



# A structural equation model predicting adults' online learning self-efficacy

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## Abstract

We aimed to model the direct effects of the theorized relationships of academic self-efficacy, computer use self-efficacy, learning management system self-efficacy, internet and information-seeking self-efficacy, and online learning self-efficacy using structural equation modeling. The study proves that academic self-efficacy has positive predictive relationships with computer use self-efficacy, learning management system self-efficacy and internet and information self-efficacy. Secondly, modeling revealed that computer use self-efficacy, learning management system self-efficacy and internet and information self-efficacy positively predicts online learning self-efficacy. This study provides empirical evidence on a previously theorized set of relationships and informs policy makers on significant relationships they can employ to inform program development aimed at improving online learning self-efficacy anchored on their particular use cases.

**Keywords** Philippines · E-Learning · Online Learning · Behavioral Modelling · Structural Equation Model

As the world halts to a standstill due to the COVID-19 global pandemic (Elflein, 2020), every nation worldwide is forced to adapt to a "new normal" in various life sectors, especially education. As of March, over a billion learners (over 90% of the worldwide learner population) cannot attend school due to the measures to stop the pandemic (McCarthy, 2020). This underlines a core educational dilemma—how do we educate

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the world's current learner population effectively while battling COVID-19? The most recent answer in many countries seems to be the same—online learning.

According to the World Economic Forum, COVID-19 recently catalyzed the rise of e-learning, as various educational institutions of all levels scramble to undertake all instruction activities in different online digital platforms amidst the outbreak. Despite the rapid shift and the myriad of challenges it brings, educators are seemingly taking this situation and using the COVID-19 as an inflection point—a shift from traditional educational environments to purely online or blended environments (Li & Lalani, 2020).

Going fully online, of course, comes with unique challenges most educational systems worldwide are not familiar with. Much can be studied from these myriads of challenges before us today. Despite the uncertainty, it seems most educators and educational systems are embracing the shift (Dignan, 2020) and taking all challenges to the change in system and environment head-on. However, to maximize the adaption, we believe it is also noteworthy to look at the opposite side of the coin—the learners. Are the learners ready or do they *think* they are ready for online learning? Or perhaps more interestingly, do the more than 28 million Filipino learners (UNESCO, 2020) *think* they are ready for online learning?

We believe it is interesting to explore what beliefs Filipinos have developed regarding their capability to learn online effectively. Whether they believe their abilities to acquire knowledge is sufficient, given the new learning milieu, and if that belief will affect their learning outcomes. This is traditionally referred to as self-efficacy (Bandura, 1994) and has been established as a predictor of actual performance in traditional learning environments and situations. Given the current online learning shift, it is interesting to predict this phenomenon in that context.

Online learning self-efficacy describes an individual's perceptions of their abilities to complete specific tasks required in online learning (Zimmerman and Kulikowich, 2016). The concept of self-efficacy is task- or domain-specific. It does not focus on an individual's actual ability to perform but rather what an individual *perceives* that they can do (Bandura, 2010). Experts on online education have suggested that individuals with low self-efficacy or those who do not believe that they have the needed skills to succeed in an online learning program are less likely to complete said program. Others may just opt not to enroll at all (Moore and Kearsley 2005, as cited in Zimmerman & Kulikowich, 2016). A review of the literature noted that self-efficacy for online education is associated with the following task- or domain-specific self-efficacy constructs: academic, computer, internet and information seeking, and learning management system.

