

## Analysis of Islamic Higher Education Quality Mapping Based on Student Service Satisfaction Using Multidimensional Scaling Method

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### ABSTRACT

This study aims to analyze the mapping of the quality of Islamic higher education based on the similarity of student service satisfaction. This study used ex-post-facto research with an explorative. It employed a descriptive design. The subjects consisted of students from various study programs at the FETI, the SII Ambon. Data were collected through student satisfaction questionnaires. Data analysis was performed using Multidimensional Scaling. The results showed similarities in mapping the quality of Islamic higher education based on student service satisfaction from 6 study programs. It calculated the closest Euclidean distance between objects located in Biology Education and Islamic Education study programs or vice versa, where the proximity is 0.233. It indicates that the quality of education in student service satisfaction between Biology Education and Islamic Education study programs has the highest similarity compared to other study programs. The output of the MDS analysis obtained a stress value of 0.03671 (3.67%) and  $R^2$  of 0.99606. It represents an acceptable spatial map ( $R^2 \geq 0.6$ ).

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## INTRODUCTION

Managers of Islamic higher education, in this case, universities, should be oriented towards ensuring the quality of education. Quality assurance in Islamic higher education is carried out through establishing, implementing, evaluating, controlling, and improving Islamic higher education standards. Minister of Research and Technology Regulation No. 62 of 2016 concerning the Higher Education Quality Assurance System has been updated with the Minister of Education and Culture regulation, emphasizing Islamic higher education autonomy in the Internal Quality Assurance Standards (IQAS) and providing more detailed guidance.<sup>1</sup> The policy determines the feasibility and achievement of the quality of Islamic higher education institutions and study programs. The managers of Islamic higher education should strive for internal sustainable efforts to improve the quality of Islamic higher education in reaching higher education vision and mission and meet stakeholders' needs through controlling the *Tri Dharma* of higher education.<sup>2</sup>

In general, it can be said that the quality of a product or service can be realized if all the organization's activities are service quality-oriented.<sup>3</sup> At universities, efforts to provide services for users carried out by each study program can be used to measure the quality of the educational institution. Five elements can determine service quality related to user satisfaction: reliability, responsiveness, assurance, empathy, and tangibles.<sup>4</sup> The essence of service quality, especially user satisfaction, is the reliability of a person carrying out service tasks consistently, showing all forms of actualization of pleasurable service activities with responsiveness, ensuring the existence of assurance, empathy when giving services, and showing seen tangible.<sup>5</sup>

Every service in Islamic higher education requires a reliable form of handling, including the services provided by the study program to students (reliability). It means that

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<sup>1</sup> Lalu Zulkifli et al., 'Pengembangan Manual Mutu Berbasis Karakter Untuk Meningkatkan Kualitas Layanan Pendidikan', in *Prosiding Seminar Nasional FKIP Universitas Mataram*, vol. 1, 2020, 234-48; Elbadiansyah and Masyni Masyni, 'The Implementation of Internal Quality Assurance (IQA) in Three Private Universities In Samarinda', *Erdio Journal of Educational Innovation* 8, no. 1 (2021): 53-60; Raphael Muzondiwa Jingura and Reckson Kamusoko, 'A Competency Framework for Internal Quality Assurance in Higher Education', *International Journal of Management in Education* 13, no. 2 (January 2019): 119-32.

<sup>2</sup> Khaled Alzafari and Jani Ursin, 'Implementation of Quality Assurance Standards in European Higher Education: Does Context Matter?', *Quality in Higher Education* 25, no. 1 (2019): 58-75; Sri Winarsih, 'Kebijakan Dan Implementasi Manajemen Pendidikan Tinggi Dalam Meningkatkan Mutu Pendidikan', *Cendekia: Jurnal Kependidikan Dan Kemasyarakatan* 15, no. 1 (2017): 51-66.

<sup>3</sup> Aji Sofanudin, 'Manajemen Inovasi Pendidikan Berorientasi Mutu Pada MI Wahid Hasyim Yogyakarta', *Cendekia: Jurnal Kependidikan Dan Kemasyarakatan* 14, no. 2 (2016): 301-16.

<sup>4</sup> Doha Tijjani, 'Service Quality Analysis of Private Universities Libraries in Malaysia in the Era of Transformative Marketing', *International Journal for Quality Research* 13, no. 2 (2019): 269-84; Lomendra Vencataya et al., 'Assessing the Impact of Service Quality Dimensions on Customer Satisfaction in Commercial Banks of Mauritius', *Studies in Business and Economics* 14, no. 1 (2019): 259-70; Quang Nguyen et al., 'Understanding Customer Satisfaction in the UK Quick Service Restaurant Industry: The Influence of the Tangible Attributes of Perceived Service Quality', *British Food Journal*, 2018.

