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Evaluation of Continued use Factors on Academic Chatbot Utilization in Higher Education

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Abstract

This study examines the factors influencing the continued use of chatbot use as an academic information platform and identifies key factors contributing to its utilization. Data were collected through interviews and questionnaires, then analyse using the PLS-SEM method with Adanco software. The results show that System Quality has the strongest influence on Perceived Ease of Use (0.5326), which subsequently has a positive impact on Continued Use (0.4816). E-Service Quality also significantly affects User Satisfaction (0.3516). However, Information Quality and Perceived Usefulness show low influence on *User Satisfaction (0.2234) and Continued Use (0.1354), respectively. In terms of reliability, the constructs Continued Use (0.9147), E-Service Quality (0.9203), and Perceived Usefulness (0.8866) demonstrate strong measurement consistency, while System Quality (0.6363) requires improvement. The Q^2 analysis indicates that the model has good predictive relevance, with Continued Use (0.4349) emerging as the dominant variable.

A. Introduction

In this era of modernization, the involvement of technology in supporting the needs of society in certain aspects is very important, especially in the academic aspect. In the academic aspect, technology must be applied in every academic element so that the alignment between technological advancement and the world of education can continue to progress together. Because before there was technology to provide information and respond to both technical and non-technical inquiries, and it took a considerable amount of time to perform and respond, it hindered the ability to provide information as quickly as possible. Eventually, around the year 1950, AI or Artificial Intelligence began to emerge, with ELIZA, the earliest machine capable of "thinking" and "speaking," created by Joseph Weizenbaum. ELIZA was designed to mimic a Rogerian psychotherapist and could engage in simple conversations with humans. With the success and advancement of this technology, the term Chatbot or chat robot has finally emerged. A computer program designed to engage in conversation with humans [1].A chatbot is a component of the Helpdesk, a type of academic information feature. One of the programs that can link users and administrators to fix a problem is Helpdesk [2].This is why the combination of chatbot technology and a help desk function is so appropriate: the goal is to support academic information with quick and high-quality responses. For the next step in dissecting the concept of this journal, it will be supported by several theories from previous researchers, namely

The Technology Acepptance Model (TAM) is a widely accepted research concept by Davis, used in studies on using information technology and in individual evaluations of new technologies. TAM is used to understand how to adopt new technologies, and its purpose is to provide guidance to individuals in their work to adopt new technologies [3]. Next, The Theory of Planned Behaviour, a concept introduced by Ajzen in 1991, explains the factors influencing an individual's decision-making process, including control perception, objective norms, and impulsive behaviour [4]. Next, The Unified Theory of Application and Use of Technology (UTAUT) is a technology theory developed by Venkatesh, Morrish, Davis, and Davis in 2003, which focuses on the application of technology and its application [5].

The development of chatbots heavily relies on the support of advanced technologies, which has become increasingly feasible due to rapid technological advancements. One of the key technologies that support chatbot development is Natural Language Processing (NLP). NLP involves fundamental processes such as tokenization, natural language generation, and parsing [6]. In addition to NLP, Artificial Intelligence (AI) plays a crucial role in the chatbot framework, as it enables the system to comprehend the meaning of user input. This capability significantly enhances the effectiveness of chatbots, particularly when utilized as a medium for delivering academic information [7]. Moreover, the integration of Application Programming Interfaces (APIs) further strengthens chatbot functionalities. APIs offer various features that allow chatbots to perform more intelligently and to better understand user intentions or inputs [8].

B. Research Method

The following outlines the stages of the research design conducted by the author, which includes the formulation of a hypothesis to support both the research framework and its data processing phase. Establishing a hypothesis is essential to provide a preliminary assumption regarding the issues addressed in this study.

