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The Influence of Service Quality on Student Satisfaction in Online Distance Learning Higher Education Based on the E-Quals Model

Recsatasha Sigiyuwanta[1]
[1]Universitas Negeri Malang, Indonesia
recsatashasigiyuwanta@gmail.com *

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Abstract

This research is motivated by the importance of service quality in increasing student satisfaction in the Online Distance Learning (ODL) system. The Electronic-Quality for Academic Learning Service (E-QUALS) model is used as a conceptual framework to analyze the various service dimensions that affect student satisfaction levels. The purpose of this study is to empirically examine the effect of service quality dimensions on student satisfaction in the context of higher education at the Open University, Indonesia, which implements Online Distance Learning. The research method used is a quantitative approach with a survey method. The population in this study consisted of 356 Open University students, and a sample of 188 students was selected using random sampling calculated with the Slovin formula with a margin of error of 5%. Data were collected using a questionnaire with a five-point Likert scale and analyzed using the Structural Equation Model method using SmartPLS 4.0. The results showed that e-learning system quality, course content and design, support services, interactivity, and teaching and instructor quality had a significant positive influence on student satisfaction. However, resources and technology infrastructure did not have a significant influence. Overall, this study confirms the importance of Online Distance Learning (ODL) providers to focus on improving technical and non-technical aspects to increase student satisfaction. This study introduces the E-QUALS model as a new approach to measure multidimensional service quality in the context of online distance learning. This model has a significant positive effect on higher education institutions, providing strategic guidance to improve the quality of online distance learning services and its development in various dimensions.

INTRODUCTION

Higher education continues to undergo significant transformation along with the development of information and communication technology. One form of such transformation is the emergence of Online Distance Learning (ODL), which provides flexibility for students to access education without being limited

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by time and space. Online education has evolved from email, then radio, television, and now to online lectures, reflecting advances in educational technology (Kentnor, 2015). This is inseparable from the new paradigm that has developed since the acceleration of technology in education, namely connectivism. Connectivism is a theory that states that knowledge is distributed across a network of connections, and therefore learning consists of the ability to build and traverse that network (Utomo & Rosmansyah, 2020). It is undeniable that digital technology has been at the center of education for development for thousands of years.

Distance learning is developing rapidly, aiming to increase the level of education and reduce economic costs through the use of modern Internet-based information and communication technologies (Pushnova, 2020). Distance learning allows expanding the number of students and integrating education into the international educational space, while improving the quality of education thanks to the rapid enrichment of the world's educational resources (Sergeeva et al., 2021). Distance learning offers convenience and flexibility, but may decrease physical and mental health, social needs, and academic quality (Lamanauskas & Makarskaitė-Petkevičienė, 2021). Online education has advantages such as increased access to knowledge and reduced teaching costs, but it also has disadvantages such as weakening the quality of learning and limiting dialog with lecturers/teachers (Asaqli, 2020). Various advantages and disadvantages must be a concern for higher education institutions to produce a successful learning process. One important aspect in the success of this learning model is the quality of services provided to students.

Delivering quality services requires a process that is not short. The process of creating a distance education program involves forming a development team, creating an engaging online experience, and incorporating network technologies and pedagogical approaches (Koptelov & Turner, 2021). Distance education requires an instructional design approach that can lead to educational transformation. It is characterized by high flexibility, learner autonomy, and extensive use of digital technologies to improve learning outcomes (Vlachopoulos & Makri, 2019). Online education has become mainstream, and improving the service quality of online courses has become a social necessity (Li & Au-Gsb E, 2024). The Online Courses platform model has many advantages because training and learning materials are presented systematically and concisely through online patterns, accessible to a wide audience through online learning management (Muslihati et al., 2023). In designing, developing and delivering distance education, students' needs must be considered (Zouiri & Kinani, 2022). In this regard, service quality is a key factor that not only affects learning effectiveness but also shapes the level of student satisfaction as users of higher education services.

User satisfaction is a fundamental concept in modern marketing thought and practice, which emphasizes customer satisfaction and obtaining benefits in return (Supriyanto et al., 2025). Student satisfaction is an indicator of the success of higher education in providing quality education services. According to (Lovelock & Wright, 2007), service quality is the level of excellence expected and control over that level of excellence to meet customer desires. Service quality is the most dominant factor affecting student satisfaction with the learning management system (Ohliati & Abbas, 2019). Perceived e-learning service quality has a significant positive relationship with student satisfaction (Dangaiso et al., 2022; Pham et al., 2019). This satisfaction not only affects student perceptions of the institution, but also impacts learning motivation,

retention, and the overall reputation of the institution. In addition, student satisfaction is one of the main objectives of marketing educational services as an illustration of achieving the success rate of educational implementation, program excellence, and institutional effectiveness and efficiency (Wiyono et al., 2017). Therefore, it is important for universities to understand the factors that influence student satisfaction, especially in the context of online learning which has its own challenges such as limited direct interaction and dependence on technology.

