# Factors Affecting Students' Perspectives on the Usefulness of Learning Online

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**Abstract—**The more students perceive the usefulness of the learning mode, the more they accept it, hence inference to their learning success. The purpose of the study is to identify factors that impact students' perspectives on the usefulness of learning online in their learning process based on the Technology Acceptance Model. Learners' styles and their e-learning self-efficacy were integrated into the model to explore the relationships between these factors and their perceived usefulness of learning online. A questionnaire survey was administered to 356 voluntary students of a private university in Vietnam. Data analysis methods include the Cronbach's alpha test to examine the scales' reliability, Confirmatory Factor Analysis method to determine the factors of learners' learning online styles, and the structural equation modeling method to estimate the correlations between the dependent and independent constructs. The results indicate that four in six learners' learning online styles had a significant relationship with perceived usefulness. In particular, tactile and group factors, and the Individual factor have directly and indirectly positive effects on perceived usefulness respectively while Kinaesthetic factor has a direct negative effect on perceived usefulness. The other factors such as visual and auditory show no relationship with perceived usefulness. Learners' e-learning self-efficacy and perceived ease of use components have a direct and positive impact on perceived usefulness. Pedagogical implications and limitations of the study are also discussed.

**Keywords—**TAM, learning styles, learners' e-learning self-efficacy, online learning, higher education

## 1 Introduction

Albeit some reported drawbacks on its limitations to learners' interaction, online learning has become ubiquitous in education at multi-levels, from primary to tertiary education due to its flexibility, accessibility, and learners' learning individualization [1]. Among many well-known Massive Open Online Course (MOOC) platforms for online courses, such as edX, Udacity, Khan Academy, and so forth, Coursera has confirmed its increase in growth worldwide [2]. The utilization of online learning alongside traditional courses poses a need to identify learners' readiness to learn in this new learning environment. Tsai and Lin's [3] study showed that learners' perceptions of the Internet can affect their attitudes and behavior towards their Internet self-efficacy and the

usefulness of the Internet in their online learning. Developed from the Theory of Reasoned Action [4],[5], the Technology Acceptance Model (TAM) devised by Davis [6] was widely used as a tool to predict users' acceptance of new technology. In this model, perceived usefulness (PU) and perceived ease of use (PE) are the two key determinants that directly affect users' behavioral intention to use the technology system. What is more, this model allows the addition of external factors to verify other determinants of the validity of the TAM constructs. External variables include system characteristics, such as system functionality, system interactivity, system response time [7], [8], and user characteristics comprised of self-efficacy, Internet experience, interaction, and learners' learning styles [1], [9].

Recently many scholars have utilized this theoretical framework to anticipate students' intention to use Virtual Reality in the classrooms [10], or in online learning environments [11], students' continuance intention of learning in MOOC platforms [12], in LMS [13], factors affecting students' acceptance of technology as an instrument for learning [14], factors affecting faculty's intention to adopt online technological tools [15], or to use MOOCs as a resource to attain their educational aims [16]. In Vietnam, an increasing number of studies have employed the TAM to explore factors influencing students as well as lectures' adoption of technology and their attitudes and intentions to use technology during the teaching and learning process in both online and blended learning environments. For example, some studies focused on identifying factors affecting students' e-learning acceptance and students' learning achievements [17], teachers' adoption of an online learning management system [18], and students' learning online in public and private universities [19]. Others investigated students' attitudes toward the use of a blended learning environment [20], and students' attitudes and intentions toward the use of social media [21].

It can be drawn that although the adoption of TAM has been well documented, there is a dearth of research examining students' factors such as learning styles and their perceived self-efficacy on their perspectives of the usefulness of online learning. This gap gives an impetus for the current study, especially at the saddening outbreak of COVID-19 when almost all tertiary educational institutions nationwide have no choice but to have their students study online. In particular, this study adapted Al-Azawei et al.'s [22] model in the context of e-learning in a private university in the Mekong Delta, Vietnam, by examining the effects of the two aforementioned external variables on students' perspectives on the usefulness of online learning.

## 2 Research model and theoretical framework

### 2.1 An extension of the technology acceptance model (TAM)

Al-Azawei et al. [22] investigated the influence of learning styles based on the Index of Learning Styles (ILS) Questionnaire by Felder and Soloman (n.d.) on students' satisfaction in a blended learning environment. Their model included e-learning self-efficacy (LE), learning styles (LS), perceived satisfaction, perceived usefulness (PU), perceived ease of use (PEOU), and intention to use. Using PLS-SEM path modeling, they

discovered that PEOU showed a direct significant effect on PU, LE had positive impacts on PEOU and PU, whereas the hypothesis that LS had a positive direct influence on PU was not supported. However, a study by Lee et al. [23] using Reid's Perceptual Learning Style Preference Questionnaire (PLSPQ) [24] indicated that four learning styles, namely visual, auditory, kinesthetic, and tactile, were positively correlated with their learning via network-based computer technology. The controversial roles of LS during students' learning process in online learning have paved the way for further research on this issue.

