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Integrated Selection of Permanent Teacher Appointments Recommended MCDM-AHP and WASPAS Methods

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Abstract: The teacher's role is very important in improving the national learning system. Many honorary teachers are empowered in curriculum development in a number of schools who want to collaborate in improving the quality of their students. The purpose of this research is to provide rewards to honorary teachers who have long served for the progress of the nation in the world of education to be appointed as permanent teachers. The selection method was carried out through a criteria weighting technique with the MCDM-AHP method which was integrated with the WASPAS method. The technique of developing the MCDM-AHP method as an eigenvector measurement concept with proof of optimization through mathematical algebra matrices that is correlated with the Expert Choice application to get optimal values. The result optimization value is integrated with the WASPAS method as a determinant of the ranking system for permanent teacher candidates. This method is a unification of the concepts of the weight product model and weight sum model methods, so that it has special stages to support decision making with the WASPAS method. The results of selecting twelve honorary teachers for appointment as permanent teachers can be seen from the acquisition of the Qi optimization value as a ranking. The results of support for decision making for permanent teacher appointments with the highest optimization value were given to TC04 with a weight of 0.878; followed by a significant difference in the next rank. The findings of this study provide evidence that the integration of the MCDM-AHP and WASPAS methods provides continuous optimization results for decision-making support.

Keywords: Appointment teachers candidate, MCDM-AHP, WASPAS, Multi-criteria, optimization.

INTRODUCTION

Development of the world of education is a milestone in the progress of a nation, with education providing an overview of the civilization of people's lives (Eskelson, 2020). It is undeniable that the development of a mindset is a symbol of advancing the level of futuristic understanding. The contribution to the progress of education for honorary teachers is able to provide a new paradigm in competing in compiling learning materials in the world of education in increasing their pedagogical creativity (Swanzy-Impraim et al., 2023). Many educational institutions are inseparable from human resources who use honorary staff in supporting the progress of education, so that it is appropriate for the need for honorary teacher staff who already have broad competence (Hanaysha et al., 2023) and knowledge that is much more mature to be given the opportunity through selection to be given a proper living. The purpose of this study is to provide a detailed description of the process of selecting honorary teachers as rewarding becoming permanent teachers with careful consideration in the integrated selection process of two methods that are contradictory to the multi-criteria type with optimal results.

The selection of teacher candidates still needs a barometer for the assessment process, it takes a lot of criteria to measure the assessment (Storme et al., 2022). The more criteria needed, the more difficult it will be to give the assessment. In this study eight assessment criteria were determined consistently from experts, namely last education (LED), grade point average (GPA), micro teaching (MTE), age (AGE), Dedactic (DDT), methodical (MTD), and distance (DST). These eight criteria are the main assessment in selecting permanent teacher candidates. Review again that the eight criteria one through seven bind the type of benefit and the eighth criterion binds the type of cost. The benefit type criteria will of course add to the total value, while the cost type criteria will reduce the total value. The instrumentation used to accommodate input from 140 respondents was in the form of a questionnaire with convenience sampling technique. The data processing process can use the Multi-criteria Decision Making of Analytic Hierarchy Process (MCDM-AHP) and many researchers use this method. (Badulescu et al., 2022; Sotoudeh-Anvari, 2022; Ul Islam et al., 2022). Acquisition of the results of the calculation of the

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criteria is determined through the eigenvector (Abdrabo et al., 2023) which is the advantage of the MCDM method (Jamal & Muqeem, 2023) in ranking using AHP (Kumar & Pant, 2023) as a weighting technique with optimal results which is carried out with the iteration process stages until no difference is found between the last eigenvector value and the previous eigenvector value. The real difference in the assessment criteria is that not all of them have the same type, but instead provide a different assessment of the acquisition of the value of the criteria results. Benefit-type criteria will provide added value, while cost-type criteria will, on the contrary, reduce the acquisition value.

Integration of the Weight Average Sum Product Assessment (WASPAS) method (Perec & Radomska-Zalas, 2022) can be done properly after finding the eigenvector quantity (Deretarla et al., 2023) as the weighting of the eight criteria. The role of the WASPAS method is to ensure a rating system (Masoomi et al., 2022a) of teacher candidates still elected. This method in detail is a combination of two methods (Perec & Radomska-Zalas, 2022) a different one, namely the Weight Sum Model (WSM) (Debnath et al., 2023) and Weight Product Model (WPM) (Perec & Radomska-Zalas, 2022) which is taken by dividing the two results with a weight of 0.5 each to find a new solution in the ranking system, thus the process of selecting the ranking of permanent teacher candidates becomes gradual.

Based on the above understanding a number of valuable contributions can be explained, namely 1) providing a detailed description of the application of the MCDM-AHP method which can be obtained through proving the acquisition of eigenvector values through testing mathematical algebra matrices and expert choice apps which have identical results. 2) The application of the WASPAS method with contradictory types of criteria simultaneously can be carried out without reducing the assessment of decision-making support, even though the two methods are carried out in an integrated manner and still produce optimal results which provide significant results.