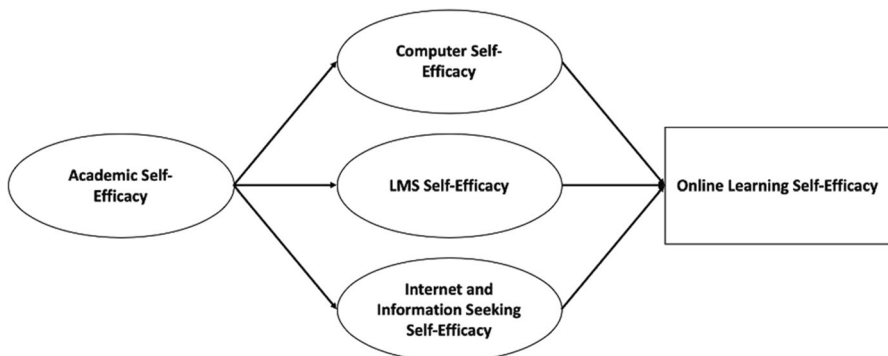
We aim to (1) explore factors predictive of adult Filipino learners' online learning self-efficacy; (2) explore if academic self-efficacy's effect on online learning self-efficacy is mediated by a) Computer Self-Efficacy, b) LMS Self-Efficacy, c) Internet and Information Seeking Self-Efficacy; 3) formulate a statistically significant model using structural equation modeling. The results could offer educational policymakers and curriculum leaders, and program manager insights into online learning self-efficacy antecedents, ultimately leading to greater academic success of adults (in this case, anyone 18 years old and above, based on UN definitions; UN General Assembly, 1989).

## 1 Review of Literature

As the COVID-19 pandemic force global learning institution closures since the start of its global spread (UNESCO, 2020), several studies have endeavored to fill the dearth in literature that emerged due to the sudden shift to online learning. In particular, several studies have stated the technological barriers related to learning that have arisen due to the pandemic, ranging from problems in the availability, as well as use and competence in, of technological tools (Internet, computer hardware, learning management systems, etc.) applied in online learning, bringing forth pedagogical implications that suggest the vital role of technology use in learning today (Aguilera-Hermida et al., 2021; Amri and Alasmari, 2021; Baticulon et al., 2021; Dianito et al., 2021; Dizon et al., 2021; Ignacio, 2021; Imsa-ard, 2020; Wenceslao and Felisa, 2021).

Since learners are currently forced to employ these technologies in learning, a significant gap in literature regarding their belief of their abilities to do so presents itself. A prior literature review (Alqurashi, 2016) posits a possible relationship between related self-efficacies in this regard—academic self-efficacy to computer use self-efficacy, internet and information seeking self-efficacy, and learning management self-efficacy, and these three to online learning self-efficacy—and recommends further investigation on the nature of these relationships. To answer this, the study uses these theoretical posits as a conceptual frame work (see Figure 1).

*Self-Efficacy* is defined as individuals' beliefs about their abilities to produce desired behavior/s (Bandura, 1994). This core belief is the foundation of human motivation, performance accomplishments, and emotional well-being (Bandura, 2010). Individuals with low self-efficacy tend to back away from very daunting tasks. These individuals often see these tasks as threats. They also set lower targets and have a weak commitment to their set goals. They habitually focus on their self-doubts, the consequences of the failure, their deficiencies, and give up rather than contemplating ways to do better. Individuals that report high self-efficacy levels often do the complete opposite (Bandura, 2010). Since the introduction of



**Fig.1** A conceptual model to depicting factors that predict online learning self-efficacy of adult Filipino Learners

self-efficacy in the 1960s, it has been applied to study factors of success in health interventions (Cameron et al., 2018; Hyde et al., 2008; King et al., 2010; Larson & Daniels, 1998;), engineering education (Carberry et al., 2010; Chyung et al., 2010; Hutchison et al., 2006) nursing education (Henderson et al., 2018; Kim & Suh, 2018; Leigh, 2008), computer-based instruction (Moos & Azevedo, 2009; Yeşilyurt et al., 2016), online learning (Alqurashi, 2016; Hayashi et al., 2020; Zhu, 2019)

Tsai et al. (2011) suggested that to yield greater validity and predictive ability, self-efficacy assessments should be done at a domain- or task-specific level (i.e., learning a specific skill or subject). Studies have identified factors associated with self-efficacy for online learning 1) computer self-efficacy: online communication and interactions, 2) internet and information-seeking self-efficacy: Online knowledge, 3) learning management System (LMS) self-efficacy: social influence, online learning experience, and knowledge and feedback and reward, 4) Academic Self-Efficacy: learner motivation and attitude (Alqurashi, 2016; Peechapol et al., 2018; Zhu, 2019).