### 2.2 Learning styles (LS) and learners' e-learning self-efficacy (LE)

Learning styles as an important predictor of students' research self-efficacy was confirmed by previous studies [25], [26]. In their study, students with more active and intuitive LS showed higher self-efficacy in research. Similarly, using the Index of Learning Styles [27] as the instrument to assess students' LS, Direito et al. [28] found a high relationship between undergraduate engineering students' LS and their self-efficacy in their soft skills. Nevertheless, the correlation between these two factors varied [29], and had no effect on each other [30]. In this paper, learning style factors include Visual (Vis), Auditory (Aud), Kinaesthetic (Kin), Tactile (Tac), Individuals (Ind), and Group (Gro). From prior research contradictory results, we propose that:

- H1.1.1: Visual directly affects E-learning Self-efficacy (LE).
- H1.2.1: Auditory directly affects E-learning Self-efficacy (LE).
- H1.3.1: Kinaesthetic directly affects E-learning Self-efficacy (LE).
- H1.4.1: Tactile directly affects E-learning Self-efficacy (LE).
- H1.5.1: Individuals directly affect E-learning Self-efficacy (LE).
- H1.6.1: Group directly affects E-learning Self-efficacy (LE).

### 2.3 Learning styles and perceived ease of use

A study conducted by Gu et al. [31] employing Structural Equation Modelling (SEM) to examine the effects of students' learning styles on their Perceived Ease of Use when studying online shows that students find it easy to use the online learning tool. In a similar vein, findings from a recent empirical study by Lu, Lin, and Chen [32] surveying 322 university students resonate with this result. However, Al-Azawei and Lundqvist [33] did not find any direct significant influence of students' LS on PE. Therefore, we hypothesize that:

- H1.1.2: Visual directly affects perceived ease of use (PE).
- H1.2.2: Auditory directly affects perceived ease of use (PE).
- H1.3.2: Kinaesthetic directly affects perceived ease of use (PE).
- H1.4.2: Tactile directly affects perceived ease of use (PE).
- H1.5.2: Individuals directly affect perceived ease of use (PE).
- H1.6.2: Group directly affects perceived ease of use (PE).

### 2.4 Learning styles and perceived usefulness

This study employed Reid's [24] Perceptual Learning Style Preference Questionnaire (PLSPQ) since it has been widely adopted in the past few decades to investigate learners from different contexts and nationalities [23]. The questionnaire incorporates 30 purposively random items for the six learning style preferences, namely visual, auditory, kinaesthetic, tactile, group learning, and individual learning. Participants in the survey reply on a five-point Likert scale, ranging from strongly agree to strongly disagree. Identifying learners' learning styles would not only benefit learners themselves but also various stakeholders. For students, it helps to enhance their learning performances since learning in their favorable style would make their learning become more enjoyable [34]. For instructors, comprehending students' learning styles enables them to choose appropriate educational activities and teaching materials to effectively boost their students' learning [35], [36]. In addition, Felder and Brent [35] suggested that the insufficient balance of learners' learning styles may lead to a dropout rate and poor performance. However, pedagogical implications based on learning styles have been still controversial due to the lack of convincing evidence to support it [33], [37]. It can be inferred from the aforementioned studies that there seems to be a positive correlation between students' learning style preferences and learning environment as learners may not be in favor of a learning environment if they do not perceive the usefulness of the learning environment to their learning process. Therefore, the following hypothesis is proposed:

- H1.1.3: Visual directly affects Perceived Usefulness (PU).
- H1.2.3: Auditory directly affects Perceived Usefulness (PU).
- H1.3.3: Kinaesthetic directly affects Perceived Usefulness (PU).
- H1.4.3: Tactile directly affects Perceived Usefulness (PU).
- H1.5.3: Individual directly affects Perceived Usefulness (PU).
- H1.6.3: Group directly affects Perceived Usefulness (PU).

### 2.5 Learner's e-learning self-efficacy with perceived ease of use and perceived usefulness

Computer self-efficacy is defined as the user's judgment of their capability to perform certain learning tasks when learning in an e-learning environment [7]. In this study, e-learning self-efficacy refers to students' beliefs about their ability to study in online courses based on web-based instructions. Previous studies have indicated that computer self-efficacy has a positive effect on Perceived ease of use [7], [38]-[40], and on perceived usefulness as well [9], [22], [41], while this impact was challenged [42]. Hence, it is proposed that:

- H2.1: Learners' e-learning self-efficacy directly affects perceived ease of use.
- H2.2: Learners' e-learning self-efficacy directly affects perceived usefulness.

