

## What Drives Workers to Learn Online during COVID-19 Pandemics?

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### Abstract

*One of the common practices during the COVID-19 pandemic is to work or study from home. This study aims to reexamine the factors affecting individual continuance intention of e-learning. During the pandemic, via a survey conducted in 2022, we assessed workers' continuance intention of e-learning from different sectors in Taiwan. This research brought motivations as mediators in continuance intention to e-learning. Through the statistical analysis, we identified the mediation effect of motivations based on the self-determination theory. The results show that autonomous motivation facilitates the learners' computer self-efficacy, the quality of the system and content toward continuance intention; controlled motivation could mediate the monetary award in influencing the continuance intention. The internalization of motivation is also an effective mediator. The obtained results not only add new knowledge of what affected the continuance intention of e-learning during the pandemic but also provide guidance for employers to allocate resources to boost e-learning after the pandemic.*

**Keywords:** COVID-19, e-learning, continuance intention, technology acceptance models, self-determination theory.

### 1. Introduction

Since late 2019, COVID-19 pandemic has been causing unprecedented death and economic impact around the world. According to the International Labor Organization (ILO) estimation, compared with 2019, 14.6% of total working hours decreased in Europe and 13.7% in the Americas in 2020. Also in Q2, 2021, there are 140 million jobs lost globally and a \$1.3 trillion loss in global worker income (Jackson & Congressional Research Service, 2021). The impacts on human beings are extensive and profound.

After COVID-19 hit, our living and working routines have been forced to change, mainly shifting more toward online channels to fulfill the needs of life and business. More than digital transformation, some

people even called this change the digital revolution (Anandan et al., 2022). In the workplace, people also have to engage in re-skilling through job retraining programs or educational activities (Parker et al., 2021). Before COVID-19, people preferred to learn or train in real classrooms, and the progress of acceptance of online learning and training was slow. Due to the COVID-19 pandemic, online learning and training became an alternative approach to resume knowledge activities in almost every organization, including schools, companies, and NGOs. Many enterprises and governments offered incentives to promote online learning for their employees through monetary reward, organizational support, and other assistance (Caligiuri et al.; Pan & Zhang, 2020).

In order to have a better understanding of what happened in learning activities when organizations were hit by the pandemic, we interviewed four organizations in Taiwan, including one government department, one hospital, one financial association, and one medical company from November 2020 to January 2021. We obtained some important perspectives from the executives who were conducting e-learning activities for the organizations. For example, the Workforce Development Agency (WDA) of the Ministry of Labor is one of the bureaus offering online training services to the general public with the contents relevant to business management and vocational skills. Starting from 2010, the mission for the WDA is to enhance workers' capabilities through its e-learning platform. In the middle of March in 2020, WDA launched the bailout policy to subsidize workers who are unemployed due to the pandemic. This policy encouraged workers to sign on to online courses. When we interviewed executives from companies whose employees benefited from this bailout policy, they considered the policy of subsidy from WDA as the main reason to motivate their employees' online learning activities. However, they were unsure about their employees' continuance intention of e-learning. They were concerned workers might return to their offline learning habits when the pandemic ends. They were eager to know what they could do in sustaining their employees' online learning practice during or even after the pandemic. This

motivated us to reexamine the factors affecting the continuance intention of online learning after people experienced online learning during the pandemic.

The outbreak of the pandemic indeed forced people to continue their knowledge activities via online platforms. The transition to online mode would become a “new normal” (Jamaludin et al., 2020). Previous research shows that a lot of factors have significant impact on user’s continuance to use e-learning systems, such as self-efficacy, social influence, system quality, etc. (Granić, 2022). Different from previous research, this research tries to understand what factors will make people change their behaviors during the pandemic. Additional to previous factors, such as the motivation to adopt e-learning systems from the government policy and organizational environment, what could serve as extrinsic or intrinsic motivations based on Self-Determination Theory (SDT). We are curious to know what factors of continuance intention of e-learning that the researchers explored will stay valid. If any changes of factors affect e-learning continuance, what would be the most influential and important factors? We summarized the research question as follows. “*What would keep workers’ intention to continue their e-learning practice after the COVID-19 pandemic?*”