LITERATURE REVIEW

Multi-criteria Decision Making (MCDM)

The Multi-criteria Decision Making (MCDM) approach is one of the best approaches in managing multiple criteria for the results obtained (Shabani et al., 2022),(Garai & Garg, 2023), this has been widely tested with other methods such as Multi-criteria Decision Analysis (MCDA)(Wątróbski et al., 2022),(Kozlov & Sałabun, 2021), Multi-objective Decision Making (MODM)(Fan et al., 2011),(A. Baky & Abo-Sinna, 2013), and Multi-criteria Analysis (MCA)(Tadese et al., 2022). MCDM has become a sequence for researchers to prove comparative value against a number of criteria. This approach is often closely associated with the Analytic Hierarchy Process (AHP) method. (Abdullahi et al., 2023) which has developed a variety of functions to date. The linkage of this method provides consideration through the value of the comparison of interests, of course, in giving the value of interest, it is supported by experts who understand correctly about the mature considerations of experts. Expert judgment is processed by many methods as shown above. The assessment carried out can be in the form of quantitative research or qualitative research or a combination of both, so that the MCDM method is widely applied (Sarkodie et al., 2022) in various studies.

Analytic Hierarchy Process (AHP)

The Analytic Hierarchy Process (AHP) method is a method that is applied hierarchically in solving complex problems into simple decomposition (Mamat & Daniel, 2007). Problems can be composed into several parts in a simple way and if it is necessary to recompose, it can be continuously carried out to reach a very simple and easy to understand point in the form of hierarchical modeling to simplify testing. (Radomska-Zalas, 2022). Obtaining the calculation value of each comparison must be done by knowing how many orders will be used and to determine the number of comparisons you can use equation 1, so to determine the number of comparisons to be applied must be arranged in matrices according to equation 2 as pairwise matrices.

$$NC = \frac{n*(n-1)}{2} \tag{1}$$

Exp: CN: Number of comparison ; n: materices ordo

$$X_{(i,j)} = \begin{bmatrix} em_{(1,1)} & em_{(1,2)} & em_{(1,3)} & \dots & em_{(1,j)} \\ em_{(2,1)} & em_{(2,2)} & em_{(2,3)} & \dots & em_{(2,j)} \\ em_{(3.1)} & em_{(3,2)} & em_{(2,4)} & \dots & em_{(3,j)} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ em_{(i,1)} & em_{(i,2)} & em_{(i,3)} & \dots & em_{(i,j)} \end{bmatrix} \tag{2}$$

Exp: $X_{(i,j)}$: Matrices X in row i and colomn j

$em_{(i,j)}$: elemen matrices in row i and colomn j

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The AHP method applies an assessment of the results by testing the consistency (Franek & Kresta, 2014), (J. Benítez et al., 2011) which includes the following steps to determine the Consistency Index (CI) as stated in equation 3, the Consistency vector which is the average of the length of the vector (λ max), up to the Consistency vector (CV) which can be searched using equation 4 and the Consistency ratio (CR) as the final assessment of decision support by taking into account the feasibility of the decision.

$$CI = \frac{(\lambda \text{ max} - \text{n})}{(n-1)} \tag{3}$$

Exp: CI: Consistency index; λ max: length of vector; n: ordo matrices

$$CV = \prod_{n=i}^{j} \lambda \text{ max} \tag{4}$$

Exp: CV: Consistency vector; i= in row; j: vector totality

$$CR = \frac{CI}{RI} \tag{5}$$

Exp: CR: Consistency ratio; RI: Random index in table

The calculation of the calculation of the acquisition of the CR value is very decisive for decision-making support, both temporary and final. The Saaty stipulation says that the CR value must be less than 0.1 to be eligible for acceptance to the next stage of the process. To correct errors in the CR value, it is best to trace back the contents of the respondents through a questionnaire. The elements of the gain from the CR value must comply with the suitability of the matrices order used according to Table 1 on the Random index.

Table 1. Random Index (Deretarla et al., 2023)

Ordo	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RI	0	0	0.6	0.9	1.12	1.24	1.32	1.41	1.45	1.48	1.51	1.48	1.56	1.57	1.58

Weight Aggregated Sum Product Assesment (WASPAS)

The Weight Aggregated Sum Product Assessment (WASPAS) method is a method that can be used to provide an assessment of the ranking system. In practice, this method is a combination of the two ranking methods, namely the Weight Sum Model (WSM) and the Weight Product Model (WPM), each of which is given a partial value of the two methods. (Julio Benítez et al., 2011), so that it becomes a new method called WASPAS. The combination of the two WASPAS methods describes two methods known as Quantity for each alternative Q_i.

The first step in implementing WASPAS is to prepare the consideration of decision matrices (Perec & Radomska-Zalas, 2022),(Masoomi et al., 2022b), whose drawing process is identical to the arrangement of element matrices in pairwise matrices in AHP. Look at equation 6 which describes the decision matrices in WASPAS.

$$M = \begin{bmatrix} x_{(1,1)} & x_{(1,2)} & x_{(1,3)} & & x_{(1,q)} \\ x_{(2,1)} & x_{(2,2)} & x_{(2,3)} & \cdots & x_{(2,q)} \\ x_{(3,1)} & x_{(3,2)} & x_{(3,3)} & & x_{(3,q)} \\ & \vdots & & \ddots & \vdots \\ x_{(p,1)} & x_{(p,2)} & x_{(p,3)} & \cdots & x_{(p,q)} \end{bmatrix} \tag{6}$$