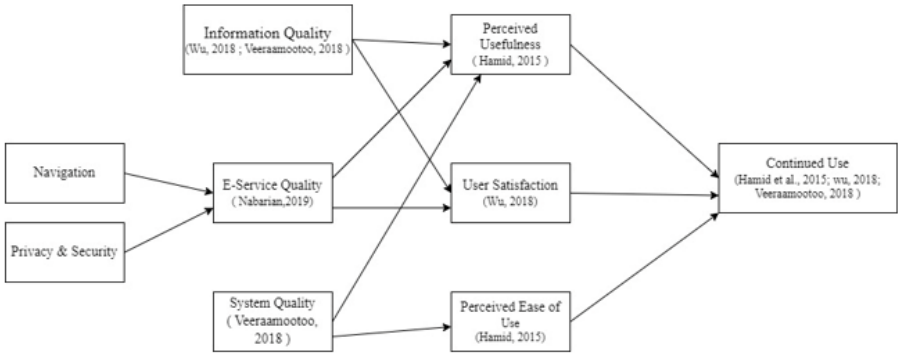

Figure 1. Research hypothesis

This study proposes a set of hypotheses to explore the factors influencing the continued use of an information system. First, Information Quality is considered a crucial factor, where it is hypothesized that higher information quality provided by the system will lead to increased perceived usefulness (H1a) and greater user satisfaction (H1b). Second, Perceived Ease of Use is believed to play a significant role in shaping users' perceptions and behaviours. It is hypothesized that when a system is perceived as easy to use, it will enhance the perceived usefulness of the system (H2a), increase user satisfaction (H2b), and encourage users to continue using the system (H2c). Third, E-Service Quality is expected to influence user attitudes, with the hypothesis that higher service quality will lead to improved user satisfaction (H3a), which in turn will foster continued use of the system (H3b). The fourth factor, Privacy and Security, is also considered essential. It is hypothesized that users' perceptions of privacy and data security will have a significant impact on their satisfaction (H4a), and that a high level of privacy and security will build user trust, thereby encouraging continued system use (H4b). Finally, Perceived Usefulness and User Satisfaction are hypothesized to have a direct and significant effect on users' intention to keep using the system (H5a).

Type of research

This study employs an explanatory research approach by referencing relevant academic journals to test hypotheses and examine the relationships between variables. The research process includes literature review, analysis, research design, data collection, data processing, and conclusion. Focused on technology-related topics, particularly the sustainability of chatbot use, this research aims to identify the factors that influence the continued use of chatbots as academic information tools and assess their feasibility in academic settings.

Data Analysis Method

The method that will be used is quantitative to observe the respondents from the users involved in this topic title. Quantitative is very suitable for identifying the factors that influence the use of Chatbots as a medium for academic information, especially for students, as this will have a significant impact on students if applied to academic information.

Data Collection Methods

This research utilizes three main data collection methods. First, interviews are conducted with students to explore the key factors influencing the sustainable use of chatbots for academic information. This method is essential in determining whether chatbot implementation can be continuously utilized in academic settings. Second, a questionnaire is distributed to gather responses from a larger number of participants. This helps ensure objectivity and provides valid data based on user experiences and perceptions, which are crucial for structured and accurate analysis. Third, a literature review and document analysis is carried out to examine previous studies and gather reliable references. This provides a theoretical foundation to support the technical aspects of chatbot development and assess its long-term benefits in academic environments.

Testing Method

The method used in the testing employs R Square and Q Square, where R-Square or R2 is a statistic used in regression analysis that functions to adjust the regression model and can explain the variation of each dependent variable. The value of R-Square itself [9] typically ranges from 0 to 1 according to the formula of R-Square itself. then Q-Square is a measure in PLS-SEM testing, which functions to assess the predictive ability of the model. Q-Square indicates how well the model can utilize and predict the value of the dependent variable [10].

