Improvement of Experts’ Weights Based on *Tat Twam Asi* in the *TOPSIS* Method as a Supporting Parameter for Optimization of *Blended Learning* Evaluation Results

Dewa Gede Hendra Divayana1,a), P. Wayan Arta Suyasa1 and Agus Adiarta2

1 Department of IT Education, Universitas Pendidikan Ganesha, Singaraja-81116, Indonesia
2 Department of Electrical Education, Universitas Pendidikan Ganesha, Singaraja-81116, Indonesia

a) Corresponding author: hendra.divayana@undiksha.ac.id

**Abstract.** This research aimed to show the calculation process of the improvement of the experts’ weight values based on *Tat Twam Asi* in the *TOPSIS* (*Technique for Order Preference by Similarity to Ideal Solution*) method. The calculation process was conducted to obtain an equalization of experts’ weight values. The equivalent experts’ weight values will support the evaluation results optimization of the blended learning implementation. The approach was used in this research was a quantitative approach by simulating the improvement calculation toward experts’ weight values in the *TOPSIS* method. There were four experts involved in giving weights to each evaluation indicator. Data collection tools of experts’ weight values using questionnaires. The analysis technique of the weighting results was carried out by comparing the fives’ scale effectiveness standards with the total percentage of the expert’s assessment average toward the evaluation indicators. The research results showed that the experts’ weights on each evaluation indicator were categorized as very effective because the effectiveness percentage obtained was 90.65%.

# Keywords: Experts’ Weights, *Tat Twam Asi*, *TOPSIS*, Blended Learning, Evaluation.

# INTRODUCTION

Blended learning is a learning model appropriate to use as an alternative in implementing the learning process during the *Covid-19* pandemic. In general, this learning model combines face-to-face learning in class with online learning using information technology assistance [1-4]. However, during the *Covid-19* pandemic, all blended learning activities were carried out online mechanism. Face-to-face activities in blended learning that should be done face-to-face in class replace by face-to-face online meetings through facilities such as *Zoom*, *Meet Google*, *Webex*, etc. It is done to avoid crowds in the learning process, so that transmission of the *Covid-19* can be minimized.

Generally, blended learning model is suitable for use during the *Covid-19* pandemic, but it is necessary to conduct an in-depth evaluation of its implementation. Optimization of the evaluation results of the blended learning implementation is very dependent on the method used to obtain the measuring results of the blended learning effectiveness. One method that can be used is *TOPSIS* (*Technique for Order Preference by Similarity to Ideal Solution*).

This method is part of a decision support system to function as a method for making decisions in evaluating. Decisions that can be taken by using *TOPSIS*, included: a) determining the dominant aspects that support the quality of computer learning [5], b) determining students’ achievement [6], c) determining the awarding of scholarships [7], etc.

Determination of decisions in evaluating blended learning using the *TOPSIS* method is inseparable from the value parameters of weighting given by experts or decision-makers. The weighted values greatly influence the calculation results in making decisions. The importance of giving weighted values from each expert sometimes creates problems in practice in the fields. Sometimes perceptions in the fields tend to blame and corner the experts if the decision results do not match the expectations of users or interested parties due to errors or injustices in assigning weight values.

The effort needed to overcome that problem was to improve the weight values of experts or decision-makers by prioritizing the concepts of justice and rights equality. One of the innovations that can be done to make rights equality in weighted is optimizing the experts’ weight values by inserting the *Tat Twam Asi* concept in the weights improvement process. Generally, *Tat Twam Asi* is a local wisdom concept in Bali that prioritizes rights equality or obligations and considers all to be equal, so that justice will be created [8-10]. Based on that innovation, so the research question: “How is the calculation process of the improvement in the experts’ weight values based on *Tat Twam Asi* in the *TOPSIS* Method to obtain the optimal weight values?”

Some of the studies that base-lined this research were Başaran and Haruna’s research in 2017, Mohammed et al.’s research in 2018, Turker et al.’s research in 2019, and Alqahtani and Rajkhan’s research in 2020. The research of Başaran and Haruna [11] had also shown the priority weights of experts for each *MLAM* (*Mobile Learning Applications for Mathematics*) evaluation criteria. However, the limitation of Başaran and Haruna’s research was that it had not shown the process for obtaining those priority weight values. Mohammed et al.’s research [12] had shown the weight values assigned to each of the evaluation criteria in the e-learning implementation. However, the limitation of Mohammed et al.’s research was that it had not shown the calculation process of determining the weight values of each decision-maker. Turker et al.’s research [13] had shown the alternative weights assigned by decision-makers for each of the evaluation criteria. However, Turker et al.’s research had not shown the calculation process to determine the equivalent of these alternative weight values. Alqahtani and Rajkhan’s research [14] had shown the priority weight values given by experts to each of the e-learning evaluation criteria during the *Covid-19* pandemic. However, the working method had not been shown to obtain the priority weight values and the equalization of experts’ weight values also had not been shown the fairness in weighting.