Exp: M: Decision matrices; $x_{(p,q)}$: element matrices x in row p and colomn q

The process of normalizing matrices has two types, the first type is for criteria with a benefit type and criteria with a cost type, this can affect the total value of the weighting of each criterion, taking into account the use of the two types of criteria. For criteria declared as a type of benefit, it will give a positive value to the alternative assessment and for criteria that are of the cost type, of course, it will reduce the alternative assessment. At this point researchers must pay attention to the type of criteria that will be used, because setting criteria should not be misinterpreted, so it is better if setting criteria must be declared properly first.

$$X_{(p,q)} = \frac{x_{(p,q)}}{Max_p x_{(p,q)}} \text{ ; } criteria\ benefit \tag{7}$$

Exp: $x_{(p,q)}$: alternative acquisition value on line p and column q; $Max_p x_{(p,q)}$: alt. maximum value.

$$X_{(p,q)} = \frac{Min_{(p)} x_{(p,q)}}{x_{(p,q)}} \text{ ; } criteria\ cost \tag{8}$$

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Exp: $x_{(p,q)}$: alternative acquisition value on line p and column q; $Min_{(p)}x_{(p,q)}$: alt. minimum value alt.

The rating system that is implemented using the WASPAS method in detail can pay attention to the work of combining the formulas given with half the weight of combining the two Weight Sum Model (WSM) and Weight Product Model (WPM) methods. This can be seen clearly in detail shown in equation 9 as a combination of the two methods.

$$Q_i = 0.5 \sum_{j=q}^{n} x_{(p,q)}w + 0.5 \prod_{j=1}^{n} x(p,q)^{(w,q)} \quad (9)$$

METHOD

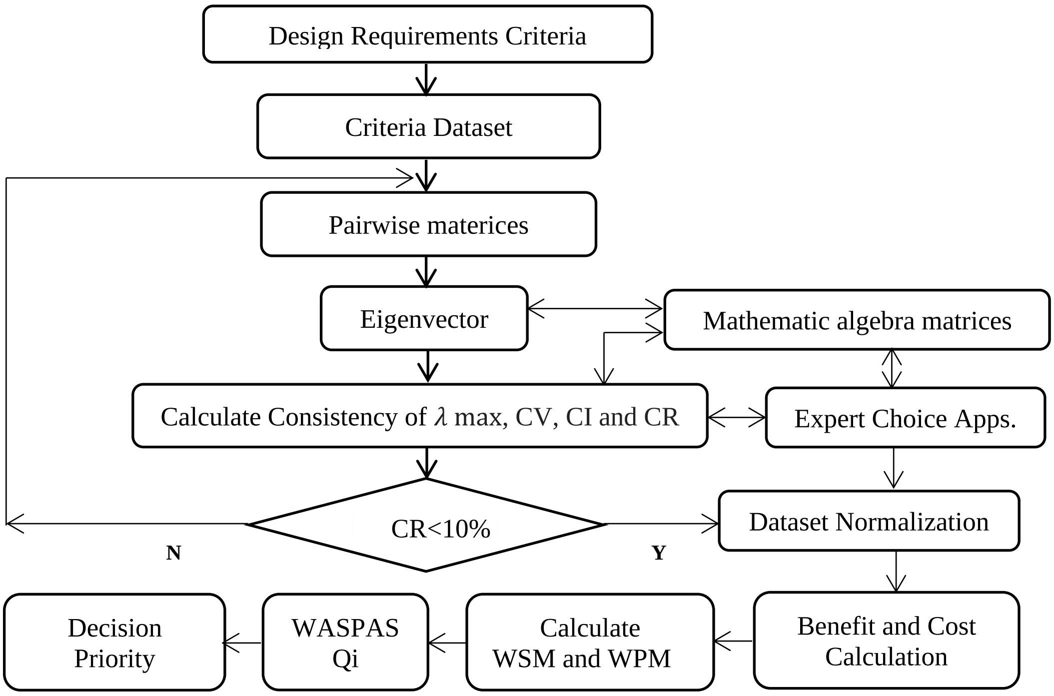

Fig. 1. MCDM-AHP-WASPAS Algoritm

Pay attention to Fig. 1 as the algorithm that becomes the research completion activity can be seen in detail which describes the MCDM-AHP collaboration that was carried out first to find the eigenvector as the weighting used by the WASPAS method. Optimally, the eigenvector search process will go through an approximation process using mathematical algebra matrices (Hema Surya et al., 2023), to test the feasibility of the results on the acquisition value of the eigenvector. Of course, these results do not stop at the pont, but testing is continued using expert choice apps. (Yunus et al., 2013), (Ahmad et al., 2020). As parallel evidence that will be the maturity of the consideration of obtaining optimal and feasible eigenvector values to be used as the integrity of the two methods, both the MCDM-AHP method and the WASPAS method. Eigenvector testing with mathematic algebra matrices (Hema Surya et al., 2023) intended to see the feasibility of the optimal eigenvector value with a CR value that must be less than 0.1; while testing with expert choice apps. Used to find inconsistency and synthesis values. The resulting inconsistency is lower than the resulting CR value, so it can be used in real terms to determine dataset normalization to the benefits and costs of the type of criteria used. According to the algorithm that has been carried out, it can be continued for the acquisition of WSM and WPM up to the determination of WASPAS quantification which is assessed based on the magnitude of the Q_i value to be able to determine decision priority.