Indonesia has implemented various distance learning programs, including open junior high schools and open universities, to adapt to local geography, demography, and culture (Asmawi, 2018). To date, based on Directorate General of Higher Education, Research, and Technology of Indonesia Letter Document No. 0827 which contains data on distance education study programs of higher education institutions in Indonesia, there are 26 universities with 94 study programs. The universities consist of 11 state universities, 13 private universities, and 2 health universities. There has not been much research on service quality at Online Distance Learning (ODL) colleges in Indonesia. Most of these studies are still focused on specific global or regional contexts, so the validity of the results in Indonesia, especially in universities that adopt the Online Distance Learning (ODL) model, has not been fully confirmed. The study by Momen et al., (2023) on Determinants of students' satisfaction with digital classroom services suggests that additional research be conducted in several developing countries in future studies to generalize the findings of this study. In line with this, Tran, (2022) in his research on Perceived satisfaction and effectiveness of online education, stated that if data is obtained from various countries and in different time spans, it will provide more comparable findings to understand students' perspectives.

Based on research by Setiawan & Munajah, (2020), the implementation of online learning in universities in Indonesia generally shows good results, but still needs to be improved in terms of learning assistance services. To improve the service, quality assurance is definitely needed to ensure the success of the service. Quality assurance in distance learning involves approaches and tools such as course evaluation, self-assessment, and external review, to ensure set standards and satisfaction of all stakeholders Gaftandzhieva et al., (2023). In addition, quality assurance in higher education distance learning involves consideration of sub-systems such as management, administration, instructional design, teaching, and student interaction to ensure a holistic process (Bandeira & Cardoso, 2020).

Quality assurance in the quality of open and distance learning services in Asian universities faces challenges and opportunities for improvement, with quality starting from within and a multidimensional approach (Zuhairi et al., 2020). In a study by AlMulhem, (2020) it was suggested for further development by adding new factors that can play an important role in improving the quality of e-learning systems. The E-QUALS model is a new framework that has not been empirically tested, especially at the Online Distance Learning based higher education level. This model emerged as one of the approaches that can be used to analyze and improve service quality in distance learning systems with a multidimensional approach (Sigiyuwanta & Supriyanto, 2025).

The model identifies key dimensions of e-learning systems, course design and content, service support, interactivity, teaching quality, and technology infrastructure, which contribute to user satisfaction. The application of this model in Online Distance Learning -based universities is to

measure the extent to which the services provided can meet students' expectations. Therefore, this study fills the void in the validation of the model and its relevance to the education system in Indonesia.

This study aims to empirically test the E-QUALS model, a conceptual framework formulated based on the previous systematic literature review. Testing the model is expected to contribute to strengthening the theoretical validity of the model and provide practical guidance for higher education institutions in improving their service quality. Through this research, an analysis of service quality factors in shaping student satisfaction with Online Distance Learning will be conducted using a quantitative approach. Data will be collected from students of the Open University, which is one of the Online Distance Learning providers in Indonesia, to identify the relationship between service quality dimensions and student satisfaction levels. The results of this study will not only confirm the relevance of the E-QUALS model in the context of Online Distance Learning higher education in Indonesia but also provide strategic recommendations for institutional managers to improve the quality of their educational services.

METHODS

This research adopts a quantitative approach with a survey research method. The survey design provides a quantitative description of trends, attitudes, and opinions of a population, or tests the relationship between variables of a population, by studying a sample of the population (Asril et al., 2023a; Creswell, 2015; Engkizar et al., 2018; PutrI et al., 2020; Yusnita et al., 2018). Structural Equation Modeling (SEM) is a powerful method for examining relationships between complex and multidimensional variables, such as those in the E-QUALS model for online distance learning. SEM enables the testing of theories that link various quality factors to student satisfaction, which is the ultimate outcome to be achieved in this study.

The SEM-PLS method was chosen due to its ability to overcome the problem of multicollinearity between variables, as well as the ease of handling non-normalized data and relatively small samples (Hair et al., 2017). In addition, PLS-SEM is very useful for testing exploratory and in-depth models, such as the E-QUALS model which is a new concept. The use of this method also provides a more holistic understanding of the relationship between latent variables that affect student satisfaction in an online education environment, so that it can make a significant scientific contribution to the educational service quality literature (Asril et al., 2023b; Engkizar et al., 2025). The following is a conceptual framework design in the context of this research.