<sup>5</sup> Abdurrahman Faizal Bahari, 'Analisis Kualitas Layanan Dalam Upaya Meningkatkan Kepuasan Narapidana Di Lapas Narkotika Kelas II A Pamekasan', *JUSTITIA: Jurnal Ilmu Hukum Dan Humaniora* 7, no. 1 (2020): 84-102; Suardi Palaba, 'Pengaruh Kualitas Pelayanan Terhadap Keputusan Memilih Hotel Dan Wisma Di Kabupaten Pinrang', *Pusaka: Journal of Tourism, Hospitality, Travel and Business Event* 2, no. 1 (2020): 35-43.

in providing services, the study program is expected to have the ability to include: knowledge, expertise, independence, mastery, and high work professionalism so that the work activities carried out produce consistent or reliable forms of service to users. In this case, it is the students.<sup>6</sup> It is also essential to ensure the importance of responsiveness service quality for the services provided by the study program manager. Every student who gets service needs an explanation of the services provided to make the service clear and understandable. To realize those things, the quality of responsiveness has a vital role in meeting various explanations in giving services to the students.<sup>7</sup>

Based on the results of the accreditation assessment of study programs within the Faculty of Education and Teacher Training (henceforth FETT), the State Islamic Institute of Ambon (henceforth SII Ambon) showed different achievement results. It shows the achievement of different qualities between study programs. There are eight study programs within the FETT of the SII Ambon with the acquisition of category A accreditation. One of the quality assessments in the study program can be viewed from the satisfaction of student services. The accreditation results within the FETT of the SII Ambon show differences in the form of student services that are carried out even though they are still under the auspices of one faculty. So it is necessary to identify student service satisfaction carried out by each study program to map the quality of education in the FETT of the SII Ambon environment. Identification can be made based on the distance on the configuration map in each study program at FETT of the SII Ambon. The analysis results show how the study programs are grouped based on the satisfaction of the student services performed. One of these mappings can be done using Multidimensional Scaling analysis.

## RESEARCH METHOD

This research was an *ex post facto* research with descriptive explorative design. The research was conducted at the FETT of the SII Ambon. Researchers took samples from each study program using the Simple Random Sampling technique. This technique was done by taking a sample of students from various batches in each study program on a simple random basis. The participants involved in this study were 71 students. The data was collected using a questionnaire containing student service satisfaction and made on a rating scale. Student service satisfaction consists of the following aspects: 1) reliability, consisting of the ability of lecturers, education staff, and managers to provide services; 2) responsiveness, consisting of the willingness of lecturers, education staff, and managers to help students and providing services quickly; 3) assurance, consisting of the ability of lecturers, education staff, and managers in convincing the students that the services

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<sup>6</sup> I M Salinda Weerasinghe and R Lalitha Fernando, 'Students' Satisfaction in Higher Education', *American Journal of Educational Research* 5, no. 5 (2017): 533-39; Suroso, 'The Development of Islamic Community Participation for Education Services in The Underdeveloped Regions', *Cendekia: Jurnal Kependidikan Dan Kemasyarakatan*, 19, No 1 (2021): 89-107.

<sup>7</sup> Michael J Guralnick, 'Early Intervention for Children with Intellectual Disabilities: An Update', *Journal of Applied Research in Intellectual Disabilities* 30, no. 2 (2017): 211-29; Freekley Steyfli Maramis, Jantje L Sepang, and Agus S Soegoto, 'Pengaruh Kualitas Produk, Harga Dan Kualitas Pelayanan Terhadap Kepuasan Konsumen Pada Pt. Air Manado', *Jurnal EMBA: Jurnal Riset Ekonomi, Manajemen, Bisnis Dan Akuntansi* 6, no. 3 (2018): 1658-1667.

provided are following the provisions; 4) empathy, consisting of lecturers', education staff's, and managers' care in paying attention to students; and 5) tangibles, consisting of student assessment toward the adequacy, accessibility, quality of facilities and infrastructure.

Before the instrument was used, the researcher conducted verification of the validity and estimation of reliability. The instrument's validity is proven through content validity based on expert judgment; then, the coefficient is calculated using Aiken's V formula.<sup>8</sup> The Aiken's V formula is as follows:

$$V = \frac{\sum s}{n(c - 1)}$$

Description:

V = rater deal index

n = number of raters

S = score assigned by each rater minus the lowest score in the category used  
( $S = r - lo$ )

lo = the lowest value of the validity assessment (in this case = 1)

c = the highest number of validity assessments (in this case = 5)

r = number given by an appraiser/validator

While the estimation of reliability of the instrument was analyzed using Cronbach's Alpha.<sup>9</sup> The Cronbach alpha formula is as follows:

$$\alpha = \left( \frac{k}{k - 1} \right) \left( 1 - \frac{\sum \sigma_i^2}{\sigma_t^2} \right)$$

Description:

$\alpha$  = instrument reliability coefficient

k = number of statement items in the instrument

$\sum \sigma_i^2$  = total variance of instrument items

$\sigma_t^2$  = total score variance

Data analysis was performed using ALSCAL Multidimensional Scaling. The procedure for Multidimensional Scaling analysis in this research is as follows.

