# Extending ECM with Quality Factors to Investigate Continuance Intention to Use E-learning

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***Abstract*—This paper has purpose to investigate the impact of quality factors on satisfaction and continuing intention in using e-learning system. The study employs expectation–confirmation model (ECM) to express the effect of Information Quality, System Quality, Service Quality on Confirmation and Satisfaction and adds Perceived Usefulness and Self efficacy to reveal their effect on Satisfaction. The proposed model was tested using 325 respondents. They are young people that live in digital native culture. The analysis of data was carried out in two stages, the first stage is validity and reliability checking to perform correlation analysis of variables when pass the checking. The second stage, the causal effects of variables are examined using Structural Equation Modelling (SEM) using Partial Least Square (PLS). The findings of the study reveal quality factors as the determining factors for the confirmation of the satisfying and using e-learning continually. The confirmation also was determined by the perceived usefulness of the system and the self-efficacy in using the system. The findings disclose the quality of e-learning system is prominent factor on continuance intention to use the system.**

***Keywords—e-learning, satisfaction, continuance intention quality factors***

## I. INTRODUCTION

Education at universities in Indonesia during the Covid-19 pandemic underwent such great changes, making many innovations, especially in the application of technology to improve e-learning-based learning. At this time forcing teaching and learning to be done in a limited way or at home. These restrictions encourage the acceleration of the implementation of e-learning-based learning. At this time online learning needs to be studied more deeply in terms of technology, namely system quality, service quality, and information quality, student satisfaction in learning, and student independence in e-learning learning.

The current condition of e-learning in universities is stable, so it is important to see student satisfaction in the quality of using e-learning technology for the sustainability of its use. E-learning is an integrated system with teaching materials or materials in the form of multimedia and has presentation facilities, assignments, quizzes, online discussions and chat [1].

In general, an e-learning system is an information system that combines various activities of students, instructors and administrators and academic information system entities and learning management systems so as to make learning meaningful. Distance learning offers easy access, flexibility and scalability has become commonplace [2], so school businesses are able to accommodate the needs of students who need distance education.

The quality of the system in question is the e-learning system used by students and lecturers, where the material in the form of multi-media can be accessed easily. A good e-learning is one that has a good system quality [3]. The quality of information that is timely, relevant and effectively understood by students [4] is important in e-learning. Content in the quality of information is easy to access and in accordance with the lectures that are followed. The quality of service in this case is seen from the integration of the e-learning system with related systems in student academics, so that it gives the impression of being effective and timely [5].

Student self-efficacy in academics supports students being satisfied in online learning by using computers [6]. Students are confident in their ability to use computer technology. Even self-efficacy builds employee creativity and innovation so that it motivates them to do entrepreneurship [7].

In this study, ECM was developed by adding quality factors (Information Quality, Service Quality, and System Quality) and also adding the Self Efficacy of students used in e-learning adoption. This development is proposed to be a contribution in this research.

## II. RELATED WORK

The basic theory of the Expectation-Confirmation Model (ECM) [8] is a further development of the Technology Acceptance Model [9,10] by adding Satisfaction and Confirmation variables. There are four variables in the basic ECM namely Confirmation, perceived benefits, Satisfaction, and also Continuance Intension. The use of both basic and developed ECM in adoption technology research has been carried out by many researchers.

In [11], ECM added with personality trait variables (Conscientiousness, Openness to experience, Neuroticism, Agreeableness, and Extraversion) were used to motivate users' continued intentions towards Facebook.

Expectation-confirmation theory (ECT) was also used to understand the main drivers in MOOC Satisfaction and

sustained intention to use. In this model, ECT is added with variables Perceived Interest, Flow and also Intention to Recommend [12]. And in [13] ECM is also used to measure the satisfaction of e-learning users.

In his research [14], ECM is also used for Continuance of E-learning intentions with conditions related to open innovation. The variables used are the same as in this study, but the difference is that the quality factor is associated with the usefulness or benefit variable and also satisfaction, the SE is for teachers not students.

