and S. Q. Ali, "Virtual data integration for a clinical decision support systems," *International Journal of Electrical and Computer Engineering*, vol. 13, no. 5, pp. 5243–5252, Oct. 2023, doi: 10.11591/ijece.v13i5.pp5243-5252.

[32] R. Taufiq and A. A. Permana, "Sistem Pendukung Keputusan Penerimaan Karyawan Menggunakan Simple Additive Weighting Studi Kasus PT. Trafoindo Prima Perkasa," *JURNAL Al-AZHAR INDONESIA SERI SAINS DAN TEKNOLOGI*, vol. 4, no. 4, p. 186, 2018, doi: 10.36722/sst.v4i4.309.

[33] M. Thesing, Theo; Feldmanna, Carsten; Burchardtb, "Agile versus Waterfall Project Management: Decision Model for Selecting the Appropriate Approach to a Project," *Procedia Comput Sci*, vol. 181, pp. 746–756, 2021, doi: 10.1016/j.procs.2021.01.227.