

Implementing quality function deployment using service quality and Kano model to the quality of e-learning

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ABSTRACT

E-learning has become an important aspect of university education. System evaluation must be carried out by higher education management to identify the number of e-learning successes and future improvement efforts. Three research methodologies were used in this study to measure, classify, and translate service quality into an improvement process, namely SERVQUAL, Kano model, and quality functional deployment (QFD). A survey involving 219 UPN "Veteran" Jakarta students as e-learning users were done to examine the developed methodology. The partial least square (PLS) method was used to process the data. This study employed the quantitative method. Website content, assurance, empathy, responsiveness, tangibles, reliability, and learning content are variables in this approach. This study provided knowledge on identifying and analyzing the quality of e-learning services using the service quality (SERVQUAL) method by calculating the score gap between the perceived service quality assessment (performance) and the expected service quality using website content, assurance, empathy research variables, responsiveness, tangibles, reliability, learning content, e-learning quality, satisfaction, and behavioral intention. This study also evaluates what improvements can be made to improve the quality of e-learning services.

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1. INTRODUCTION

The transformation of the implementation of traditional education to the implementation of e-learning will face the challenges of information and communication technology (ICT) and operational risks [1]. E-learning is an educational technology for disseminating information, effective teaching methods, increasing knowledge [2]–[4], and enabling students to carry out the learning process according to student needs, learning according to their time and at lower costs [5]. The use of e-learning strongly supports the learning process that can be accessed using technology in formal environments and are already using these technologies in order to support their learning process [6] and is different from 'distance learning' which can be communicated using paper [7], [8]. E-learning can be categorized based on its main purpose as technology-based, delivery-system-oriented, communication-oriented, or educational paradigm-oriented [9]. Service quality refers to service fulfillment by meeting customer requirements, expectations, and satisfaction [10]–[12] and refers to service quality through these attributes: tangible, reliability, power responsiveness, assurance, and empathy [13], [14], service quality represents user support by the Information Systems department, measured by responsiveness, reliability, and empathy [15], [16]. The quality of e-learning has been recognized and assessed utilizing a triangle consisting of teacher quality, the quality of e-learning, and the quality of lecture materials represented by learning content in the study [16], as seen in Figure 1.

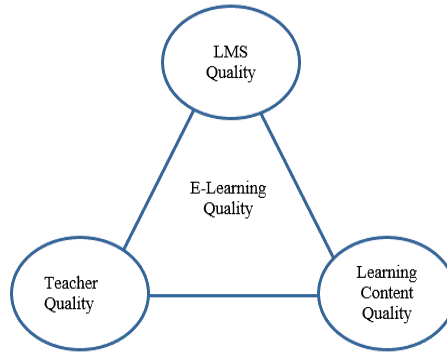


Figure 1. E-learning quality [16]

To broaden the scope of service variables, we propose the teacher quality dimension, which includes assurance, empathy, dependability, and responsiveness. Informativeness and usability are two aspects of learning management systems (LMS) quality. A single component is included in the dimension of learning content quality, which can be seen in Figure 2. E-learning has become a significant aspect of university education. Because e-learning is a great complement to traditional learning. Therefore, it is important to identify how well it runs [17]. It is required to assess the quality of e-learning services to measure the success rate of adopting e-learning as an online learning medium at Universitas Pembangunan Nasional (UPN) “Veteran” Jakarta, Indonesia.

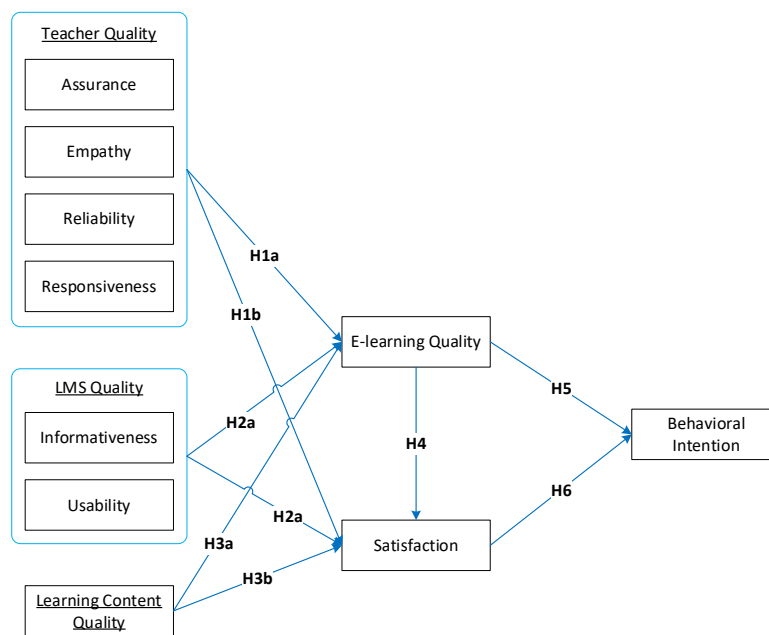


Figure 2. Model development of e-learning quality [16]

The service quality technique is a technique to improve the quality of e-learning services. The five aspects of service quality (reliability, responsiveness, assurance, empathy, and tangibility) have a major impact on service quality and there is a strong and positive relationship between service quality variables and customer satisfaction [18]. In general, satisfaction refers to a person’s feelings of joy or disappointment deriving from the comparison between the product’s performance (outcome) and the expected performance (result). The customers is very satisfied or happy if performance exceeds expectations [19].