1. Calculating the average attribute assessment related to student service satisfaction from each study program.
2. Calculating the distance matrix using the Euclidean distance. The proximity between objects on the perceptual map can be calculated using the Euclidean distance between the first object to the  $j^{\text{th}}$  object with the formula:<sup>10</sup>

<sup>8</sup> Eko Wahyunanto Prihono, 'Validitas Instrumen Kompetensi Profesional Pada Penilaian Prestasi Kerja Guru', *Ekspose: Jurnal Penelitian Hukum Dan Pendidikan* 18, no. 2 (2020): 897-910; Heri Retnawati, *Validitas Reliabilitas Dan Karakteristik Butir* (Yogyakarta: Parama Publishing, 2016).

<sup>9</sup> Retnawati, *Validitas Reliabilitas Dan Karakteristik Butir*, 2016.

<sup>10</sup> Lam Hong Lee et al., 'An Enhanced Support Vector Machine Classification Framework by Using Euclidean Distance Function for Text Document Categorization', *Applied Intelligence* 37, no. 1 (2012): 80-99.

$$d_{ij}(\mathbf{X}) = \left[ \sum_{a=1}^n (x_{ia} - x_{ja})^2 \right]^{\frac{1}{2}}$$

Description:

$d_{ij}$  = distance between object i and object j (Euclidean distance)

$n$  = the number of dimensions

$x_{ia}$  = the result of measuring the i-th object on the variable k

$x_{ja}$  = the result of measuring the j-th object on the variable

### 3. Calculating the value of Stress and $R^2$ .

The formula calculates the stress value:

$$S = \sqrt{\frac{\sum_{ij} (d_{ij} - \hat{d}_{ij})^2}{\sum_{ij} d_{ij}^2}}$$

The stress value is good if the value is getting smaller or closer to 0. Stress indicates the proportion of variance differences (disparity) that the model does not explain.<sup>11</sup> The criteria for stress values are presented in Table 1.

**Table 1.** Criteria for Stress Score in MDS

Stress (%)	Goodness of Fit
> 20	Not good
10 < stress ≤ 20	Pretty good
5 < stress ≤ 10	Good
2,5 < stress ≤ 5	Very good
< 2,5	Perfect

$R^2$  shows the accuracy of the scaling model to represent the input data. The higher the value of  $R^2$ , the better the result of the spatial map is. It indicates an acceptable spatial map ( $R^2 \geq 0,6$ ).

### Multidimensional Scaling

Multidimensional Scaling (MDS) is a multivariate technique that can be used to determine the position of an object to other objects based on their similarity.<sup>12</sup> In addition, MDS is a technique that can transform respondents' judgments about the similarities or preferences of a set of objects under study into a multidimensional space. MDS is an algorithmic technique that is useful for identifying the dimensions underlying the evaluation of an object or determining the observed object's basic features.<sup>13</sup> There are many variations of MDS, but the general purpose of this analysis is to determine the degree of similarity of an object in a multidimensional space so that similar objects are close

<sup>11</sup> Joseph B Kruskal and Myron Wish, *Multidimensional Scaling* (Sage Publication, Inc., 1978).

<sup>12</sup> Joseph F Hair et al., *Multivariate Data Analysis* (New Jersey: Prentice Hall, Inc, 2009).

<sup>13</sup> Gudono, *Analisis Data Multivariat*, 3rd ed. (Yogyakarta: BPFE, 2014); Kruskal and Wish, *Multidimensional Scaling*.

together or far apart. MDS has been used for data and dimension visualization in cognitive diagnostics, test analysis, and many other areas of psychometric measurement.<sup>14</sup> The coordinates obtained from the MDS can be treated as a feature that stores information from the actual process in the data analysis process. With proper rotation, each trait represents a change in a particular skill or pattern of behavior within the respondent group.