*Academic Self-Efficacy* (GASE) is the students' perceptions of their classroom success (Bandura, 1997). ASE also involves self-regulated learning, which helps students use their resources to plan, control, and analyze the execution of tasks, activities, and the preparation of learning products (Nielsen et al., 2018; Schunk & Pajares, 2009). There have been multiple and exhaustive studies done regarding ASE (Tsai et al., 2011). Earlier literature noted that students' ASE has positive effects on their academic performance, motivation, and perceptions of the effectiveness of internet or online learning systems (Chyung et al., 2010; Lim et al., 2016; Reychev et al., 2016; Song et al., 2011, Tsai et al., 2011).

*Online Learning Self-Efficacy* (OLSE) can be defined by specifying Bandura's (1994, 2010) definition first in the context of education and then in an online, technological environment. In education, the context will be desired behaviors that dictate the learners' "choices of activities, effort invested, persistence, interests, and achievements" (Schunk & Pajares, 2009), and "use of self-regulatory processes" (Zimmerman, 2000). Additionally, we can marry this with McDonald and Siegal's (1992) description of technological self-efficacy, defined as an individual's belief in their capability to perform complex technological tasks. This results in the defining Online Learning Self-Efficacy as a learner's belief to produce desired behaviors that work towards a desired educational outcome within and using an online, technological environment. (Hayashi et al., 2020; Lim, 2001; Peechapol, et al., 2018; Prior, et al., 2016; Zhu, 2019).

*Computer Use Self-Efficacy* (CUSE) is one's confidence in the use of computers, as well other peripheral or tangent technological tools, limited not only in minute skills in using the tool (e.g., opening a program or printing a file) but also the extensive, self-initiated use of these skills for more complex tasks (Alqurashi, 2016). Higher computer self-efficacy, consistent with Bandura's (1994, 2010) definition, is an antecedent to learning engagement and performance (Chen, 2017). An increase in CUSE correlates to a decrease in computer anxiety (Cazan et al., 2016; Mohamed & Karim, 2012; Simsek, 2011), therefore positively impacting academic success (Cassidy & Eachus, 2002; Hashempour & Mehrad, 2014; Schlebusch, 2018). CUSE also significantly affects learners' intention to use digital technology in their learning (Ferdousi, 2019).

Computers are a useful set of tools to augment traditional learning experiences and scaffold knowledge gaps towards the facilitation of autonomous learning (Liebermann & Linn, 1991; Schacter & Fagnano, 1999).

Alqurashi (2016) also identified *Internet and Information-Seeking Self-Efficacy* (IISE) as another task-specific construct associated with online learning. IISE was studied separately and extensively by Clark (2017), wherein both agreed that IISE is related to overall learning outcomes. Clark (2017) further elaborated that successful information-seeking activities were more reliant on IISE than other factors (e.g., procedural knowledge, system features).

Learning Management System (LMS) Self-Efficacy (LMSSE), defined as self-assessment regarding one's skills using an LMS, maybe a critical factor in e-learner satisfaction (Lee and Hwang, 2007; Martin et al., 2010). LMSSE was also identified as another task-specific self-efficacy construct by Alqurashi (2016), albeit noting that it has no positive effect on online learners per se, but only for hybrid learners. However, researchers have studied its importance as an outcome predictor for learners. It is posited to be more critical to the outcome than actual online engagement (Broadbent, 2016; Martin et al., 2010) and is positively correlated to it (Prior et al., 2016), which leads to lesser LMS-related roadblocks. This contributes to the belief that a learner can complete the course within an LMS, consistent with Bandura's (2010) definitions.