Evaluation of e-learning must be carried out by the management to identify the amount of e-learning success and future enhancement efforts. Quality is a comparison (gap) between expectations and performance [10]. Service quality is a metric that assesses how well a company's level of service meets or exceeds consumer expectations. The Kano model, on the other hand, is a technique for evaluating service quality by

categorizing product or service features based on their ability to satisfy or exceed customer needs. The fuzzy approach to Kano's model accurately expresses interviewed customers, aids researchers in gathering more full customer data, and decreases the subjectivity of user assessments [20]. By considering the issues, the following research questions are formulated: "How is the quality of e-learning services?" "What adjustments can be done to improve the quality of e-learning services in terms of the wants and needs of its users?"

2. RESEARCH METHOD

The research process is made up of various steps, defining the e-learning service quality attributes for universities. Creating a questionnaire, collecting data, and then testing the questionnaire's validity and reliability. Kano's model divides the features of SERVQUAL results into three categories: must-be, one-dimensional, and attractive, and then defines the value that will be assigned to the categorization's outcomes (4, 2, or 1). Integration of the SERVQUAL and Kano models yields the measuring of these instruments' relevance. The results of the two's integration are then fed into quality functional deployment (QFD).

Service quality is defined as the difference between the perceived service and the expected service, both measured against five quality dimensions – reliability, responsiveness, assurance, empathy, and tangibles [21], [22]. There are seven SERVQUAL characteristics in this research paradigm (assurance, empathy, responsiveness, reliability, tangibles, website content, and learning quality content) and one direct driver of e-learning quality and satisfaction. Assurance is a guarantee and surety of lecturers' knowledge and understanding of the content delivered to provide trust and ensure that assessments are fair and unbiased [21]–[24]. Empathy (EM) refers to lecturers' attention and care for students, as well as their encouragement and motivation to do their best [21]–[24]. Responsiveness (RS) is defined as the willingness to assist, answer questions and comments, and pay attention [21]–[24]. Reliability (RE) entails being constant in giving material, being trustworthy, and correcting information if it is incorrect [21]–[24]. Tangibles refer to a user interface that is simple to use, administer, and access, as well as a variety of learning activities [21]–[24]. Website content (WC) specifies e-learning as having multimedia aspects, as well as the availability of accurate, helpful, high-quality, and relevant material to the subjects being taught [22]. Learning content quality refers to the availability of materials and services that are directly related to student learning outcomes [21]. The research approach employed in this study is a combination of the SERVQUAL methodology and the Kano model integrated into the QFD, as shown in Figure 3.