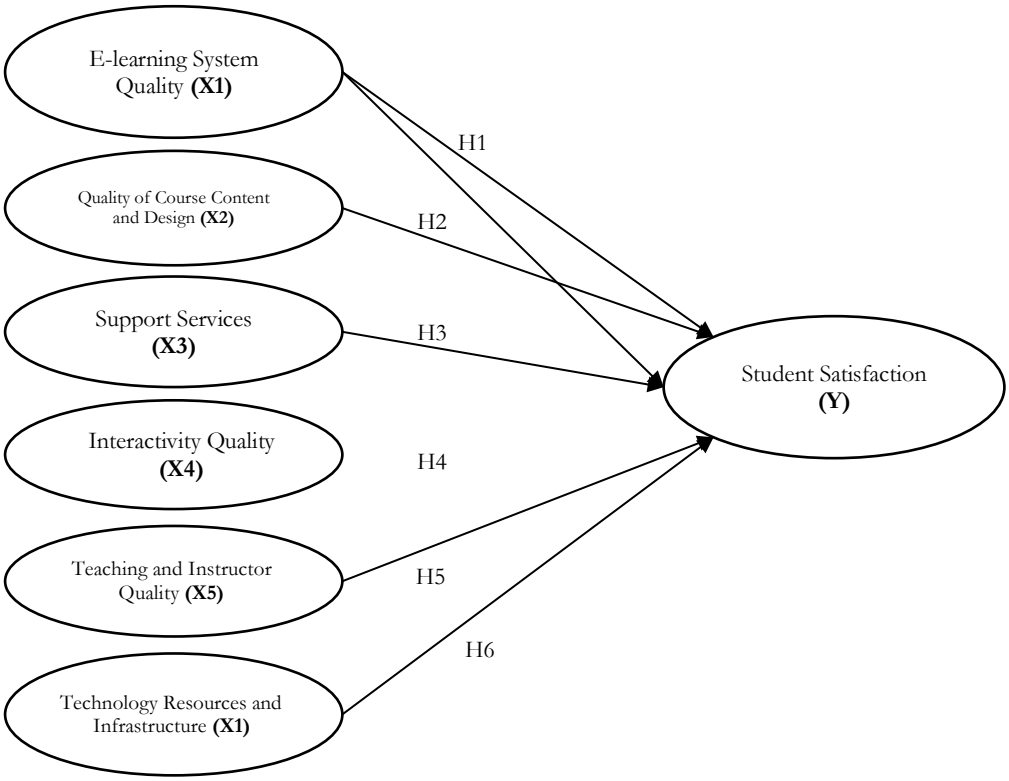

Fig 1. Research design

Consequently, this research posits the following hypothesis:

a. Hypothesis 1: E-Learning system quality significantly influences student satisfaction.
b. Hypothesis 2: Content quality and course design significantly influences student satisfaction.
c. Hypothesis 4: Interactivity quality significantly influences student satisfaction.
d. Hypothesis 5: Teaching and instructor quality significantly influences student satisfaction.
e. Hypothesis 6: Technology resources and infrastructure significantly influence student satisfaction.

Within the scope of this study, the population who were respondents were Open University Pokjar Trenggalek students with a total of 356 students. From a population of 356, a sample was taken using the Simple Random Sampling Technique calculated using the Slovin formula and a 5% margin of error. The calculation resulted in a total of 188 respondents. The population and sample selection is considering that the population is homogeneous or students get the same Online Distance Learning services from various regions and opportunities. So that a small representative sample is sufficient to describe the population as a whole. The Open University is a pioneer university with the implementation of an online distance education system. Meanwhile, this research is still at an early stage to prove the online college service quality model that contributes to student satisfaction.

The type of data used in this study is primary data, which is information collected based on respondents' answers from distributing questionnaires measured using five-point Likert scale questions, with answers ranging from 1 (strongly disagree) to 5 (strongly agree). The exogenous latent variables in this study are E-learning System Quality, Course Content and Design Quality, Support Services, Interactivity Quality, Teaching and Instructor Quality, and Technology Resources and Infrastructure. While the endogenous latent variable

is student satisfaction. The following is the operationalization of each variable referring to the E-QUALS model from (Sigiyuwanta & Supriyanto, 2025).

Table 1. Operationalization of research variables

Dimension/Variable	Indicator	Survey Question
E-learning System Quality	Ease of Access	Do you find it easy to access the e-learning platform used by the college?
	Navigation and Interface	Is the display and navigation on the e-learning platform easy to understand?
	Technical Support	Do you get adequate technical assistance when facing technical issues on the e-learning platform?
Quality of Course Content and Design	Relevance of Material	Does the material presented in the course match your needs and learning objectives?
	Alignment with Needs	Does the course content match your academic and professional needs?
	Course Design	Did the course design (structure and organization of the material) help you understand the material better?
Support Services	Academic and Non-academic Services	Do you feel that you receive adequate academic services (such as guidance or counseling) from the university?
	Non-academic	Do you feel that you receive adequate academic services (such as guidance or counseling) from the university?
	Administrative Support	Are administrative processes (such as registration and timetabling) responsive and efficient?
	Responsiveness	Do you feel that the college is responsive to your needs regarding online learning services?
Interactivity Quality	Student-Instructor Interaction	Do you feel like you have enough opportunities to interact with the instructor in the online course?
	Collaboration between students	Do you feel you have enough opportunities to collaborate with fellow students in online learning?
	Student-Content Interaction	Do you feel like you have enough opportunities to interact with the material content in the online course?
Teaching and Instructor Quality	Instructor Competency	Do the instructors in the online course demonstrate sufficient competence in teaching the material?
	Technology	Is the instructor able to use online

	Mastery	learning technology well?
	Instructor Responsiveness	Is the instructor responsive to your questions and needs in online learning?
Technology Resources and Infrastructure	Availability of Learning Materials	Are learning materials always available and easily accessible at any time?
	Internet Connection Stability	Do you rarely face internet connectivity issues when accessing e-learning platforms?
	Technical Facilities	Do the technical facilities such as software and hardware provided support your online learning?
Student Satisfaction	Quality of Experience	Overall, are you satisfied with the online learning experience provided by the college?
	Expectation Match	Does the e-learning service meet your expectations in terms of quality and effectiveness?
	Service Satisfaction	Are you satisfied with the support, interaction and teaching services provided during the online learning process?