### 2.6 Technology acceptance model

The technology acceptance model-TAM [6] based on the theory of reasoned action by Fishbein and Ajzen [5] was proposed to predict users' willingness to accept new technology. The key variables in this model are the perceived usefulness (PU) and the perceived ease of use (PE) which influence user behavioral intentions on using technology. Perceived ease of use was defined as "the degree to which an individual believes that using a particular system would be free of physical and mental effort." [43, p.26], while perceived usefulness referred to the degree to which the user believes in new technology that can boost his/her job performance (ibid.). Davis [43] hypothesized that PE had a significant direct impact on PU. Prior research also indicated this direct relationship [9], [42]-[46]. Hence, it is hypothesized as follows:

- H3: Perceived ease of use (PE) directly affects perceived usefulness (PU).

In the present study, PE refers to the extent to which students find it easy to study in Coursera and/or FUNiX courses, and PU refers to the degree to which students perceive how effective their learning in E-learning (Coursera and or FUNiX platforms) is. The current study model incorporates learning styles (LS), perceived e-learning self-efficacy (LE), perceived ease of use (PE), and perceived usefulness (PU). Based on the aforementioned hypotheses, our research model is presented in Figure 1.

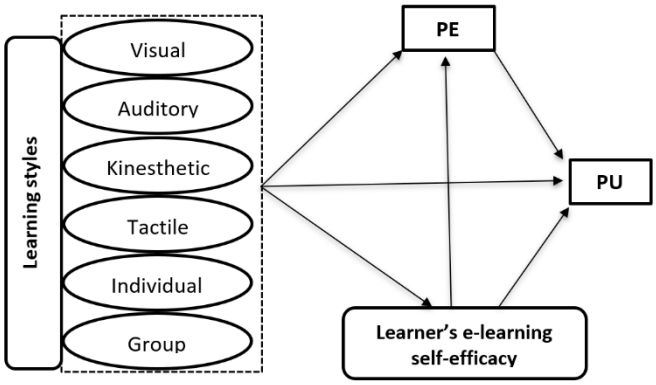


**Fig. 1.** The proposed research model based on TAM model by Davis (1989)

## 3 Method

### 3.1 Participants

The present study sought to obtain the confidence level and the margin of error of 95% and 5% respectively. The population of the present study was 2043 students, so the sample size was 343 participants [47]. Among 453 responses from the online Google Form questionnaire, collected from June 08 to June 23, 2021, 356 were qualified for data analysis after filtering data errors and/or duplicated ones. They are students

aging from 18 to 20 majoring in Business, IT, and English at a private university in Vietnam. They were selected as participants for the survey because they had taken at least one subject on Coursera/FUNiX as required by their majors, and so fit the study aim. Table 1 provides the demographics of the participants of the study.

**Table 1.** Participant demographics

| | | N | Percentage (%) |
|---|---|---|---|
| Gender | Male | 165 | 46.3 |
| | Female | 191 | 53.7 |
| Age | 18-20 | 103 | 28.9 |
| | > 20 | 253 | 71.1 |
| School year | 1st year | 34 | 9.6 |
| | 2nd year | 111 | 31.2 |
| | 3rd year | 114 | 32 |
| | 4th year | 97 | 27.2 |
| Majors | Business | 169 | 47.5 |
| | IT | 145 | 40.7 |
| | English | 42 | 11.8 |

### 3.2 Research instruments

The questionnaire survey employed in this study was adapted from prior studies. In particular, the LS scale was adapted from Reid [24], and e-learning self-efficacy was measured by Al-Azawei et al. [22]. In order to make sure that the respondents would comprehend the items correctly, we translated them into Vietnamese which was carefully double-checked for language equivalents by two colleagues who both had a Ph.D. and a Master's degrees overseas, and then conducted a piloting phase before delivering the questionnaire to the participants. Participants were required to rate each statement according to a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

### 3.3 Data collection and analysis

Prior to data collection, the questions were double-checked for language equivalents by two colleagues who had a Ph.D. and a Master's degrees overseas; the questionnaire was then administered to 30 students for the piloting phase before being delivered to the participants. Participants were required to rate each statement according to a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The questionnaire was sent to the participants via Google Forms. To ensure the consistency of every scale, the Statistical Package for the Social Sciences (IBM SPSS) Statistics version 25 was utilized for data analysis.

# 4 Results

## 4.1 The reliability of the research instrument

Cronbach Alpha was run to test the internal consistency of every scale. Table 2 shows that all values are between 0.79 to 0.93 and the correlation coefficient of each observed variable with the total variable is greater than 0.3, indicating the high reliability of each construct.