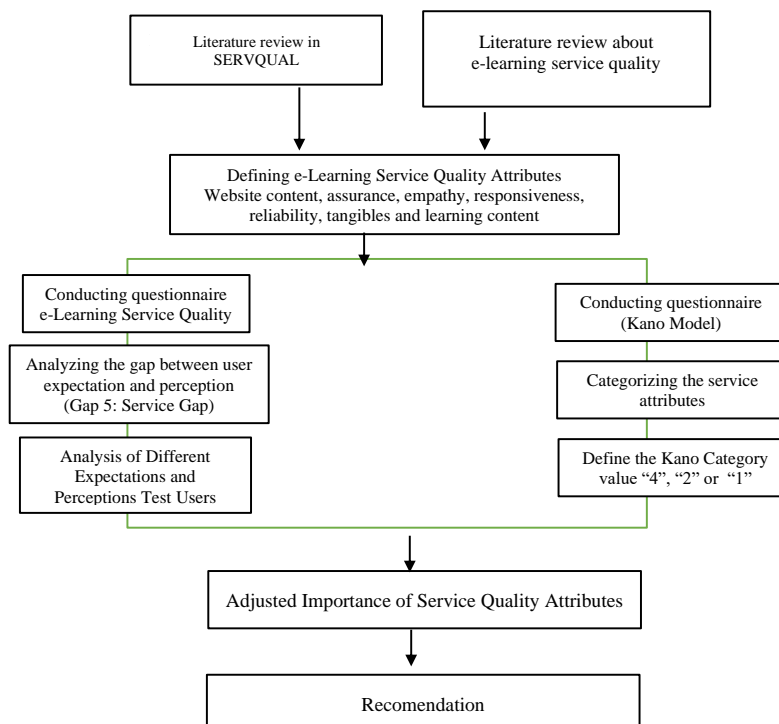


Figure 3. Research methodology

3. RESULTS AND DISCUSSION

3.1. Demographics of respondents

Education through online platforms requires a collaborative effort between teachers and students, which sometimes requires more open innovation processes than the traditional teaching system [24]. A survey was used in this study, involving 219 participants who were students using e-learning. According to the data collected, there are more male respondents than female respondents, with 133 male respondents (57.32%) and 86 female respondents (42.68%). E-learning's frequency of use (Every day 35.03%, 1 month 3.82%, once a week more than once a month 48.41% and once a week 2.74%). Duration of accessing e-learning (less than 15 minutes 19.11%, 15 minutes to less than 30 minutes 45.86%, 30 minutes to less than 1 hour 24.84%, 1 hour to less than 2 hours 8.92% and more than 2 hours 1.27%)

3.2. Validity and reliability tests

Each questionnaire contains 23 questions for the variables of expectations and perceptions from a total of 46 question items. A 5-point Likert scale was used in the questionnaire. The statistical package for the social sciences (SPSS) version 23.0 application was used to test the validity and reliability of this study. For a total of 219 samples ($df=217$), the r table value is 0.133. The validity test revealed that the r computed corrected item-total correlation on the SPSS output was positive and greater than the value of the r table for all 46 question items on the questionnaire. The r table value for 219 respondents is 0.1333, whereas the alpha value for all the questions is in the range of 0.751. A reliability coefficient (alpha) of 0.70 or higher is considered acceptable reliability in SPSS [25]. As a result, it can be concluded that the questionnaire can be used as a measuring tool in this study.

3.3. Measurement with SERVQUAL

E-learning service quality is defined as the variation between service expectations and students' perceived experience [26], by looking at five measurements tangibles, responsiveness, reliability, empathy, and assurance (SERVQUAL) [27]. The 219 respondents were given questionnaires. For the expectation variable, there are four options: Not important (NI), less important (LI), moderately important (MI), important (I), and extremely important (EI). From the results of the questionnaire on respondents' expectations of service quality attributes, it can be seen that the majority of the respondents chose important (I), and extremely important (EI) answer for each question given for the expectancy dimension of e-learning services. This shows that the respondents have high expectations of the e-learning services they want to receive from UPN "Veteran" Jakarta.

In the results of the questionnaire on respondents' perceptions of service quality attributes, the majority of the respondents gave answers between "enough", "good", and "very good". This shows that the respondents did receive services that were almost in line with their expectations. There is a difference between the dimensions of the respondents' expectations with the dimensions of perception. Based on the measured quality dimensions, the website content variable has the highest assessment score, followed by empathy and tangible variables. For the variable perception of the attributes of e-learning services, there are five choices, namely very bad (VB), bad (B), enough (E), good (G), and very good (VG). In the results of the questionnaire on respondents' perceptions of service quality attributes, the majority of respondents gave answers between "enough", "good", and "very good". This shows that the respondents did receive services that were almost in line with their expectations. There is a difference between the dimensions of the respondents' expectations with the dimensions of perception.

Based on the measured quality dimensions, the website content variable has the highest assessment score, followed by empathy and tangible variables. Meanwhile, the respondent's perception data can also be seen if the website content quality dimension gets the highest score, followed by the assurance and empathy variables. The quality of teachers has a positive influence on the success of e-learning and the quality is assessed using eight instruments in four categories of teacher attitudes, teacher behavior, teacher self-efficacy, and peer-teaching interactions [28]. Based on the results of the two questionnaires, the respondents prioritized the assurance variable for e-learning services where this assurance variable contained points about the assurance and certainty of the lecturers' knowledge and understanding of the material provided as well as the lecturer's ability to provide confidence and be fair and impartial in giving an assessment.

The second variable that is of concern to the respondents is the assurance variable. Variable assurance includes knowledge of lecturers in accordance with their fields, ability to be fair and impartial in providing assessments, lecturers' ability to answer all student questions thoroughly, and lecturers' having an understanding of the material provided. Meanwhile, the third variable is the empathy variable which is related to the attention and concern of the lecturers towards students, encouraging and motivating students to do their best. The fourth variable that the respondents pay attention to is website content related to multimedia features, and the availability of information that is accurate, useful, quality, and relevant to the courses being taught.

3.4. Expected value and perception

Service quality, an important factor affecting user satisfaction using the SERVQUAL measurement instrument aims to know customers' needs, meet their expectations, and satisfy them by fulfilling their requirements, especially critical requirements [29]. The next step is to calculate the value (total score) of expectations and perceptions of each of the attributes of e-learning services. The results show that the percentage of respondents' expectations of e-learning services is between 80% to 90%. Meanwhile, the percentage value for respondents' perceptions of e-learning services ranges from 60% to 80%. Then, it can be seen that there is a difference between the level of expectations and the level of perception of the respondents on the quality attributes of e-learning services.