In [15], ECM is also used to look at student satisfaction and sustainable intentions of cloud-based e-learning systems, as well as the role of interactivity and course quality factors. In his research, Cheng uses ECM which is added with Interactivity, Course Content Quality, and Course Design Quality variables.

In [16], ECM is used to see students' expectations, satisfaction, and ongoing intentions in using digital textbooks. In this research, Joo adds the Perceived Enjoyment variable.

In [17], ECM is used to examine the level of student satisfaction and intention to continue using E-Learning. In his model, Wing S Chow combines ECM with Post-Adoption Expectation variables (Learning process, Tutor Interaction, Peers interaction, Course design).

In [18], ECM is used for social comparison and sustainable intention of smart fitness devices. In his model, Anil Gupta adds the variables Perceived Health Outcomes, Social Comparison Tendency and Intentions to Recommend.

In [19], used ECM to investigate sustained intention among MOOC participants, including the role of MOOC habits and performance. In the model Dai uses ECM with additional variables MOOC Performance, Attitude and Habit.

Dai [20] also uses ECM to explain Chinese students' continuing learning intentions in a MOOC setting, by modifying the ECM with the addition of Attitude and Curiosity variables.

In [21], ECM is used to explain the role of system quality and content quality in explaining e-learning continuation intentions of Malaysian e-learning users. Additional variables in the research model are Self Efficacy, Learner Interface, Learning Community, and E-learning Effectiveness.

Cheng, Y. M. [22], used ECM to examine the continuing intention of medical professionals from a cloud-based e-learning system, which is a continuation of ECM with flow theory with the addition of Human Factor, Organizational Factor, Technology Factor, Flow Experience variable

M. Zhang [23], developed an ECM to examine students' ongoing intention to use remote virtual laboratories in formal education. Additional variables used in this research is Flow Experience.

Aisha [24], used ECM to examine the effects of perceived usefulness, confirmation and satisfaction on sustained intentions in MOOC.

L. Zheng [25], used ECM to investigate the role of emotions in the intention to continue playing mobile games, and an additional variable used in the study was Positive Emotions.

Chang, CC [26], examines the direct and indirect effects of perceived innovation characteristics into intentions to pay which mediate ongoing intentions to use e-learning, the variables used in this study are Relative advantage, Complexity, Compatibility, Self-efficacy , Continuance Intention to use, Intention to pay.

Z. Junjie [27], using ECM to investigate the factors that influence MOOC continuation intentions for online collaborative learning, additional variables used in the study are Knowledge outcome and Performance proficiency, Social influence.

Lew, SL, Lau, SH, & Leow, MC [28], examined the usability factor to predict the continuation of intention to use cloud e-learning applications, the variables used in this study were Computer Self Efficacy, enjoyment, Perceived Ease of Use, Perceived Usefulness, User Perception, and Continuance Intention.

Young Ju Joo, Hyo-Jeong So, Nam Hee Kim [29] investigated the relationship between student self-determination, technology acceptance, satisfaction, and continued intention to use K-MOOCs. And the variables used are Self-determination, Perceived Usefulness, Perceived Ease of Use, Satisfaction, Continuance Intention.

In [30] also uses ECM to examine the impact of the system and service quality on customer loyalty in E-Marketplace acceptance with the addition of System Quality, Service Quality, Perceived Ease of Use variables.

In [31] uses ECM to research technology adoption for the use of smartphones for learning. Additional variables used are SI, Innovativeness, Effort Expectancy (EE), Performance Expectancy (PE), Perceived Performance, Satisfaction, BI.

In the model proposed in this study is ECM with the development of the addition of the variable factor Quality and Self Efficacy.

## III. PROPOSED MODEL AND HYPOTHESIS

In this study, an adoption model for e-learning was developed using the ECM model and based on research in the last 6 years regarding technology adoption for e-learning can be seen in Figure 1.