**Table 2.** The results of Cronbach's alpha test

| Variables | Code | Corrected Item-Total Correlation |
|---|---|---|
| ***Auditory-Aud, Cronbach's alpha coefficient= 0.83*** | | |
| When the teacher tells me the instructions, I understand better. | Aud1 | 0.54 |
| When someone tells me how to do something in class, I learn it better. | Aud2 | 0.67 |
| I remember things I have heard in class better than things I have read. | Aud3 | 0.61 |
| I learn better in class when the teacher gives a lecture. | Aud4 | 0.68 |
| I learn better in class when I listen to someone. | Aud5 | 0.63 |
| ***Group-Gro, Cronbach's alpha coefficient= 0.87*** | | |
| I get more work done when I work with others. | Gro1 | 0.67 |
| I learn more when I study with a group. | Gro2 | 0.74 |
| In class, I learn best when I work with others. | Gro3 | 0.70 |
| I enjoy working on an assignment with two or three classmates. | Gro4 | 0.71 |
| I prefer to study with others. | Gro5 | 0.68 |
| ***Individuals-Ind, Cronbach's alpha coefficient= 0.88*** | | |
| When I study alone, I remember things better. | Ind1 | 0.61 |
| When I work alone, I learn better. | Ind2 | 0.71 |
| In class, I work better when I work alone. | Ind3 | 0.79 |
| I prefer working on projects by myself. | Ind4 | 0.69 |
| I prefer to work by myself. | Ind5 | 0.78 |
| ***Kinesthetic-Kin, Cronbach's alpha coefficient= 0.84*** | | |
| I prefer to learn by doing something in class. | Kin1 | 0.62 |
| When I do things in class, I learn better. | Kin2 | 0.73 |
| I enjoy learning in class by doing experiments. | Kin3 | 0.70 |
| I understand things better in class when I participate in role-playing. | Kin4 | 0.50 |
| I learn best in class when I can participate in related activities. | Kin5 | 0.71 |
| ***Tactile-Tac, Cronbach's alpha coefficient= 0.85*** | | |
| I learn more when I can make a model of something. | Tac1 | 0.63 |
| I learn more when I make something for a class project. | Tac2 | 0.68 |
| I learn better when I make drawings as I study. | Tac3 | 0.62 |
| When I build something, I remember what I have learned better. | Tac4 | 0.66 |
| I enjoy making something for a class project. | Tac5 | 0.71 |
| ***Visual-Vis, Cronbach's alpha coefficient= 0.79*** | | |

| | | |
|---|---|---|
| I learn better by reading what the teacher writes on the chalkboard. | Vis1 | 0.44 |
| When I read instructions, I remember them better. | Vis2 | 0.58 |
| I understand better when I read instructions. | Vis3 | 0.67 |
| I learn better by reading than by listening to someone. | Vis4 | 0.61 |
| I learn more by reading textbooks than by listening to lectures. | Vis5 | 0.53 |
| ***Learner's e-learning self-efficacy-LE, Cronbach's alpha coefficient= 0.89*** | | |
| I can use e-learning (Coursera and/or FUNiX), if there is no one around to tell me what to do as I go. | LE1 | 0.81 |
| I can use e-learning (Coursera and/or FUNiX), even if I have never used a system like it before. | LE2 | 0.73 |
| I can use e-learning (Coursera and/or FUNiX), even if there are no assistant illustration tools with the system. | LE3 | 0.80 |
| ***Perceived ease of use-PE, Cronbach's alpha coefficient= 0.90*** | | |
| The interaction feature in e-learning (Coursera and/or FUNiX) is clear and understandable. | PE1 | 0.76 |
| Interacting with e-learning (Coursera and/or FUNiX) does not require a lot of mental effort. | PE2 | 0.74 |
| I would find it easy to get e-learning (Coursera and/or FUNiX) to do what I want it to do. | PE3 | 0.82 |
| I would find the e-learning (Coursera and/or FUNiX) easy to use. | PE4 | 0.80 |
| ***Perceived usefulness-PU, Cronbach's alpha coefficient= 0.93*** | | |
| Using e-learning (Coursera and/or FUNiX) improves my performance. | PU1 | 0.87 |
| Using e-learning (Coursera and/or FUNiX) increases my scientific performance. | PU2 | 0.84 |
| Using e-learning (Coursera and/or FUNiX) enhances my learning effectiveness. | PU3 | 0.87 |

### 4.2 Correlations between components of learning styles

Confirmatory factor analysis (CFA) was performed to analyze the reliabilities of 06 variables of LS, namely auditory (Aud), visual (Vis), group (Gro), tactile (Tac), kinaesthetic (Kin), and individuals (Ind). The result indicates that variables Aud and Vis were eliminated due to their standardized loading estimates falling below 0.5 (standardized loading estimates of auditory and visual =0.49 and 0.37<0.5, respectively), according to Hair et al. [48]. Therefore, the revised CFA analysis was as follows.