# Method

This research used a quantitative approach by simulating experts’ weight improvement in the *TOPSIS* method. The calculation was focused in determining the improvement of the weight values given by the experts or decision-makers by inserting the *Tat Twam Asi* concept. The formula was used in determining the weights improvement for values equalization based on *Tat Twam Asi* refers to the *DIVAYANA* formula. *DIVAYANA* formula can be seen completely in equation (1) [15,16].

 (1)

Notes:

$W\_{Yack}$= Improvement of the weights’ average

$\overbar{x}$ = Weights’ average given by each decision-maker (experts and evaluators) through joint discussion

The numbers of experts involved in giving weights to each evaluation indicator of the blended learning were four experts, included: two evaluation experts and two informatics education experts. Data collection tools related to experts’ weight values using questionnaires consisting of 31 questions.

The analysis technique of the weighting results was carried out by comparing the total percentage of the assessment’s average from experts toward evaluation indicators with the five’s scale effectiveness standards. The formula for the effectiveness of experts’ judgment refers to equation (2) [17-20]. The five’s scale effectiveness standards can be seen in Table 1 [21-24].

 **Effectiveness Percentage = (f×N-1) ×100%** (2)

Where:

f = number of scores was obtained; N = maximum number of scores

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| **TABLE 1.** Effectiveness standards based on five’s scale |
| **Classification of Effectiveness**  | **Range of Percentage** |
| Very Effective | 90 to 100 |
| Effective | 80 to 89 |
| Enough | 65 to 79 |
| Less | 55 to 64 |
| Ineffective | 0 to 54 |

# Results and discussion

The answer scores given by four experts to 31 questions were used to determine the experts’ weight values in the blended learning evaluation process. The score for each expert’s answer can be entirely seen in Table 2.

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| **TABLE 2.** Answers’ score of each expert toward question items |
| **Items** | **Experts** | **Average** |
| **Expert-1** | **Expert-2** | **Expert-3** | **Expert-4** |
| I1 | 5 | 4 | 5 | 5 | 4.75 |
| I2 | 4 | 5 | 5 | 4 | 4.50 |
| I3 | 5 | 4 | 5 | 4 | 4.50 |
| I4 | 4 | 5 | 5 | 5 | 4.75 |
| I5 | 5 | 4 | 4 | 5 | 4.50 |
| I6 | 4 | 5 | 5 | 5 | 4.75 |
| I7 | 5 | 4 | 5 | 4 | 4.50 |
| I8 | 5 | 5 | 4 | 5 | 4.75 |
| I9 | 4 | 4 | 4 | 4 | 4.00 |
| I10 | 4 | 5 | 4 | 5 | 4.50 |
| I11 | 4 | 5 | 5 | 5 | 4.75 |
| I12 | 5 | 5 | 4 | 5 | 4.75 |
| I13 | 4 | 5 | 5 | 5 | 4.75 |
| I14 | 5 | 4 | 5 | 4 | 4.50 |
| I15 | 4 | 4 | 5 | 5 | 4.50 |
| I16 | 5 | 4 | 4 | 4 | 4.25 |
| I17 | 4 | 4 | 5 | 5 | 4.50 |
| I18 | 5 | 4 | 4 | 4 | 4.25 |
| I19 | 5 | 5 | 5 | 5 | 5.00 |
| I20 | 5 | 4 | 4 | 4 | 4.25 |
| I21 | 4 | 5 | 5 | 5 | 4.75 |
| I22 | 5 | 4 | 4 | 5 | 4.50 |
| I23 | 4 | 5 | 5 | 4 | 4.50 |
| I24 | 5 | 4 | 4 | 5 | 4.50 |
| I25 | 4 | 5 | 5 | 4 | 4.50 |
| I26 | 5 | 4 | 4 | 5 | 4.50 |
| I27 | 4 | 5 | 5 | 4 | 4.50 |
| I28 | 4 | 4 | 4 | 5 | 4.25 |
| I29 | 4 | 5 | 5 | 5 | 4.75 |
| I30 | 5 | 4 | 4 | 4 | 4.25 |
| I31 | 4 | 4 | 5 | 5 | 4.50 |
| **Total** | **140.50** |
| **Percentage (%)** | **90.65** |

There were 31 question items were used to obtain the results in Table 2. Those items can be entirely seen in Table 3. The answer score given by the experts refers to a *Likert* scale, which consists of five choices of assessment scores, included: a score of 1 (poor category), a score of 2 (less category), a score of 3 (enough category), a score of 4 (good category), and a score of 5 (excellent category) [25-28].