## 1.1 Research Objectives

Through structural equation modeling, we aim to achieve the following:

1. Examine factors predictive of adult Filipino learners' online learning self-efficacy.
2. Examine if academic self-efficacy affects a) Computer Self-Efficacy, b) LMS Self-Efficacy, c) Internet and Information Seeking Self-Efficacy.
3. Examine if a) Computer Self-Efficacy, b) LMS Self-Efficacy, c) Internet and Information Seeking Self-Efficacy affect online learning self-efficacy.
4. Formulate a statistically significant model using structural equation modeling.

## 2 Methods

### 2.1 Design

We used a non-experimental, cross-sectional, analytic survey research design to test the conceptualized model and relationships of Computer-, LMS-, General Academic-, Internet and Information Seeking Self-Efficacies and Online Learning Self-Efficacy.

### 2.2 Sample and Setting

We did a power analysis utilizing the computer-based statistical software G\*Power v3.1 (Faul, et al., 2009). The computation revealed that for a model using four predictors, power=0.95, alpha=0.05, and a small to medium effect size=0.085, the

required sample size was two hundred twenty-four (224) participants. We used a non-randomized convenience sampling methodology. We recruited participants by forwarding an invitation to participate in a research survey using snowball sampling. The study's inclusion criteria limited participation to adult Filipino learners aged 18 years old and older (based on UN definitions; UN General Assembly, 1989), who understand English, and with residential addresses in the Philippines.

### 2.3 Instrument

**Demographic Profile** The instrument's initial section gathered information regarding the participants' age, educational background, socioeconomic level, prior experience with online education, LMS use, and massive online open courses.

*General Academic Self-Efficacy (GASE)* was measured using a Rasch-tested four-item inventory (Nielsen et al., 2017). We asked the participants to rate themselves with a 5-point Likert scale: (1) strongly disagree, (2) disagree, (3) neither agree nor disagree, (4) agree, and (5) strongly agree. When assessed against Rasch measurement models, the GASE short form's reliability was *satisfactory* for a broad group of students considering that the scale only consists of four items (Nielsen et al., 2018).

*Computer Use Self-Efficacy (CUSE)* was assessed using a thirty-item inventory designed in 2002 that exhibited more than satisfactory levels of internal reliability ( $\alpha = .97$ ) (Cassidy & Eachus). The CUSE uses a 6-point Likert scale ranging (1) *Strongly disagree* to (6) *Strongly agree*. There are several items (item # 3, 4, 5, 7, 10, 13, 14, 15, 17, 19, 21, 22, 23, 25, 26, 28, and 30) that are negatively stated, which scores will be reversed before analysis, the corrected scores are to be totaled. A higher total score indicates more positive computer use self-efficacy beliefs (Cassidy & Eachus, 2002).

**Learning Management System Self-Efficacy (LMSSE)** A 24-item survey with four subscales: 1) Accessing information, 2) Posting information, 3) File management, and 4) Advanced features. We asked participants to rate the items on the survey on a four-point Likert scale ranging from (1) *Not Confident* to (4) *Very Confident*. The reliability of this survey instrument was .92 (Martin et al., 2010). A higher LMSSE score indicates a higher level of perceived self-efficacy for learning management systems.

**Information Seeking and Manipulation Self-Efficacy Scale (IISE)** An eight-item inventory with two subscales: 1) Information seeking and 2) Information Manipulation will be adopted. We asked the participants to rate items on the survey using a five-point Likert scale ranging from (1) *strongly disagree* to (5) *strongly agree* (Tang & Tseng, 2013).

**Online Learning Self-Efficacy Scale (OLSES)** The OLSES (Zimmerman & Kulikowich, 2016) consists of 22-item grouped into 3 subscales: learning in the online environment (10 items;  $\alpha = .89$ ), time management (5 items;  $\alpha = .86$ ) and technology use (7 items;  $\alpha = .84$ ). There was no significant difference between

groups of students with diverse backgrounds with and without online learning experience during the scale development, making it a valuable scale for both groups. We asked the participants to rate their self-efficacy for online learning using a 6-point Likert scale ranging from (1) meaning they would *perform the task poorly* to (6) meaning they could *perform the task at an expert level* (Zimmerman & Kulikowich, 2016).