There are several provisions in MDS use, including 1) The model has been adequately specified; 2) using the right level of measurement. For example, using a ratio or interval scale for MDS metrics is better. 3) The number of objects is at least as many as the dimensions. If the number of objects is less than the number of dimensions, the MDS will not be stable. If the number of objects is slightly more than the number of dimensions,  $R^2$  will be inflated. The number of objects is at least four times the number of dimensions plus 1; 4) The scale used is equivalent, and if it is not equivalent, then the measure used should be a standardized value; 5) Comparability, meaning that the object being compared should have certain similarities that are meaningful enough to be worthy of being compared; and 6) many samples involved is not required, but the minimum size of the object (variable) is 4.<sup>15</sup>

Based on the measurement scale, the MDS type is divided into two. They are metric and nonmetric MDS. In MDS Metrics, the data used is ratio data. Using MDS Metrics aims to obtain the configuration of data points in a multidimensional space whose proximity shows similarities to the observation data.<sup>16</sup> In Nonmetric MDS, the data used is ordinal. Nonmetric MDS aims to establish a nonmonotonic relationship between the distance between points and the observed similarity (Dexter, Rollwagen-Bollens, and Bollens 2018). The advantage of nonmetric MDS is that it does not require assumptions about the underlying transformation function. The only assumption required is that the data processing is ranking (or ordinal) data.

MDS provides non-matrix multidimensional scaling from one to five-dimensional equality or inequality matrices. Multidimensional scaling is a powerful means of data reduction and can be used with a direct equation, inequality matrices, or matrices derived from correlated square data. MDS does not assume statistical distribution, and this is because MDS, like cluster analysis, operates directly on inequalities. However, there is another crucial assumption in MDS. First, multidimensional scaling is a spatial model. To be able to use MDS, data must meet the following metric requirements: 1) The object's distance to itself is 0; 2) the distance of object A to B is the same as the distance from B to A; 3) the distance of object A to C is less than or equal to the distance of object B to C (often called the triangle inequality). Second, there are ways of deriving distances from rectangular data that do not satisfy the metric axioms. It is assumed that all objects will fit in the same metric space.

There are several advantages of MDS, namely: 1) being able to analyze the perception

<sup>14</sup> Ingwer Borg, Patrick J F Groenen, and Patrick Mair, *Applied Multidimensional Scaling and Unfolding* (Springer, 2018).

<sup>15</sup> Kruskal and Wish, *Multidimensional Scaling*.

<sup>16</sup> Kruskal and Wish; Michael D Lee, 'Determining the Dimensionality of Multidimensional Scaling Representations for Cognitive Modeling', *Journal of Mathematical Psychology* 45, no. 1 (2001): 149-66.

of consumer preference data using graphs partially; 2) can be used in the ordinal, interval, and ratio data scales; 3) can be done at the individual level (called disaggregate analysis), in addition to the segment level and the aggregate level (called aggregate analysis); and 4) can "generate" dimensions without having to describe product attributes.<sup>17</sup>

## RESULT AND DISCUSSION

### Service Satisfaction

Five elements can determine the concept of service quality related to user satisfaction. They are reliability, responsiveness, assurance, empathy, and tangibles.<sup>18</sup> The essence of service quality, especially user satisfaction, is a person's reliability in carrying out service tasks consistently, showing all forms of actualization of pleasurable service activities with responsiveness, fostering assurance, a sense of empathy when providing services, and showing tangible evidence.<sup>19</sup>

Every form of service requires certainty for the services provided. The form of certainty of service is determined mainly by the assurance of the study program that provides services so that people who receive services feel satisfied and believe that all forms of service affairs carried out will be finished and completed appropriate with the speed, accuracy, convenience, smoothness, and quality of the services provided.<sup>20</sup> Service activities require understanding and knowing the shared assumptions or interests of a matter related to the service. The service will run smoothly and with quality, if every party involved has a sense of empathy or concern in completing or has the same commitment to service.<sup>21</sup> The physical facilities and infrastructure of the study program can be relied upon to show the surrounding environment's state. Those are tangible evidence of the services provided to students. It includes physical facilities, for instance, lecture devices, lecture teaching materials, lecture rooms, equipment, and equipment used (technology). The physical facilities and infrastructure of the study program that can be relied upon to show the state of the surrounding environment are tangible evidence of the services provided to

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<sup>17</sup> Borg, Groenen, and Mair, *Applied Multidimensional Scaling and Unfolding*; Gudono, *Analisis Data Multivariat*.

<sup>18</sup> Tijjani, 'Service Quality Analysis of Private Universities Libraries in Malaysia in the Era of Transformative Marketing'; Vencataya et al., 'Assessing the Impact of Service Quality Dimensions on Customer Satisfaction in Commercial Banks of Mauritius'; Nguyen et al., 'Understanding Customer Satisfaction in the UK Quick Service Restaurant Industry: The Influence of the Tangible Attributes of Perceived Service Quality'.

