Bulletin of Informatics and Data Science
Vol. 2 No. 1, May 2023
ISSN 2580-8389 (Media Online)
Page 37−41
https://ejurnal.pdsi.or.id/index.php/bids/index

Implementation of Weighted Product Method for Selection of Math Olympiad Participant

Siti Khairunnisa[1,*], Vriska Amanda[1], Rohan Kristini Purba[2], Mesran[2]

[1] Information Systems Study Program, Budi Darma University, Medan, Indonesia
[2] Informatics Technique Study Program, Budi Darma University, Medan, Indonesia
Email: [1,*]sitikhairunnisa835@gmail.com, [2]vriskaa0@gmail.com, [3]rohankristinip@gmail.com, [4]mesran.skom.mkom@gmail.com
Coressponding Author: sitikhairunnisa835@gmail.com

Abstract−So far, the selection of participants for the Mathematics Olympiad still has a number of problems, including a teacher or principal choosing a subject based on eye grades, even though the Science Competition questions that are asked in cities, districts and within the country require other aspects, such as intelligence and experience in Mathematics Competitions. . In addition to the above, sometimes the teacher does not pay attention to all of the above aspects when selecting students, which makes the end result not optimal. In overcoming these problems a system was formed that supports results in the selection of people who will take part in math competitions. In this research, the authors use the Weighted Product method with the results of the research obtained is alternative A5 with a value of 0.2391 as the best alternative.

Keywords: Olympiad; Mathematics; DSS; Weighted Product

1. INTRODUCTION

Mathematics Olympiad is a very famous educational competition today. This competition offers students the opportunity to compete and improve their math skills. This competition with a large collection of prizes attracted the attention of the public and institutions to participate. Mathematics is an important subject in education. Mathematics plays a role in the development of the era and makes it more valuable in the minds of scientists. Mathematicians who have so far successfully researched and found the formulas used in this era, as well as public attention to the importance of mathematics. Mathematics education is the center of attention for students, teachers and even parents of students who often use mathematics as a measure of their children's educational success. Mathematics is very important for teachers to teach students the basic concepts of mathematics so that students are prepared when the next talent in the field is needed mathematics.

With years of experience in selecting students, there are several problems including a teacher or principal having a decision that only students have teaching achievements, even though the questions tested at the city, provincial and national levels will require other aspects, such as intelligence or experience participating in math competitions. before [3]. In addition to the problems above, sometimes teachers do not consider all of the factors above when selecting students so that the results are less than optimal. Based on the problems described above, it is necessary to develop a decision support system to help decision makers collect information.

A decision support system is an example of implementing a system that aims to be a management tool for making decisions. It is programmed to produce various alternatives that are offered to decision making in carrying out tasks [1], [2]. The decision support system unites computer expertise in serving its users with processing or manipulation processes that use models or rules that can produce alternatives according to the situation. The problem of making a decision initially belongs to choosing from various decisions that undergo a certain process, the hope is to make a good decision. Likewise, when looking for students who will participate in math competitions at the city level, it needs to be analyzed properly so that students can match together with the ability of these students to compete with others. In decision making there are several types of methods including Elimination Et Choix Traduisant La Reealite (ELECTRE)[3], Weighted Product (WP), Simple Additive Weighting (SAW), WASPAS [4], MOORA, TOPSIS and others [5]. Therefore, in selecting which Contest participants can be accepted into the Contest, an orderly process is needed that can be considered, by carrying out screening. The method used is by selecting in this research the participants in the mathematics contest using the Weighted Product method. This method evaluates several alternatives for a set of attributes/criteria, each attribute is independent of one another.

In making this article the author uses several previous studies which are used as benchmarks or references. Research conducted by Anita Dewi Susanti, et al in (2017) discussed the Ranking of Prospective New Students by Invitation Path, the WP method was used to overcome problems, for example in making decisions and developing alternatives. In previous research [6], Triana Elizabeth andTinaliah (2020), in the Decision to Select Lecturer Assistants, the WP method was used to get priority for the choice of appropriate attributes by using weights [7].