## 2. Literature review

### 2.1 Continuance e-learning intention

The continuance intention to use information systems (ISCI) proposed by (Bhattacharjee, 2001), is determined by users’ satisfaction with the use of information systems and perceived usefulness of continued usage, based on the expectation-confirmation model (ECM). The research in ISCI has grown exponentially in the last two decades, and more than 152 papers are related to ISCI studies (Franque et al., 2020). Researchers identified ISCI by acceptance theories, such as innovation diffusion theory (IDT), motivational model (MM), technology acceptance model (TAM), and the unified theory of acceptance and use of technology (UTAUT and UTAUT2) to predict the intention to use (Franque et al., 2020; Granić, 2022). Most studies of continuous use target the continuous use of e-learning information systems (ELIS). Three groups of researchers addressed various aspects of ISCI. First group employs the adoption of information systems as an independent variable for explaining the intention of continuously using e-learning systems. Second group explains the evolution of continued use over time. The third group complement theoretical perspectives with original proposed information system continuance theory, like TAM, UTAUT, Flow Theory, etc. (Franque et al., 2020; Larsen et al., 2009; Granić, 2022). This

research work belonging to the third group of ELIS extends the original theory with new perspectives and applies ELIS to different social contexts, like e-learning 2.0, mobile learning, and game-based learning (Liu et al., 2020; Prieto, 2014; Wu & Zhang, 2014). During COVID-19 pandemics, researchers have been also eager to understand how ELIS would be affected under this circumstance (Mo et al., 2021; Panisoara et al., 2020; Wang et al., 2021) and have obtained additional insightful results. For example, In (Panisoara et al., 2020), they observed the significant occupational stress factor (e.g., burnout and technostress) and the motivation constructs (e.g., self-efficacy, intrinsic motivation, and extrinsic motivation) towards their continuous use intention under online-only instruction during COVID-19 pandemic. 70% of the variance in teachers’ intention to use is significantly mediated by occupational stress with motivational practices. Wang et al. (2021) extended the ECM with a task-technology fit model to assure the effectiveness of technical support under emergency management situations. Mo et al. (2021), identified family support, instructor’s attitude, and task–technology–fit had a significant influence on continuous use intention. Moreover, these researches identified some important issues for future research. For example, to investigate the context of emergency management (Mo et al., 2021), compare across different target groups (Panisoara et al., 2020), and dig out more core factors of ELIS (Wang et al., 2021) in the post-pandemic era.

### 2.2 Antecedents influence continuance intention in the post-pandemic era

In previous studies, almost 60 relationships of constructs have been identified to testify to the ISCI model (Franque et al., 2020). Most of them are evaluated with satisfaction, perceived enjoyment, and perceived joyfulness based on TAM (Franque et al., 2020; Granić, 2022). To identify the constructs that fit the context in the post-pandemic era, in our research, we attend to adopt constructs that are related to our research questions.

**2.2.1 Self-efficacy.** A lot of ISCI researchers used TAM and its follow-up models, such as UTAUT, to model the continuance intention of using information systems. Self-efficacy based on Social Cognitive Theory (SCT) (Bandura, 1986) is one important construct in the TAM and UTAUT model. Self-efficacy is an individual’s belief that they can perform a particular task or behavior (Roca et al., 2006). Self-efficacy can be regarded as a predictor of motivation (Igbaria et al., 1996) and an antecedent as competence in SDT (Sweet et al., 2012). Self-efficacy can be differentiated into computer self-

efficacy (CSE), internet self-efficacy (ISE) (Roca et al., 2006; Salloum et al., 2019) and general self-efficacy (GSE) (Bandura, 1986; Chen et al., 2001). In our research, we merge CSE and ISE as one factor, called CSE, because nowadays using the internet and computers are almost inseparable, including e-learning. Hence, CSE can be defined as “the confidence exhibited by a learner regarding their own ability to use e-learning systems.” Thus, we propose that GSE and CSE have positive effects on e-learning continuance intention as hypotheses H1 and H2, respectively.

**2.2.2 Quality.** Service Quality is the essential construct in ECM to determine the user’s satisfaction (Bhattacharjee, 2001). It can be extended as perceived quality including information quality, service quality, and system quality (Roca et al, 2006), and system characteristics, such as content quality, information quality, and system quality (Salloum et al., 2019). To focus on functionality of e-learning services, our model only uses two constructs, system quality (SQ) and content quality (CQ). SQ determines the system characteristics like usability, reliability, availability, and adaptability when workers use e-learning systems, and CQ denotes the depth and frequent updates of the content (Salloum et al., 2019). Thus, we propose that SQ and CQ have positive effects on e-learning continuance intention as hypotheses H3 and H4, respectively.