Table 3 shows that Chi-square/df = 2.7 < 3.0, TLI = 0.92, CFI = 0.93 were all larger than 0.90, and RMSEA = 0.070 < 0.08. This means that the proposed model was appropriate for further analysis of the surveyed data (Chin & Todd, 1995; Segar & Grover, 1993). Table 3 also indicates that three variables, namely group (Gro), tactile (Tac), Kinaesthetic (Kin) and individuals (Ind), have standardized loading estimates higher than 0.5 and statistically significant (P<0.01), responding to confidence level of 0.10, indicating their good convergent validity [49].

**Table 3.** Standardized loading estimates

| Relationship | | | Estimate | Significance | Relationship | | | Estimate | Significance |
|---|---|---|---|---|---|---|---|---|---|
| Gro1 | → | Gro | 0.75 | *** | Kin1 | → | Kin | 0.64 | *** |
| Gro2 | → | Gro | 0.81 | *** | Kin2 | → | Kin | 0.77 | *** |
| Gro3 | → | Gro | 0.76 | | Kin3 | → | Kin | 0.78 | |
| Gro4 | → | Gro | 0.74 | *** | Kin4 | → | Kin | 0.58 | *** |
| Gro5 | → | Gro | 0.75 | *** | Kin5 | → | Kin | 0.83 | *** |
| Ind1 | → | Ind | 0.71 | *** | Tac1 | → | Tac | 0.68 | *** |
| Ind2 | → | Ind | 0.78 | *** | Tac2 | → | Tac | 0.75 | *** |
| Ind3 | → | Ind | 0.87 | | Tac3 | → | Tac | 0.69 | |
| Ind4 | → | Ind | 0.68 | *** | Tac4 | → | Tac | 0.74 | *** |
| Ind5 | → | Ind | 0.79 | *** | Tac5 | → | Tac | 0.80 | *** |

Note. ***: $p < 0.01$

Table 4 indicates that the correlations between constructs in the CFA model had a good discriminant validity, except for the correlation between Kin and Tac due to their p-values (P=0.15) larger than 0.05 ([48], [51]).

**Table 4.** Correlations between subscales of LS

| Correlation | | | Estimate | SE | CR | P |
|---|---|---|---|---|---|---|
| Kin | <--> | Tac | 0.97 | 0.02 | 1.44 | 0.15 |
| Kin | <--> | Ind | 0.49 | 0.07 | 6.81 | 0.00 |
| Kin | <--> | Gro | 0.76 | 0.06 | 4.36 | 0.00 |
| Tac | <--> | Ind | 0.55 | 0.07 | 6.32 | 0.00 |
| Tac | <--> | Gro | 0.72 | 0.06 | 4.75 | 0.00 |
| Ind | <--> | Gro | 0.17 | 0.08 | 9.78 | 0.00 |

Table 5 indicates that all variables ensure the measurement reliability (Cronbach's alpha > 0.8) and convergent validity of the model. All standardized loading estimates in the CFA model are above the acceptable threshold of 0.5 and statistically significant ($p < 0.05$). In addition, CR and AVE of all constructs are above the minimum acceptable threshold 0.7 and 0.5 respectively ([48]; These, together, ensure the measurement reliability and convergent validity of the model.

**Table 5.** Convergent and discriminant validity testing

| Constructs | Cronbach's alpha | Composite Reliability (CR) | Average Variance Extracted (AVE) |
|---|---|---|---|
| Kinaesthetic | 0.84 | 0.85 | 0.53 |
| Tactile | 0.85 | 0.85 | 0.53 |
| Group | 0.87 | 0.87 | 0.58 |
| Individual | 0.88 | 0.88 | 0.59 |

In sum, Tables 3-5 indicate that the four variables of LS were ensured for reliability, convergent validity, and discriminant validity of the CFA measurement model. In addition, the results of the aforementioned CFA analysis have confirmed the appropriateness of the four components of LS in learning online in higher education, including: Kinaesthetic, tactile, group, and individual. Two components, namely auditory and visual, were omitted. Therefore, Hypotheses H1.1.1-3 and H1.2.1-3 were eliminated.