In previous research, Muqorobin, Aflahah Apriliyani, Kusrini (2019), in Scholarship Acceptance, the WP method is used in making decisions because there is a ranking process that will select the best alternative from a number of alternatives [8]. Many schools make competitions a mandatory program for students or extracurriculars. This shows that the Mathematics Competition is one of the things that this school is proud of. Around the world, mathematics competitions are no longer aimed at gifted children, but aim to provide experience and stimulate students' interest in learning mathematics outside the classroom,

Copyright © 2023 **Siti Khairunnisa**, Page 37
This Journal is licensed under a Creative Commons Attribution 4.0 International License

broaden their horizons by interacting in a more diverse environment and develop their potential In addition, the math competition always presents non-routine math questions that encourage students to improve their math skills in a wider field.

Based on the background of the problems that have been discussed, the researcher is interested in conducting research using the Weighted Product method which is able to select the prospective participants in the mathematics competition to be selected. This study was designed to determine the acceptance of prospective contestants by selecting various criteria and predetermined weights. The WP method is expected to provide good results in helping to select criteria effectively and efficiently. In this study, weights were generated using the ROC method.

2. RESEARCH METHODOLOGY

2.1 Research Stages

The research stages are steps to solve a problem, starting directly with the data collection that will be carried out. In order for the steps taken to produce the best results, below is a picture of the research stages used.

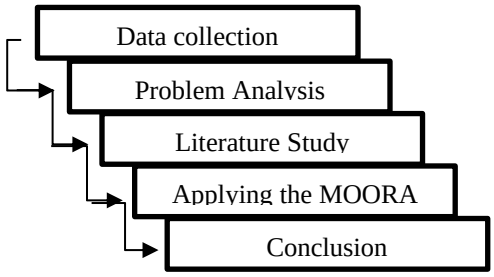

Figure 1. Research Stages

The steps to be carried out in the research are given in figure 1:
1) Data collection from the company under investigation.
2) Problem Analysis. In analyzing the problem the author looks for what problems arise, the causes of the problems, and what methods can be done.
3) Literature Study. In solving problems by tracing sources of writing that have been made before.
4) Applying the Multi-Objective Optimization on the Basis of Ratio Analysis (MOORA) method.
5) Conclusion. The author drawconclusions from all the results of the stages that have been made by the author.

2.2 Decision Support System

A decision support system is a system capable of providing solutions in semi-structured and unstructured conditions. It should be noted that the SPK is a supporting tool, not a decision-making tool. The purpose of SPK is to provide information, create value, and direct information users to make good decisions[9]–[13].

2.3 Weighted Product Method

The Weighted Product method is a method for completing Multi Attribute Decision Making (MADM). The WP method uses multiplication techniques to connect rating attributes, where the rating of each attribute must be raised to the first power of the attribute weight in question. This method evaluates several alternatives to a set of attributes or criteria, where each attribute is independent of one another[14]–[18].

Completion Steps:

1. Create a Decision Matrix

$$X_{ij} = \begin{bmatrix} X_{11} & X_{12} & \cdot & X_{1n} \\ X_{21} & X_{22} & \cdot & X_{2n} \\ \cdot & \cdot & \cdot & \cdot \\ X_{m1} & X_{m2} & \cdot & X_{mn} \end{bmatrix} \quad (1)$$

Keterangan:

2. count Vektor (S_i)

$$S_i = \prod_{j=1}^{n} X_{ij}^{W_j} \quad (2)$$

3. count Preference (V_i)

Copyright © 2023 **Siti Khairunnisa**, Page 38
This Journal is licensed under a Creative Commons Attribution 4.0 International License

$$V_i = \frac{\prod_{j=1}^{n} x_{ij}^{w_j}}{\prod_{j=1}^{n} (x_{ij^*})^{w_j}} \quad (3)$$