<sup>19</sup> Bahari, 'Analisis Kualitas Layanan Dalam Upaya Meningkatkan Kepuasan Narapidana Di Lapas Narkotika Kelas II A Pamekasan'; Bryant R England et al., '2019 Update of the American College of Rheumatology Recommended Rheumatoid Arthritis Disease Activity Measures', *Arthritis Care & Research* 71, no. 12 (2019): 1540-55; Palaba, 'Pengaruh Kualitas Pelayanan Terhadap Keputusan Memilih Hotel Dan Wisma Di Kabupaten Pinrang'.

<sup>20</sup> Muhaini Prihatin, Zaili Rusli, and Hasim As' ari, 'Kualitas Pelayanan Publik Pada Kantor Camat Dumai Kota', *Jurnal Niara* 14, no. 3 (2022): 266-74; Risa Susanti, Tonich Uda, and Rinto Alexandro, 'Kualitas Pelayanan Jasa Pada Usaha Laundry Ririn Di Jalan G. Obos XII Kota Palangka Raya', *Jurnal Pendidikan Ilmu Pengetahuan Sosial (JPIPS)* 11, no. 02 (2019): 244-51.

<sup>21</sup> Adrian Heng Tsai Tan, Birgit Muskat, and Raechel Johns, 'The Role of Empathy in the Service Experience', *Journal of Service Theory and Practice*, 2019; Khanifatul Khusna, 'Pengembangan Dimensi Empati Sebagai Upaya Peningkatan Kualitas Pelayanan Publik Di Kantor Kecamatan Gubeng Surabaya', *Matra Pembaruan: Jurnal Inovasi Kebijakan* 1, no. 3 (2017): 177-88.

students. It includes physical facilities. For example, lecture devices, lecture teaching materials, lecture rooms, equipment, and equipment used (technology). The physical facilities and infrastructure of the study program that can be relied upon to show the state of the surrounding environment are tangible evidence of the services provided to students. It includes physical facilities, such as lecture devices, lecture teaching materials, lecture rooms, equipment, and teaching tools used (technology).<sup>22</sup>

Every service in Islamic higher education requires a reliable form of handling, including the services provided by the study program to students (reliability). It means that in providing services, the study program is expected to have the ability to include: knowledge, expertise, independence, mastery, and high work professionalism so that the work activities carried out produce consistent or reliable forms of service to users. In this case, it is students.<sup>23</sup> The importance of responsiveness service quality for the services provided by the study program manager does matter. Every student who gets services needs an explanation of the services provided to make the service clear and understandable. Thus, the quality of responsiveness service needs to be scaled up to fulfill the demand for explanations in providing services to the students of Islamic higher education.<sup>24</sup>

### Validity and Reliability

Efforts to produce a good instrument are carried out by proving the validity and estimation of reliability. The researcher proved the content validity based on expert judgment and then calculated the coefficient using Aiken's V formula. The results of Aiken's V index calculation of content validity are presented in Table 2.

**Table 2.** Calculation Results of Aiken's V Index Content Validity

Items	Code	V1	V2	V3	s1	s2	s3	$\sum s$	V	Category
1	A_1	4	4	3	3	3	2	8	0.67	High
2	A_2	4	5	4	3	4	3	10	0.83	Very high
3	A_3	4	4	4	3	3	3	9	0.75	High
4	A_4	4	5	3	3	4	2	9	0.75	High
5	A_5	5	4	3	4	3	2	9	0.75	High
6	A_6	4	5	4	3	4	3	10	0.83	Very high
7	A_7	4	4	4	3	3	3	9	0.75	High
8	A_8	4	5	4	3	4	3	10	0.83	Very high
9	B_1	4	5	4	3	4	3	10	0.83	Very high
10	B_2	4	4	5	3	3	4	10	0.83	Very high
11	B_3	4	4	5	3	3	4	10	0.83	Very high
12	B_4	4	4	5	3	3	4	10	0.83	Very high

<sup>22</sup> Ganang Setianto and Sri Wartini, 'Pengaruh Bukti Fisik Dan Empati Terhadap Loyalitas Konsumen Melalui Kepuasan Konsumen', *Management Analysis Journal* 6, no. 4 (2017): 367-76.

<sup>23</sup> Weerasinghe and Fernando, 'Students' Satisfaction in Higher Education'.

<sup>24</sup> Guralnick, 'Early Intervention for Children with Intellectual Disabilities: An Update'; Maramis, Sepang, and Soegoto, 'Pengaruh Kualitas Produk, Harga Dan Kualitas Pelayanan Terhadap Kepuasan Konsumen Pada Pt. Air Manado'.