3.5. SERVQUAL gap score

After obtaining the expected value and perception value, the SERVQUAL gap score for each e-learning service attribute was measured. The gap for each item is calculated as the perception of the actual service delivered by the firms within that service sector (perception) minus customer expectations concerning a service (expectation) (P-E) [30]. Table 1 and Figure 4 show the level of discrepancy between the dimensions of expectation and perception of the SERVQUAL measurement that has been carried out previously. It can be seen that all the results of the SERVQUAL gap score are in a negative position. From the whole calculation process for the SERVQUAL method used, the following conclusions can be drawn, questions 1 to 4 refer to the assurance variable with an average gap score of -0.507.

Table 1. SERVQUAL gap score

No	Quality attribute	Perception value	Expected value	Gap score	Average gap score
1	Lecturers have knowledge according to their field	3.767	4.324	-0.557	-0.507
2	Lecturers are fair and impartial in giving assessments	3.858	4.288	-0.429	
3	Lecturer answers all student questions thoroughly	3.772	4.311	-0.539	
4	I believe the lecturer has an understanding of the material given	3.868	4.370	-0.502	
5	Lecturers pay attention and care about students	3.571	4.242	-0.671	-0.626
6	Lecturers understand student needs	3.507	4.237	-0.731	
7	Lecturer gives the best assessment for students	3.781	4.315	-0.534	
8	Lecturers encourage and motivate students to do their best	3.708	4.274	-0.566	-0.700
9	Lecturers respond to student needs quickly and efficiently	3.420	4.201	-0.781	
10	Lecturers are willing to help students in solving problems	3.612	4.274	-0.662	
11	Lecturers always respond to student questions and comments	3.594	4.251	-0.658	-0.658
12	Lecturers consistently provide material	3.667	4.370	-0.703	
13	Lecturer can be reliable	3.516	4.192	-0.676	
14	Lecturer corrects the information that has been given when needed	3.621	4.215	-0.594	-0.790
15	The e-learning user interface is easy to use	3.224	4.123	-0.900	
16	E-learning is fast and easy to access	3.128	4.055	-0.927	
17	E-Learning includes various learning activities	3.434	4.215	-0.781	-0.535
18	E-Learning is easy for students to manage	3.685	4.237	-0.553	
19	E-learning using multimedia features	3.461	4.155	-0.694	
20	E-learning provides useful information	3.840	4.260	-0.420	-0.479
21	E-learning provides accurate information	3.708	4.187	-0.479	
22	E-learning provides quality information	3.616	4.210	-0.594	
23	Information on e-learning is relevant to the subject being taught	3.781	4.269	-0.489	

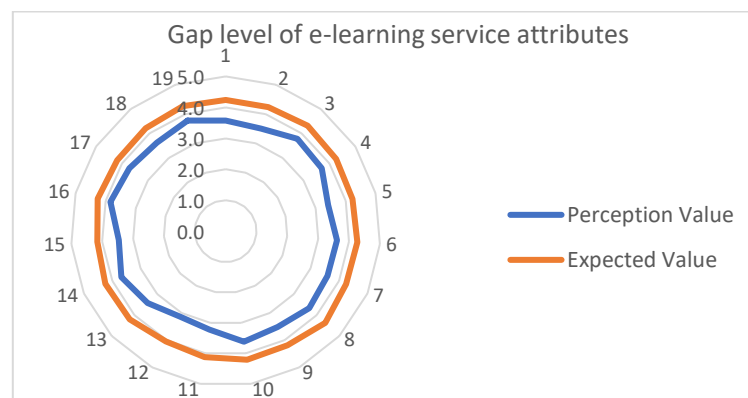


Figure 4. Service attribute gap level chart

Questions 5 to 8 refer to the empathy variable with an average gap score of -0.626. Questions 9 to 11 refer to the response variable with an average gap score of -0.700. Questions 12 to 14 refer to the reliability variable with an average gap score obtained of -0.658. Questions 15 to 18 refer to tangible variables with an average gap score of -0.790. Questions 19 to 23 refer to the website content variable with an average gap score of -0.535. A negative gap score implied that expectations have not being met, quality is perceived to be unsatisfactory [30]. So, it can be concluded that the respondents' expectation value cannot be matched by the value of their perception which has a negative impact on the gap score. This proves that e-learning services have not been able to meet the expectations of their users.