Table 1 lists the computed reliability coefficients for the tested self-efficacy scales from this study.

As the instruments we used were developed from separate studies, the Likert scale per variable differs. To avoid possible confusion, we separated each scale into a dedicated section on the form. In relation to this, we are aware of possible Likert scale biases such as social desirability responding (Kuncel and Tellegen, 2009, as stated in Kreitchmann et al., 2019) or acquiescent responding (Weijters et al., 2013, as stated in Kreitchmann et al., 2019). However, we argue that the current shift to online learning has yet to instill a significant impression on what is socially desirable given the current situation, thus these biases can be ignored.

## 2.4 Data Procedure

We used the free, web-based software, "Google Forms." Google Forms is a tool included in the free offerings of Google drive's services, which allows us to remotely collect information from internet users via publication and direct e-mailing of the study's personalized survey. We then downloaded the connected Google Spreadsheet into an MS Excel file. We checked for missing data for exclusion before subjecting the data set to statistical analysis. Data collection was done from May 2020 – July 2020.

## 2.5 Data Analysis

We used Microsoft's Excel program to process the statistics to describe the sample using means and percentage computations. We used structural equation modeling (SEM) to test the conceptual model to evaluate the effect of academic self-efficacy on computer self-efficacy, internet & information-seeking self-efficacy, and LMS self-efficacy. Secondly, we used SEM to measure the impact of computer self-efficacy, internet & information-seeking self-efficacy, and LMS self-efficacy on Online Learning Self-Efficacy. We used ScriptWarp Systems' WarpPLS v7.0 to carry out the structural equation modeling. We used the Partial Least Square – Structural Equation Modeling (PLS-SEM) due to its strength in exploratory or prediction modeling (Hair, et al., 2012). We set the P-value at < 0.05 for determining the significance of findings.

**Table 1** Computed reliability coefficients for the self-efficacy scales (n=343)

	GASE	CUSE	LMSSE	IISE	OLSES
Composite Reliability	0.925	0.949	0.969	0.933	0.981
Cronbach's Alpha	0.891	0.943	0.967	0.918	0.980

## 2.6 Ethical Considerations

We endeavored to protect and respect the participants' rights to full disclosure, self-determination, confidentiality, non-maleficence, and privacy. We provided each participant a cover letter explaining (1) the nature of the study; (2) the responsibilities of the participants and the researcher; (3) the benefits and risks of the study; (4) the participant's right to withdraw from the study at any given time and to be free from the discrimination or prejudice. We entertained questions the participants had and secured a voluntarily signed informed consent before administration of the questionnaire. We sought ethical clearance and secured approval from the Holy Angel University – Institutional Review Board. Electronic data was saved in a password-protected server and stored for 3 years, then deleted from the server.

## 3 Results

### 3.1 Participants' Profile

The sociodemographic profile of the 343 individuals who participated in our study is shown in Table 2. It shows that the average age of the sampled adult learners was 27.22 (SD=9.91), the majority are female (59.48%), full-time students (48.69%), or employed for wages (44.90%), and had a monthly household income under 40,000 Philippine Pesos (51.60%). The majority of the sample of adult learners reported having studied via online or blended learning in formal educational institutions.

Table 3 lists the average total scores of the sampled adult learners in the five self-efficacy scales. Relatively high average total scores were observed in the general academic self-efficacy scale and information and internet self-efficacy scale. The average total score of the adult learners' computer use self-efficacy, learning management self-efficacy, and online learning self-efficacy is moderately high.

Table 4 lists the significant parameter estimates of the direct effects of general academic self-efficacy on computer use self-efficacy, learning management self-efficacy, and information and internet self-efficacy. Table 5, on the other hand, lists the direct effects of computer use self-efficacy, learning management self-efficacy, and information and internet self-efficacy on online learning self-efficacy.

