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Design of *Formative-Summative* Evaluation Model Based on *Tri Pramana-Weighted Product*

I Putu Wisna Ariawan [1*], Wayan Sugandini [2], I Made Ardana [1], I Made Suwastika Dharma Arta [3], Dewa Gede Hendra Divayana [4]

[1] *Department of Mathematics Education, Universitas Pendidikan Ganesha, Jl. Udayana No. 11 Singaraja, Bali, 81116, Indonesia.*

[2] *Department of Health Science,Universitas Pendidikan Ganesha, Jl. Udayana No. 11 Singaraja, Bali, 81116, Indonesia.*

[3] *Department of Health Science, STIKES Buleleng, Jl. Raya Air Sanih Km. 11 Bungkulan, Singaraja, Bali, 81171, Indonesia.*

[4] *Department of IT Education, Universitas Pendidikan Ganesha, Jl. Udayana No. 11 Singaraja, Bali, 81116, Indonesia.*

Abstract

Quality in the implementation of e-learning in health universities can be measured both during the learning process and after the learning ends. Measurement can be performed through evaluation activities. The evaluation model needed was an innovative evaluation model that can look for the dominant aspects that determined the quality of e-learning implementation. One breakthrough evaluation model produced in this research to answer this need was the *Formative-Summative* evaluation model based on the *Tri Pramana-Weighted Product*. The main objective of this research was to show the quality of the *Formative-Summative* evaluation model design based on the *Tri Pramana-Weighted Product*. This research approach was based on the Borg & Gall development model, which focused on the design development stage. The subjects involved in conducting trials of the evaluation model design were 34 respondents. The technique for determining the subject was carried out using a purposive sampling technique. In addition, the tool used to conduct the trial was a questionnaire. The location for filling out the questionnaire was in health universities and colleges in the province of Bali. The technique used to analyze the data from the test results was descriptive quantitative by comparing the average percentage of the quality of the test results with the percentage of quality that refers to the five-scale categorization. The results showed that the percentage of the design quality of the *Formative-Summative* evaluation model based on the *Tri Pramana-Weighted Product* of 88.02%. This means that the quality of the evaluation model design was included in the good category. The impact of the results of this research on the field of education was to present an innovation in evaluation activities that made it easier for educational evaluators to measure the quality of e-learning, especially in health universities and colleges.

Keywords:
Formative-Summative;
Evaluation Model;
Tri Pramana;
Weighted Product;
Educational Technology;
E-Learning.

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1- Introduction

E-learning is very important and needed in supporting the learning process in universities as a manifestation of the 'Independence of Learning' policy issued by the Indonesian Ministry of Education, Culture, Research, and Technology, both during the outbreak of the *Covid-19* pandemic and after the *Covid-19* pandemic. This also happens in universities in the health sector (especially in Bali). Based on the need and importance of the role of e-learning in the learning process in health universities and colleges, the quality of the use of e-learning needs to be maintained. The implementation quality of e-learning can be seen from the effectiveness of the evaluation results obtained during the learning process

* **CONTACT**: wisna.ariawan@undiksha.ac.id

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and after the learning is completed [1]. Many evaluation models can be used to evaluate the implementation of e-learning [2], however, the facts show that there is no accurate evaluation model to carry out a thorough evaluation in determining the priority aspects that determine the e-learning quality [3].

The ideal condition that is expected is the existence of an evaluation model that can be evaluated in view of observation during the learning process and in view of reflection and assessment processes at the end of learning. The initial idea that can be used to achieve that ideal condition is to use a *Formative-Summative* evaluation model. However, the model has not been able to obtain accurate data on aspects that determine the e-learning quality as viewed from formative and summative components based on observation, reflection, and assessment activities in learning. Based on that, another idea emerged to realize a *Formative-Summative* evaluation model based on a *Tri Pramana-Weighted Product*. Through this model, evaluation activities in the learning progress and after learning was completed can be performed based on the *Formative-Summative* evaluation component. Observation, reflection, and assessment activities refer to the *Tri Pramana* concept. *Tri Pramana*, meaning three ways to gain knowledge, consists of three parts, including: *Pratyaksa-Pramana*, *Anumana-Pramana* and *Agama-Pramana* [4]. *Pratyaksa-Pramana* means gaining knowledge by seeing directly, *Anumana-Pramana* means gaining knowledge by concluding analysis; and *Agama-Pramana* means gaining knowledge by trusting the notifications of holy people who never lie [5].

Observation activities in the learning process were carried out based on the *Tri Pramana* concept, especially *Pratyaksa-Pramana*, reflection activities were carried out based on the *Anumana-Pramana* concept, and assessment activities after the learning process were based on the concept of *Agama-Pramana*. The process of finding priority aspects of quality determinants was calculated accurately using the concept of artificial intelligence, especially the *Weighted Product.*

Based on these problems and innovation ideas, the question of this research was, "To what extent was the design of the *Formative-Summative* evaluation model based on the *Tri Pramana-Weighted Product* in determining the quality level of the implementation of e-learning as a form of embodiment of the policy of independent learning at health universities in the Province of Bali?"

The main purpose of this research was to demonstrate innovation in the form of designing an evaluation model that can be used in order to determine the priority aspects that determine the quality of e-learning at health universities in Bali Province. The urgency of this research was to obtain the form of a *Formative-Summative* evaluation model based on *Tri Pramana* by inserting a *Weighted Product* calculation to obtain the highest preference value as a basis for recommendations on aspects that determine the quality of implementing e-learning at health universities in Bali Province.

Several previous research results were behind the emergence of this research, including research conducted in 2019 by Ariawan *et al*. [6] obtained an overview of the results of the *CIPP* (*Context-Input-Process-Product*) evaluation model based on *Simple Additive Weighting* which was used to measure the effectiveness of learning at health science high schools in Bali. The problem was that the form of a web-based application that can be accessed online had not been shown. A 2020 study on the development of a *Simple Additive Weighting*-based *CIPP* evaluation application conducted by Ariawan *et al*. [7], obtained visualization results from a *Simple Additive Weighting*-based *CIPP* evaluation application that could be used to measure the effectiveness of online learning in health science high schools in Bali. The problem was that the application had not yet been implemented on a wide scale. The 2021 research on the dissemination and application of the *Simple Additive Weighting*-based *CIPP* evaluation application at several health colleges in Bali, conducted by Divayana *et al*. [8], showed the successful application of the *Simple Additive Weighting*-based *CIPP* evaluation application.