3.6. Kano model

Kano Model developed a model to categorize the attributes of a product or service based on how well they are able to satisfy customers' requirements to improve service quality [29]. The Kano model brings a different perspective in order to analyze the possibilities of improving the quality of products and services [30]. The results show that 23 attributes of e-learning services, some fall into the Kano "I" category or 10 in different categories. The remaining 13 attributes fall into the "O" or one-dimensional Kano category. In Kano model, if an attribute is included in the indifferent category, it can be concluded that these attributes can be ignored because they have no effect on user satisfaction with services, in this case, e-learning.

Service users, in this case, students, do not care about the existence of attributes that fall into this indifferent category. Of concern is the attributes that fall into category O. For the attributes in category O, if they are not met, it will affect the level of user satisfaction with e-learning services. For the one-dimensional category, there are 13 attributes included, lecturers have knowledge according to their fields, lecturers are fair and impartial in giving assessments, I believe the lecturer has an understanding of the material given, lecturers give the best assessments for students, lecturers encourage and motivate students to do their best, lecturers respond to student needs quickly and efficiently, lecturers are willing to help students in solving problems, lecturer corrects the information that has been given when needed, the user interface of e-learning is easy to use, e-learning includes various learning activities, e-learning provides useful information, e-learning provides accurate information, and e-learning provides quality information.

3.7. Development of the quality house QFD

Quality function deployment (QFD) is a quality tool that helps to translate the voice of the customer into new products that truly satisfy their needs [31]. QFD is a customer-oriented approach that offers many facets with the end goal of ensuring that customer requirements are satisfied [31]. Support the design team in developing new products in a structured way, based on an assessment of customer needs [32]. In the process of compiling the house of quality, the authors used data related to customer needs which are attributes of e-learning services, and data of technical responses from management and e-learning service managers. The service attribute is an amalgamation of the SERVQUAL method and the Kano model. In compiling the house of quality, there are several calculation processes that must be carried out, namely looking for the adjusted importance value, looking for the weighted value of the connectedness matrix, and looking for the technical response weight value. Therefore, before entering the house of quality, it is necessary to adjust the level of importance (adjusted importance) to the attributes of e-learning services [33], [34].

QFD and Kano model can be effectively integrated to identify customer needs more specifically and result in maximum customer satisfaction [35], [36], understand customer needs in a better way, and can focus on them properly. Based on the instructions in the house of quality calculation process in the QFD, the results obtained are the level of importance or the adjusted importance value of the e-learning service quality attribute. All attributes obtained an importance level value of 4 because the total expectation score of the two attributes is above 878. The results of the calculation of the customer satisfaction score (CSS) of e-learning service quality attributes using the formula: customer satisfaction score=Gap score * level of interest. The value of the level of importance is obtained based on a special table that contains the category of each value of service importance (not important, less important, quite important, important, and very important). Given that from the Kano model category classification, there are several attributes that fall into the indifferent category, then these attributes are ignored and omitted so that they are not included in the process of calculating the adjusted importance value. Kano category scores are 4 for the attractive category, 2 for the one-dimensional category, and 1 for the must-be category.

From Table 2, it can be seen that the adjusted importance value for each quality attribute has a one-dimensional Kano category. Kano's model can help firms categorize user needs and provide appropriate action or investment in user satisfaction improvement in the context of e-learning services [37]. The adjusted importance value shows the priority level of the measured attributes, which attributes need to be prioritized for improvement first. This can be seen by sorting the results of the adjusted importance value obtained. From the Table 1, the highest priority is attributed 15 while the lowest is attribute 20. In the house of quality, the adjusted importance value is placed in the importance level column.

Table 2. Adjusted importance value of e-learning service quality attributes

No	Quality attribute	Value category Kano	CSS	Adjusted importance value	Order of priority
1	Lecturers have knowledge according to their field	2	2.20	4.40	8
2	Lecturers are fair and impartial in giving assessments	2	1.72	3.44	12
4	I believe the lecturer has an understanding of the material given	2	2.00	4.00	10
7	Lecturer gives the best assessment for students	2	2.16	4.32	9
8	Lecturers encourage and motivate students to do their best	2	2.24	4.48	7
9	Lecturers respond to student needs quickly and efficiently	2	3.24	6.48	2
10	Lecturers are willing to help students in solving problems	2	2.64	5.28	4
14	Lecturer Corrects the information that has been given when needed	2	2.36	4.72	5
15	The e-learning user interface is easy to use	2	3.60	7.20	1
17	E-Learning includes various learning activities	2	3.12	6.24	3
20	E-learning provides useful information	2	1.68	3.36	13
21	E-learning provides accurate information	2	1.92	3.84	11
22	E-learning provides quality information	2	2.36	4.72	6

3.8. Technical response

The bottom of the house of quality shows the target values that the design team has determined must be met to meet the technical responses [38]. The technical response is the translation of user needs or user requirements for a service they receive into the language of the organization. The organizational language here is defined as a process, procedure, or solution owned and used by the organization to meet the needs of service users. To determine the technical response here, the author held a discussion with the UPN Veteran Jakarta web manager, namely the integrated service unit (ISU) of information technology. From the results of interviews with ISU information technology and computers at UPN Veteran Jakarta, some technical response information related to the fulfillment of e-learning services was obtained. Improvements to the e-learning user interface so that e-learning is easy to use with an easy-to-remember interface. A user-friendly e-learning platform is a mandatory requirement that needs to be part of the service provided to avoid customer dissatisfaction, focusing on the contents and materials [39], the flexibility of time and hours, mandatory quizzes and exercises, download area, and attendance are important elements to increase the perceived value of e-learning [40].