In processing the data in this study, Structural Equation Modeling (SEM) analysis was used. In general, the analysis method and function in SEM - PLS consists of two stages of model evaluation, namely outer model and inner model analysis using SmartPLS 4 software. This process is then continued with hypothesis testing through the bootstrapping method, as explained by (Hardisman, 2021). Outer model analysis in SEM - PLS aims to evaluate the validity and reliability of research instruments in measuring latent variables or commonly called the Measurement Model Test. At this stage, convergent validity, discriminant validity, and reliability are examined. Meanwhile, inner model analysis is a step to test the model or hypothesis, also known as structural analysis. The analysis is also commonly called the Structural Model Test which includes model feasibility testing and hypothesis testing including the Fit Model Test, R-Square Test, Q-Square Test and Significance Test.

RESULT AND DISCUSSION

Demographic profile

The researcher has collected answers from respondents totaling 188 students from the Open University. The demographic data obtained is illustrated in the table below. In this study, 188 students were involved, of which 112 (59.57%) were female and 76 (40.43%) were male. As for the characteristics of the study period, the largest number of respondents were 4th semester students and the smallest number of respondents were 2nd semester students.

Table 2. Respondent characteristics

Characteristics	Frequency	%
Gender		
Male	76	40,43
Female	112	59,57
Study Period		
1st semester	-	-

2nd semester	5	2,65
3rd semester	23	12,23
4th semester	45	23,93
5th semester	23	12,23
6th semester	43	22,87
7th semester	33	17,55
8th semester	16	8,51
Semester >8	-	-

Outer model analysis

Outer model in SEM - PLS can be done to review the validity and reliability of research instrument items that can be used as guidelines for measuring latent variables. In this regard, Convergent validity, discriminant validity, and also reliability are the analysis carried out on the SEM-PLS outer model.

Convergent validity

Convergent validity is an assessment of the validity of each predictor or instrument item against its combined score. The magnitude of the factor loading of each predictor on its latent variable determines the validity of the indicator. Each item can be said to be valid if a loading factor value is greater than 0.7 for confirmatory research. However, in some studies, a loading factor value of 0.5 to 0.6 is still acceptable (Sarstedt et al., 2021). The following is the loading factor value for each item that has been calculated using Smart PLS.

Table 3. Loading factor value

	X1	X2	X3	X4	X5	X6	Y
X1.1	**0.807**	0.574	0.55	0.475	0.580	0.344	0.622
X1.2	**0.905**	0.732	0.642	0.620	0.658	0.336	0.776
X1.3	**0.782**	0.753	0.615	0.447	0.446	0.284	0.664
X2.1	0.708	**0.862**	0.623	0.641	0.693	0.217	0.790
X2.2	0.769	**0.872**	0.614	0.565	0.627	0.335	0.698
X2.3	0.578	**0.763**	0.473	0.361	0.424	0.388	0.562
X3.1	0.661	0.632	**0.849**	0.590	0.531	0.221	0.695
X3.2	0.573	0.536	**0.840**	0.413	0.369	0.167	0.524
X3.3	0.562	0.508	**0.788**	0.437	0.482	0.209	0.609
X3.4	0.613	0.616	**0.864**	0.602	0.630	0.390	0.622
X4.1	0.492	0.475	0.499	**0.827**	0.643	0.156	0.494
X4.2	0.397	0.458	0.432	**0.848**	0.687	0.368	0.597
X4.3	0.670	0.674	0.630	**0.886**	0.823	0.444	0.757
X5.1	0.614	0.697	0.586	0.802	**0.922**	0.565	0.732
X5.2	0.650	0.620	0.535	0.742	**0.909**	0.598	0.725
X5.3	0.567	0.608	0.530	0.768	**0.879**	0.371	0.599
X6.1	0.243	0.266	0.203	0.291	0.373	**0.706**	0.232
X6.2	0.399	0.336	0.285	0.350	0.522	**0.915**	0.376
X6.3	0.163	0.197	0.165	0.271	0.421	**0.620**	0.143
Y1	0.665	0.650	0.607	0.532	0.532	0.144	**0.825**
Y2	0.692	0.715	0.593	0.570	0.662	0.354	**0.789**
Y3	0.723	0.715	0.654	0.741	0.711	0.394	**0.893**

From the results above, it can be seen that overall all items meet valid standards. There is one item that is below 0.7 which is Item X6.3 but it is still

within the tolerance limit, namely between the loading factor values of 0.5 to 0.6.