The problem was that the evaluation application did not use evaluation aspects that were integrated with the concept of Balinese local wisdom, thus the measurement of student knowledge domains in the learning process could not be measured optimally and in depth according to student characteristics. Based on the results and limitations of some of these studies, it was necessary to do further research by developing a *Formative-Summative* evaluation model based on *Tri Pramana* by inserting a *Weighted Product* calculation. An overview of the expected results in this further research was the formation of a *Tri Pramana*-based *Formative-Summative* evaluation model design by inserting a *Weighted Product* calculation to be able to determine the aspects that determine the quality of e-learning implementation. Referring to the previous studies and the further research ideas that have been disclosed, the flow of this research is easier to understand if it is explained in the form of a research roadmap. The research roadmap in question can be seen in Figure 1.

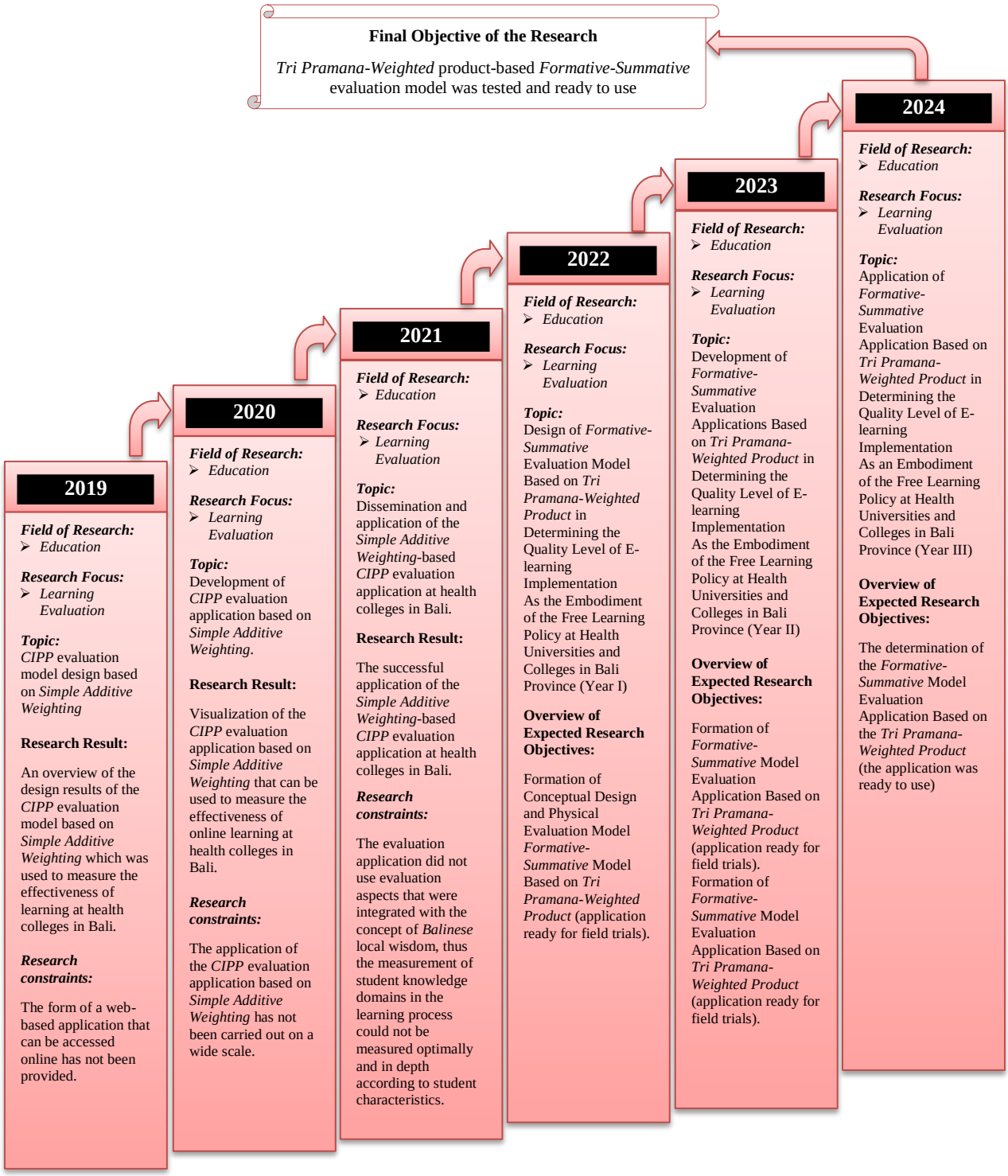

Figure 1. Roadmap for Design of *Formative-Summative* Evaluation Model Based on *Tri Pramana-Weighted* Product

Mubayrik's research [9] shows the use of the *Formative-Summative* evaluation model as a new trend in evaluating adult education. The limitation of Mubayrik's research was that it had not shown the aspects that determine the quality of learning in terms of formative and summative components. Dwiyanti & Suwastini's research [10] focuses on measuring students' writing skills in online learning viewed from formative and summative assessments. The limitation of Dwiyanti & Suwastini's research was that it had not shown an accurate calculation process in determining the formative and summative assessment aspects which are the priority determinants of the quality of students' writing skills in online learning. Research by Kasani *et al.* [11] focused on showing the weaknesses of formative assessment in the e-Learning Management System. Research limitation of Kasani *et al.* was that it did not show priority aspects in the formative and summative evaluation components as a determinant of the quality of learning outcomes using the e-Learning Management System.

Liu's research [12] demonstrates the use of a *Formative-Summative* evaluation model to evaluate the effectiveness of distance education. The limitation of Liu's research was that it did not discuss in depth the aspects that were the priority determinants of the effectiveness of distance education. Ridhwan's research [13] showed the theoretical concept of the *Formative-Summative* model that could be used to assess the learning process. The limitation of Ridhwan's research was that it did not show the priority aspects of the *Formative-Summative* model that could be used as a determinant of the effectiveness of the learning process. The research of Sudakova *et al*. [14] focused more on formative assessment, but did not show the formative and summative aspects as a whole in conducting the assessment. Donkin & Askew's research [15] focused on comparing the effectiveness of classroom learning with learning through e-learning using a formative evaluation model. The limitation of Donkin & Askew's research was that it did not provide accurate calculation results in determining the highest priority evaluation aspects as a determinant of the effectiveness of e-learning and in-class learning.

Based on the limitations or gaps that are still found in those other studies when compared with this research, it is clear that the position of the presence of this research is an answer to overcome those obstacles. The contribution of this research is in the form of designing an evaluation model that can be used to determine the priority aspects that determine the quality of e-learning. The evaluation model is called the *Formative-Summative* evaluation model based on the *Tri Pramana-Weighted Product.*

2- Material and Methods

- ***Research Approach***

This study used a development approach with the Research and Development method. The research development model was *Borg* and *Gall* which consists of 10 stages of development [16-20], including: (1) research & field data collection; (2) planning; (3) design development; (4) initial trial; (5) revision of the results of the initial trial; (6) field trials; (7) revision of the results of field trials; (8) trial use; (9) final product revision; (10) dissemination and implementation of the final product. Based on the objectives of this research, this research focuses on several stages, including: (1) research & field data collection; (2) planning; (3) design development; (4) initial trial; and (5) revision of the initial trial results.