**2.2.3 Social support.** Social support is another influential motivator affecting workers’ continuous use intention. Especially, in the VUCA era, under the highly competitive markets, social support should be considered as an important but neglected factor that will reinforce workers in using e-learning. Based on social support theory, research revealed that social support in the workplace has a positive effect on ELIS (Weng et al., 2015). Research in (Mo et al., 2021) identified family support and instructor attitude, which extend the continuance intention model from social support during the pandemic. Our research model concludes with two constructs, peer support (PS) which is defined as the support from worker’s colleagues or peers by providing feedback that could be perceived as caring, understanding, or affirmative (Weng et al., 2015), and also organizational support (OS) which refers to workers’ perception about the extent to which their managers or organization values their contributions and cares about them (Chuo et al., 2011). Thus, we propose that PS and OS have positive effects on e-learning continuance intention as hypotheses H5 and H6, respectively.

**2.2.4 External influence from policy and crisis.** In SDT, external regulation is defined by the experience or perception that one is doing the behavior because of an

external contingency (Ryan & Deci, 2018). During the pandemic, organizations tried to motivate their employees to use e-learning by providing monetary subsidies and acknowledged them the urgency to accept e-learning as the main tool that replaces the traditional way of training, for example, the WDA had done at that time. Monetary subsidy policy from organizations or governments will be an important factor toward post-pandemic e-learning continuance intention. Although in SDT, monetary reward (MR) refrains intrinsic motivation, the use of MR in proper timing may trigger the internalization of motivation. Another factor we try to identify in the research is the perceived competitive intensity, which conceptualizes the workers’ acknowledgment of the urgency to adopt e-learning under critical conditions, such as the COVID-19 pandemic, geopolitical crisis, broken supply chain, or even Gray Rhino events (Undheim, 2022). Since previous research in continuance intention seldom discussed this issue, we adopted the construct from perceived industry competitive intensity (IC) from marketing, which denotes that people will increase their attention to learning while they perceive their environment is getting competitive (O’Cass & Weerawardena, 2010). The IC has a positive and significant effect on learning capability in the workplace. In this study, we extend the construct IC to identify that people will pay more attention to continuing to use e-learning in the post-pandemic era. Thus, we propose that MR and IC have positive effects on e-learning continuance intention as hypotheses H7 and H8, respectively.

## 2.3 Motivation toward using e-learning system

In previous studies, most of the research confirmed that perceived ease of use can mediate the relationship between confirmation, satisfaction, confirmation, and perceived usefulness with ELIS (Franque et al., 2020), based on the constructs from ECM. However, other factors, such as subjective norms, culture variables, and motivation, should be considered additional to those factors in previous research works in continuance intention (Franque et al., 2020). In our research, we try to extend the perspective to bring motivation into consideration. Because motivation is suitable not only in training (Motivation to learn) (Huang & Jao, 2015) but also in learning (Chang et al., 2012). Several researchers also echoed this point of view. They introduced Self-Determination Theory (SDT) (Ryan & Deci, 2000) to facilitate learners’ extrinsic motivation (*e.g.*, perceived usefulness, social pressure) and intrinsic motivation (*e.g.*, perceived joyfulness) to examine the effects of SDT constructs, and the results show that such extension of ELIS with constructs can represent workers’ three

basic psychological needs. Intrinsic motivation is a good way to predict their e-learning continuance intention (Igbaria et al., 1996; Sørebo et al., 2009). These basic psychological needs, including autonomy, relatedness, and competence, motivate users to learn online. Learners are more likely to be encouraged to perform specific behaviors by intrinsic-oriented motivation (e.g., autonomous motivation (AMO) and perceived playfulness) than by extrinsic-oriented motivation (e.g., controlled motivation (CMO) and perceived usefulness) (Chang et al., 2012; Liu et al., 2020). Figure 1 illustrates the model of continuance intention of using e-learning systems. In this study, we adopted SDT to check the mediation effect of controlled vs. autonomous motivations (CMO vs. AMO) from antecedents to continuance intention. We would like to differentiate their mediation effects from AMO and CMO, and hypothesize H9 and H10, respectively; that is, AMO and CMO positively mediate e-learning continuance intention from antecedents, respectively.