3. RESULTS AND DISCUSSION

To determine participants who will take part in the Mathematics Olympiad, the authors have determined the criteria data, weight results and alternatives used by the committee to determine participants who will take part in the Mathematics competition. The participant is he who is declared worthy and meets the eligibility requirements to take part in the mathematics competition. In the selection of participants for the Mathematics competition, there are 5 criteria and have types of benefits. The table 1 of criteria used as a reference for selecting participants in the Mathematics competition is as follows:

Table 1. Criteria and Weight

Criterion	Description	Weight	Type of Criteria
C1	Prestation	0.457	Benefit
C2	Grade point average	0.257	Benefit
C3	liveliness	0.157	Benefit
C4	Confidence	0.09	Benefit
C5	Behavior	0.04	Benefit

Because criteria C1, C3, C4 and C5 are linguistic criteria, they must be weighted first. The following describes the weighting (wj) in table 2:

Table 2. Criteria Value Weight

Description	Value
Very Good	4
OK	3
Good Enough	2
Less Good	1
Champion 1	1
Champion 2	2
Champion 3	3
Hope 1	4
Hope 2	5
Hope 3	6

The next stage is to determine the alternatives used in selecting participants for the Mathematics competition obtained through field research. The following table will describe the alternative data:

Table 3. Alternative

Alternative	C1	C2	C3	C4	C5
Deni (A1)	3rd Champion in District Level Football	80	Good	Very good	Not good
Sinta (A2)	Hope 3 Dance Contest	75	Very good	Not good	Very good
Rian (A3)	3rd Place Marathon Competition	85	Not good	Good	Very good
Anisa (A4)	Hope 2 Write a Story	85	Very good	Not good	Pretty good
Budi (A5)	Hope 3 Karate	95	Good	Pretty good	Good

After the alternative data displays alternative data as in table 3, the next step is to display the suitability rating for each alternative in table 4 below.

Table 4. Compatibility Rating of Each Alternative

Alternative	C1	C2	C3	C4	C5
A1	3	80	3	4	1
A2	6	75	4	1	4
A3	3	85	1	3	4
A4	5	85	4	1	2
A5	6	95	3	2	3

Copyright © 2023 **Siti Khairunnisa**, Page 39
This Journal is licensed under a Creative Commons Attribution 4.0 International License

If the data is fulfilled, the next step is to implement the WP method. Prior to that, weighting will be carried out using the ROC method as follows:

$W_1 = \frac{1+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\frac{1}{5}}{5} = 0{,}457$

$W_2 = \frac{0+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\frac{1}{5}}{5} = 0{,}257$

$W_3 = \frac{0+0+\frac{1}{3}+\frac{1}{4}+\frac{1}{5}}{5} = 0{,}157$

$W_4 = \frac{0+0+0+\frac{1}{4}+\frac{1}{5}}{5} = 0{,}090$

$W_5 = \frac{0+0+0+0+\frac{1}{5}}{5} = 0{,}040$

In practice, the ROC method basically has a level of importance or priority of criteria and alternatives to give ideal weight according to ranking. Next is the application of the WP method, the steps are as follows:

a. Create a Decision Matrix

$$X_{ij} = \begin{bmatrix} 3 & 80 & 3 & 4 & 1 \\ 6 & 75 & 4 & 1 & 4 \\ 3 & 85 & 1 & 3 & 4 \\ 5 & 85 & 4 & 1 & 2 \\ 6 & 95 & 3 & 2 & 3 \end{bmatrix}$$

b. count Vektor (S_i)

$S_1 = 3^{0,457} * 80^{0,257} * 3^{0,157} * 4^{0,090} * 1^{0,040}$
$= 1{,}6521 * 3{,}0283 * 1{,}1882 * 1{,}1329 * 1 = 6{,}7346$