As well as updating e-learning which was originally static to dynamic e-learning. The improvements include updating the Moodle version that is used to Moodle version 3.10, providing access to various interactive content such as interactive videos combined with adding a quiz feature that is displayed in the middle of the material given through learning videos. So that students will feel the use of e-learning is more dynamic. Adding a progress tracking feature that makes it easier for lecturers to know the progress of students towards the lecture material being followed. Lecturers can see interactions or activities carried out by students, including attendance, or completely following the instructions given by the lecturer. So that lecturers can monitor and the learning process becomes rational and monitored.

Adding a menu of ratings (competencies), (grades) or awards (badges), lecturers can give ratings (competencies), and scores directly on assignments that have been given (grades) or awards (badges) for students who have completed their assignments. Digital badges can be used by instructors to acknowledge and recognize skills, achievements, and learning that happen inside or outside of the formal classroom [41]. Students will be more active and independent in learning. Therefore, student-centered learning process will be achieved. To support points 1 to 3, it is necessary to increase server capacity among others for the needs of load balancers, web servers, database servers, and backup servers. The use of a backup server to back up data on the web server that is used now and is made as a secondary server, so that if the main server is interrupted, e-learning can function because there is a second server. The increase in bandwidth is intended to improve the quality and speed of the network or internet connection so that the implementation of online learning can be carried out properly.

Database synchronization is required between applications, both e-learning, science and technology index (Sinta) Google Scholar, and academic information systems. With the synchronization of databases between applications on the web databases, updating data can be done easily, for example updating of student attendance data, student assignment scores, both individual assignments and group assignments. The use of mobile learning will provide flexibility to students in learning. This is because the process of learning is not limited by place and time [4]. Students can access various learning contents in the form of learning videos and text-based. With mobile learning, students can collaborate online which makes it easier for students to interact and work together quickly without having to meet face to face. The use of mobile learning will facilitate the personalization function that can make it easier for students to follow the learning agenda, increasing the sense of involvement and motivation of students, and can make it easier for students to find and retrieve information quickly and easily.

There is a need for a notification feature that makes it easier for students and lecturers to get the latest information and information about deadlines given by students to send assignments and lecturer notifications to check the assignments that have been collected by students. An upgrade of forum, chat and messaging features is required. Synchronous discussion forums facilitate students' reflexivity in e-learning, providing opportunities for participants to comment (post the essay writing activity itself) on the essays they wrote about several aspects of the module, especially aspects of comparison and contrast [42]. Users can chat together to discuss or have a series of conversations by inserting files (documents, spreadsheets or slides) and tasks together to help everyone get the same information. Users can send photos, videos, voice messages to other users such as lecturers or other students. Students can express their emotions through the sticker facility provided. Chat room and forum chat facilities that can be used to chat online can be one by one or with all members. Users can also record sound which you can then directly send to your chat friends.

Addition of e-learning management staff, the integrated service unit of information technology UPN Veteran Jakarta only has six staff members, lacking for managing the entire e-learning. For this reason, it is necessary to add staff members, especially in the faculties as e-learning managers. The integrated service unit of information technology UPN Veteran Jakarta cooperates with other organizational units such as the ministry of education and culture related to information held by lecturers, including fields of interest by lecturers, knowledge possessed by lecturers in terms of making teaching materials, research and community service carried out by the lecturer. With better cooperation with other organizations, such as synchronizing the menu update of lecturer profiles with Sinta and Google Scholar, students will feel confident that their interests or research fields are in accordance with the subjects taught by the lecturer.

3.9. Technical response and service attributes relationship

The house of quality is focused on collecting, understanding, and use the voice of the customer as the starting point and foundation for all future QFD activities [43]. In the house of quality, it is important to see the relationship between the technical response that has been obtained and the service attributes. The relationship between the two is arranged in a matrix which will later contain a strong value or not the relationship between technical responses and service attributes that become user needs [44]. The relationship can be a strong, moderate, or weak relationship. Each of these types of relationships is symbolized by a symbol which can be explained as: i) Strong relationship (●), which is a strong relationship between technical response and service attributes, has a connectedness weight=9; ii) Medium relationship (○), the moderate relationship between technical response and service attributes has a connectedness weight=3; and iii) Weak relationship (Δ), which is a weak relationship between technical response and service attributes, has a connectedness weight=1. Of the 12 technical responses compiled, there are 10 technical responses whose development directions need to be improved, and 2 technical responses whose development directions are fixed. For a technical response with an upward direction of development, it is necessary to do because the technical response does not yet exist and is only in the planning stage. As for the technical response with a fixed development direction, no increase is made because it already exists or is already running, it just needs attention so that there is no decline.