Discriminant validity

Discriminant validity analyzes the validity of predictors by looking at how this validity relates to other variables. The indicator that can be used in this analysis is cross loading. It is said to be valid if the predictor shows a cross loading value greater than 0.7 or the cross-loading of the predictor has a higher loading value than the latent variable itself and than on the other variables mentioned. From the cross loading measurement results in table 5 above, it can be seen that the largest cross loading value of each indicator corresponds to its latent variable provided that the cross-loading value of the predictor has a higher loading value than its own latent variable and than on other variables. To further ensure discriminant validity, you can also use Fornell-Larcker. The condition is that the value of the latent variable must be greater than the value of the other variables, which is the standard used as an indicator for the root of the AVE. If the AVE square root value of each construct is greater than the correlation value between constructs and other constructs in the model, then the model is said to have good discriminant validity value (Ghozali, 2021).

Table 4. Square root value of AVE

	X1	X2	X3	X4	X5	X6	Y
X1	**0.833**						
X2	0.827	**0.834**					
X3	0.725	0.69	**0.836**				
X4	0.623	0.642	0.619	**0.854**			
X5	0.677	0.712	0.61	0.852	**0.903**		
X6	0.385	0.363	0.298	0.399	0.575	**0.757**	
Y	0.830	0.830	0.740	0.740	0.763	0.362	**0.836**

From the results above, it can be seen that the root AVE value (the value on the main diagonal) is greater than each correlation between latent variables (the value below the main diagonal).

Reliability

In this reliability is reviewed using the Cronbach's Alpha and Composite Reliability values. A research instrument is said to be reliable if the Cronbach's Alpha value is> 0.60 (Ghozali, 2016; Hair et al., 2014) states that the composite reliability value must be> 0.70 even though the value of 0.60 is still acceptable. The following are the results of the reliability test calculations that have been carried out in this study.

Table 5. Cronbach's Alpha and composite reliability values

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
X1	0.777	0.792	0.871	0.694
X2	0.782	0.804	0.872	0.696
X3	0.856	0.862	0.902	0.698
X4	0.818	0.852	0.890	0.729
X5	0.888	0.898	0.930	0.816
X6	0.636	0.789	0.797	0.573
Y	0.784	0.789	0.874	0.700

From the results above, all constructs have a composite reliability value above 0.70 and Cronbach's alpha above 0.60. So it can be concluded that the constructs have good reliability.

Inner model analysis

This analysis, also called structural analysis, is an analysis stage that aims to evaluate the model or hypothesis. The first step in the Structural test of this model is the model feasibility test (model fit) The model feasibility test is carried out using SmartPLS 4 with the bootstrapping procedure. From this PLS algorithm, the Standardized Root Mean Residual (SRMR) and NonFit Index (NFI) are obtained. The fit model criteria of SRMR <0.100 indicate that the model is said to be fit. If obtained 0.60 < NFI < 0.80, a model is marginal fit, while if NFI < 60, then the model is non-fit (Hair et al., 2017).

Table 6. SRMR & NFI values

	Saturated model	Estimated model
SRMR	**0.089**	**0.089**
d_ULS	2.002	2.002
d_G	1.461	1.461
Chi-square	1337.307	1337.307
NFI	**0.629**	**0.629**

From the above results, the SRMR and NFI values have met the prerequisites for model feasibility so it can be concluded that this model meets the criteria for a good fit.

Then the analysis of the R-Square value in SmartPLS is obtained along with the validity and reliability analysis (outer model) in the PLS-Algorithm analysis step. The model falls into strong criteria if the R Square value is> 0.75, moderate if the value is 0.50 < R Square < 0.75, weak if 0.25 < R square < 0.5, and falls into very weak criteria if < 0.5 (Sarstedt et al., 2021). The R-Square value presented in table 7 shows that 6 variables (X1, X2, X3, X4, X5, X6) affect Y with an R-Square value of 0.816 and an adjusted R square of 0.810. Therefore, the exogenous construct of 6 variables (X1, X2, X3, X4, X5, X6) affects Y by 0.810 or 81% (included in the high criteria).

Table 7. R-Square and Q-Square values

	R-square	R-square adjusted	SSO	SSE	Q^2 (=1-SSE/SSO)
Y	0.816	0.810	564	247.297	0.562

In addition, the Q-Square value is obtained by the blindfolding analysis procedure, which obtains the values of Construct Crossvalidated Redundancy. Predictive relevance (Q^2) determines whether the dependent variable construct in the study is predictively related to the independent variable (Henseler & Sarstedt, 2013). The dependent variable is said to have predictive relevance to the independent construct if $\sum Q^2 > 0$. The variable has predictive relevance if the Q^2 value is > 0, with values closer to 1 indicating a better model. (Henseler & Sarstedt, 2013). From the test results in table 7, the Q-square value is greater than 0 (zero), indicating that the model has predictive relevance. The results also show that the Q^2 value of the X1, X2, X3, X4, X5, X6 variables on variable Y is 0.562, meaning that the predictive relevance of Y includes a moderate level of predictive relevance because it ranges between 0 and 1.

Significant test

Hypothesis testing in SEM-PLS by bootstrapping, then looking at the original sample value, t-statistic, and p-values on the path coefficients. In this

study, the t-table value used is 1.96 and for p-values <0.05 so that if the t-statistic value is greater than 1.96 and the ¬p-value <0.05, the result is that the variable has a significant influence on other variables. Meanwhile, if the t-statistic value < 1.96 and the p-value> 0.05, the result is that the variable does not have a significant effect on other variables. The original sample value is to see the positive or negative effect of a variable on other variables. If the original sample value is positive, then the result is that the variable has a significant positive effect and vice versa if the original sample value is negative, then the effect given is also negative.