$S_2 = 6^{0,457} * 75^{0,257} * 4^{0,157} * 1^{0,090} * 4^{0,040}$
$= 2{,}2676 * 3{,}031 * 1{,}2431 * 1 * 1{,}0570 = 9{,}0229$

$S_3 = 3^{0,457} * 85^{0,257} * 1^{0,157} * 3^{0,090} * 4^{0,040}$
$= 1{,}6521 * 3{,}1322 * 1 * 1{,}1039 * 1{,}0570 = 6{,}6134$

$S_4 = 5^{0,457} * 85^{0,257} * 4^{0,157} * 1^{0,090} * 2^{0,040}$
$= 2{,}0865 * 3{,}1322 * 1{,}2431 * 1 * 1{,}0281 = 8{,}3523$

$S_5 = 6^{0,457} * 95^{0,257} * 3^{0,157} * 2^{0,090} * 3^{0,040}$
$= 2{,}2676 * 3{,}2231 * 1{,}1882 * 1{,}0643 * 1{,}0449 = 9{,}6575$

c. Count the value of Preferensi

$V_1 = \frac{6{,}7346}{6{,}7346+9{,}0229+6{,}6134+8{,}3523+9{,}6575} = \frac{6{,}7346}{40{,}3807} = 0{,}1668$

$V_2 = \frac{9{,}0229}{6{,}7346+9{,}0229+6{,}6134+8{,}3523+9{,}6575} = \frac{9{,}0229}{40{,}3807} = 0{,}2234$

$V_3 = \frac{6{,}6134}{6{,}7346+9{,}0229+6{,}6134+8{,}3523+9{,}6575} = \frac{6{,}6134}{40{,}3807} = 0{,}1637$

$V_4 = \frac{8{,}3523}{6{,}7346+9{,}0229+6{,}6134+8{,}3523+9{,}6575} = \frac{8{,}3523}{40{,}3807} = 0{,}2068$

$V_5 = \frac{9{,}6575}{6{,}7346+9{,}0229+6{,}6134+8{,}3523+9{,}6575} = \frac{9{,}6575}{40{,}3807} = 0{,}2391$

Table 5. Ranking of alternatives

Alternative	Value	Ranking
Deni (A1)	0,1668	4
Sinta (A_2)	0,2234	2
Rian (A_3)	0,1637	5

Copyright © 2023 **Siti Khairunnisa**, Page 40
This Journal is licensed under a Creative Commons Attribution 4.0 International License

Alternative	Value	Ranking
Anisa (A4)	0,2068	3
Budi (A5)	0,2391	1

Based on the results of these calculations, it can be concluded that the Best Preference is V5 with a value of 0.2391

4. CONCLUSION

The conclusion of this study is that the process of selecting participants for the mathematics competition can provide an overview of the decision-making process for prospective participants who will be recruited. The Weighted Product method can be used to select participants for math contests, enabling objective results to be determined in determining math contest participants.