- ***Research Subject***

The subjects in this study were determined using the purposive sampling technique, namely selecting research subjects who were determined from the start based on their direct relationship with e-learning applied to health universities and colleges in Bali. The number of subjects involved in this study was two education experts, two informatics experts, and 30 lecturers, who would later be involved in conducting initial trials of the evaluation model design and simulating the calculation of the *Weighted Product* method to search for priority aspects that determine the quality of e-learning.

- ***Research Object***

The object of research was the main topic that must be studied and researched in depth. The object of this research was the Formative-Summative evaluation model based on the Tri Pramana-Weighted Product.

- ***Research Location***

The implementation of this research was located in health universities and colleges spread across six districts in the Bali province. The six regencies were: *Gianyar*, *Tabanan*, *Buleleng*, *Klungkung*, *Denpasar*, and *Badung.*

- ***Data Collection Instruments***

The instruments/tools used in collecting data in this study were in the form of questionnaires. Questionnaires were used to obtain primary data in the form of quantitative data from respondents as a basis for making decisions about the percentage level of quality in the design of the *Tri Pramana-Weighted Product*-based *Formative-Summative* evaluation model.

- ***Simulation Search for Priority Aspects that Determine the Quality of E-Learning***

The simulation to find the priority aspects that determine the quality of e-learning was achieved through mathematical calculations using the *Weighted Product* method. The *Weighted Product* method is a method in a decision support system that uses multiplication to connect attribute ratings, where the rating of each attribute must be raised first with the weight of the attribute in question. The *Weighted Product* method consists of three calculation steps, including (1) improving the weight of the criteria, (2) determining the S-vector, and (3) determining the V-vector. The formula used to improve the weight of the criteria can be seen in Equation 1 [21, 22], the formula for determining the S-vector can be seen in Equation 2 [23, 24], and the formula for determining the V-vector can be seen in Equation 3 [25, 26].

$$w_j = \frac{w_j}{\sum w_j} \quad (1)$$

$$S_i = \prod_{j=1}^{n} x_{ij}^{w_j} \text{ with } i = 1,2,\ldots,m \quad (2)$$

$\sum w_j = 1$. S is the criterion preference which is analogous to the S-vector. x is the criterion value. $w_j$is a positive power for the profit attribute and a negative value for the cost attribute.

$$V_i = \frac{S_i}{\sum S} \text{ dengan } i = 1,2,\ldots,n \quad (3)$$

V is an alternative preference for ranking which is analogous to the V-vector.

- ***Data Analysis Technique***

The technique used to analyze the data from the design trials collected was the descriptive quantitative technique through descriptive percentage calculations. The results of the descriptive percentage calculations were used as a basis for interpreting the results of research on the *Formative-Summative* evaluation model based on the *Tri Pramana-Weighted Product*. The formula for calculating the descriptive percentage was as follows [27-30].

$$Quality\ Percentage = \frac{f}{N} \times 100\% \quad (4)$$

where, f is acquisition total value, and N is maximum total value. The percentage results obtained from the formula were then converted into the following five-scale categorization Table 1 [31-36].

Table 1. Five Scale Categorization

Quality Percentage	Category	Follow-up
90% to 100%	Excellent	No Revision Needed
80% to 89%	Good	No Revision Needed
65% to 79%	Moderate	Revision
55% to 64%	Poor	Revision
0% to 54%	Very Poor	Revision

3- Results and Discussion

At the field data collection stage, some data related to the *Formative-Summative* evaluation components were obtained which were used as evaluation standards for the implementation of e-learning at health universities and colleges in Bali, which can be seen in Table 2. Data related to evaluation aspects which would later be used as an alternative to support the realization of Quality e-learning can be seen in Table 3. Data related to the weights given by the experts for each evaluation standard for the implementation of e-learning can be seen in Table 4. Initial data for the simulation of the calculation of the *Weighted Product* method used in determining the determinants of priority aspects of the quality of e-learning can be seen in Table 5.

Table 2. Standard Components of *Tri Pramana*-Based *Formative-Summative* Evaluation

Code	*Formative* Evaluation Components	Code	*Summative* Evaluation Component
F1	Observations in the Learning Process based on the *Pratyaksa-Pramana* concept	S1	Assessment after the learning process based on the concept of *Agama-Pramana*
F2	Reflection on the *Anumana-Pramana* concept-based learning process		

Table 3. Aspects of *Formative-Summative* Evaluation Based on *Tri Pramana*

Formative Evaluation Component Code	Aspects of *Formative* Evaluation		*Summative* Evaluation Component Code	Aspects of *Summative* Evaluation	
F1	F1a	Availability of learning process recording facilities through e-learning	S1	S1a	Availability of assessment of students' cognitive aspects through e-learning
	F1b	Availability of student attendance facilities in e-learning		S1b	Availability of assessment of students' affective aspects through e-learning
	F1c	Availability of facilities to view discussion activities between students in e-learning		S1c	Availability of assessment of students' psychomotor aspects through e-learning
F2	F2a	Availability of facilities to see student responses to the learning process through e-learning		S1d	Availability of facilities that make it easier for students to see the results of the assessment
	F2b	Availability of facilities to make it easier for students and teachers to communicate and discuss in e-learning		S1e	Availability of facilities that make it easier for teachers to rank assessment results
	F2c	Availability of facilities to make it easier for teachers to see the activity and speed of students in answering oral questions and quizzes in the learning process through e-learning		S1f	Guaranteed security of assessment questions

Table 4. Weights from Experts for Each *Tri Pramana*-Based *Formative-Summative* Evaluation Standard

Code	*Formative-Summative* Evaluation Components	Weight					Weight Repair
		Expert 1	Expert 2	Expert 3	Expert 4	Σ	
F1	Observations in the Learning Process based on the *Pratyaksa-Pramana* concept	5	4	5	5	19	0.352
F2	Reflection on the *Anumana-Pramana* concept-based learning process	4	4	5	4	17	0.315
S1	Assessment after the learning process based on the concept of *Agama-Pramana*	5	4	5	4	18	0.333
					Total	**54**	**1**

Table 5. Initial Data for the *Weighted Product* Method Calculation Simulation

Evaluation Aspects	Evaluation Components		
	F1	F2	S1
F1a	0.853	0.200	0.200
F1b	0.920	0.200	0.200
F1c	0.787	0.200	0.200
F2a	0.200	0.767	0.200
F2b	0.200	0.807	0.200
F2c	0.200	0.860	0.200
S1a	0.200	0.200	0.907
S1b	0.200	0.200	0.707
S1c	0.200	0.200	0.733
S1d	0.200	0.200	0.873
S1e	0.200	0.200	0.793
S1f	0.200	0.200	0.853

Table 2 shows two standard components in the formative evaluation model and one standard component in the summative evaluation model. The two standard components of the formative evaluation model were formed based on the internalization of the *Tri Pramana* concept, especially in the *Pratyaksa-Pramana* and *Anumana-Pramana* sections. One standard component in the summative evaluation model was formed based on the internalization of the *Tri Pramana* concept, especially in the *Agama-Pramana* section.