Items	Code	V1	V2	V3	s1	s2	s3	$\sum s$	V	Category
13	B_5	4	4	5	3	3	4	10	0.83	Very high
14	C_1	4	5	3	3	4	2	9	0.75	High
15	C_2	4	4	5	3	3	4	10	0.83	Very high
16	C_3	4	4	5	3	3	4	10	0.83	Very high
17	C_4	5	4	4	4	3	3	10	0.83	Very high
18	C_5	4	3	3	3	2	2	7	0.58	Medium
19	D_1	5	4	4	4	3	3	10	0.83	Very high
20	D_2	4	3	5	3	2	4	9	0.75	High
21	D_3	4	4	5	3	3	4	10	0.83	Very high
22	D_4	4	4	3	3	3	2	8	0.67	High
23	D_5	5	4	4	4	3	3	10	0.83	Very high
24	D_6	4	4	5	3	3	4	10	0.83	Very high
25	E_1	5	3	3	4	2	2	8	0.67	High
26	E_2	4	4	4	3	3	3	9	0.75	High
27	E_3	5	5	3	4	4	2	10	0.83	Very high
28	E_4	4	4	3	3	3	2	8	0.67	High
29	E_5	4	5	4	3	4	3	10	0.83	Very high
30	E_6	5	4	4	4	3	3	10	0.83	Very high

The instrument used in this study must measure what it is supposed to measure. In addition, a good instrument can measure the specified variable accurately. Thus, an instrument is considered suitable for measuring certain variables if the level of validity and reliability is met.<sup>25</sup> Validity supports empirical facts and theoretical reasons for interpreting an instrument's score and is related to measurement accuracy. Content validity in this study was carried out through expert judgment or judgment. Three experts carried out the assessment, and the scores were used to calculate the content validity coefficient using Aiken's formula.

Based on the acquisition of Aiken's index, most of the statements have a high validity category. Aiken's index ranged from 0.58 to 0.83, with the average acquisition of Aiken's index of 0.78. Aiken's V content validity coefficient value is 0.60 with the high validity category. Based on the content validity criteria, it can be stated that the instrument is content valid.<sup>26</sup>

Next, the researcher estimated the reliability using Cronbach's alpha formula. Table 3 is the result of the reliability estimation in this study.

<sup>25</sup> Marina Ramadani, Supahar, and Dadan Rosana, 'Validity of Evaluation Instrument on the Implementation of Performance Assessment to Measure Science Process Skills', *Jurnal Inovasi Pendidikan IPA* 3, no. 2 (2017): 180-88; Eko Wahyunanto Prihono and Supahar, 'The Measurement of Professional Competency to School Teacher's Achievement at PGRI University Yogyakarta Laboratory', *Refleksi Edukatika: Jurnal Ilmiah Kependidikan* 8, no. 2 (2018).

<sup>26</sup> Retnawati, *Validitas Reliabilitas Dan Karakteristik Butir*.

**Table 3.** Reliability Statistics

Cronbach's Alpha	N of Items
.951	30

The results of the reliability estimation show that the 30 statement items given to 71 respondents obtained a reliability coefficient of 0.951 with a high-reliability category. It shows confidence in the freedom of the measurement results from error. The higher the reliability coefficient, the higher the confidence level in the measurement results.

### Multidimensional Scaling Analysis

#### Average of Attribute Rating

Data were obtained from participants in the form of ratio data. The researchers then calculated the average attribute assessment based on student service satisfaction. The average assessment of student service satisfaction attributes for each study program in the SII Ambon is presented in Table 4.

**Table 4.** The Average Assessment of Student Service Satisfaction

Attribute	Study Program					
	IEM	BE	ME	IE	ETE	SE
<i>Reliability</i>	2.33	2.92	2.96	2.91	3.34	3.13
<i>Responsiveness</i>	2.68	3.05	2.85	2.90	3.33	3.21
<i>Assurance</i>	2.56	3.08	3.15	2.93	3.29	3.23
<i>Empathy</i>	2.10	2.98	2.71	2.95	3.36	3.00
<i>Tangible</i>	2.20	2.83	2.88	2.92	3.31	3.13

Based on Table 4, an image mapping consisting of 5 attributes can be obtained, and each attribute has an average score. In general, MDS is often referred to as perceptual mapping. This technique allows researchers to know the relative position of a set of objects based on a respondent's perception. This relative perception can be mapped in a multidimensional space. Dimensions in MDS are divided into 2, namely subjective and objective dimensions. Subjective and objective dimensions may differ due to 1) individual differences, meaning differences in the dimensions used to evaluate and/or the weights for these dimensions, and 2) interdependence between dimensions that results in unexpected evaluations. The data analyzed in this study are indirect. The researcher makes an average in the initial analysis procedure to determine the attributes. It is contrary to direct data collection, which does not determine its attributes first. Indirect data collection has determined its attributes first.<sup>27</sup> In this study, the attributes determined by the researcher are elements of student service satisfaction, including reliability, responsiveness, assurance,

<sup>27</sup> Kruskal and Wish, *Multidimensional Scaling*; Esti Dwi Rinawiyanti, Mochammad Arbi Hadiyat, and Hardi Yanto, 'Analisis Positioning Dengan Multi Dimensional Scalling (MDS) Dan Analisis Faktor Untuk Pemetaan City Car Di Makassar', *Jurnal Manajemen Teori Dan Terapan* 11, no. 1 (2018).

empathy, and tangibles.