REFERENCES

[1] R. B. I. N. M Mesran, Syefudin, Sarif Surorejo, Muhammad Syahrizal, Aang Alim Murtopo, Zaenul Arif, Nugroho Adhi Santoso, Wresti Andriani, Soeb Aripin, Gunawan, *Pengantar Teknologi Informasi*. CV. Graha Mitra Edukasi, 2023.
[2] E. Turban, J. Aronson, and T. Llang, *Decision Support Systems and Intelligent Systems*. 2003.
[3] Mesran, S. Anita, and R. D. Sianturi, "IMPLEMENTASI METODE ELECTRE DALAM PENENTUAN KARYAWAN BERPRESTASI (STUDI KASUS : PT . MEGARIMAS SENTOSA)," *J. Ris. Sist. Inf. dan Tek. Inform.*, vol. 3, no. 3, pp. 32–45, 2018.
[4] N. K. Daulay, B. Intan, and M. Irvai, "Comparison of the WASPAS and MOORA Methods in Providing Single Tuition Scholarships," *IJICS (International J. Informatics Comput. Sci.*, vol. 5, no. 1, pp. 84–94, 2021.
[5] Mesran, E. P. Sumantri, Supriyanto, S. H. Sahir, and N. K. Daulay, "Implementation of Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) in Recommendations for New Position in Companies," *Int. J. Inf. Syst. Technol.*, vol. 4, no. 2, pp. 661–669, 2021.
[6] A. D. Susanti, M. Muslihudin, and S. Hartati, "Sistem Pendukung Keputusan Perankingan Calon Siswa Baru Jalur Undangan Menggunakan Simple Additive Weighting (Studi Kasus : Smk Bumi Nusantara Wonosobo)," *Semin. Nas. Teknol. Inf. dan Multimed. 2017*, vol. 5, no. 1, pp. 37–42, 2017.
[7] T. Elizabeth, "Sistem Pendukung Keputusan Pemilihan Asisten Dosen Menggunakan Metode SAW," *JATISI (Jurnal Tek. Inform. dan Sist. Informasi)*, vol. 7, no. 1, pp. 71–80, 2020.
[8] M. Muqorobin, A. Apriliyani, and K. Kusrini, "Sistem Pendukung Keputusan Penerimaan Beasiswa dengan Metode SAW," *Respati*, vol. 14, no. 1, pp. 76–85, 2019.
[9] D. Diana and I. Seprina, "Sistem Pendukung Keputusan untuk Menentukan Penerima Bantuan Sosial Menerapkan Weighted Product Method (WPM)," *J. Edukasi dan Penelit. Inform.*, vol. 5, no. 3, p. 370, 2019.
[10] S. N. Amida and T. Kristiana, "Sistem Pendukung Keputusan Penilaian Kinerja Pegawai Dengan Menggunakan Metode Topsis," vol. 2, no. November, pp. 193–201, 2019.
[11] T. Limbong *et al.*, *Sistem Pendukung Keputusan: Metode & Implementasi*. Medan: Yayasan Kita Menulis, 2020.
[12] D. Nofriansyah, *Konsep Data Mining Vs Sistem Pendukung Keputusan*. 2015.
[13] D. Nofriansyah and S. Defit, *Multi Criteria Decision Making (MCDM) pada Sistem Pendukung Keputusan*. 2018.
[14] R. Tari and F. Harefa, "Sistem Pendukung Keputusan Penentuan Dosen Komputer Terbaik dengan Menerapkan Metode Weighted Aggregated Sum Product Assesment (WASPAS)," pp. 558–563, 2019.
[15] V. Amalia, D. Syamsuar, and L. Atika, "Komparasi Metode WP SAW dan WASPAS Dalam Penentuan Penerima Beasiswa Penelusuran Minat dan Kemampuan," *J. Inform.*, vol. 6, no. 1, pp. 114–121, 2019.
[16] M. R. Hamdan, A. Triayudi, and A. Iskandar, "Komparasi Metode Simple Addtive Weighting dan Weight Product Menggunakan Sistem Pendukung Keputusan pada Penerimaan BLT," *JURIKOM (Jurnal Ris. Komputer)*, vol. 9, no. 5, pp. 1543–1550, 2022.
[17] Solikhun, "Perbandingan Metode Weighted Product dan Weighted Sum Model dalam Pemilihan Perguruan Swasta Terbaik Jurusan Komputer," *Klik - Kumpul. J. Ilmu Komput.*, vol. 4, no. 1, p. 70, 2017.
[18] R. Y. Dedek Cahyati Panjaitan, Hengki Juliansa, "Perbandingan Metode Saw Dan Wp Pada Sistem Pendukung Keputusan Dalam Kasus Pemilihan Kegiatan Ekstrakulikuler," *J. Ilm. Bin. STMIK Bina Nusant. Jaya Lubuklinggau*, vol. 3, no. 1, pp. 30–38, 2021.

Copyright © 2023 **Siti Khairunnisa**, Page 41
This Journal is licensed under a Creative Commons Attribution 4.0 International License