RESULT

In the filtering process of a number of selected criteria in determining the main criteria from a number of experts, eight criteria can be compiled which become a measurement barometer for twelve honorary teachers who are ready to be selected to become permanent teacher candidates. The selection process is carried out objectively and without interference from all parties. This is done to provide rewards to honorary teachers who have served in building the progress of the world of education for a long time. For this purpose, a number of criteria are needed

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as a barometer for selecting honorary teachers who should be given compensation that can elevate their status as permanent teachers.

The barometer used consists of eight selected criteria, to be used as an assessment tool for honorary teachers who will be selected as permanent teachers. These criteria are last education (LED), length of teaching time (LOT), micro teaching (MTE), age (AGE), dactic (DDT), methodical (MTD), and distance (DST). All of these criteria have been agreed upon by a number of experts from a number of schools, who were selected through the expert choice method and mathematical algebra matrices. Respondents who were used as input came from experts from a number of school environments which can be said to be favorites and require teaching staff who previously had honorary status to be appointed as permanent teachers. Honorary teachers who have served a long time and have good etiquette and have educated students with ratings that are categorized as very good, should be rewarded in the form of appointments as permanent teachers. Input in the form of a questionnaire totaling 120 valid respondents and with conventional questionnaire distribution techniques used as input for processing assessment data against criteria by comparison of their importance values.

The criteria data is processed by converting data from the arithmetic scale to the geometric scale and finally converted to the AHP scale. The maturation of the AHP scale was arranged according to the number of criteria being compared which totaled 28 comparisons. The acquisition of this value is determined using equation 1. The extraction results are arranged in the form of pairwise matrices as shown in equation 2. All matrices elements are arranged into pairwise matrices to be processed using mathemaic algebra matrices with five iterations of matrices multiplication. The iteration of matrices multiplication aims to obtain the optimal eigenvector value. To find out that the optimal eigenvector value has been formed, it is determined by subtracting the last eigenvector value from the previous eigenvector value where there is no difference between them. The results of forming pairwise matrices to find the optimal eigenvector can be seen in Table 2.

Table 2. Pairwise matrices criteria using algebra matrices

Criteria	LE	GPA	LD	MT	AGE	DE	ME	DI	Eigenvector
Last Education (LED)	1.000	2.068	2.873	2.937	3.026	2.803	2.963	4.327	0.270
GPA (GPA)	0.484	1.000	2.073	2.036	3.153	3.957	2.984	5.152	0.212
Length of Teaching Time (LOT)	0.348	0.482	1.000	1.327	2.034	3.015	3.879	4.216	0.147
Micro Teaching (MTE)	0.340	0.491	0.754	1.000	3.124	2.152	3.042	3.223	0.133
Age (AGE)	0.330	0.317	0.492	0.320	1.000	2.892	2.116	2.172	0.087
Dedactic (DDT)	0.357	0.253	0.332	0.465	0.346	1.000	2.124	2.053	0.064
Methodic (MTD)	0.337	0.335	0.258	0.329	0.473	0.471	1.000	1.421	0.050
Distance (DST)	0.231	0.194	0.237	0.310	0.460	0.487	0.704	1.000	0.038
	λ max = 8.521			Consistency Index (CI) = 0.074					
				Consistency Ratio (CR) = 0.053 (*Acceptable*)					

Paying attention to Table 2, it can be explained that the acquisition of the eigenvector values generated through the iteration process stages up to five iterations, this must be done to obtain optimal eigenvector values, this is done by finding the difference in the last eigenvector value with the previous eigenvector value of zero , this is done on different understandings among experts on the value of the importance of the criteria that are processed so that there are no differences in understanding. It does not end here, but must prove the feasibility of the process by looking for a consistency ratio (CR) value with a proven weight of less than 10%. This proof will be more complete if it is supported with the help of expert choice apps. To find out the inconsistency value of the acquisition of the eigenvector values that occur to test the feasibility of optimal and feasible results, this can be seen in Figure 3 which is accumulated by synthesis as the final result of completion and is supported by data entry criteria whose input values must be the same as those shown in Fig. 2.

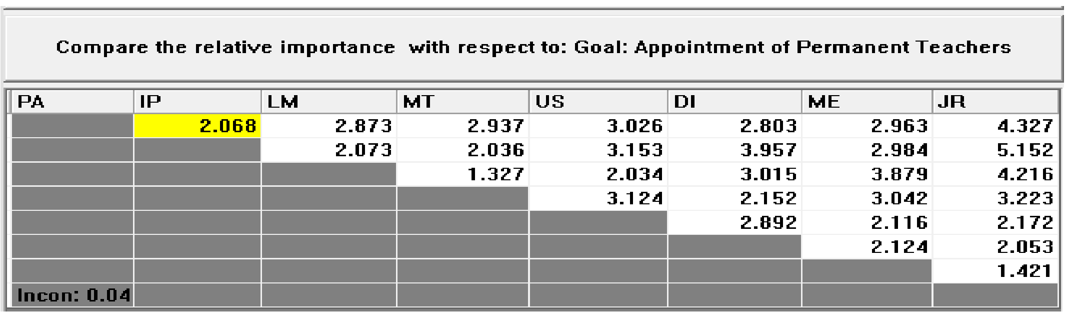

Fig. 2. Pairwise matrices using expert choice apps.