Table 3 shows six aspects of evaluation in the formative evaluation model and six aspects of evaluation in the summative evaluation model. The six evaluation aspects of the formative evaluation model are used as a reference in evaluating during the learning process, while the six evaluation aspects of the summative evaluation model are used as a reference in evaluating after the learning process is complete.

Table 4 shows the weighting by experts for each component of the *Formative-Summative* evaluation. The scoring of the weights was based on the assessment score of each question in the questionnaire about the *Formative-Summative* evaluation component. The assessment score for each question refers to a Likert scale. A score of 5 for the interest rating was categorized as excellent. A score of 4 for the interest rating was categorized as good. A score of 3 for the interest rating was categorized as moderate. A score 2 for the interest rating was categorized as poor. A score 1 for the interest rating was categorized as very poor. The improvement score of the evaluation criteria/component weights was determined based on the formula shown in Equation 1.

At the planning stage, arrangements were made for the human resources involved and the time required in order to design a *Formative-Summative* evaluation model based on *Tri Pramana-Weighted Product*. In addition, at this stage, human resources and time were needed to simulate the calculation of the *Weighted Product* method in determining the priority aspects that determine the quality of e-learning. The resource planning and time required in designing the evaluation model and *Weighted Product* simulation can be seen in Table 6.

Table 6. Management of Human Resources and Time in Making the Evaluation Model Design and Simulation Time for the Calculation of the *Weighted Product* Method

Activities	Human Resources (Person)	Time (Day)
Making Evaluation Model Design	3	7
Weighted Product Calculation Simulation	30	3
Initial Trial of Evaluation Model Design	34	30

At the design development stage, which involved three human resources (one chair and two research members) made a design for a *Formative-Summative* evaluation model based on *Tri Pramana-Weighted Product*. The display design of the evaluation model in question can be seen in Figure 2.

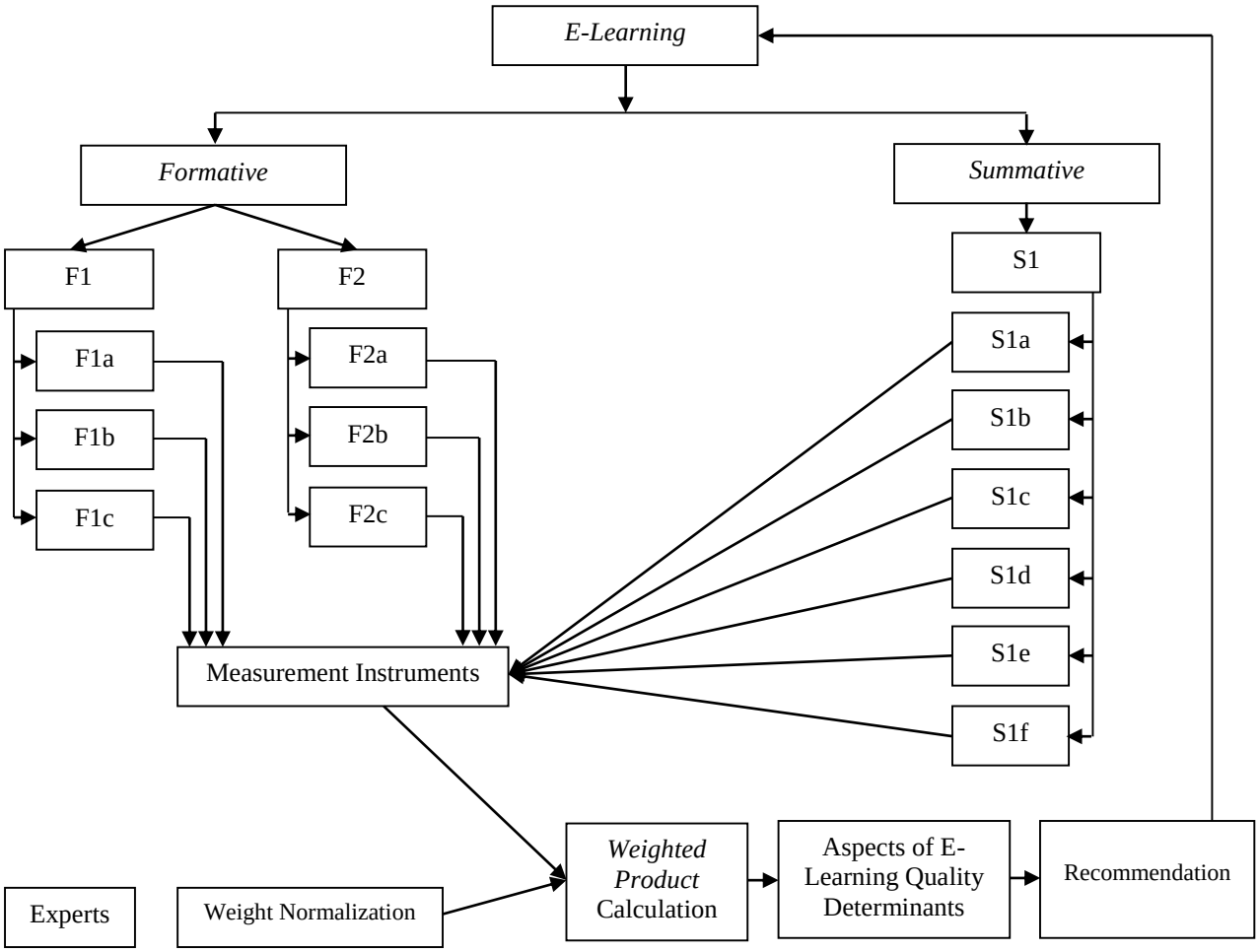

Figure 2. *Formative-Summative* Evaluation Model Design Based on *Tri Pramana-Weighted Product*

Figure 2 shows the design of an innovative evaluation model that combines the concept of a *Formative-Summative* evaluation model, the *Tri Pramana* concept, and the *Weighted Product* method. The *formative* evaluation model has two evaluation components that were integrated with the *Tri Pramana* domain, including F1 (Observation in the *Pratyaksa-Pramana* concept-based learning process), and F2 (Reflection in the *Anumana-Pramana* concept-based learning process). The *summative* evaluation model has two evaluation components that were integrated with the *Tri Pramana* domain, namely S1 (Assessment after the *Agama-Pramana* concept-based learning process). The F1 component has 3 evaluation aspects that were used to measure the quality of e-learning, including F1a (availability of recording facilities for the learning process through e-learning), F1b (availability of student attendance facilities in e-learning), and F1c (availability of facilities to view activities discussion between students in e-learning). The F2 component has 3 evaluation aspects that were used to measure the quality of e-learning, including F2a (availability of facilities to see student responses to the learning process through e-learning), F2b (availability of facilities to facilitate students, and teachers in communicating and discussing e-learning), and F2c (availability of facilities to make it easier for teachers to see the activity and speed of students in answering oral questions and quizzes in the learning process through e-learning).