## 2.4 Internalization of motivation.

To understand how people will transfer their intention from external regulation to intrinsic motivation and make a persistent change, another important perspective in SDT is internalization. It means when people experience behaviors that satisfy their three basic needs by a regulation, the more perceived locus of causality (PLOC) they will sense. People will be more autonomous or self-determined as they experience more internalized regulations. In SDT, the acquisition of extrinsic regulation and values through internalization to transform people's personality to be more mature and active is an important step to develop the growth of individuals (Ryan & Deci, 2018, P180). Social contexts can also increase the effect of internalization of extrinsic motivation by supporting the satisfaction of the individual's basic psychological needs (Ryan & Deci, 2018, P215), which are OS, PS, MR, and IC from our previous hypothesis. According to the internalization of motivation, we assume that controlled motivation will have a high tendency toward autonomous motivation. Moreover, AMO mediates between CMO and CI. Thus, we hypothesize H11 as AMO mediates CMO toward continuance intention of e-learning. Figure 1 shows a causal and effect diagram of the model.

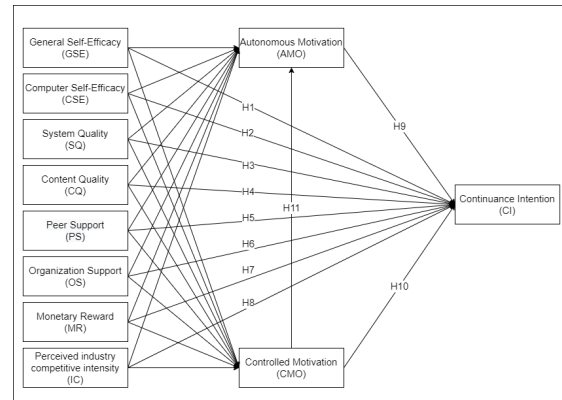


Figure 1. The research model of continuous use of e-learning systems

## 3. Method

We conducted an online survey using an online questionnaire platform, *Surveycake*. The questionnaire is composed of 35 items, used to measure 11 constructs of the model. Table 1 provides the number of items with corresponding constructs. The survey was conducted starting from January 13th, 2022, and ending on February, 28th, 2022. At that time, citizens in Taiwan just experienced level three alert for the pandemic (5/15/2021 ~ 07/26/2021) and then set back to level two alert (07/27/2021 ~ 02/28/2022) (Wikipedia, 2022). The survey was conducted right after workers in Taiwan had experienced the emergent responses to the pandemic in their living and working contexts. Our target population is users of e-learning systems, including synchronous and asynchronous e-learning systems. We adopted a convenient sampling approach. We posted our survey link in one famous e-learning Facebook group in Taiwan and some line groups related to e-learning. We used a snowball method to gather data by asking our friends and colleagues working in government units or industries to forward the questionnaire to their friends.

## 4. Analysis

Our survey totally obtained 388 respondents. We deleted 10 responses from the data that are 0 in the variance test. We removed 1 response that is blank in both organization type ("Your organization category") and civil servant type ("Yes/No, if you are an officer or not.") fields. We also checked several responses that the civil servant type is blank and filled in the value as "unwilling to disclose", and we have 11 responses in this situation. In the end, we obtained 376 responses which were used for the follow-up analysis. 36% of respondents work in government vs. 64% of them in

corporations. Due to the target population of this research being laborers, we limited the age of the respondents to be above eighteen years old. From the result of our survey, among 376 effective responses, 295 respondents (78.5%) agree or highly agree that they will use e-learning continuously; 245 respondents (65%) express that they will regularly use e-learning systems and strongly recommend others to use e-learning. 230 respondents (61%) are female and 146 respondents are male. Regarding the educational level, 94% of respondents earned bachelor degrees or above.

For further analysis, we used the Partial Least Squares Structural Equation Modeling (PLS-SEM) and bootstrapped PLS-SEM (in 10,000 resamples) as our main analysis methods. We preferred to use PLS-SEM to estimate highly complex mediation models since this model consists of 11 constructs (Sarstedt et al., 2020). We used SmartPLS Version 3.3.7 (Ringle et al., 2015) and SEMinR 2.3.0 (Danks & Ray, 2021) in RStudio 2022.02.2+485 to test this model. First, we ran the reliability and validity diagnostics, collinearity test and model fit test with RStudio and SEMinR. We used these two PLS-SEM tools to test models, the outcomes are close to each other. In this research, we took the results from SmartPLS as the main result for further discussion.