The input display shown in Fig. 2 is of course much different as shown in Table 2 pairwise matrices using mathematic algebra matrices. The real difference in Fig. 2 is that it only displays the matrix elements, only the

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upper triangle. For input pairwise matrices with a mathematical algebra matrices approach, applying the reciprocal concept and data items that become reciprocal must be displayed in all matrices elements in the pairwise matrices criteria. Consistency value by using expert choice apps. Both will be shown in Fig. 2 pairwise matrices and Figure 3 in synthesis with a value of 0.04. this illustrates meeting the feasibility limits that the results of the acquisition of the eigenvector values are acceptable. This means that the eigenvector value can be applied as integrity with the WASPAS method through long stages.

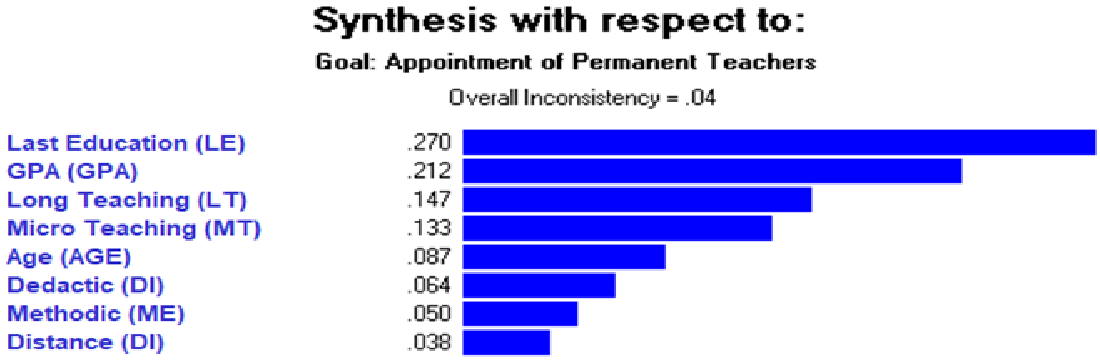

Fig. 3. Synthesis eigenvector using expert choice apps.

Shown in Fig. 3 explains that the acquisition of eigenvector values is the same concept as the mathematical algebra matrices approach, namely carrying out a reduction process of the different views of experts, until an optimum value is obtained for the eigenvector value and is indicated by the acquisition of an overall inconsistency value with a weight of 0.04; means to measure the deviation value found against the understanding of the value assessment of the importance of the criteria. This is a different technique performed with other AHP methods.

In the next stage, it's time to prove the role of the WASPAS method in the selection process for honorary teacher ratings who are deemed worthy of being awarded the award for appointment as permanent teachers. The integration of the two MCDM-AHP and WASPAS methods turned to twelve honorary teacher candidates. As an overview, it is explained from a number of criteria used and the type of each criterion which can be seen in Table 3 which describes in detail the results stages starting from the normalized dataset using the determination of the maximum value and minimum value for each criterion until it is ready to be processed into the WASPAS method and immediately included with the data type and the weight of each criterion obtained through the MCDM-AHP stages until it reaches its optimization.

Table 3. Dataset Normalization

Criteria	C1	C2	C3	C4	C5	C6	C7	C8
EV	0.270	0.212	0.147	0.133	0.087	0.064	0.050	0.038
Alt.\Type	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(C)
TC01	0.714	0.955	0.564	0.987	0.879	0.842	1.000	0.600
TC02	1.000	0.832	0.200	0.856	0.818	0.895	0.947	1.000
TC03	1.000	0.843	0.291	0.898	0.848	0.821	0.905	0.840
TC04	0.714	0.981	1.000	0.956	1.000	0.905	0.916	0.500
TC05	0.714	0.891	0.327	0.922	0.788	0.947	0.895	0.553
TC06	1.000	0.867	0.136	0.823	0.788	0.979	0.842	0.389
TC07	0.714	0.944	0.527	0.928	0.848	1.000	0.874	0.913
TC08	1.000	0.840	0.136	0.853	0.788	0.916	0.968	0.467
TC09	0.714	1.000	0.718	0.966	0.909	0.884	1.000	0.457
TC10	0.714	0.859	0.845	0.973	0.939	0.968	0.905	0.292
TC11	0.714	1.000	0.382	1.000	0.788	0.926	0.968	0.875
TC12	1.000	0.851	0.145	0.824	0.848	0.895	0.979	0.568

In Table 3, of course, the algorithm stage has been carried out which includes the process of calculating the criteria for the type of benefit and cost. At this stage it must be done carefully, so as not to get stuck in giving an assessment of each criterion used because the type of criteria determines the support for decision making. The WASPAS method is a combination of two methods, namely the WSM and WPM methods, each of which is given a weight of fifty percent of the merging process which will be applied to the WASPAS method.

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The calculation of the sum of each criterion with the eigenvecto value is the first stage of the WASPAS method, the acquisition of these results provides strong support from several processes to determine the basis of the WSM. Look at Table 4 which explains the concept of the weight sum model method.