The S1 component has 6 evaluation aspects that were used to measure the quality of e-learning, including S1a (availability of assessment of student cognitive aspects through e-learning), S1b (availability of assessment of student affective aspects through e-learning), S1c (availability of assessment of student psychomotor aspects through e-learning), S1d (availability of facilities that make it easier for students to see the results of the assessment), S1e (availability of facilities that make it easier for teachers to rank assessment results), and S1f (assurance of security of assessment questions). The instrument in the form of questionnaires that refers to the *Formative-Summative* evaluation aspects is used to measure the quality of e-learning. The score of the measurement results using the questionnaires, then combined with the normalization results of weights from experts. The combined results were then calculated using the *Weighted*

Product method to obtain the dominant aspects that determine the e-learning quality. The dominant aspects found were used as the basis for making appropriate recommendations. Those recommendations will be given to decision-makers to follow up on improving the e-learning quality.

In the initial trial phase, a simulation of the *Weighted Product* method was carried out and a trial of the *Formative-Summative* evaluation model design based on the *Tri Pramana-Weighted Product* was carried out. The results of the design trials can be seen in Table 8, while the simulation of the calculation of the *Weighted Product* method can be shown as follows:

- The normalization process that produces the S-vector.

  Based on Equation 2, the initial data are shown in Table 5, and the weight improvement of each evaluation component can be shown in Table 4, it can be calculated normalization to obtain the S-vector. The calculation of the S-vector can be shown as follows:

  $S_1 = (0.853^{0.352}) \times (0.200^{0.315}) \times (0.200^{0.333}) = 0.333$
  $S_2 = (0.920^{0.352}) \times (0.200^{0.315}) \times (0.200^{0.333}) = 0.342$
  $S_3 = (0.787^{0.352}) \times (0.200^{0.315}) \times (0.200^{0.333}) = 0.324$
  $S_4 = (0.200^{0.352}) \times (0.767^{0.315}) \times (0.200^{0.333}) = 0.305$
  $S_5 = (0.200^{0.352}) \times (0.807^{0.315}) \times (0.200^{0.333}) = 0.310$
  $S_6 = (0.853^{0.352}) \times (0.860^{0.315}) \times (0.200^{0.333}) = 0.317$
  $S_7 = (0.920^{0.352}) \times (0.200^{0.315}) \times (0.907^{0.333}) = 0.331$
  $S_8 = (0.787^{0.352}) \times (0.200^{0.315}) \times (0.707^{0.333}) = 0.305$
  $S_9 = (0.200^{0.352}) \times (0.200^{0.315}) \times (0.733^{0.333}) = 0.308$
  $S_{10} = (0.200^{0.352}) \times (0.200^{0.315}) \times (0.873^{0.333}) = 0.327$
  $S_{11} = (0.200^{0.352}) \times (0.200^{0.315}) \times (0.793^{0.333}) = 0.316$
  $S_{12} = (0.200^{0.352}) \times (0.200^{0.315}) \times (0.853^{0.333}) = 0.324$

- Determination of the V-vector as the basis for ranking.

  Based on Equation 3 and the S-vector score for each evaluation aspect, the can be calculated the V-vector. The calculation of the V-vector can be shown as follows:

$$V_1 = \frac{S_1}{S_1+S_2+S_3+S_4+S_5+S_6+S_7+S_8+S_9+S_{10}+S_{11}+S_{12}}$$

$$V_1 = \frac{0.333}{0.333+0.342+0.324+0.305+0.310+0.317+0.331+0.305+0.308+0.327+0.316+0.324} = 0.087$$

$$V_2 = \frac{S_2}{S_1+S_2+S_3+S_4+S_5+S_6+S_7+S_8+S_9+S_{10}+S_{11}+S_{12}}$$

$$V_2 = \frac{0.342}{0.333+0.342+0.324+0.305+0.310+0.317+0.331+0.305+0.308+0.327+0.316+0.324} = 0.089$$

$$V_3 = \frac{S_3}{S_1+S_2+S_3+S_4+S_5+S_6+S_7+S_8+S_9+S_{10}+S_{11}+S_{12}}$$

$$V_3 = \frac{0.324}{0.333+0.342+0.324+0.305+0.310+0.317+0.331+0.305+0.308+0.327+0.316+0.324} = 0.084$$

$$V_4 = \frac{S_4}{S_1+S_2+S_3+S_4+S_5+S_6+S_7+S_8+S_9+S_{10}+S_{11}+S_{12}}$$

$$V_4 = \frac{0.305}{0.333+0.342+0.324+0.305+0.310+0.317+0.331+0.305+0.308+0.327+0.316+0.324} = 0.079$$

$$V_5 = \frac{S_5}{S_1+S_2+S_3+S_4+S_5+S_6+S_7+S_8+S_9+S_{10}+S_{11}+S_{12}}$$

$$V_5 = \frac{0.310}{0.333+0.342+0.324+0.305+0.310+0.317+0.331+0.305+0.308+0.327+0.316+0.324} = 0.081$$

$$V_6 = \frac{S_6}{S_1+S_2+S_3+S_4+S_5+S_6+S_7+S_8+S_9+S_{10}+S_{11}+S_{12}}$$

$$V_6 = \frac{0.317}{0.333+0.342+0.324+0.305+0.310+0.317+0.331+0.305+0.308+0.327+0.316+0.324} = 0.082$$

$$V_7 = \frac{S_7}{S_1+S_2+S_3+S_4+S_5+S_6+S_7+S_8+S_9+S_{10}+S_{11}+S_{12}}$$

$$V_7 = \frac{0.331}{0.333+0.342+0.324+0.305+0.310+0.317+0.331+0.305+0.308+0.327+0.316+0.324} = 0.086$$