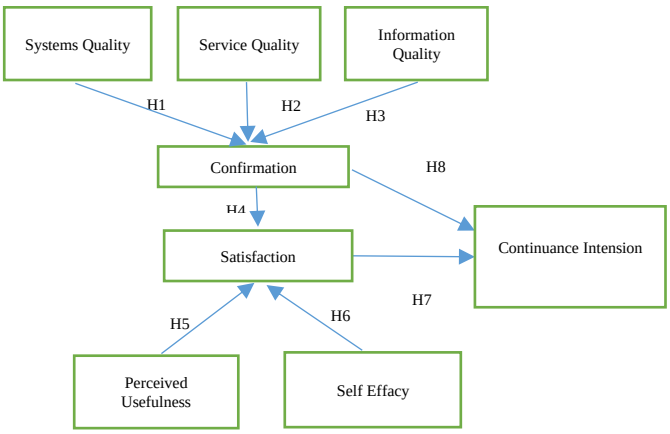


Fig. 1. Proposed model

### A. *System Quality, Service Quality, and Information Quality on Confirmation on (H1, H2, H3)*

In the research of Gokhan [32] and Park [33] expanding ECM with information on quality, System Quality, and Service Quality, based on this research, hypotheses can be made H1, H2, and H3.

**H1: Systems Quality has a positive effect on Confirmation**

**H2: Service Quality has a positive effect on Confirmation**

**H3: Information Quality has a positive effect on Confirmation**

### B. *Confirmation, Perceived Usefulness, and Self Efficacy on Satisfaction (H4, H5, H6)*

In research that has been done by [8,32-34] there is a positive correlation between confirmation and perceived usefulness with satisfaction, so hypotheses H4 and H5 can be prepared based on this. While the relationship between self-efficacy variables has also been investigated by [14, 35], based on this research, hypothesis H6 was made.

**H4: Confirmation has a positive effect on Satisfaction**

**H5: Perceived Usefulness has a positive effect on Satisfaction**

**H6: Self Efficacy has a positive effect on Satisfaction**

### C. *Confirmation and Satisfaction on Continuence Intension (H7, H8)*

Based on studies conducted using ECM or modified ECM [11-31] there is a positive correlation between Confirmation with Continuance Intension and Satisfaction with Continuance Intension, so hypotheses H7 and H8 are formulated.

**H7: Confirmation has a positive effect on Continuance Intension to use**

**H8: Satisfaction has a positive effect on Continuance Intension to use**

## IV. METHODOLOGY

The data used in this study were 340 respondents who were e-learning users at the Soegijapranata Catholic University, Semarang. Not all of these 340 data were used because there were 15 invalid data, so the data used were only 325 respondents.

This study was tested using SEM PLS. Before being tested using SEM PLS, first tested the common bias variance using SPSS. Testing the common bias variance using Harman's single factor test, this test aims to find out how much bias occurs between the variables used in this study.

The next test after the common bias test is the Measurement Model Test which includes the Validity Test, Reliability Test, and Multicollinearity Test. After the Measurement Model Test is declared to meet the requirements, then the Structural Model Test is carried out, namely the Path Coefficient Test, Coefficient of Determination, and Hypothesis Testing.

In the validity test there are two stages, namely the Convergent Validity Test and the Discriminant Validity Test. After the validity test meets the criteria, it is continued by conducting a reliability test. In the reliability test that is measured is the price of Composite Reliability and also Cronbach Alpha. The conditions that must be met in this reliability test are that the Composite Reliability and Cronbach Alpha prices must be greater than 0.7.

Test the ability of the independent variable on the latent variable using the value of R Square, it is declared strong if the value of R Square is more than 26%. The last Structural Test Model is to test the hypothesis that has been prepared using the Hypothesis Test. If the P value is more than 0.05, then the hypothesis is rejected, meaning that the compiled hypothesis is not proven. On the other hand, if the P value is less than 0.05, then the hypothesis is correct or acceptable.