3.10. Technical response weight

Technical requirements are located at the top of the house of quality and are combined to form the service strategies or techniques established through negotiation and communication between the related departments in a firm [44]. The technical response weight is an assessment of each technical response which is calculated based on the level of connection (relation matrix) between technical responses to the needs of users who have a relationship with the relevant technical response. The calculation of the technical response weight is referred to as the calculation of absolute importance or absolute importance (AI) and the value of relative importance (RI). Both calculations use the following formula as in (1) and (2) [45]. The results of the calculation of the absolute importance and relative importance can be seen in Table 3. The table indicates the order of priority for the existing technical response. This priority order describes what technical responses need priority attention from management and e-learning staff to meet user needs. Based on the table, the technical response that gets the highest priority is "Synchronizing databases between applications" and the lowest is "Increasing server capacity."

$$\text{absolute importance value} = \sum \text{Value of importance level} \times \text{value of the relationship matrix between technical response and service attributes} \quad (1)$$

$$\text{relative importance value} = \frac{\text{Absolute Importance}}{\sum \text{technical response}} \quad (2)$$

Table 3. Value of absolute importance and relative importance

No	Technical response	AI	RI	Order of priority
1	Improved e-learning user interface	75.44	6.29	9
2	The addition of a progress tracking feature helps lecturers monitor student progress	104.64	8.72	6
3	Added menu rank (competencies), (grades) or awards (badges)	91.44	7.62	7
4	Server capacity increase	38.16	3.18	12
5	Increased bandwidth	77.04	6.42	8
6	Database synchronization between applications	181.12	15.09	1
7	Application of mobile learning	63.36	5.28	11
8	Notification features	122.40	10.20	5
9	Upgraded forum, chat and private messaging features	166.80	13.90	2
10	Synchronize the lecturer profile update menu with Sinta and Google Scholar	130.08	10.84	4
11	Addition of e-learning management staff	156.96	13.08	3
12	Cooperation with other organizational units	75.36	6.28	10

3.11. Relationship between technical response

The relationship between the technical response is the interrelationship between the existing technical response [43] can be seen in Figure 5 and Figure 6. Determination of the relationship between the technical response is carried out by identifying the tradeoffs that must be made in determining the technical response that needs attention from the service manager [43]. This relationship was obtained based on interviews with the staff members of the integrated service unit (ISU) of information technology UPN Veteran Jakarta. The relationship between this technical response is described by using symbols. Strong positive relationship (●), the relationship between technical responses is unidirectional, i.e., if one of the technical responses increases or decreases, it will have a strong impact on increasing or decreasing other related items. Positive relationship (○), is a relationship where if one of the technical responses increases or decreases, it will affect the increase or decrease in the related technical response.