$$V_8 = \frac{S_8}{S_1+S_2+S_3+S_4+S_5+S_6+S_7+S_8+S_9+S_{10}+S_{11}+S_{12}}$$

$$V_8 = \frac{0.305}{0.333+0.342+0.324+0.305+0.310+0.317+0.331+0.305+0.308+0.327+0.316+0.324} = 0.079$$

$$V_9 = \frac{S_9}{S_1+S_2+S_3+S_4+S_5+S_6+S_7+S_8+S_9+S_{10}+S_{11}+S_{12}}$$

$$V_9 = \frac{0.308}{0.333+0.342+0.324+0.305+0.310+0.317+0.331+0.305+0.308+0.327+0.316+0.324} = 0.080$$

$$V_{10} = \frac{S_{10}}{S_1+S_2+S_3+S_4+S_5+S_6+S_7+S_8+S_9+S_{10}+S_{11}+S_{12}}$$

$$V_{10} = \frac{0.327}{0.333+0.342+0.324+0.305+0.310+0.317+0.331+0.305+0.308+0.327+0.316+0.324} = 0.085$$

$$V_{11} = \frac{S_{11}}{S_1+S_2+S_3+S_4+S_5+S_6+S_7+S_8+S_9+S_{10}+S_{11}+S_{12}}$$

$$V_{11} = \frac{0.316}{0.333+0.342+0.324+0.305+0.310+0.317+0.331+0.305+0.308+0.327+0.316+0.324} = 0.082$$

$$V_{12} = \frac{S_{12}}{S_1+S_2+S_3+S_4+S_5+S_6+S_7+S_8+S_9+S_{10}+S_{11}+S_{12}}$$

$$V_{12} = \frac{0.324}{0.333+0.342+0.324+0.305+0.310+0.317+0.331+0.305+0.308+0.327+0.316+0.324} = 0.084$$

The V-vector scores were recapitulated in Table 7. Table 7 contains the evaluation component, the aspects that determine the quality of e-learning, and the V-vector score for each of these aspects.

Table 7. Recapitulation of Ranking Results

Evaluation Components	Evaluation Aspects	V-Vector	Ranking
F1	F1a	0.087	II
	F1b	0.089	I
	F1c	0.084	III
F2	F2a	0.079	VI
	F2b	0.081	V
	F2c	0.082	IV
S1	S1a	0.086	I
	S1b	0.079	VI
	S1c	0.080	V
	S1d	0.085	II
	S1e	0.082	IV
	S1f	0.084	III

Based on the results of the recapitulation, it was clear that the dominant aspect that determines the quality of e-learning in the formative evaluation component was F1b (availability of student attendance facilities in e-learning). The F1b aspect becomes the most dominant because its V-vector score is the highest compared to other aspects in the formative evaluation component. Therefore, this aspect of F1b needs to be maintained for its existence and effectiveness. The dominant aspect that determines the quality of e-learning in the summative evaluation component was S1a (availability of assessing students' cognitive aspects through e-learning). S1a was the most dominant because its V-vector score was the highest compared to other aspects in the summative evaluation component. Therefore, this aspect of S1a also needs to be maintained, and its effectiveness.

In addition to the dominant aspects that determine the quality of e-learning, in Table 7 it can also be seen that there were priority aspects that need to be addressed. The priority aspect of improvement in the formative evaluation component was F2a (availability of facilities to see student responses to the learning process through e-learning). The F2a aspect was a priority for improvement because its V-vector score is the lowest compared to other aspects in the *formative* evaluation component. The priority aspect of improvement in the summative evaluation component was S1b (availability of assessing students' affective aspects through e-learning). The S1b aspect was a priority for improvement because the V-vector score was the lowest compared to other aspects in the *summative* evaluation component. The trial of the *Formative-Summative* evaluation model design based on the *Tri Pramana-Weighted Product* was carried out by 34 people, including 30 lecturers, 2 education experts, and 2 informatics experts. The questionnaires used by the 34 respondents in conducting the trial can be seen in Appendix I. The trial results intended can be seen in Table 8.

Table 8. The Trial Results of the *Formative-Summative* Evaluation Model Design based on the *Tri Pramana-Weighted Product*

Respondents	Items-											∑	Quality Percentage (%)
	1	2	3	4	5	6	7	8	9	10	11		
Respondent-1	4	5	4	5	4	5	5	5	4	4	4	49	89.09
Respondent-2	5	4	5	4	4	4	5	4	4	4	5	48	87.27
Respondent-3	4	4	5	4	5	4	4	4	4	5	4	47	85.45
Respondent-4	4	5	5	5	4	4	5	4	5	5	5	51	92.73
Respondent-5	4	4	5	4	5	4	4	4	4	5	4	47	85.45
Respondent-6	4	5	5	5	5	4	5	4	5	5	5	52	94.55
Respondent-7	4	4	5	4	4	4	4	4	4	5	4	46	83.64
Respondent-8	4	5	5	5	4	4	4	4	5	5	5	50	90.91
Respondent-9	4	4	5	4	4	4	5	4	4	5	4	47	85.45
Respondent-10	4	5	5	5	5	5	4	4	5	5	5	52	94.55
Respondent-11	4	4	5	4	5	4	5	5	4	4	4	48	87.27
Respondent-12	4	5	5	5	5	5	5	4	4	5	5	52	94.55
Respondent-13	4	4	5	4	5	5	5	5	4	4	5	50	90.91
Respondent-14	4	5	5	5	5	4	5	5	4	5	4	51	92.73
Respondent-15	4	4	4	4	5	5	5	4	4	4	5	48	87.27
Respondent-16	4	5	4	5	5	4	5	5	4	5	5	51	92.73
Respondent-17	4	4	4	4	5	5	5	4	4	4	4	47	85.45
Respondent-18	4	5	4	5	5	4	5	5	4	5	5	51	92.73
Respondent-19	5	5	4	4	5	5	4	4	4	4	4	48	87.27
Respondent-20	5	5	4	4	4	5	5	5	4	5	5	51	92.73
Respondent-21	4	4	4	4	4	5	5	5	4	4	4	47	85.45
Respondent-22	4	5	4	4	4	4	4	4	4	4	4	45	81.82
Respondent-23	4	4	4	4	4	5	5	4	4	4	4	46	83.64
Respondent-24	4	5	4	4	4	4	4	4	4	4	4	45	81.82
Respondent-25	4	5	4	5	5	4	5	4	4	4	4	48	87.27
Respondent-26	4	4	5	5	4	4	4	4	4	4	4	46	83.64
Respondent-27	5	4	4	4	4	4	5	4	4	4	5	47	85.45
Respondent-28	4	4	5	4	4	4	4	4	4	4	4	45	81.82
Respondent-29	5	4	5	5	4	5	4	4	4	4	4	48	87.27
Respondent-30	5	4	5	4	4	4	4	4	5	5	4	48	87.27
Respondent-31	5	4	5	5	4	5	4	4	4	4	4	48	87.27
Respondent-32	5	5	5	4	4	5	5	4	4	4	5	50	90.91
Respondent-33	4	4	5	5	4	5	4	4	4	4	4	47	85.45
Respondent-34	4	4	4	5	5	5	5	4	5	5	4	50	90.91
Average Quality(%)													**88.02**