Implementation and Evaluation Methods

PLS-SEM or Partial Least Square - Structural Equation Modelling is a multivariate analysis method that allows the author to examine the complexity between variables and other variables to obtain a complete picture of a comprehensive model. In implementing PLS-SEM [11], it is assisted by the user-friendly Adanco application, which supports reflective and formative models, and has strong features such as bootstrap, blindfolding, and HTMT validation[12].

C. Result and Discussion

In the processing of PLS-SEM variable data, there is a part called Graphical Output to provide an overview of the relationships between variables and reliability. The results of the Graphical Output will refer to other tests, such as R-Square and Q-Square. Below is an image of the existing Graphical Output results. In the image above, we can see that each variable in the path model has its own value, and from these values, a decision will be made, whether valid or not valid. To see the details, we can look below as part of the Final Result.

Graphical Output

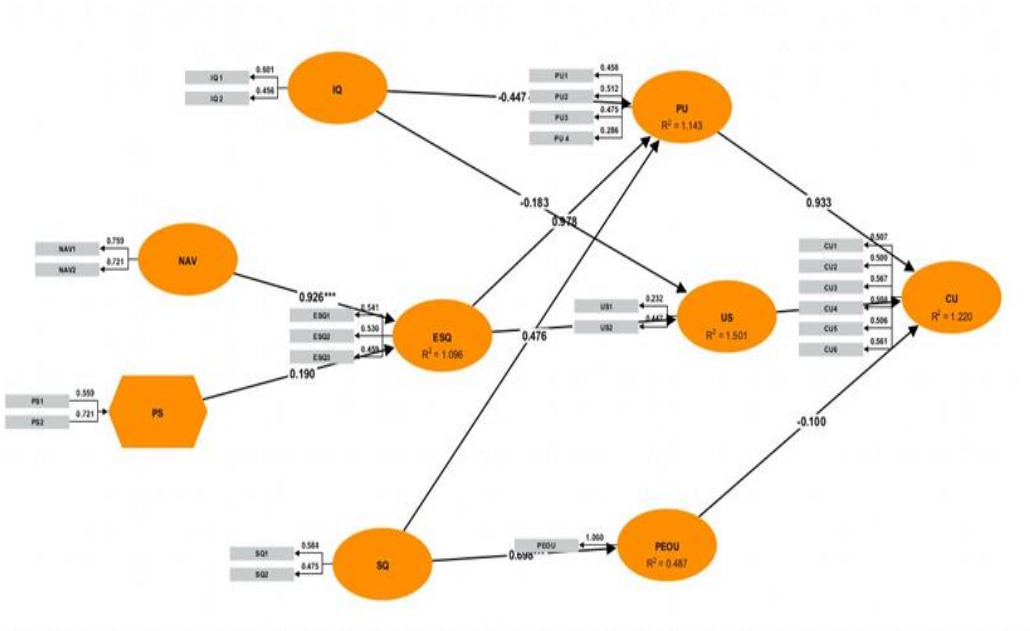

Figure 2. Graphical Output

Path Coefficients

Path Coefficients mean path coefficients, which refer to the strength and direction of the relationships between variables with other variations in the SEM – PLS model. Essentially, Path Coefficients also refer to creating numerical values that will represent both direct and indirect influences on other variables. These coefficients will be estimated through statistical analysis mechanisms, typically using the Partial Least Squares method [13].

Table 1. Path Coefficients

Hypothesis	Path Coefficients
E - Service Quality -> Perceived Usefulness	0.1419
E - Service Quality -> User Satisfaction	0.3516
Information Quality -> Perceived Usefulness	0.0875
Information Quality -> User Satisfaction	0.2234
Navigation -> E - Service Quality	0.2962
Perceived Ease of Use -> Continued Use	0.4816
Perceived Usefulness -> Continued Use	0.1354
Privacy & Security -> E - Service Quality	0.3192
System Quality -> Perceived Ease of Use	0.5326
System Quality -> Perceived Usefulness	0.2306
User Satisfaction -> Continued Use	0.2646

- The relationship with a strong influence is found in System Quality - Perceived Ease of Use with a score of (0.5326).
- The relationship with a small influence is found in Information Quality - Perceived Usefulness with a score of (0.0875).
- A significantly notable factor is found in E-Service Quality - User Satisfaction with a score of (0.3516).