### 4.3 Structural model

The structural equation modeling (SEM) method was performed to estimate the correlations between the dependent variables, including Kin, Ta., Gro, Ind, and independent constructs, namely: learner's e-learning self-efficacy (LE), perceived ease of use (PE), and perceived usefulness (PU). The analysis results from SEM recorded: Chi-square/df = 2.6 < 3.0; TLI = 0.91, CFI = 0.92 are both greater 0.90; RMSEA = 0.066 < 0.08: shows the results of multiple fit indices of the structural model. The result from the initial SEM analysis indicated the correlations between these variables, as follows:

**Table 6.** The initial SEM analysis

| Relationship | | | Λ | P |
|---|---|---|---|---|
| Gro | → | LE | 0.64 | *** |
| Gro | → | PE | -0.10 | 0.26 |
| Gro | → | PU | 0.02 | 0.84 |
| Ind | → | LE | 0.43 | *** |
| Ind | → | PE | -0.13 | 0.07 |
| Ind | → | PU | -0.14 | 0.17 |
| Kin | → | LE | 0.51 | 0.32 |
| Kin | → | PE | -0.34 | 0.34 |
| Kin | → | PU | -0.74 | 0.12 |
| Tac | → | LE | -0.83 | 0.11 |
| Tac | → | PE | 0.55 | 0.14 |
| Tac | → | PU | 0.86 | 0.10 |
| LE | → | PE | 0.94 | *** |
| LE | → | PU | 1.18 | *** |
| PE | → | PU | -0.24 | 0.22 |

The structural equation modeling (SEM) method was re-performed to eliminate the non-significant correlations between the dependent and the independent constructs, as indicated in Figure 1. The result indicated that the structural model fits the data surveyed well (see Table 7 for further detail).

**Table 7.** The final SEM analysis

| Relationship | | | Λ | P |
|---|---|---|---|---|
| Gro | → | LE | 0.57*** | *** |
| Gro | → | PU | 0.20*** | 0.01 |
| Ind | → | LE | 0.35*** | *** |
| Kin | → | LE | -0.25** | 0.03 |
| Kin | → | PU | -0.58** | 0.05 |
| Tac | → | PE | 0.14*** | *** |
| Tac | → | PU | 0.54** | 0.05 |
| LE | → | PE | 0.81*** | *** |
| LE | → | PU | 0.65*** | *** |
| PE | → | PU | 0.18** | 0.03 |

***: P < 0.01; **: P < 0.05.

### 4.4 Hypotheses testing

From the results of Tables 6 and 7, we concluded that:

The path coefficient of kinaesthetic (Kin) to perceived ease of use (Kin→PE) is not significant at 0.05 level (λ=-0.47, P=0.34>0.05), hence H1.3.2 is rejected. Furthermore, Kin has direct negative effects on learners' e-learning self-efficacy (LE) (λ=-0.25, P=0.03<0.05) and perceived usefulness (PU) (λ=-0.58, P=0.05≤0.05), thus H1.3.1 and H1.3.3 are supported.

There is no statistically significant correlation, at the 95 percent confidence level, between Tac and LE (λ=-0.47, P=0.34>0.05), hence H1.4.1 is rejected. On the contrary, Tac has a direct positive effect on PE (λ=0.14, P<0.01), and perceived usefulness-PU (λ=0.54, P=0.05≤0.05), hence H1.4.2-3 are supported.

The paths coefficients of Individual to perceived ease of use (Ind→PE: λ=-0.13, P=0.07>0.05), and perceived usefulness (Ind→PU: λ=-0.14, P=0.17>0.05) are not significant at 0.05 level, so H1.5.2-3 are refuted. However, Ind has indirect positive effects on PE and PU via its influence on LE. On the other hand, it has a direct positive influence on learners' e-learning self-efficacy (LE) (λ=0.35, P=0.00<0.01), hence H1.5.1 is supported.

There is no statistically significant correlation between the subscale group of the construct learning styles and PE (λ=-0.10, P=0.26>0.05), hence H1.6.2 is refuted. In contrast, group has direct positive effects on learner's LE (λ=0.57, P=0.00<0.01) and PU (λ=0.20, P=0.01 ≤0.05), hence H1.6.1 and H1.6.3 are supported.

The results also indicate the direct positive impact of LE on PE (LE→PE: λ=0.81, P=0.00<0.01) and PU (LE→PU: λ=0.65, P=0.00<0.01), thus H2.1-2 are supported. In addition, PE has a direct positive effect on PU (PE→PU: λ=0.18, P=0.03<0.05), thus H3 is supported.

The results indicate that the model explained 82% of the variance in perceived usefulness when students study in an online environment (as indicated in Figure 2). The determining factors which have direct positive effects on perceived usefulness are ranked from the highest impact to the lower ones: learner's e-learning self-efficacy

(λ=0.65), tactile (λ=0.54), group (λ=0.20) and perceived ease of use (λ=0.18). On the other hand, kinaesthetic has a direct negative influence on students' perceived usefulness of learning online.