After testing two measurement models, the final model predicting online learning self-efficacy revealed that general academic self-efficacy has a statistically significant positive effect on computer use self-efficacy ( $\beta=0.44$ ), learning management self-efficacy ( $\beta=0.30$ ), and information and internet self-efficacy ( $\beta=0.41$ ). Subsequently, these three self-efficacies have statistically significant effects on online learning self-efficacy. Firstly, computer use self-efficacy was observed to have a statistically significant positive predictive impact on online learning self-efficacy ( $\beta=0.18$ ). Secondly, learning management system self-efficacy was also observed to have a statistically significant positive predictive effect on online learning self-efficacy ( $\beta=0.46$ ). Lastly, information and internet self-efficacy were also observed to have a statistically significant positive predict on online learning self-efficacy ( $\beta=0.31$ ).



**Table 2** Participants' Sociodemographic Profile

Variable	n=343	%
Age ( $\bar{x}\pm SD$ )	27.22 $\pm$ 9.91	-
<b>Sex</b>		
Female	204	59.48
Male	139	40.52
<b>Occupation</b>		
Full-time student	167	48.69
Employed for wages	154	44.90
Self Employed	9	2.62
Out of work and looking for work	9	2.62
Out of work but not currently looking for work	2	0.58
Retired	1	0.29
A homemaker	1	0.29
<b>Monthly Household Income*</b>		
Under 40,000	177	51.60
40,000-59,999	66	19.24
60,000-99,999	58	16.91
100,000-249,999	28	8.16
250,000 and over	14	4.08
<b>Ever studied via online or blended learning provided by a formal school or university</b>		
Yes	230	67.06
No	113	32.94

Note: \*1 US Dollar = 48.35 Philippine Pesos (Bangko Sentral ng Pilipinas, 2020)

**Table 3** Average total scores for each of the Self-Efficacy Scales

Self-Efficacy Scales	Average total score $\pm$ SD
General Academic Self-Efficacy (GASE)	15.76 $\pm$ 3.31
Computer Use Self-Efficacy (CUSE)	127.45 $\pm$ 24.66
Learning Management System Self-Efficacy (LMS)	67.65 $\pm$ 16.75
Information and Internet Self-Efficacy (IISE)	31.17 $\pm$ 6.07
Online Learning Self-Efficacy (OLSE)	91.99 $\pm$ 25.47

Note: GASE (Highest Possible Score [HPS]: 20); CUSE (HPS: 180); LMSSE (HPS: 96); IISE (HPS: 40); OLSE (HPS: 132)

**Table 4** Parameter estimates of the effects of GASE on CUSE, LMSSE, and IISE for the sample of Filipino Adult Learners (n=343)

	$\beta$	SE	P-value	$f^2$
GASE $\rightarrow$ CUSE	0.44	0.05	<.01	0.19
GASE $\rightarrow$ LMSSE	0.30	0.05	<.01	0.09
GASE $\rightarrow$ IISE	0.41	0.05	<.01	0.17

Note:  $\beta$ =Path Coefficient, SE=Standard Error, Cohen's  $f^2$ =effect size

**Table 5** Parameter estimates of the effects of CUSE, LMSSE, and IISE on OLSE for the sample of Filipino Adult Learners (n=343)

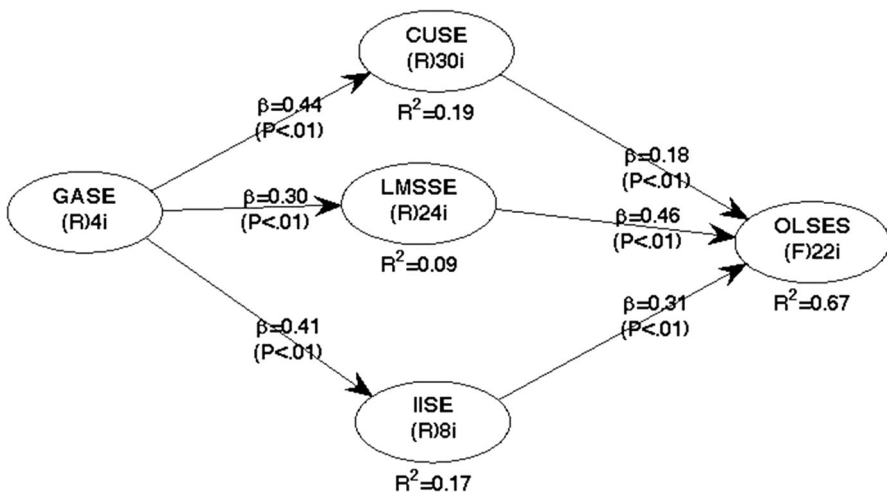
	$\beta$	SE	P-value	$f^2$
CUSE -> OLSE	0.18	0.05	<.01	0.11
LMSSE -> OLSE	0.46	0.05	<.01	0.35
IISE -> OLSE	0.31	0.05	<.01	0.21