## V. DATA ANALYSIS AND DISCUSSION

### A. *Demographic of Respondents*

Demographic data from respondents are shown in Table I.

TABLE I. TABLE DEMOGRAPHICS RESPONDENS

| **Total Respondents (n=325)** | | |
|---|---|---|
| **Age:** | | |
| 16-18 | 131 | 40% |
| 19-21 | 165 | 51% |
| 22-24 | 26 | 8% |
| >25 | 3 | 1% |
| **Gender:** | | |
| Male | 161 | 49.54% |
| Female | 164 | 50.46% |

By using Table I, it can be seen that the respondents who filled out the most were students aged 19-21 years (51%), with male sex about 49.54% more than female respondents, namely 50.46%.

Before the data is processed using Smart PLS, the data will be tested first for the common bias factor using Harman's single factor. The results of the common bias variance test are 38.5%, this shows that the common bias variance test has met the requirements, because it is less than 50% which is the threshold of Harman's single test.

### B. *Measurement Model Test*

#### 1. *Convergent validity*

By using the model that has been compiled in Figure 1, it is tested using PLS to find out its validation using the outer loading can be seen in Table II.

TABLE II. THE LOADING FACTOR VALUE TO TEST THE VALIDITY OF THE INDICATOR

| | CI | Conf | IQ | PU | SQ | SE | SrQ | Sat |
|---|---|---|---|---|---|---|---|---|
| CI1 | 0.844 | | | | | | | |
| CI2 | 0.870 | | | | | | | |
| CI3 | 0.900 | | | | | | | |
| Conf1 | | 0.851 | | | | | | |
| Conf2 | | 0.817 | | | | | | |
| Conf3 | | 0.789 | | | | | | |
| Conf4 | | 0.782 | | | | | | |
| Conf5 | | 0.854 | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| IQ1 | | | 0.803 | | | | | |
| IQ2 | | | 0.787 | | | | | |
| IQ3 | | | 0.786 | | | | | |
| IQ4 | | | 0.799 | | | | | |
| IQ5 | | | 0.783 | | | | | |
| PU1 | | | | 0.929 | | | | |
| PU2 | | | | 0.920 | | | | |
| PU3 | | | | 0.715 | | | | |
| SQ1 | | | | | 0.796 | | | |
| SQ2 | | | | | 0.850 | | | |
| SQ3 | | | | | 0.797 | | | |
| SE2 | | | | | | 0.805 | | |
| SE3 | | | | | | 0.813 | | |
| SE4 | | | | | | 0.855 | | |
| SrQ1 | | | | | | | 0.771 | |
| SrQ2 | | | | | | | 0.792 | |
| SrQ3 | | | | | | | 0.839 | |
| SrQ4 | | | | | | | 0.706 | |
| Sat1 | | | | | | | | 0.870 |
| Sat2 | | | | | | | | 0.888 |
| Sat3 | | | | | | | | 0.869 |
| Sat4 | | | | | | | | 0.866 |

Seen in Table II, the value of each indicator on the outer loading is greater than 0.7 which is the threshold value of this validity test.

Furthermore, this validity is still being tested, seen from the Average Variance Extracted (AVE) value, the results can be seen in Table III.

TABLE III. NILAI AVERAGE VARIANCE EXTRACTED (AVE)

| Variable | Average Variance Extracted (AVE) |
|---|---|
| CI | 0.760 |
| Con | 0.671 |
| IQ | 0.627 |
| SE | 0.680 |
| PU | 0.740 |
| SQ | 0.664 |
| Sat | 0.762 |
| SrQ | 0.606 |

From Table III it can be seen that the AVE value of all variables is greater than 0.5 which is the limit value of this AVE. Based on Table II and Table III, it can be seen that the variables in this model have met the requirements of convergent validity.

*2. Discriminant Validity*

The test results of the Discriminant Validity Test can be seen in Table IV, the Fornell-Lacker Criteria used.