### Euclidean Distance Matrix

The results of the calculation of the Euclidean distance are presented in the following matrix:

	1	2	3	4	5	6
1	,000					
2	1,388	,000				
3	1,268	,349	,000			
4	1,328	,233	,336	,000		
5	2,190	,821	1,001	,905	,000	
6	1,745	,427	,558	,530	,473	,000

Description:

- 1: Islamic Education Management (IEM)
- 2: Biology Education (BE)
- 3: Mathematics Education (ME)
- 4: Islamic Education (IE)
- 5: Elementary Teacher Education (ETE)
- 6: Science Tadris (ST)

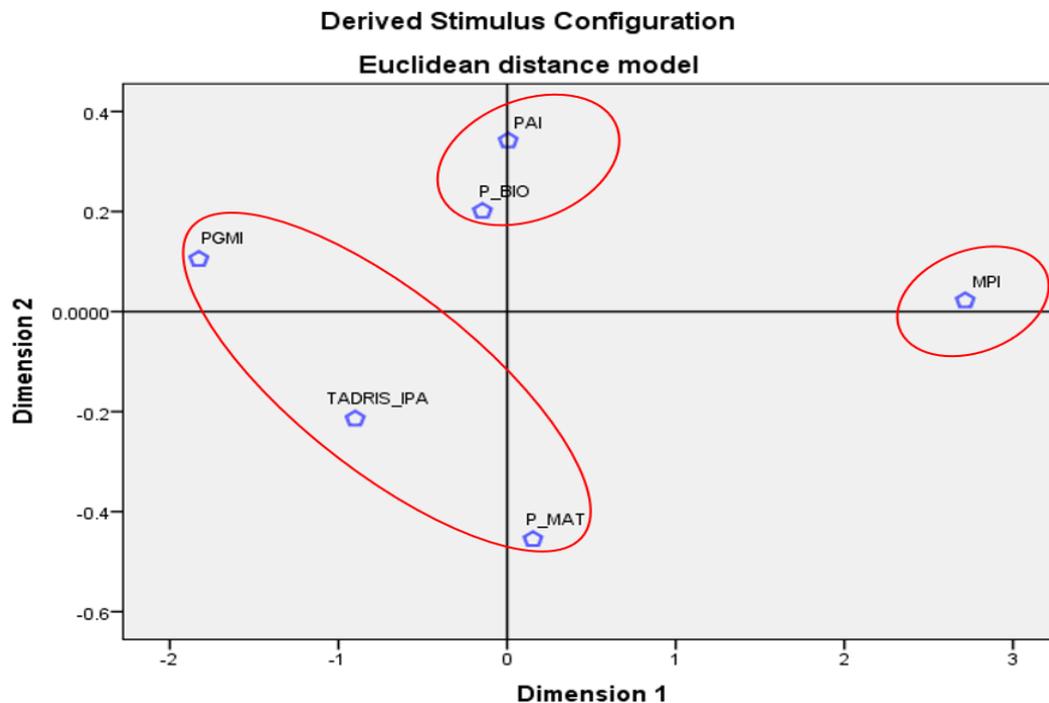
The calculation results show the closeness of objects to one another, in other words, indicating the closeness of the level of student service satisfaction from each study program in the FETT of the SII Ambon. It can be seen based on the proximity: 1) IEM and BE have the proximity of 1.388; 2) IEM and ME have the proximity of 1.268; 3) IEM and IE have the proximity of 1.328; 4) IEM and ETE have the proximity of 2,190; 5) IEM and ST have the proximity of 1.745; 6) BE and ME have the proximity of 0.349; 7) BE and IE have the proximity of 0.233; 8) BE and ETE have the proximity of 0.821; 9) BE and ST have the proximity of 0.427; 10) ME and IE have the proximity of 0.336; 11) ME and ETE have the proximity of 1.001; 12) ME and ST have the proximity of 0.558; 13) IE and ETE have the proximity of 0.905; 14) IE and ST have the proximity of 0.503, and 15) ETE and ST have the proximity of 0.473.