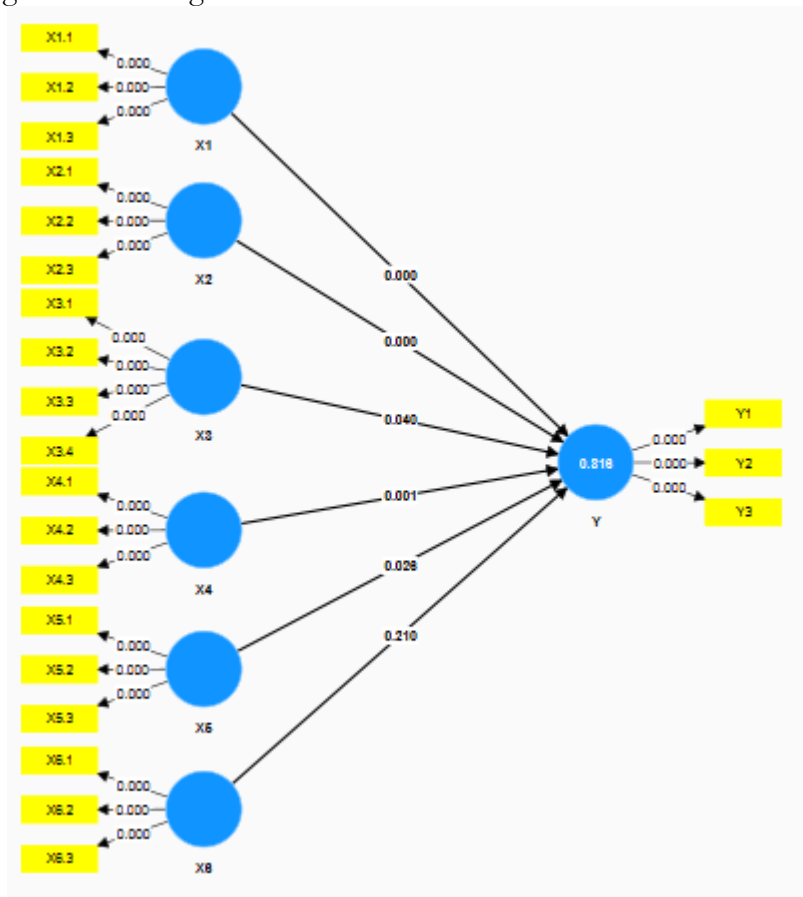

Fig 2. Framework of influence test results

Table 8. Influence test results

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
X1 -> Y	0.305	0.301	0.070	4.337	0.000
X2 -> Y	0.277	0.272	0.056	4.986	0.000
X3 -> Y	0.141	0.150	0.069	2.054	0.040
X4 -> Y	0.169	0.172	0.051	3.341	0.001
X5 -> Y	0.164	0.156	0.073	2.233	0.026
X6 -> Y	-0.06	-0.051	0.048	1.252	0.210

Influence of E-Learning system quality on student satisfaction

Based on the results of the influence test in table 8, the t-statistic value of 4.337 which is greater than the t-table value of 1.96 and the p-value of 0.000 is smaller than 0.05, indicating that the quality of the e-learning system has a significant influence on student satisfaction. These results are also supported by previous research from AlMulhem, (2020); Dangaiso et al., (2022); Limbu & Pham, (2023) which states that system quality has a positive and significant

effect on students. This means that the better the quality of the e-learning system used, such as the smoothness of the platform, system reliability, and ease of access, the higher the satisfaction felt by students.

The quality of the e-learning system includes technical aspects such as the availability of an easily accessible platform, user-friendly interface design, and stable performance during the learning process. This positive influence shows the importance of good e-learning platform management. E-learning cognitive engagement strengthens satisfaction and improves achievement (Masa'deh et al., 2022). Online teaching and learning not only transforms face-to-face programs, but also delivers them through internet-based platforms (Nurabadi et al., 2022). Weng & Qin, (2023) also suggested that to improve the online education experience academic institutions can invest in improving online learning platforms. This is also in line with the recommendation of Widiantoro et al., (2022), universities should focus on providing excellent service, technical support, and user training for e-learning platforms to increase user satisfaction and intention to continue. So in this case investment in e-learning systems is a must especially in Online Distance Learning colleges with the aim is to provide a comfortable learning experience for students, which in turn will increase their level of satisfaction.