TABLE IV. FORNELL-LARCKER CRITERION VALUES

| | CI | Con | IQ | SE | PU | SQ | Sat | SrQ |
|---|---|---|---|---|---|---|---|---|
| CI | 0.872 | | | | | | | |
| Con | 0.632 | 0.819 | | | | | | |
| IQ | 0.599 | 0.730 | 0.792 | | | | | |
| SE | 0.728 | 0.580 | 0.602 | 0.825 | | | | |
| PU | 0.543 | 0.438 | 0.440 | 0.521 | 0.860 | | | |
| SQ | 0.626 | 0.676 | 0.788 | 0.612 | 0.547 | 0.815 | | |
| Sat | 0.729 | 0.760 | 0.668 | 0.758 | 0.601 | 0.702 | 0.873 | |
| SrQ | 0.634 | 0.732 | 0.813 | 0.637 | 0.454 | 0.748 | 0.714 | 0.778 |

Based on Table IV above, it can be seen that each variable has the greatest value to itself when compared to other variables, this is a criterion for Discriminant Validity, so it can be said that the variables in this model have met the requirements for Discriminant Validity.

3. Reliability Test

The reliability test in this study was used by measuring the Cronbach's Alpha and Composite Reliability values of each variable, which can be seen in Table V.

TABLE V. THE VALUE OF COMPOSITE RELIABILITY AND CRONBACH'S ALPHA

| | Cronbach's Alpha | Composite Reliability |
|---|---|---|
| CI | 0.841 | 0.905 |
| Conf | 0.877 | 0.911 |
| IQ | 0.851 | 0.894 |
| Man | 0.765 | 0.864 |
| PU | 0.816 | 0.894 |
| SQ | 0.746 | 0.855 |
| Sat | 0.896 | 0.928 |
| SrQ | 0.782 | 0.860 |

The value of Cronbach's Alpha and Composite Reliability of all variables in Table V is greater than 0.7 which is the threshold value of the reliability of a variable. Therefore, all variables in this research model are reliable.

*C. Structural Model Test*

The next step after the variables in the model are tested for validity and reliability through the model measurement test is to test the variables in this research model using a structural model test. In the structural test of this model, it is done by looking at the Path Coefficient test, the Coefficient of Determination Test, and the last is to test the hypothesis.

*1. Test the path coefficients*

This Path Coefficient is used as a basis for determining whether a hypothesis is accepted or not. The results of the Path Coefficient test can be seen in Table VI.

TABLE VI. VALUE OF PATH COEFFICIENTS

| | CI | Con | IQ | SE | PU | SQ | Sat | SrQ |
|---|---|---|---|---|---|---|---|---|
| CI | | | | | | | 0.413 | |
| Con | 0.279 | | | | | | 0.499 | |
| IQ | | 0.309 | | | | | | |
| SE | | | | | | | 0.477 | |
| PU | | | | | | | 0.172 | |
| SQ | | 0.166 | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Sat | | | | | | | | |
| SrQ | | 0.356 | | | | | | |

The path coefficient value in Table VI is greater than 0.1, which means that the variables that have been compiled have a correlation with each other.

*2. Coefficient of Determination*

Coefficient of Determination Test or R Square to determine the accuracy of the predictions of the model that has been compiled in this study. The magnitude of the relationship between the independent variable and its latent variable is shown in this Coefficient of Determination. There are three levels, namely weak, medium, and strong effects. The results of the Coefficient of Determination (R Square) of this research model can be seen in Table VII.

TABLE VII. R SQUARE AND R SQUARE ADJUSTED VALUES

| | **R Square** | **R Square Adjusted** |
|---|---|---|
| CI | 0.617 | 0.614 |
| Conf | 0.599 | 0.595 |
| Sat | 0.681 | 0.679 |

From Table VII it can be seen that the coefficient value of the three variables in this model is greater than 26%, which means that the relationship is strong.