Notes: Item-1: Questions about the clarity of formative evaluation components in model design;

Item-2: Questions about the clarity of the summative evaluation component in the model design;

Item-3: Questions about the clarity of evaluation aspects in the formative component of the model design;

Item-4: Questions about the clarity of evaluation aspects in the summative component of the model design;

Item-5: Questions about the clarity of the internalization of the Pratyaksa-Pramana concept into the formative evaluation component;

Item-6: Questions about the clarity of internalization of the Anumana-Pramana concept into the formative evaluation component;

Item-7: Questions about the clarity of internalizing the concept of Agama-Pramana into the summative evaluation component;

Item-8: Questions about the clarity of the position of the measuring instrument in the model design;

Item-9: Questions about the clarity of the use of the Weighted Product method in model design;

Item-10: Questions about the clarity of recommendations on model design;

Item-11: Questions about the clarity of the stages of evaluation work on the design of the model.

In addition to providing a quantitative assessment of the *Formative-Summative* evaluation model design based on the *Tri Pramana-Weighted Product*, the respondents also gave a qualitative assessment by providing several suggestions regarding the design of the model. The suggestions intended can be seen in Table 9.

Table 9. Suggestions from Several Respondents on the Design of *Formative-Summative* Evaluation Models based on *Tri Pramana-Weighted Product*

No.	Respondents	Recommendations
1	Respondent-3	Write a complete description of the evaluation aspects, do not just write code!
2	Respondent-9	The code for evaluation aspects is replaced with a complete description
3	Respondent-15	Show *Weighted Product* formula on model design!
4	Respondent-29	Don't just display the aspect code, please complete it with complete information!
5	Respondent-32	It is necessary to give color to the design to distinguish the evaluation components and evaluation aspects.

Based on the suggestions shown in Table 9, it is necessary to revise the design of the *Formative-Summative* evaluation model based on the *Tri Pramana-Weighted Product*. The final view of the model design after revision can be seen in Figure 3.

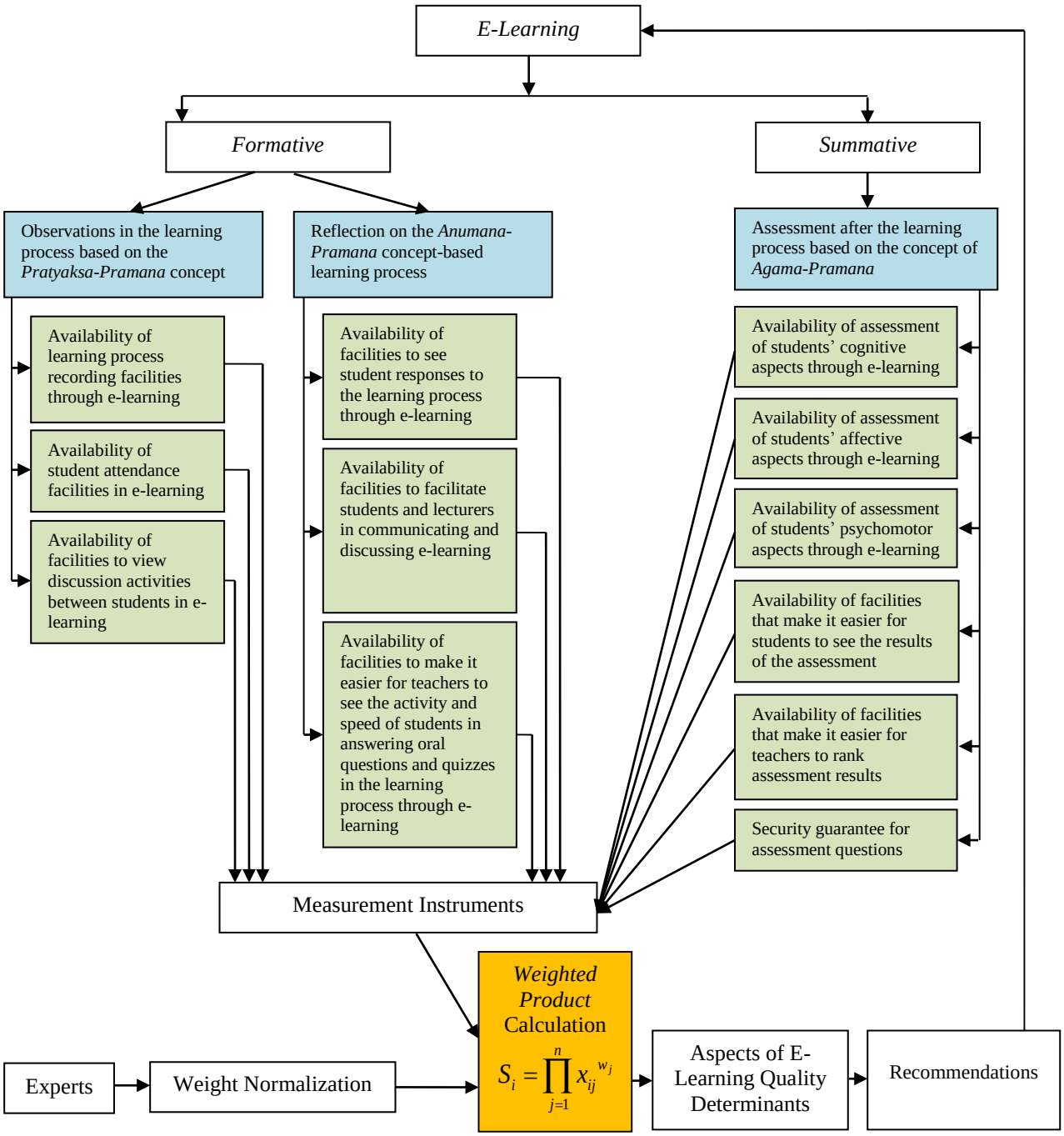

Figure 3. Final Design of *Formative-Summative* Evaluation Model Based on *Tri Pramana-Weighted Product*

Figure 3 shows the final design of the evaluation model based on some suggestions given by the respondents in the initial trial. The light blue and green boxes were revisions based on the input given by respondent-3, respondent-9, respondent-29, and respondent-32. The orange box is a revision based on the input given by respondent-15.