Influence of content quality and course design on student satisfaction

The results of the influence test in table 8 show that the quality of course content and design has a significant positive effect on student satisfaction. This is because the t-statistic value of 4.986 is greater than the t-table of 1.96 and the p-value of 0.000 is less than the significance value of 0.05 and for the original sample value is positive. These results show that the factors of quality content and interesting and easy-to-follow course design have a great influence in increasing student satisfaction. It also confirms that relevant, up-to-date content and well-structured course design play an important role in influencing student satisfaction levels. This research is supported by the findings of Limbu & Pham, (2023); Littlefield et al., (2019); Nikou & Maslov, (2023); Tran, (2022) that content quality and course design have a significant positive effect on student satisfaction. Good course content will be relevant to the needs of its students. Wang et al., (2023) have identified two types of content relevance that can satisfy students as follows: i) personal relevance, which is the degree to which course content aligns with each learner's personal goals and interests. Higher personal relevance results in greater satisfaction because students find the material meaningful. ii) social relevance, which refers to how the course content meets the needs of society and contributes to collective issues. Quality content includes material that matches the curriculum, is easy to understand, and comes with supporting materials such as videos, additional reading, and interactive quizzes. Educational institutions should focus on developing technical tools and improving teaching practices aligned with global standards, including refining assessment methods and ensuring that electronic content is engaging and accessible (Albanyan, 2024).

Moreover, high-quality online courses in higher education focus on course design, promoting a consistent and engaging learning experience (Wright et al., 2023). Good course design lies not only in the clear and progressive structure of the material, but also involves attractive visual design elements to make the learning experience more enjoyable and less boring. The findings of Agyeiwaah et al., (2022) indicate the need for educational institutions to develop attractive and motivating visual environments for online course delivery with the aim of a stimulating online learning atmosphere. Effective instructional design should focus on identifying learner

needs, setting clear objectives, and creating engaging learning activities (Zuhairi et al., 2020). Therefore, e-learning providers need to ensure that the content provided is not only useful, but also presented in an interesting way so that students feel motivated and satisfied.

Influence of support services on student satisfaction

Support services, which include various forms of assistance and responses provided to students during the learning process, also have a significant effect on student satisfaction. This is evidenced by the t-statistic value of 2.054 greater than the t-table of 1.96 and the p-value of 0.040 less than the significance value of 0.05. These results indicate that students feel more satisfied when they get good support services, such as academic, non-academic, and administrative services. Although the effect is smaller compared to system quality and course content, support services still have a positive impact that cannot be ignored. In other studies Haverila et al., (2021); Umar & Hasan, (2024) support services have the highest impact on student satisfaction levels. Support services for students are an important driver in the success of university programs and can be a key factor in attracting and retaining these students (Perez-Encinas & Ammigan, 2016).

The availability of timely and responsive services can help overcome challenges faced by students, both academic and technical. Responsiveness is the strongest dimension of service quality that affects student satisfaction in higher education institutions (Darawong & Sandmaung, 2019). Prompt and responsive support, especially in overcoming technical problems faced by students, greatly affects their satisfaction. This suggests that emotional and technical factors in the use of e-learning need to be well accommodated, especially in dealing with challenges that arise during the online learning process. Effective Student Support Services are essential to increase learning engagement and motivation (Zuhairi et al., 2020). In line with this, (Sumarsono et al., 2021) stated that the quality of services, both academic and non-academic, can affect student learning motivation, and this will have an impact on the achievement of learning outcomes or achievement. Cognitive, emotional, and management support services are positively correlated with student learning satisfaction (Zhao et al., 2022). Therefore, it is important for e-learning providers to provide easily accessible support channels, such as chat support or help centers available during study hours.

Influence of interactivity quality on student satisfaction

Interactivity in e-learning, which includes the ability of students to interact with teachers, classmates, and teaching materials actively, has a significant positive influence on student satisfaction. This is because the t-statistic value of 3.341 is greater than the t-table of 1.96 and the p-value of 0.001 is smaller than the significance value of 0.05. The higher the level of interaction that can occur in learning, the more satisfied students are with their learning experience. In this regard, according to various studies, learner interaction and content are the strongest predictors of student satisfaction in online education courses (Alqurashi, 2019; Kuo et al., 2014; Zhang & Lin, 2020).

Educational activities are behavioral activities in which there are various social interactions between educators and students, students and students, and or educators with students and their environment (Sigiyuwanta et al., 2024). Interactivity in online learning includes online discussion forums, question and answer sessions with teachers, and collaboration in learning groups. The study from (Albanyan, 2024) emphasizes the importance of interactive elements in enhancing students' learning experience in the form of engagement through

real-time discussion and interaction is essential for effective online education. Effective interaction can enrich the learning experience and improve understanding of the material, while creating a sense of connection between students despite learning remotely. One of the selling points based on student satisfaction with online learning programs is facilitator interaction and feedback. Therefore, e-learning providers must design learning that allows for more dynamic interactions between students and teachers as well as fellow students.

The influence of teaching quality and instructors on student satisfaction

The quality of teaching and instructors is proven to have a significant influence on student satisfaction. This is because the t-statistic value of 2.233 is greater than the t-table of 1.96 and the p-value of 0.026 is less than the significance value of 0.05. These results indicate that students feel more satisfied when instructors are able to manage learning well, deliver material clearly, and provide constructive feedback. Good teaching skills, both technically and in terms of communication, are very instrumental in increasing student satisfaction with e-learning systems. This is also in line with research from (Han et al., 2022), where instructor-related factors, such as teaching support, technology acceptance, and perceived presence, have the highest influence on students' online learning satisfaction. The study of Dennen et al., (2007) stated instructor actions focused on course content and providing feedback for knowledge demonstration were associated with learner performance, while interpersonal communication and treating learners as individuals were associated with satisfaction.