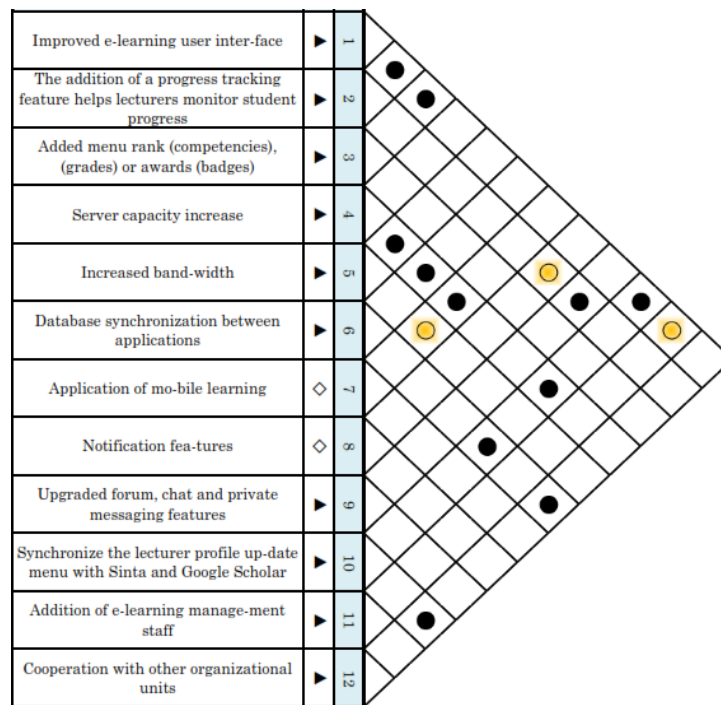


Figure 5. Relationship between technical response

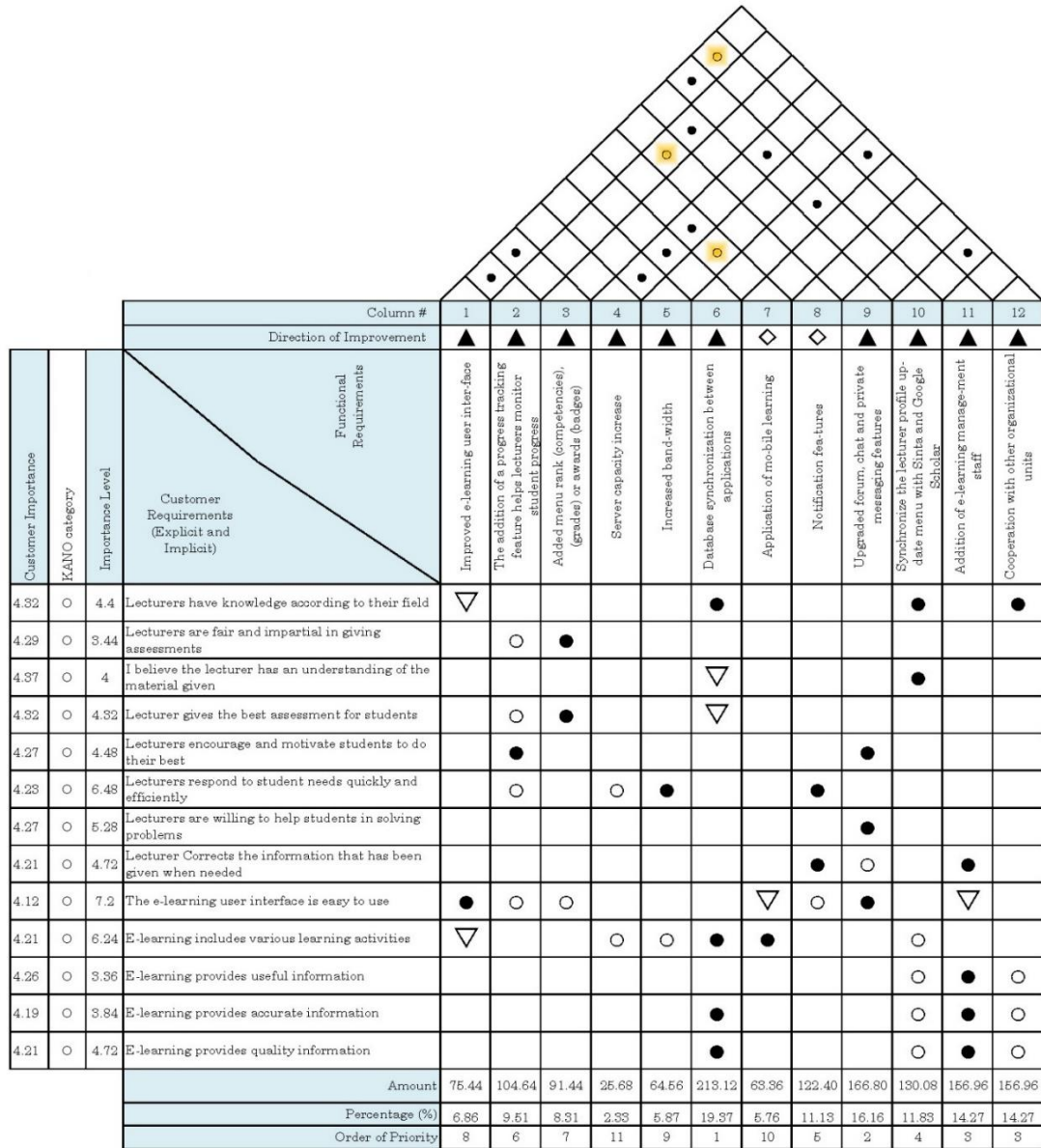


Figure 6. KANO house of quality

4. CONCLUSION

The SERVQUAL method shows that all 23 attributes have a negative gap score, indicating that the value of user expectations for the service is lower than the perceived value of its users, indicating that user satisfaction with learning variables is still low. This suggests that the level of learning that runs in UPN Veteran Jakarta is still low. There were 12 technical responses provided as a solution to the needs of service users indicated by SERVQUAL service attributes throughout the QFD formulation process. The technical responses that need to be carried out or followed up by the management and IT unit staff to improve the quality of the e-learning web. Based on the results in point 3 regarding service attributes, the technical responses that need to be carried out or followed up by the management and Information Systems staff to improve the quality of e-learning web are database synchronization across programs, forum features, chat, and private messaging should all be updated, staffing for e-learning management has been added, the lecturer profile update menu should be synchronized with Sintia and Google Scholar, and features of notifications.

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