Note:  $\beta$ =Path Coefficient, SE=Standard Error, Cohen's  $f^2$ =effect size

Modeling revealed that GASE has positive predictive relationship ( $\beta= 0.44$ ;  $p<0.01$ ) with CUSE, a positive predictive relationship ( $\beta= 0.30$ ;  $p<0.01$ ) with LMSSE, and a positive predictive relationship ( $\beta= 0.41$ ;  $p<0.01$ ) with IISE. Moreover, modeling revealed that CUSE ( $\beta= 0.18$ ), LMSSE ( $\beta= 0.46$ ), IISE ( $\beta= 0.31$ ) were positive predictive of OLSES ( $p<0.01$ ).

Figure 2 illustrates the relationships and path coefficients of the final modeling predicting Online Learning Self Efficacy.

Final measurement model's fit was satisfactory (Average path coefficient [APC] = 0.350,  $p<0.001$ ; Average R-squared [ARS]= 0.281,  $p<0.001$ ; Average adjusted R-squared [AARS]= 0.278,  $p,0.001$ ; Average block VIF [AVIF]= 1.832, Average full collinearity VIF [AFVIF]= 2.257, Tenenhaus Goodness of Fit [GoF]=0.414. The model accounts for 67% of the variance in Online learning self-efficacy.



**Fig. 2** The final model predicting Online Learning Self-Efficacy

## 4 Discussion

We wanted to explore the factors predictive of adult Filipino learners' online learning self-efficacy. Our literature review led us to examine the possible relationships of academic self-efficacy's effect on a) Computer Self-Efficacy, b) LMS Self-Efficacy, c) Internet and Information Seeking Self-Efficacy, and the latter three's effect on online learning self-efficacy. We arrived at a statistically significant model predicting Filipino Adult Learners' online learning self-efficacy through structural equation modeling.

Results show that Academic Self-Efficacy positively predicts Computer Self-Efficacy, LMS Self-Efficacy, and Internet & Information-Seeking Self-Efficacy, consistent with a systematic review indicating the positive influence self-efficacy towards attaining "attributes towards outcomes desired from Internet-based learning" (Tsai et al., 2011). This provides much-needed groundwork direction to the initial studies of CSE, IISE, and LMSSE. A possible explanation for this is that individuals may view computers in an online environment, searching for information over the web and LMS interface use as technological facades to a particular learning goal or set of learning goals. Therefore, higher GASE translates to higher self-efficacy in these factors. If an individual believes to be self-effective in a learning goal, the facades themselves may not be so steep a learning curve anymore or may be viewed as part and parcel to the learning goal.

The first variable positively predicting OLSE is CSE. It is easy to accept this positive correlation if we recall CSE as an antecedent to learning performance (Chen, 2017; Prior et al., 2016) and a factor of learning success (Cassidy & Eachus, 2002; Hashempour & Mehrad, 2014; Schlebusch, 2018), as well as learners' intention to use technology for learning (Ferdousi, 2019; Mohamed & Karim, 2012; Prior et al., 2016), and interpret this increase in intention to being an indicator of the self-belief in the capability to perform technological tasks (McDonald and Siegall, 1992). We can speculate that adult online learners view computers in the same light they view pencils, pens, notebooks, and other traditional equipment as necessary for learning.