Qualified instructors and user-friendly interfaces contribute to high student satisfaction in online programs (Nazneen et al., 2020). Instructor communication is required, i.e. the way educators interact with students can increase or hinder satisfaction levels. (Weng & Qin, 2023). Instructor teaching experience is a determinant of student satisfaction (Berbegal-Mirabent et al., 2018). Instructors who are responsive and have the ability to explain the material in an interesting and easy-to-understand way can help students absorb the material more effectively. Quality teaching also involves the use of appropriate teaching methods, such as the use of engaging multimedia and interactive technologies that facilitate student understanding. Structured learning, which utilizes the LMS to build a learning environment that is friendly and easy to use for students (Maisyaroh et al., 2024).

The influence of technology resources and infrastructure on student satisfaction

Contrary to the results for other variables, technological resources and infrastructure do not show a significant effect on student satisfaction. The result of the influence test shows the t-statistic value of 1.252 is smaller than the t-table of 1.96 and the p-value of 0.210 has a value greater than the significance value of 0.05. This indicates that although adequate infrastructure and technological resources are important for the smooth operation of e-learning, this factor does not directly affect student satisfaction. The results of this study, in line with research from the variable availability of resources has no significant influence on student satisfaction with online learning (Pradhan et al., 2020). The negative original sample value indicates that the relationship between Technology Resources and Infrastructure and Student Satisfaction tends to be negative, although the relationship is very weak and insignificant. This means that an increase in technological resources and infrastructure does not directly increase student satisfaction significantly in the context of this study. According to the study of Weng & Qin, (2023) the quality of resources

is related to the availability and effectiveness of educational resources have a significant impact on the student experience. Then the results of research from Memon et al., (2022) technology has a positive impact on student satisfaction, through interactive and independent learning. In this case, it means that infrastructure and technology affect satisfaction indirectly through other variables, such as learning experience.

In this regard, there is a possibility that the available technology resources and infrastructure do not match their specific needs in supporting the learning process. For example, technology facilities that lack integration with the curriculum or specific academic needs may reduce the relevance of their existence. Effective use of learning resources in an online problem-based learning environment requires efficient access, meaningful processing and collaborative collaboration (Jeong & Hmelo-Silver, 2010). The use of technology in higher education can significantly enhance student learning when aligned with teaching objectives and fully embedded in modules (Turney et al., 2009). It is also possible that the opposite is true. If students feel that the existing technology resources and infrastructure are sufficient to meet minimum expectations, then this factor is no longer a major determinant in increasing their satisfaction. Satisfaction may be more influenced by other variables, such as teaching quality, lecturer-student interaction, or other supporting facilities. In this case, students do not feel significant obstacles related to the existing technology or it is possible that according to students, the existing infrastructure is sufficient so that the influence is not too great.

The results that show the absence of this effect can also be influenced by statistical analysis problems. One of the allegations is related to sample size. According to Hair et al., (2017) the minimum number of samples that should be used is 10 times the number of all indicators. Sugiyono, (2017) also states that in multivariate analysis, the minimum number of sample members is 10 times the number of predictors studied. So if you refer to this opinion, this research requires an ideal sample of 220. This is based on the purpose of the study which is to test a new conceptual model, and has many dimensions or variables under study. Nonetheless, it is important to note that inadequate infrastructure can hinder students' learning experience, so although not significant in this test, technology improvements and maintenance are still needed to support smooth learning. Providing resources to plan, develop, and evaluate online programs is one rubric to help institutions maintain high standards but also encourage continuous improvement in distance education practices (Littlefield et al., 2019).

CONCLUSION

Based on the research results, it can be concluded that the quality of the e-learning system, the quality of course content and design, support services, the quality of interactivity, and the quality of teaching and instructors all have a significant positive influence on student satisfaction in using the e-learning system. This suggests that to improve student satisfaction, e-learning providers need to focus on improving technical aspects, content, course design, interaction, and teaching. However, technological resources and infrastructure did not show a significant influence in this study, although it remains important to ensure that the existing infrastructure is adequate to support a smooth online learning experience. Thus, to improve the quality of e-learning experience, organizers need to pay attention to all the factors discussed, not only technological infrastructure, but also non-technical aspects such as teaching, interaction, and relevant and quality course content. This research

introduces the E-QUALS model as a new approach to measure service quality in the context of online distance learning. The model includes important dimensions, such as e-learning system quality, course content and design, support services, interactivity, teaching and instructor quality, and technology infrastructure. This research makes a significant practical contribution to higher education institutions, by offering strategic guidance to improve the quality of e-learning services. However, this study also has some limitations. The research sample only includes Open University students within a regional scope, so the results may lack generalizability to other institutions. In addition, as a new model, the application of E-QUALS requires further validation in various contexts to ensure its reliability and a larger sample is needed. This study also did not explore external factors, such as government policies, social or economic conditions, that might influence the online learning experience.

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