1. Standard Path Coefficients to assess strength with path values ranging from -1 to 1.

- Close to 0: The relationship is very weak or even non existent.
- 0.01 – 0.19: Weak relationship.
- 0.02 – 0.29: Moderate relationship (sufficient but not strong).
- > 0.30: Strong relationship.
- > 0.50 : The relationship is very strong.

2. Significant assessment to determine whether the shown relationship is truly statistically significant.

- T-value: > 1.96 is significant if the significance level is 5% or P < 0.05.
- T-value: > 1.96 is not significant.
- P-value: < 0.05 Significant
- P-value: > 0.05 Not significant

With this research, it will make it easier for the author to determine reliability and validity in the future [14].

Outer Model

In the outer model, the calculation of Composite Reliability and Cronbach alpha will be performed on the outer model data above. For this stage, the author will create a Composite Reliability table to make it easier to understand later.

Table 2. Outer Loadings

	Composite Reliability
IQ	0.7658
NAV	0.8629
PS	0.8787
ESQ	0.9504
SQ	0.8461
PEOU	1.0000
US	0.6953
PU	0.9218
CU	0.9338

In the table above, it shows that all variables have a Composite Reliability value above 0.7, indicating high reliability using the calculation formula:

$$\textit{Composite Reability} = (\Sigma\lambda i)^2 / (\Sigma\lambda i)^2 + \Sigma(1-\lambda i^2) \quad (1)$$

λi = Loading factor of the value of the i-th indicator

Σ = Summation

With value interpretation:

- composite reliability > 0.7: The indicator has good reliability in measuring the construct.
- 0.6 < composite reliability < 0.7: Reliability is still acceptable, but it needs to be considered for binding.
- composite reliability 0 < 0.6: Low reliability, indicators need to be revised or replaced.

Cronbach's Alpha

Table 3. Cronbach's alpha

	Cronbach's alpha
Continued Use	0.9147
E - Service Quality	0.9203
Information Quality	0.6784
Navigation	0.6821
Perceived Ease of Use	-
Perceived Usefulness	0.8866
Privacy & Security	0.7238
System Quality	0.6363
User Satisfaction	0.6950

Cronbach's Alpha measures the reliability or internal consistency of a construct in a research model. This value ranges from 0 to 1 [15], where:

- ≥ 0.9 → Very good
- 0.7 – 0.9 → Good
- 0.6 – 0.7 → Sufficient
- < 0.6 → Less reliable
- < 0.5 → Not reliable

Conclusion:

- Continued Use (0.9147) Highly reliable, indicating that the indicators in this construct are very consistent in measuring the concept of usage sustainability.
- E-Service Quality (0.9203) High reliability, indicating that this construct has very good internal consistency.
- Perceived Usefulness (0.8866) Very reliable, indicating that the indicators in this construct are consistent in measuring the perceived usefulness of the system.

- Privacy & Security (0.7238) Reliability is quite good, indicating that the aspects of security and privacy have an acceptable level of consistency.
- Information Quality (0.6784) Relatively low but still within acceptable limits.
- Navigasi (0.6821) Moderate.
- User Satisfaction (0.6950) Almost reaching the threshold of good reliability.
- System Quality (0.6363) The score is quite low, indicating that the indicators in this construct are less consistent in measuring system quality.
- Perceived Ease of Use (-) There is no score because the number of items is too few.