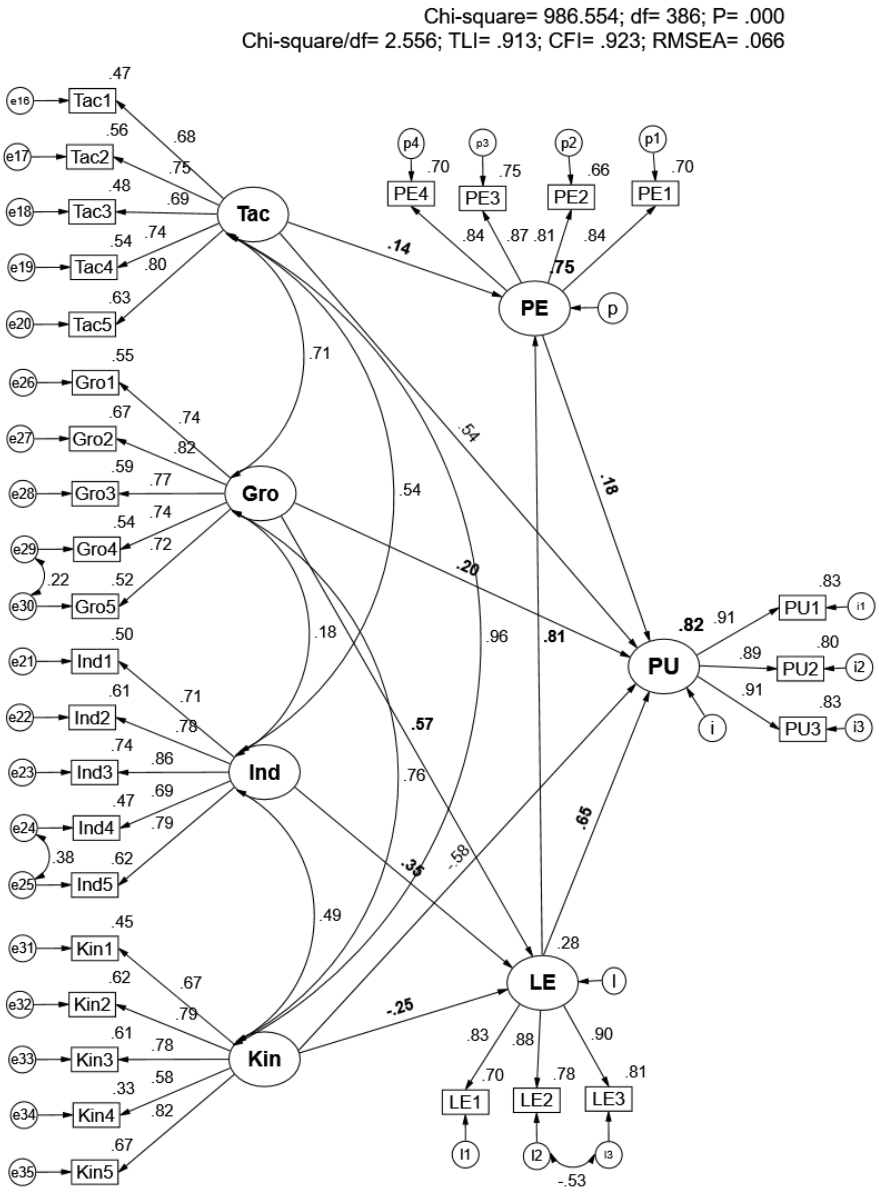


**Fig. 2.** The results of the analysis of the correlation between the variables

# 5 Discussion

In contrast to Lee et al. [23] finding, the results of the structural model of this study reveal that the two components, namely Auditory and Visual of Learning styles are excluded from the proposed research model, while the other four subscales of students' learning styles, including Kinaesthetic, tactile, group and individual are statistically significant in improving the model estimation fit. In this study, these factors have significant effects on learners' e-learning self-efficacy, perceived ease of use, and perceived usefulness. These findings significantly differ from previous results reported in a study by Al-Azawei et al. [22]. The discussion below highlights similarities and differentiates the differences from other studies.

## 5.1 Learning styles and learners' e-learning self-efficacy

The Kinaesthetic had a direct negative effect on learner's e-learning self-efficacy. This component is not really an element of the Index of Learning Styles which was applied in previous studies presented in the literature review. However, Reid [24] featured it as "learn by doing something", or "participate in role-play", which we believe that learners can still perform even in online platforms. Participants of this study did not enjoy this style of learning when they study online. This can be inferred that online learning is not apt for learning activities which require more physical interaction. This finding has pedagogical implication for teachers in choosing appropriate online learning activities.