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| **TABLE 3.** Question items |
| **Items** | **Descriptions** |
| I1 | Regulations from the government regarding the need for a blended learning model during the *Covid-19* pandemic |
| I2 | School regulations that support the blended learning implementation during the *Covid-19* pandemic |
| I3 | The approval of the headmaster regarding the blended learning implementation during the *Covid-19* pandemic |
| I4 | The support of development teams |
| I5 | Teachers’ enthusiasm in implementing the blended learning model during the *Covid-19* pandemic |
| I6 | Students’ enthusiasm in following the learning process based on blended learning during the *Covid-19* pandemic |
| I7 | The support of the supervisory board or school committee in implementing blended learning during the *Covid-19* pandemic |
| I8 | The support of students’ parents for the blended learning implementation during the *Covid-19* pandemic |
| I9 | The suitability of academic and scientific qualifications owned by the blended learning management teams during the *Covid-19* pandemic |
| I10 | The competency of the management teams in realizing blended learning during the *Covid-19* pandemic |
| I11 | The availability of hardware with sufficient specifications to realize blended learning in the *Covid-19* pandemic |
| I12 | The availability of software or platforms to support the needs in implementing blended learning during the *Covid-19* pandemic |
| I13 | The availability of adequate internet access in the blended learning implementation during the *Covid-19* pandemic |
| I14 | The availability of physical infrastructure to support blended learning which suitable for use |
| I15 | The teacher’s ability to operate computers and the internet was needed to support the smooth blended learning implementation |
| I16 | The teacher’s ability to prepare digital teaching materials for supporting the smooth blended learning implementation during the *Covid-19* pandemic |
| I17 | The students’ expertise in operating computers and the internet was needed to support the smooth blended learning implementation |
| I18 | The existence of outreach for teachers about the procedures for making digital teaching materials needed in the blended learning implementation during the *Covid-19* pandemic |
| I19 | The socialization of the use of blended learning for teachers and students |
| I20 | The timing of blended learning implementation according to the time agreed upon by the students and teachers |
| I21 | The quality of the material transferred by the teacher through blended learning was able to be readily accepted and understood by students |
| I22 | The condition of virtual classrooms used to support the blended learning implementation during the *Covid-19* pandemic. |
| I23 | The condition of digital teaching materials used in the blended learning-based learning process during the *Covid-19* pandemic |
| I24 | The speed in accessing the platform used to support the implementation of blended learning during the *Covid-19* pandemic |
| I25 | The users’ ease to operate the platforms for supporting blended learning during the *Covid-19* pandemic |
| I26 | The platform’s speed in responding to the data manipulation process (input, edit, and delete) of digital teaching materials used in the blended learning implementation. |
| I27 | The speed of response given by the teacher when discussing with students through the supporting platform for the blended learning implementation |
| I28 | The safety guarantee of the test questions entered by the teacher into the blended learning platform |
| I29 | The safety guarantee of each assignment that was deposited by students through the blended learning platform  |
| I30 | The availability of facilities in the blended learning platform to input suggestions/complaints from students regarding the blended learning implementation |
| I31 | The availability of facilities in the blended learning platform to input feedback provided by the teacher to respond to students’ suggestions |

Based on the data in Table 2 and referring to equation (1), it was possible to calculate the weights’ improvement in obtaining the equalization weight values based on *Tat Twam Asi*. The calculation process ultimately can be seen as follows.

(WYack)1 = 4.75/(4.75 + 4.50 + 4.50 + 4.75 + 4.50 + 4.75 + 4.50 + 4.75 + 4.00 + 4.50 + 4.75 + 4.75 + 4.75 + 4.50 + 4.50 + 4.25 + 4.50 + 4.25 + 5.00 + 4.25 + 4.75 + 4.50 + 4.50 + 4.50 + 4.50 + 4.50 + 4.50 + 4.25 + 4.75 + 4.25 + 4.50) = 0.034

(WYack)2 = 4.50/(4.75 + 4.50 + 4.50 + 4.75 + 4.50 + 4.75 + 4.50 + 4.75 + 4.00 + 4.50 + 4.75 + 4.75 + 4.75 + 4.50 + 4.50 + 4.25 + 4.50 + 4.25 + 5.00 + 4.25 + 4.75 + 4.50 + 4.50 + 4.50 + 4.50 + 4.50 + 4.50 + 4.25 + 4.75 + 4.25 + 4.50) = 0.032