Table 4. The results of the WSM acquisition calculation process

Criteria	C1	C2	C3	C4	C5	C6	C7	C8
EV	0.270	0.212	0.147	0.133	0.087	0.064	0.050	0.038
Alt.\Type	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(C)
TC01	0.193	0.202	0.083	0.131	0.076	0.054	0.050	0.023
TC02	0.270	0.176	0.029	0.114	0.071	0.057	0.047	0.038
TC03	0.270	0.179	0.043	0.119	0.074	0.053	0.045	0.032
TC04	0.193	0.208	0.147	0.127	0.087	0.058	0.046	0.019
TC05	0.193	0.189	0.048	0.123	0.069	0.061	0.045	0.021
TC06	0.270	0.184	0.020	0.109	0.069	0.063	0.042	0.015
TC07	0.193	0.200	0.078	0.123	0.074	0.064	0.044	0.035
TC08	0.270	0.178	0.020	0.113	0.069	0.059	0.048	0.018
TC09	0.193	0.212	0.106	0.129	0.079	0.057	0.050	0.017
TC10	0.193	0.182	0.124	0.129	0.082	0.062	0.045	0.011
TC11	0.193	0.212	0.056	0.133	0.069	0.059	0.048	0.033
TC12	0.270	0.180	0.021	0.110	0.074	0.057	0.049	0.022

Taking into account the results obtained from Table 4, it proves that decision-making support is still partial, because it has not fulfilled the final stages of the WASPAS method. The continuation of this process is expected to know the calculation process carried out in the second stage of the WASPA method, namely some of the processes obtained from the weight product model method. The WPM stages will be a complement to the combined WASPAS method with process calculations, which can be seen in Table 5.

Table 5. The results of the WPM acquisition calculation process

Criteria	C1	C2	C3	C4	C5	C6	C7	C8
EV	0.270	0.212	0.147	0.133	0.087	0.064	0.050	0.038
Alt.\Type	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(C)
TC01	0.913	0.990	0.919	0.998	0.989	0.989	1.000	0.981
TC02	1.000	0.962	0.789	0.980	0.983	0.993	0.997	1.000
TC03	1.000	0.964	0.834	0.986	0.986	0.987	0.995	0.993
TC04	0.913	0.996	1.000	0.994	1.000	0.994	0.996	0.974
TC05	0.913	0.976	0.849	0.989	0.979	0.997	0.994	0.978
TC06	1.000	0.970	0.746	0.974	0.979	0.999	0.991	0.965
TC07	0.913	0.988	0.910	0.990	0.986	1.000	0.993	0.997
TC08	1.000	0.964	0.746	0.979	0.979	0.994	0.998	0.971
TC09	0.913	1.000	0.953	0.995	0.992	0.992	1.000	0.971
TC10	0.913	0.968	0.976	0.996	0.995	0.998	0.995	0.954
TC11	0.913	1.000	0.868	1.000	0.979	0.995	0.998	0.995
TC12	1.000	0.966	0.753	0.975	0.986	0.993	0.999	0.979

It can be noted that the results in Table 5 which explains the second stage of the complementary WASPAS method, has become a bright spot for determining a rating system that will find decision-making support with one next step is to carry out a combined calculation with each giving a weight of fifty percent of the combination of the two WASPAS method. In accordance with the determination stated in equation 9 which describes the gain Q_i in the quantification measure of the rating system using the WASPAS method. Look at Table 5 which describes the ranking system with the highest index as the winner as a result of the selection for the appointment of honorary teachers to become permanent teachers.

Table 5. Quantification of Selection of Appointment of Permanent Teachers

No.	Candidate	Qi	Ranking
1	TC04	0.878	1
2	TC09	0.834	2
3	TC10	0.819	3
4	TC01	0.804	4
5	TC07	0.802	5
6	TC03	0.789	6
7	TC11	0.785	7
8	TC02	0.763	8
9	TC12	0.731	9

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10	TC05	0.729	10
11	TC08	0.720	11
12	TC06	0.716	12

Look at Table 5 which is the final result of the selection process of the twelve optimal decision support alternatives with the highest weight TC04 with a magnitude of 0.878 and followed in the second and third positions following TC09 and TC 10 with a weight gain of 0.834 and 0.819 respectively. The difference in the difference in the value of this very thin weight, is of particular concern to the accuracy of the resulting calculation process.

DISCUSSIONS

The integration of the MDCDM-AHP and WASPAS methods implemented in the selection of honorary teacher appointments to become teachers remains a special concern for the processing of the weight calculation which is very thin, the difference between each honorary teacher as an alternative pays close attention to the level of accuracy and avoids the error factor in the final weight assessment of twelve alternatives. Selection of criteria must be carried out consistently and objectively and obtained based on research results and not determined based on user wishes. This can be done by using the MCDM-AHP method as the best choice, because the stages of the process must be proven empirically by testing the feasibility value using the mathematical algebra matrix approach with five iteration stages of matrices multiplication, to prove the acquisition of eigenvector values by taking into account temporary decisions the value of the consistency ratio must be reasonable with a value of less than ten percent and the acquisition value of the overall synthesis results. The second test was carried out using the expert choice apps approach; which proves that the acquisition of eigenvector values has identical results with the mathematical algebra matrices approach, this is very difficult to do because to get identical results there are many considerations of high accuracy, because eigenvector values will be applied as an assessment with integrated methods to provide optimal results. The WASPAS method is also the final determinant of decision-making support, this method is also a derivative of the two methods contained therein, namely the WSM and WPM methods. The WASPAS method is used to determine the rating system for the selected alternative, it turns out that the WASPAS method is able to provide decisions that have very sharp accuracy in ranking data processing. The difference in the results found is very slight, so high accuracy is needed in making ranking decisions for eight alternatives.