*3. Hypothesis testing*

The last step in the structural model test is hypothesis testing. In this hypothesis test, it will be proven that the model built has a relationship between variables. In testing this hypothesis using a two-tailed test, the implementation using Smart PLS. In this hypothesis test the results can be seen in Table VIII. If the P price is below 5%, it means that the hypothesis is accepted, and vice versa if the P price is above 5%, the hypothesis is rejected.

TABLE VIII. HYPOTHESIS TEST RESULTS

| | Sample Mean (M) | Standard Deviation (STDEV) | T Statistics (\|O/STDEV\|) | P Values | Hypothesis |
|---|---|---|---|---|---|
| Sat -> CI | 0.413 | 0.048 | 8.560 | 0.000 | Accepted |
| Conf -> CI | 0.279 | 0.049 | 5.745 | 0.000 | Accepted |
| Conf -> Sat | 0.499 | 0.047 | 10.652 | 0.000 | Accepted |
| IQ -> Conf | 0.309 | 0.079 | 3.924 | 0.000 | Accepted |
| SE -> Sat | 0.477 | 0.050 | 9.617 | 0.000 | Accepted |
| PU -> Sat | 0.172 | 0.048 | 3.582 | 0.000 | Accepted |
| SQ -> Conf | 0.166 | 0.071 | 2.352 | 0.019 | Accepted |
| SrQ -> Conf | 0.356 | 0.082 | 4.339 | 0.000 | Accepted |

The hypothesis testing that has been developed by the model turns out to be all hypotheses accepted because the P value is below 0.05 or 5%, so the model can be rearranged as shown in Figure 2.

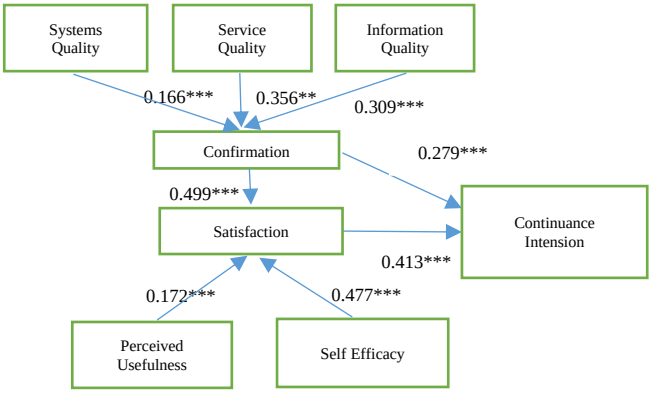


Fig. 2. The final model after testing. $^{**}p<0.01$, $^{***}p = 0$

This study has two necessary findings related to young people in using e-learning and their perception of the qualities of e-learning services. The respondents are in range of 16 – 38 years old and the half of them (51 percent) is in range of 19 – 21 years old. Most of them lived on digital native culture wherein the quality factors are determinant in their decision to accept the system. The findings of this study verify the phenomena.

This study verified that in the pandemic Covid-19 era, the quality of the e-learning system is the essential thing for the students. Systems, Service, and Information Qualities of e-learning are determinant factors to their Confirmation in using it. Firstly, the findings conform the result of the researches by Gokhan [32] and Park [33].

Secondly, this study fit the ECM theory by [8]. The confirmation is a the most factor to the satisfaction and the acceptance in using e-learning. This study confirms that Confirmation is the main factor to satisfy and decide to continue in using e-learning system. The previous researches [11-31, 8, 32-34] also have the appropriate results with the findings. Furthermore, the researchers conducted by [11-31] also confirm the finding that Satisfaction has positive effect on their decision to continue using e-learning system.

The other findings regard to satisfied perception in using e-learning affected by their self-efficacy and perceived usefulness in using it conform the previous research by [8, 14, 32-35]. Finally, this study confirms the theory of ECM model and related previous researches and verify that quality factors of e-learning system are crucial factor in shaping student confirmation and realizing their satisfy and continue intention to use the system. The study on pandemic Covid-19 era is reinforcing factor to the findings.

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