**Table 1. Constructs and number of items**

Construct	# of items	Source
Computer Self-efficacy (CSE)	2	Salloum et al., 2019
General Self-efficacy (GSE)	4	Chen et al., 2001
Organizational support (OS)	2	Weng et al., 2015
Peer support (PS)	3	Weng et al., 2015
Monetary Reward (MR)	3	Gagné et al., 2014
System Quality (SQ)	2	Salloum et al., 2019
Content Quality (CQ)	3	Salloum et al., 2019
Perceived industry competitive intensity (IC)	1	proposed by this study
Autonomous Motivation (AMO)	6	Moran et al., 2012
Controlled Motivation (CMO)	5	Moran et al., 2012
Continued Intention (CI)	4	Bhattacharjee, 2001

#### 4.1 Reliability and convergent validity

After removing two question items from the exploratory factor analysis (EFA). The internal consistency of the survey is good. All factors' Cronbach alpha exceeds 0.7, indicating the reliability of the data is good. Composite reliability (CR) and average variance extracted (AVE) exceed 0.7 and 0.5, respectively, indicating this research has an appropriate convergent validity (Table 2).

**Table 2. Reliability and interconstruct correlations**

	CA	CR	AVE	CSE	GSE	OS	PS	MR	IC	SQ	CQ	CMO	AMO	CI
CSE	0.879	0.942	0.892	0.944										
GSE	0.837	0.952	0.67	0.546	0.819									
OS	0.792	0.89	0.827	0.315	0.394	0.909								
PS	0.85	0.962	0.767	0.295	0.384	0.691	0.876							
MR	0.727	0.882	0.644	0.127	0.278	0.222	0.344	0.802						
IC	1	0.645	1	0.201	0.217	0.247	0.301	0.196	1					
SQ	0.852	0.926	0.871	0.375	0.491	0.333	0.391	0.321	0.186	0.933				
CQ	0.782	0.927	0.697	0.349	0.375	0.369	0.37	0.314	0.196	0.644	0.835			
CMO	0.771	0.985	0.523	0.202	0.282	0.584	0.527	0.368	0.329	0.343	0.401	0.723		
AMO	0.915	0.955	0.702	0.471	0.521	0.43	0.458	0.338	0.305	0.597	0.533	0.504	0.838	
CI	0.894	0.959	0.759	0.523	0.491	0.403	0.439	0.325	0.252	0.555	0.558	0.497	0.769	0.871

Notes. CR: composite reliability; CA: Cronbach's Alpha; AVE: Average Variance Extracted; Shaded items are the square root of AVE

#### 4.2 Discriminant validity

To examine the discriminant validity of the model, we adopted the Heterotrait-Monotrait (HTMT) method (Hair et al., 2019; Henseler et al., 2014) and calculated it in R. All the values are below 0.85, which is the threshold for HTMT Ratio, except PS→OS is 0.86 close to 0.85 (In Henseler's paper, HTMT should be significantly smaller than 1) (Henseler et al., 2016). The value of IC is NA because it only has one item. The results show that the discriminant validity problem is low in this research as shown in Table 3.

**Table 3. Heterotrait-monotrait (HTMT) ratio**

	CSE	GSE	OS	PS	MR	IC	SQ	CQ	CMO	AMO
CSE										
GSE	0.676									
OS	0.368	0.469								
PS	0.28	0.422	0.86							
MR	0.128	0.251	0.261	0.406						
IC	NaN	NaN	NaN	NaN	NaN	NaN				
SQ	0.401	0.532	0.438	0.437	0.352	NaN				
CQ	0.347	0.377	0.489	0.436	0.442	NaN	0.729			
CMO	0.115	0.204	0.545	0.522	0.488	NaN	0.457	0.533		
AMO	0.525	0.569	0.498	0.444	0.35	NaN	0.659	0.575	0.608	
CI	0.588	0.551	0.47	0.445	0.373	NaN	0.611	0.638	0.626	0.835

#### 4.3 Collinearity test: VIF

The Variance Inflation Factor (VIF) for constructs, a way to test collinearity, are all below 5, indicating that

the model has no critical level of collinearity problem as shown in Table 4.