Referring to the results of the initial trial of the evaluation model design shown in Table 8, in general, this evaluation model design belongs to the "good quality" category based on an average percentage of quality of 88.02. This percentage was classified as good if it was interpreted based on the quality percentage range between 80-89%, which refers to the five-scale categorization.

The research results by Purwaningsih & Dardjito [37] show the use of the CIPP model in determining the implementation effectiveness of e-learning during the Covid-19 pandemic. The context, input, process, and product components used in Purwaningsih & Dardjito's research have succeeded in obtaining a good level of e-learning implementation effectiveness. If compared with this study, there is one thing that has not been revealed in Purwaningsih & Dardjito's work, which is the dominant aspects that determine the implementation effectiveness of e-learning. The results of Dewantara's research [38] show the effectiveness of Indonesian learning by using the components of the stake evaluation model. If compared with this research, there are several things that have not been found in Dewantara's research, including: 1) the dominant aspects that determine the effectiveness of Indonesian language learning; 2) the calculation process in determining those dominant aspects; and 3) the evaluation component used to measure effectiveness during the learning process and after the learning process is complete. The results of Alzabidi's study [39] show the measurement of the e-learning effectiveness using self-assessment conducted by students. If compared with this research, the limitation of Alzabidi's study was that it had not shown in depth the aspects of student self-measurement that are the priority determinants of e-learning effectiveness.

The results of this study in general were able to address the weaknesses of several previous studies, which have not been able to show the dominant aspects that determine the quality of e-learning implementation. The novelty of this research can be seen in the internalization of the concept of Balinese local wisdom called "*Tri Pramana*" into the *Formative-Summative* evaluation component and its integration with mathematical calculations using the *Weighted Product* method. This novelty was the added value of this research, making it easier for evaluators to obtain the dominant aspects that determine the quality of e-learning. This research is strengthened by the results of study by Rosiyanti & Faisal [40], which also evaluates the quality of e-learning. However, the difference lies in the evaluation model used, where Rosiyanti & Faisal used the CIPP evaluation model while this study uses an innovative evaluation model that combines the educational evaluation model with the concept of local wisdom and the decision support system method. Research studies such as Timbi-Sisalima *et al*. [41], Firmansyah *et al*. [42], Naibaho [43], Setiawan & Munajah [44], and Suswanto *et al*. [45] also corroborate the results of this study by showing the results of the quality test of the implementation of e-learning, even though using a different evaluation model.

Although the results of this study show innovation and novelty and can be a solution to previous research obstacles, this research also has limitations. The limitation of this study was that if the evaluation aspect score was 0, then the *Weighted Product* calculation would always result in 0. The limitations of this study also have similarities with other studies, such as Supriyono & Sari [46], Saputra *et al*. [47], Maulana *et al*. [48], Bire *et al*. [49], Utomo & Budiman [50], Nababan & Tuti [51], and Herdiansah *et al*. [52], which applies the *Weighted Product* method in determining the dominant alternative from several existing alternatives. The problem was also the same, namely, if the alternative score was 0, then it was certain that the calculation process could not be carried out. That was because any score when multiplied by 0, results in 0.

4- Conclusion

The results of this research have allowed us to realize the design of the *Formative-Summative* evaluation model based on the *Tri Pramana-Weighted Product*, which was categorized as good. This evaluation model design is ready to be used as a basis for determining the quality level of e-learning implementation at health universities in Bali Province. The results of this study have also been able to provide a solution to the constraints of previous studies, which have not been able to show the dominant aspects that determine the quality of e-learning implementation. The added value of this research is the existence of a new innovative educational evaluation model that is integrated with a decision support system method that can provide accurate calculation results in searching for the dominant aspects that determine the success of e-learning implementation. The impact of the results of this study on the progress of the field of education is to make a positive contribution, especially in conducting evaluation activities. The presence of this innovative evaluation model design can provide convenience for evaluators in finding the dominant aspects that determine the success of the implementation of online learning in general and specifically in the implementation of e-learning at health colleges. Future work that can be done to overcome the obstacles found in this study is to modify the design of this evaluation model. Modifications can be made by inserting other decision support system methods into the design to obtain more optimal, accurate calculation results, and not produce a zero value.

5- Declarations

5-1- Author Contributions

Conceptualization, I.P.W.A.; methodology, I.P.W.A.; formal analysis, I.P.W.A., W.S., I.M.A., I.M.S.D.A., and D.G.H.D.; investigation, I.P.W.A.; data curation, I.P.W.A., W.S., I.M.A., I.M.S.D.A., and D.G.H.D.; writing—original draft preparation, I.P.W.A. and D.G.H.D.; writing—review and editing, I.P.W.A. All authors have read and agreed to the published version of the manuscript.

5-2- Data Availability Statement

The data presented in this study are available in the article.

5-3- Funding

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5-5- Institutional Review Board Statement

Not applicable.

5-6- Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

5-7- Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

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Appendix I

Trial Questionnaire On Design Of *Formative-Summative* Evaluation Model Based On *Tri Pramana-Weighted Product*

Yours faithfully,

We lecturers at Universitas Pendidikan Ganesha are conducting research on "Design of *Formative-Summative* Evaluation Model Based on *Tri Pramana-Weighted Product*". We hereby request your willingness to spare some time fill out this questionnaire in order to obtain an accurate of the user's response to the Design of *Formative-Summative* Evaluation Model Based on *Tri Pramana-Weighted Product*. We guarantee confidentiality, both in terms of identity and all attached questions. We thank you for your willingness and time.

Name of Respondent: …….

Gender: (Male/Female) *

Position: (Expert/Lecturer) *

Location of Questionnaire Filling: …….

** Cross the unnecessary ones*

Instructions for Filling out Questionnaire

You are requested to choose one of several alternative assessment scores available by placing a check mark (√) in the range of scores located on the right side of the questions.

The elements intended are as follows:

Items-	Questions	Assessment Scores				
		Very Poor	Poor	Moderate	Good	Excellent
1	How clear is the formative evaluation component of the model design?					
2	How clear is the summative evaluation component of the model design?					
3	How clear are the evaluation aspects in the formative component of the model design?					
4	How clear are the evaluation aspects in the summative component of the model design?					
5	How clear is the internalization of the *Pratyaksa-Pramana* concept into the formative evaluation component?					
6	How clear is the internalization of the *Anumana-Pramana* concept into the formative evaluation component?					
7	How is the clarity of internalizing the concept of *Agama-Pramana* into the summative evaluation component?					
8	How clear is the position of the measuring instrument in the model design?					
9	How clear is the use of the weighted product method in the model design?					
10	How clear are the recommendations on the model design?					
11	How is the clarity of the evaluation work stages in the model design?					

Suggestions/Comments……..…..…
……..……
……..……
……..……

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Respondent