CONCLUSION

The optimization process carried out to obtain the best value uses two stages, the first is optimization in determining the weighting technique for obtaining the eigenvector criteria, the second is normalizing the dataset through obtaining alternative optimal values. The results of the integrated selection are determined based on the largest to the smallest weight, the first rank is given to TC04 with a weight value of 0.878. This proves that the selection system for the appointment of honorary teachers to permanent teachers has proven to be integrated in providing optimum results for decision-making.

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REFERENCES

A. Baky, I., & Abo-Sinna, M. A. (2013). TOPSIS for bi-level MODM problems. *Applied Mathematical Modelling*, *37*(3), 1004–1015. https://doi.org/10.1016/j.apm.2012.03.002

Abdrabo, K. I., Kantoush, S. A., Esmaiel, A., Saber, M., Sumi, T., Almamari, M., Elboshy, B., & Ghoniem, S. (2023). An integrated indicator-based approach for constructing an urban flood vulnerability index as an urban decision-making tool using the PCA and AHP techniques: A case study of Alexandria, Egypt. *Urban Climate*, *48*(August 2022), 101426. https://doi.org/10.1016/j.uclim.2023.101426

Abdullahi, A., Jothimani, M., Getahun, E., Gunalan, J., & Abebe, A. (2023). Assessment of potential groundwater Zones in the drought-prone Harawa catchment, Somali region, eastern Ethiopia using geospatial and AHP techniques. *Egyptian Journal of Remote Sensing and Space Science*, *26*(3), 628–641. https://doi.org/10.1016/j.ejrs.2023.07.005

Ahmad, I., Kim, S. K., Lee, J., & Rho, J. J. (2020). Analytic hierarchy process model for the selection of optimal internet access technologies in rural Pakistan. *International Journal of the Analytic Hierarchy Process*, *12*(2), 254–271. https://doi.org/10.13033/ijahp.v12i2.712

Badulescu, Y., Tiwari, M. K., & Cheikhrouhou, N. (2022). MCDM approach to select IoT devices for the reverse logistics process in the Clinical Trials supply chain. *IFAC-PapersOnLine*, *55*(10), 43–48.

*name of corresponding author

https://doi.org/10.1016/j.ifacol.2022.09.365

Benítez, J., Delgado-Galván, X., Gutiérrez, J. A., & Izquierdo, J. (2011). Balancing consistency and expert judgment in AHP. *Mathematical and Computer Modelling*, *54*(7–8), 1785–1790. https://doi.org/10.1016/j.mcm.2010.12.023

Benítez, Julio, Delgado-Galván, X., Izquierdo, J., & Pérez-García, R. (2011). Achieving matrix consistency in AHP through linearization. *Applied Mathematical Modelling*, *35*(9), 4449–4457. https://doi.org/10.1016/j.apm.2011.03.013

Debnath, B., Bari, A. B. M. M., Haq, M. M., de Jesus Pacheco, D. A., & Khan, M. A. (2023). An integrated stepwise weight assessment ratio analysis and weighted aggregated sum product assessment framework for sustainable supplier selection in the healthcare supply chains. *Supply Chain Analytics*, *1*(December 2022), 100001. https://doi.org/10.1016/j.sca.2022.100001

Deretarla, Ö., Erdebilli, B., & Gündoğan, M. (2023). An integrated Analytic Hierarchy Process and Complex Proportional Assessment for vendor selection in supply chain management. *Decision Analytics Journal*, *6*(August 2022), 100155. https://doi.org/10.1016/j.dajour.2022.100155

Eskelson, T. C. (2020). How and Why Formal Education Originated in the Emergence of Civilization. *Journal of Education and Learning*, *9*(2), 29. https://doi.org/10.5539/jel.v9n2p29

Fan, S., Shi, W., Wang, N., & Liu, Y. (2011). MODM-based evaluation model of service quality in the Internet of Things. *Procedia Environmental Sciences*, *11*(PART A), 63–69. https://doi.org/10.1016/j.proenv.2011.12.011

Franek, J., & Kresta, A. (2014). Judgment Scales and Consistency Measure in AHP. *Procedia Economics and Finance*, *12*(March), 164–173. https://doi.org/10.1016/s2212-5671(14)00332-3

Garai, T., & Garg, H. (2023). An interpreter ranking index-based MCDM technique for COVID-19 treatments under a bipolar fuzzy environment. *Results in Control and Optimization*, *12*(June), 100242. https://doi.org/10.1016/j.rico.2023.100242

Hanaysha, J. R., Shriedeh, F. B., & In'airat, M. (2023). Impact of classroom environment, teacher competency, information and communication technology resources, and university facilities on student engagement and academic performance. *International Journal of Information Management Data Insights*, *3*(2), 100188. https://doi.org/10.1016/j.jjimei.2023.100188