**Table 4. Collinearity test results**

CONSTRUCT	ITEM	VIF	CONSTRUCT	ITEM	VIF
CSE	CSE1	2.597	CMO	MEX1	1.41
	CSE2	2.597		MEX2	1.474
GSE	GSE1	1.741		MIJ1	1.98
	GSE2	1.938		MIJ2	3.032
	GSE3	1.97		MIJ3	2.953
	GSE4	1.666		MID1	2.383
IC	IC2	1	MID2	3.029	
MR	MR1	1.348	MID3	2.676	
	MR2	1.623	MIR1	3.81	
	MR3	1.453	MIR2	3.413	
OS	OS1	1.754	MIR3	3.198	
	OS2	1.754	CI1	3.139	
PS	PS1	1.554	CI2	2.36	
	PS2	3.239	CQ	CQ1	1.682
	PS3	3.262		CQ2	2.016
SQ	SQ1	2.231		CQ3	1.501
	SQ2	2.231			

#### 4.4 Model fit and specification testing

We adopted bootstrapped PLS-SEM in SmartPLS to test the model fit and the result is good: standardized root mean square residual (SRMR) = 0.052, and 0.037 under 95% bootstrap quantile (<0.08), normed-fit index (NFI) = 0.870 (~=0.9), and root mean square error correlation (RMS<sub>theta</sub>) = 0.163 (in general, well-fitting should below 0.12, but the thresholds for RMS<sub>theta</sub> are yet to be determined, within the range is also acceptable) (Henseler et al., 2016; Ringle et al., 2015) and R-Square and R-Square Adjusted values for AMO are 0.549 and 0.538, respectively; for CMO are 0.449 and 0.437, respectively; for CI are 0.662 and 0.653, respectively. They are considered moderate according to Hair's suggestion (Hair et al., 2019). According to the model testing results shown in Table 5, CSE (0.261\*\*\*), SQ (0.174\*\*), CQ (0.234\*\*\*), and MR (0.047\*) have a direct effect on continuance intention; that is, H2, H3, H4, and H7 are supported. Other constructs like GSE, PS, OS, and IC have no direct effect; that is, H1, H5, H6, and H8 are not supported.

**Table 5. Results of Testing Hypotheses H1~H8**

Hypothesis	Path	Coefficients	SD	T-Values	P-Values	Support
H1	GSE → CI	0.086	0.056	1.538	0.124	No
H2	CSE → CI	0.261	0.046	5.662	0***	Yes
H3	SQ → CI	0.174	0.054	3.242	0.001**	Yes
H4	CQ → CI	0.234	0.054	4.32	0***	Yes
H5	PS → CI	0.105	0.058	1.814	0.07	No
H6	OS → CI	0.04	0.055	0.723	0.47	No
H7	MR → CI	0.091	0.046	1.985	0.047*	Yes
H8	IC → CI	0.042	0.044	0.964	0.335	No

Note: \* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001

We also identified mediation effects of AMO, CMO, and CMO→AMO to CI (Baron & Kenny, 1986), which are explained as follows, and shown in Table 6. First, we examined the direct effect of AMO and CMO on CI (0.507\*\*\* and 0.259\*\*\*) which means H9 and H10 are supported. Second, we examined the mediating effect of AMO. AMO has a full mediation effect on SQ to CI, and it has the partial mediation effect on CSE and CQ to CI, respectively. Third, we examined the mediating effect of CMO, which shows that CMO only has the full mediation effect on MR to CI. Fourth, we observed the path from CMO→AMO, and found that CMO→AMO has the full mediation effect on MR to CI, and the indirect effects of these two paths (from CMO to CI and from CMO→AMO to CI) are nearly equal (0.024\* vs. 0.020\*), which denotes that the internalization of CMO toward AMO has a significant mediation effect on MR to CI, and H11 is supported.

## 5. Discussions

### 5.1 Major findings and implications

This research confirms the direct relationships between the antecedents, such as self-efficacy in computer (*i.e.*, CSE), quality in system (*i.e.*, SQ), quality in content (*i.e.*, CQ), monetary reward (*i.e.*, MR) and e-learning continuance intention (*i.e.*, CI), specified by literature (Bandura, 1986; Salloum et al., 2019). The result implies that people with high CSE have a high tendency to continue using e-learning systems. Meanwhile, providing high-quality e-learning systems and content will attract learners' intention to keep the continuance of e-learning. Additionally, monetary rewards positively affect users on continuing e-learning.

A major contribution of this study is the exploration and confirmation of the mediation effect from motivations, *e.g.*, AMO and CMO. First, this study identifies the full mediation effect of autonomous motivation on system quality. High-quality e-learning systems could enable people with their autonomous motivation to retain their continuance intention of e-learning. This result justifies the resources spent on enhancing the quality of the e-learning system, especially for workers with autonomous motivations.