Surprisingly, tactile (preferences for "hands-on tasks" or making things) was perceived positively to the surveyed participants. Other subscales of learning styles, namely individual and group have positive influences on learners' e-learning self-efficacy. Although the learning occurs in online platforms, students still prefer to learn by doing rather passive learning (through listening or audio style, for example). This can be understood that students are in favour of hands-on tasks or collaborative and cooperative work, accompanying with practical instructions in order to ensure their self-regulated learning. This result resonates with previous studies [21]-[24] where "active learning" or "learning by doing" is students' favourite learning style. However, this finding is not consistent with studies [25], [26]. In Baltaoğlu and Güven [29], most of their participants were future teachers of languages and of primary schools, while the participants of the study by Hendry et al. [30] were medical and dental students. These kinds of majors seek to have physical interaction to have genuine experiences which can be beneficial for their future jobs. This may explain the differences for their preferred learning styles and perceived self-efficacy.

Given students' online learning self-efficacy, they still value working in groups when studying on the online learning system. This result is inconsistent with the studies by Bakir et al. [50] where the students identified some major hindrances in terms of group communication quality and group members' participation quantity and quality [52]. This finding implies that technology-related issues in online learning should be a matter of concern, especially for learners who are quite new to this teaching and learning method.

### 5.2 Learning styles and perceived ease of use

Three components of LS, except Tac in this study, had no significant impact on PE. This finding aligns with a study by Al-Azawei and Lundqvist [33], whereas is not supported by studies [31] [32]. Although the participants of the present study confirmed their positive belief in their ability to study online, they did not find it easy to perform well on this teaching and learning mode.

This finding once again urges educators and online education-service providers heed the issue of online platform interface so that it will facilitate online learners during their learning process.

### 5.3 Learning styles and perceived usefulness

In contradiction with a finding by Lee et al. [23], the kinaesthetic has a direct negative effect on learners' e-learning self-efficacy. The difference may come from students' demographics. Most of the participants in Lee et al. study, aging from 17 to 36, are females (261 vs 140) while it is 191 vs 165, aging from 18-22 and majoring in IT, business, and English language, in this study. It can be inferred that factors such as age and disciplines probably influence their learning styles and the way they perceive the significance of technology-based on their learning.

Similar to conclusions by Ahmed et al. [34], Felder and Brent [35], and Shamsuddin and Kaur [36], the effects of students' learning styles on their Perceived Usefulness were confirmed in this study. In particular, three subscales of LS, namely Tac, Gro, and Kin, had both positive and negative direct effects on PU while Ind had an indirect influence on PU. This means that the participants acknowledged and refuted the important role online learning plays in their self-regulated learning process. Consequently, it is implied that when students envision the appropriateness of their learning styles for online learning tasks, they will acknowledge the benefits of this learning mode and vice versa. More importantly, this result might be a helpful indicator for teachers as well as academic management of educational institutions to consider learning style factors in designing online tasks or diverse learning activities to meet students' expectations. Also, for students with Kinaesthetic and Tactile learning styles who do not appreciate the online learning mode, instructors need to heed their need of "doing activities" rather than sensing or intuitive ones.

### 5.4 Learner's e-learning self-efficacy with perceived ease of use and perceived usefulness

The study results demonstrated a significant positive effect of learners' e-learning self-efficacy on their perceived ease of use and perceived usefulness, and a direct positive influence of perceived ease of use on perceived usefulness. These results tied well with previous studies [7], [9], [22], [38]-[40]. It can be inferred from these findings that the more learners believe that they are able to study well in online platform, the more

they acknowledge the importance and the feasibility of online learning. Therefore, developing learner self-efficacy which is characterized as a capacity [53] is essential in online learning.

## 6 Conclusions and limitations

The present study aims to evaluate student-related factors, namely their learning styles and perceived e-learning self-efficacy, on their perspectives on the usefulness of online learning based on TAM model by Davis [6]. The proposed research model was confirmed by SEM method. This study provides practical implications for universities, educators, and instructors in implementing online courses which should be in harmony with students' learning styles. Thus, it is essential that more emphasis should be placed on diversifying online learning tasks. In addition, communicating the benefits of online learning and promoting students' positive thinking about their self-efficacy during their online learning process would enhance their active learning in the online learning environment.

The current study acknowledges three limitations. First, since the study employed self-reported survey questionnaires, it suffered from the same limitations associated with overestimation and/or underestimation of respondents, which is raised by Cole and Gonyea [54]. Second, the data were collected from only a single private university in Mekong Delta, Vietnam; hence, the generability of the findings to other contexts should be cautious. Finally, this study utilized a single design, namely the quantitative method, which limited its deeper understanding of students' explanation for their perceived usefulness of online learning.

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