Table 4. R - Square

	R-square	**R-square adjusted**
Continued Use	0.4349	0.4220
E - Service Quality	0.2350	0.2234
Perceived Ease of Use	0.2837	0.2783
Precieved Usefulness	0.1314	0.1115
Uer Satisfaction	0.2220	0.2102

This can be concluded with the following formula:

$$\mathbf{R^2 = 1 - (SSR / SST)} \qquad \mathbf{(2)}$$

R^2 = *R-Square.*

- SSR = Sum of Squared Residuals, which is the sum of the squares of the differences between the actual values of a dependent variable and the values predicted by a model.
- SST = Total Sum of Squares, which is the sum of the squares of each difference between the value of the dependent variable and the mean of the dependent variable itself.
- After we obtain the R-Square value, the next step is to calculate each of those variables using the formula.

$$\mathbf{Q2=1-\prod(1-R2)} \qquad \mathbf{(3)}$$

Where:

R2: The value of R-Square for each dependent variable in a model.

Conclusion:

- Continued Use (0.4349) The independent variable is quite strong in predicting Continued Use.

- E-Service Quality (0.2350) The model has moderate predictive relevance for this variable.
- Perceived Ease of Use (0.2837) The model has a fairly good prediction.
- Perceived Usefulness (0.1314) The independent variable has relatively low predictive relevance to Perceived Usefulness.
- User Satisfaction (0.2220) The model is quite good at predicting User Satisfaction.

Research Results

Based on the analysis results, the relationship with the strongest influence is between System Quality and Perceived Ease of Use, with a score of 0.5326, indicating that system quality has a significant impact on the perceived ease of use by users. On the other hand, the relationship with the smallest influence was found between Information Quality and Perceived Usefulness, with a score of 0.0875, indicating that information quality contributes less to the perception of system usefulness. Meanwhile, a significantly notable factor is found in E-Service Quality towards User Satisfaction, with a score of 0.3516, indicating that the quality of electronic services has a considerable impact on user satisfaction. In terms of reliability, the constructs of Continued Use (0.9147), E-Service Quality (0.9203), and Perceived Usefulness (0.8866) have very high reliability scores, indicating that the indicators in these constructs are consistent in measuring the intended concepts. Meanwhile, Privacy & Security (0.7238), Information Quality (0.6784), Navigation (0.6821), and User Satisfaction (0.6950) have fairly good reliability, although there is still room for improvement. However, System Quality (0.6363) shows a relatively low value, indicating a lack of consistency in measuring system quality. Additionally, Perceived Ease of Use does not have a reliability value due to the insufficient number of items for testing.

The results of the Q^2 analysis show that the overall research model has fairly good predictive relevance, especially for the Continued Use variable, which has the highest Q^2 value (0.4349), indicating that the model is capable of predicting the sustainability of chatbot usage quite well. However, the Perceived Usefulness variable has the lowest predictive relevance (0.1314), indicating that there are other factors that have a greater influence on the perception of the system's usefulness. From the R-Square value, it can be concluded that the Continued Use variable (0.4349) has the greatest influence in this model, while Perceived Usefulness (0.1314) has the smallest influence. Therefore, further investigation is needed to identify other factors that can enhance the predictive relevance of these variables.

D. Conclusion

This research successfully identified the factors influencing the sustainability of Chatbot as an academic information platform through analysis using the PLS-SEM method and the Adanco software. The study found that the factors of System Quality, Perceived Ease of Use, and User Satisfaction significantly affect the Continued Use of Chatbot as an academic information platform. The strongest relationship is found between System Quality and Perceived Ease of Use (0.5326), indicating that a good system quality makes it easier for users to use the Chatbot. E-Service Quality also contributes positively to User Satisfaction (0.3516).

Information Quality and Perceived Usefulness have the lowest influence in this model, with values of (0.0875) and (0.1314) respectively. This indicates the need for improvement in the aspect of Information Quality to strengthen the Perceived Usefulness of the system. Overall, the research model has good predictive relevance, particularly on the Continued Use variable (Q^2 = 0.4349). However, improvements are needed in the variables with low influence to ensure the sustainability of using the Chatbot as an academic information medium.

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