Second, the results also confirm the partial mediation of AMO for CSE and CQ to CI, respectively. These results of the AMO mediation effect indicate that a learner's computer self-efficacy or the quality of e-learning contents has a significant effect on uprising their autonomous motivations to retain their continuance intention of e-learning, and learners with autonomous motivations would trigger their continuance of e-

learning given they have computer self-efficacy, or the content quality is good. The managerial implication from these results is that the employer can boost their employees' autonomous motivation in order to pay off its resources by investing in the enhancement of e-learning content quality and the promotion of employees' computer self-efficacy.

Third, we identified that monetary reward (MR) has a full mediation effect on CI not only mediated by CMO but also by CMO→AMO. It implies that MR cannot

influence CI directly, but it could initially influence CMO, afterward it will inspire AMO through the internalization process, and then impact CI. It denotes that the managerial incentives, monetary reward could effectively maintain employees' continuance intention of e-learning depending on their controlled motivation (CMO) or the internalization of motivation from controlled to autonomous (CMO→AMO). Proper facilitation of monetary rewards will not only evoke

**Table 6. Mediation effect from predictors to CI**

Predictors	Total Effect (c')	To AMO (a <sub>1</sub> )	AMO to CI (b <sub>1</sub> )	Direct Effect (c)	Indirect Effect (a <sub>1</sub> *b <sub>1</sub> )	c' sig?	c sig?	(a <sub>1</sub> *b <sub>1</sub> ) sig?	Type
GSE	0.086	0.149*	0.507***	0.022	0.075 <sup>†</sup>	No	No	Yes	None
CSE	0.261***	0.165**		0.189***	0.084**	Yes	Yes	Yes	Partial
SQ	0.174**	0.263***		0.033	0.133**	Yes	No	Yes	Full
CQ	0.234***	0.114 <sup>†</sup>		0.139**	0.058 <sup>†</sup>	Yes	Yes	Yes	Partial
PS	0.105	0.062		0.044	0.031	No	No	No	None
OS	0.04	-0.015		-0.056	-0.007	No	No	No	None
MR	0.091 <sup>†</sup>	0.045		0.025	0.023	Yes	No	No	None
IC	0.042	0.069		-0.032	0.035	No	No	No	None
Predictors	Total Effect (c')	To CMO (a <sub>2</sub> )	CMO to CI (b <sub>2</sub> )	Direct Effect (c)	Indirect Effect (a <sub>2</sub> *b <sub>2</sub> )	c' sig?	c sig?	(a <sub>2</sub> *b <sub>2</sub> ) sig?	Type
GSE	0.086	-0.045	0.259***	0.022	-0.006	No	No	No	None
CSE	0.261***	-0.048		0.189***	-0.007	Yes	Yes	No	None
SQ	0.174**	0.028		0.033	0.004	Yes	No	No	None
CQ	0.234***	0.144 <sup>†</sup>		0.139**	0.02	Yes	Yes	No	None
PS	0.105	0.113		0.044	0.016	No	No	No	None
OS	0.04	0.403***		-0.056	0.057	No	No	No	None
MR	0.091 <sup>†</sup>	0.168**		0.025	0.024 <sup>†</sup>	Yes	No	Yes	Full
IC	0.042	0.151**		-0.032	0.021 <sup>†</sup>	No	No	Yes	None
Predictors	Total Effect (c')	To CMO→AMO (a <sub>3</sub> )	CMO→AMO to CI (b <sub>3</sub> )	Direct Effect (c)	Indirect Effect (a <sub>3</sub> *b <sub>3</sub> )	c' sig?	c sig?	(a <sub>3</sub> *b <sub>3</sub> ) sig?	Type
GSE	0.086	-0.011	0.118***	0.022	-0.005	No	No	No	None
CSE	0.261***	-0.011		0.189***	-0.006	Yes	Yes	No	None
SQ	0.174**	0.006		0.033	0.003	Yes	No	No	None
CQ	0.234***	0.033		0.139**	0.017	Yes	Yes	No	None
PS	0.105	0.026		0.044	0.013	No	No	No	None
OS	0.04	0.093**		-0.056	0.047**	No	Yes	Yes	None
MR	0.091 <sup>†</sup>	0.039 <sup>†</sup>		0.025	0.020 <sup>†</sup>	Yes	No	Yes	Full
IC	0.042	0.035 <sup>†</sup>		-0.032	0.018 <sup>†</sup>	No	Yes	Yes	None

Note: \* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001, sig = significant, Type = Mediation type (Full/Partial/None)

employees' continuance intention but also internalize their motivation from controlled to autonomous.