Similarly, the calculations continue until (WYack)31

(WYack)31 = 4.50/(4.75 + 4.50 + 4.50 + 4.75 + 4.50 + 4.75 + 4.50 + 4.75 + 4.00 + 4.50 + 4.75 + 4.75 + 4.75 + 4.50 + 4.50 + 4.25 + 4.50 + 4.25 + 5.00 + 4.25 + 4.75 + 4.50 + 4.50 + 4.50 + 4.50 + 4.50 + 4.50 + 4.25 + 4.75 + 4.25 + 4.50) = 0.032

Those results of the weights improvement were recapitulated into the equalization of experts’ weights based on *Tat Twam Asi*. The complete recapitulation results can be seen in Table 4.

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| **TABLE 4.** Recapitulation of experts’ weight values equation based on *Tat Twam Asi* |
| **Items** | **Equalization of Experts’ Weight Values Based on *Tat Twam Asi*** |  | **Items** | **Equalization of Experts’ Weight Values Based on *Tat Twam Asi*** |
| I1 | 0.034 |  | I17 | 0.032 |
| I2 | 0.032 |  | I18 | 0.030 |
| I3 | 0.032 |  | I19 | 0.036 |
| I4 | 0.034 |  | I20 | 0.030 |
| I5 | 0.032 |  | I21 | 0.034 |
| I6 | 0.034 |  | I22 | 0.032 |
| I7 | 0.032 |  | I23 | 0.032 |
| I8 | 0.034 |  | I24 | 0.032 |
| I9 | 0.028 |  | I25 | 0.032 |
| I10 | 0.032 |  | I26 | 0.032 |
| I11 | 0.034 |  | I27 | 0.032 |
| I12 | 0.034 |  | I28 | 0.030 |
| I13 | 0.034 |  | I29 | 0.034 |
| I14 | 0.032 |  | I30 | 0.030 |
| I15 | 0.032 |  | I31 | 0.032 |
| I16 | 0.030 |  | Σ | **1.000** |

Table 4 shows the equalization of experts’ weight values. The values’ equalization was carried out by prioritizing the *Tat Twam Asi* concept so that the weighted values given to each question item had the same meaning of fairness from its functionality to support the evaluation results optimization of blended learning. This indicates that all the weighted scores on each question item had the same contribution to realizing the total score.

Başaran and Haruna’s research [11] showed the integration of the *Fuzzy Analytic Hierarchy Process* (*FAHP*) method with *TOPSIS* in evaluating the application of mobile technology-based mathematics learning. Başaran and Haruna’s research showed the weighting of the criteria and ranking of each alternative. The *FAHP* method is used to determine the weights of the criteria, while the *TOPSIS* method is used for the ranking process. Bekesiene et al.’s research [29] also has the same characteristics as Başaran and Haruna’s research. The similarity is the use of the *FAHP* and *TOPSIS* in the assessment and evaluation process. Wang’s research [30] demonstrated the use of the *TOPSIS* method in evaluating teaching effects. The determination of the weights of each evaluation criteria is determined by the experts according to their respective perceptions. The difference among those some research with this research is seen in the process of determining the criteria weights. The determination of the criteria weights in this research was carried out by experts through prioritizing the concept of equalization of experts’ weight values. But, Basaran and Haruna’s research, Bekesiene’s research, and Wang’s research are not a concern to the concept of equalization in determining the weighting of the criteria.

This research had been able to answer the limitations of Turker et al.’s research [13] and also Alqahtani and Rajkhan’s research [14] by showing the calculation process to determine the equalization of the weight values given by experts to each evaluation indicator toward the blended learning implementation. This research had also been able to answer the limitations of Nanayakkara et al.’s research [31], Akram et al.’s research [32], and Durmuşoğlu and Durmuşoğlu’s research [33], by showing the calculation process of the improvement of the experts’ weight in the *TOPSIS* method to produce an equivalent and normalized weight values.

Even though it had been able to answer the limitations of several previous studies, there were obstacles in this research. The obstacles to this research are that the experts’ weight values have not been shown the most dominant value as a determinant of the optimally of blended learning implementation.

# Conclusions

In general, the results of this research have been able to show well the process of calculating the improvement of the experts’ weight values based on *Tat Twam Asi* in the *TOPSIS* method to obtain an equalization of experts’ weight values. This equalization of experts’ weight values can support the optimization of the evaluation results of the blended learning implementation. The research results also showed the effectiveness of giving weights by experts to each evaluation indicator. Future work that can be done to overcome the obstacles in this research is to integrate the *TOPSIS* method with other artificial intelligence methods to make improvements in determining experts’ weighting.

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