Hema Surya, S., Nirmala, T., & Ganesan, K. (2023). Interval linear algebra – A new perspective. *Journal of King Saud University - Science*, *35*(2), 102502. https://doi.org/10.1016/j.jksus.2022.102502

Jamal, M. K., & Muqeem, M. (2023). An MCDM optimization based dynamic workflow scheduling used to handle priority tasks for fault tolerance in IIOT. *Measurement: Sensors*, *27*(January), 100742. https://doi.org/10.1016/j.measen.2023.100742

Kozlov, V., & Sałabun, W. (2021). Challenges in reliable solar panel selection using MCDA methods. *Procedia Computer Science*, *192*, 4913–4923. https://doi.org/10.1016/j.procs.2021.09.269

Kumar, A., & Pant, S. (2023). Analytical hierarchy process for sustainable agriculture: An overview. *MethodsX*, *10*(October 2022), 101954. https://doi.org/10.1016/j.mex.2022.101954

Mamat, N. J. Z., & Daniel, J. K. (2007). Statistical analyses on time complexity and rank consistency between singular value decomposition and the duality approach in AHP: A case study of faculty member selection. *Mathematical and Computer Modelling*, *46*(7–8), 1099–1106. https://doi.org/10.1016/j.mcm.2007.03.025

Masoomi, B., Sahebi, I. G., Fathi, M., Yıldırım, F., & Ghorbani, S. (2022a). Strategic supplier selection for renewable energy supply chain under green capabilities (fuzzy BWM-WASPAS-COPRAS approach). *Energy Strategy Reviews*, *40*(January), 100815. https://doi.org/10.1016/j.esr.2022.100815

Masoomi, B., Sahebi, I. G., Fathi, M., Yıldırım, F., & Ghorbani, S. (2022b). Strategic supplier selection for renewable energy supply chain under green capabilities (fuzzy BWM-WASPAS-COPRAS approach). *Energy Strategy Reviews*, *40*(January). https://doi.org/10.1016/j.esr.2022.100815

Perec, A., & Radomska-Zalas, A. (2022). WASPAS Optimization in Advanced Manufacturing. *Procedia Computer Science*, *207*, 1193–1200. https://doi.org/10.1016/j.procs.2022.09.175

Radomska-Zalas, A. (2022). The AHP method in the optimization of the epoxidation of allylic alcohols. *Procedia Computer Science*, *207*, 456–464. https://doi.org/10.1016/j.procs.2022.09.100

Sarkodie, W. O., Ofosu, E. A., & Ampimah, B. C. (2022). Decision optimization techniques for evaluating renewable energy resources for power generation in Ghana: MCDM approach. *Energy Reports*, *8*, 13504–13513. https://doi.org/10.1016/j.egyr.2022.10.120

Shabani, A., Shabani, A., Ahmadinejad, B., & Salmasnia, A. (2022). Measuring the customer satisfaction of public transportation in Tehran during the COVID-19 pandemic using MCDM techniques. *Case Studies on Transport Policy*, *10*(3), 1520–1530. https://doi.org/10.1016/j.cstp.2022.05.009

Sotoudeh-Anvari, A. (2022). The applications of MCDM methods in COVID-19 pandemic: A state of the art review. *Applied Soft Computing*, *126*, 109238. https://doi.org/10.1016/j.asoc.2022.109238

Storme, T., Benoit, S., Van de Weghe, N., Mertens, L., Van Dyck, D., Brondeel, R., Witlox, F., Zwartjes, L., & Cardon, G. (2022). Citizen science and the potential for mobility policy – Introducing the Bike Barometer.

*name of corresponding author

Case Studies on Transport Policy, *10*(3), 1539–1549. https://doi.org/10.1016/j.cstp.2022.05.013

Swanzy-Impraim, E., Morris, J. E., Lummis, G. W., & Jones, A. (2023). Creativity and initial teacher education: Reflections of secondary visual arts teachers in Ghana. *Social Sciences and Humanities Open*, *7*(1), 100385. https://doi.org/10.1016/j.ssaho.2022.100385

Tadese, B., Wagari, M., & Tamiru, H. (2022). MCA and geospatial analysis-based suitable dumping site selection for urban environmental protection: A case study of Shambu, Oromia Regional State, Ethiopia. *Heliyon*, *8*(7), e09858. https://doi.org/10.1016/j.heliyon.2022.e09858

Ul Islam, S. M., Khan, S., Ahmad, H., Ur Rahman, M. A., Tomar, S., & Khan, M. Z. (2022). Assessment of challenges and problems in supply chain among retailers during COVID-19 epidemic through AHP-TOPSIS hybrid MCDM technique. *Internet of Things and Cyber-Physical Systems*, *2*(October), 180–193. https://doi.org/10.1016/j.iotcps.2022.10.001

Wątróbski, J., Bączkiewicz, A., & Sałabun, W. (2022). Version [1.1]–[pyrepo-mcda — Reference Objects based MCDA Software Package]. *SoftwareX*, *19*, 101197. https://doi.org/10.1016/j.softx.2022.101197

Yunus, R. M., Samadi, Z., Yusop, N. M., & Omar, D. (2013). Expert Choice for Ranking Heritage Streets. *Procedia - Social and Behavioral Sciences*, *101*, 465–475. https://doi.org/10.1016/j.sbspro.2013.07.220

*name of corresponding author