A surprising finding is that peer support (PS), organization support (OS), and perceived industry competitive intensity (IC) are neither significantly related to AMO nor CMO as a direct effect on CI. In previous research (Chuo et al., 2011; Weng et al., 2015), social support played an important role in users' continuous use of e-learning systems. However, in our study, PS and OS are not significant factors toward

continuance intention. This anomaly could be explained as follows: our survey was applied during the time period that Taiwan just ended its level three and level two alert statuses (from May 2021 to February 2022) (Wikipedia, 2022). During that time, people kept social distance or even worked from home, which reduced the physical interactions and in turn decreased the perception of peer support and organization support in general. This study may be one of the few research works (maybe the first) that consider the effect of

sharing information regarding industrial competitive intensity on the intention of continuously using e-learning systems. Although it has no significant relation to AMO and CMO, it can be explained because people worked from home, and they were losing the perceived industry competitive intensity as well.

## 5.2 Contributions

The results of this research contribute to academia and industry elaborated as follows. For academia, this study confirms that computer self-efficacy, the quality of system and content, as well as monetary reward significantly affect continuance intention of e-learning, specified by existing literature. This study introduces motivation as a mediator and validated the mediation effect. The mediation effect from autonomous motivation on continuance intention justified the resource spent by employers on improving computer self-efficacy, system quality, and content quality for those employees with high autonomous motivation. Meanwhile, the monetary reward also has a full mediation effect from controlled motivation on continuance intention. The internalization of motivation from controlled to autonomous is also significant from the results. These results add new knowledge to understanding the transformation of monetary resources to enhance the continuance intention of using e-learning systems, especially after the pandemic.

For organizations, it is important to leverage managerial practice to internalize employees' motivation from controlled to autonomous, so that they could drive their motives with their self-efficacy and take benefit from the enhancement of the quality of the e-learning system and content. A proper monetary subsidy may be a good idea. Because the mediation of controlled motivation is also effective to facilitate monetary reward to maintain the continuance intention. These results justify the resources spent by employers to enable their employees' intention to continuously use e-learning systems no matter if they are motivated internally or externally.

## 5.2 Future work

For the next step, it is worthy to identify people as employees in two different types of organizations, *e.g.*, government and corporation, to investigate any different patterns in their intention of continuous use of e-learning systems. For employees in industries, it is justifiable since they need to enhance their abilities in order to sustain their competitiveness in their industries. However, for employees in government, mainly in public service and with different social and economic states they may be involved, and their perception of the

changes in industry and society may have different effects on their continuance intention of e-learning. By using some group analysis methods like PLS-MGA testing (Henseler, 2012), we can look into these two groups and see how it differentiates the learners from these two types of organizations, from which organizations could allocate different resources to focus on different managerial operations. It will also be meaningful to expand our research target population across countries.

## 6. Conclusion

In this paper, we have identified different factors as antecedents, such as computer self-efficacy, the quality of system and content, and monetary reward affecting workers' motivation toward continuously using e-learning systems. First, computer self-efficacy, e-learning system and content quality, monetary reward have direct effects on continuance intention, which justifies the resources spent by employers on enhancing their employees' technical abilities, e-learning quality and subsidies. Second, learners' different motivations mediate different antecedents on the continuance intention of e-learning. Autonomous motivation mediates computer self-efficacy and the quality of system and content, while controlled motivation mediates monetary reward in affecting learners' intention to continue using e-learning systems; moreover, the internalization of controlled motivation toward autonomous motivation could be one benefit of monetary reward to sustain e-learning continuance. Third, peer support, and organization support, and perceived industry competitive intensity do not significantly affect continuance intention either directly or indirectly via mediators, which demonstrates the isolation of social networks during the pandemic, and its implications could be further validated after the pandemic. Finally, from the results, Taiwan's Workforce Development Agency may validate the win-win outcome of its monetary reward policy that motivates Taiwan's workers to learn online. By this policy, the autonomous motivation of people will be inspired, and once it is elicited, it will have a positive influence on their continuance of e-learning if they keep leveraging their system quality, content quality and labor training on computer skills. It becomes a positive reinforcement to attract workers to learn online.

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