Based on the Euclidean distance calculation, it can be concluded that the closest distance between objects lies in the BE and IE study programs, where the proximity is 0.233. It means that the mapping of the quality of higher education in terms of student service satisfaction of the BE study program and IE has the highest degree of similarity compared to other study programs. Meanwhile, the farthest distance between objects is in the IEM and ETE study programs, where the distance between the objects is 2,190. It shows that the most distant level of similarity (dissimilarity) in student service satisfaction lies in the IEM and ETE study programs.

### Mapping Graph

The position of student service satisfaction from 6 study programs in the FETT of

the SII Ambon can be seen based on the mapping chart on the MDS. The smaller the Euclidean distance, the closer the distance between student service satisfaction for each study program. It has a meaning that the student service criteria show similarities.



**Figure 1.** Graph of Mapping the Quality of Islamic Higher Education of the SII Ambon based on Student Service Satisfaction in Each Study Program

The mapping graph of the quality of Islamic higher education in terms of the perceptual map, Figure 1, shows student perceptions based on the students' service satisfaction attributes for each study program. There are ETE, SE, and ME study programs in group 1. The perceptual map shows similarities in characteristics and advantages of an object so that it is in the same group/region.<sup>28</sup>

This study presents a two-dimensional perceptual map consisting of four quadrants. Where quadrant I show that the ETE, BE, and IE study programs have similarities in the characteristics of the same student services. In quadrants II, III, and IV, one study program is considered to have different characteristics in student services because these study programs have a position that is separated from other study programs. Quadrant II is the IEM study program, Quadrant III is the ME study program, and Quadrant IV is the SE study program. When viewed from the plot as a whole, at least three groups of study programs have similar student services among their members but differ from other groups. The three groups consist of Group 1, including ETE, SE, and ME; Group 2 includes: BE

<sup>28</sup> Waskitho Pambudi, Sari Wulandari, and Ima Normalia, 'Perancangan Strategi Positioning Bearpath Berdasarkan Perceptual Mapping Dengan Metode Multidimensional Scaling (Mds) Dan Swot Analysis', *EProceedings of Engineering* 8, no. 5 (2021); Devy Sintya Putri, Sri Wahyuningsih, and Rito Goejantoro, 'Analisis Positioning Dengan Menggunakan Multidimensional Scaling Nonmetrik', *JURNAL EKSPONENSIAL* 9, no. 1 (2018): 85-94.

and IE; and Group 3 includes IEM. The grouping is based on the closest distance from each study program, and the type of perception in each group is based on the quadrant location of each group.

### Obtaining Stress Value and R<sup>2</sup>

Stress and determination /R squared (R<sup>2</sup>) determine whether the MDS output is good enough to represent the mix of variables used. This section describes the MDS goodness of fit.<sup>29</sup> The results of the calculation of the Stress value are presented as follows:

Young's S-stress formula 1 is used.

Iteration	S-stress	Improvement
1	,01700	
2	,01443	,00257
3	,01383	,00059

Iterations stopped because  
S-stress improvement is less than ,001000

Stress and squared correlation (RSQ) in distances

RSQ values are the proportion of variance of the scaled data (disparities) in the partition (row, matrix, or entire data) which is accounted for by their corresponding distances.  
Stress values are Kruskal's stress formula 1.

For matrix  
Stress = ,03671      RSQ = ,99606

Based on the output of the MDS analysis, the stress score is 0.03671 or 3.67%. The score includes very high criteria. The coefficient of R<sup>2</sup> indicates the proportion of input data variance that a multidimensional scaling model can explain. The model can be accepted if R<sup>2</sup> ≥ 0.6. And from the output of the MDS analysis, the obtained R<sup>2</sup> is 0.99606 > 0.6. From that, it can be concluded that the model can be accepted to describe the mapping of education quality based on student service satisfaction in each study program.

### CONCLUSION

Based on the discussion in this study, it can be concluded that the mapping of the quality of Islamic higher education, in this case, the FETT of the SII Ambon based on student service satisfaction, shows that there are at least two study programs, namely BE and IE which have a comparable level of similarity based on the calculation of the Euclidean distance and perceptual map. The MDS analysis carried out is acceptable with the fulfillment of the value of R<sup>2</sup> 0.6, indicating that the multidimensional scaling model can explain the proportion of the input data variance. Furthermore, the researcher

<sup>29</sup> Borg, Groenen, and Mair, *Applied Multidimensional Scaling and Unfolding*.

recommends that each study program in the FETT of the SII Ambon, in particular, implement a minimum standard of service as stated in the Internal Quality Assurance System of the SII Ambon and adopt a student service system from study programs that are accredited A.

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