LMSSE also positively predicts OLSE. In fact, it is the strongest predictor out of the three. One can say that most learners currently, across the different demographics, are well-versed with using computers and similar hardware, and it is always second nature for almost anyone to "google" about anything and everything (Philippine Department of Information and Communication Technology and Philippine Statistics Authority Research and Training Institute, 2020). However, not all learners have encountered an LMS, nor is a skill in a particular LMS universally translatable to another. This is coupled with the fact that most up-to-date learning systems are hosted in LMSes. This unfamiliarity may be the reason why LMSSE is a more significant predictor than CSE or IISE.

Lastly, IISE also positively predicts OLSE and is the second strongest predictor. This builds on the earlier work laid out for IISE (Alquarashi, 2016; Clark, 2017; Prior et al., 2016), from being intimately linked with learning outcomes vis-à-vis numerous varying factors and only contributing to OLSE confirming the positive predictive relationship. This could be due to the ubiquity of

online material used by course instructors and online learners to enrich learning activities. Adult learners who efficiently seek out factual and relevant information on the internet are assumed to reap the most benefit from online learning experiences.

The model enriches all previous studies and provides quantitative on the positive predictive relationship of GASE to CSE, LMSSE, and IISE. These observed relationships support the literature that academic self-efficacy captures its influence on tasks related to online learning (Nielsen et al., 2018; Peechapol, et al., 2018; Prior et al., 2016). These relationships could be due to the perception that using computers, LMS, and the internet for information seeking are necessary tasks to achieve an acceptable level of learning in the online educational milieu. Similarly, CSE, LMSSE, and IISE positively predict OLSE in adult Filipino online learners. These relationships provide strong evidence of relationships drawn out in Alqurashi (2016). The inseparability of using computers, LMS, and information seeking via the internet in online learning activities may influence this predictive relationship. Online learners may collectively view computers, LMS, and information seeking via the internet as a means to an end – learning. Overall, the model narrows the literature gap by providing empirical evidence on relationships that were previously only theorized (Alqurashi, 2016), and provides theoretical groundwork for improvement of OLSE by improving CUSE, IISE, and/or LMSSE. Conversely, the model provides guidance to educators in identifying possible mediation avenues in their respective use cases, should they find that learners have sub-optimal online learning self-efficacy. As Bandura (2010) states, high self-efficacy yields greater goal commitment to the task at hand (in this case, learning online), so the model therefore is useful for interventions on several online learning impediments that are technology-related (Aguilera-Hermida et al., 2021; Amri and Alasmari, 2021; Baticulon et al., 2021; Dianito et al., 2021; Dizon et al., 2021; Ignacio, 2021; Imsa-ard, 2020; Wencseslao and Felisa, 2021).

To temper, we must take the results of the study into consideration of its limitations. The cross-sectional and non-experimental design of this study limits its ability to examine possible cause-effect relationships. As such, future studies need to use a prospective, serial, or longitudinal timeframes using experimental designs. Despite the sufficiently powered sample size, with participants responding from across the Philippines, sampling was done conveniently, diminishing the study's generalizability. Although, the fact that the study was primarily conducted through online mechanisms may have minimized this bias while also disenfranchising others. Future researchers can look into correlating the model and actual academic performance. Additional evidence needs to investigate the effects of structural and ecologic factors on academic-, computer use, information seeking-, LMS-, and online learning self-efficacies.

Given the affirmed correlations, we recommend that educational policymakers, curriculum leaders, and program managers use the model to improve OLSE by improving the antecedent self-efficacies through teaching learners on computer use, information seeking through the internet, and a detailed walkthrough of the LMS used before exposing them to online learning. A focus on the aforesaid walkthrough is recommended in line with LMSSE being the biggest contributor to OLSE in this model. The

fact that learners' current demographic are less likely to be familiar with an LMS, less so to the specific LMS an institution uses.

## 5 Conclusion

The study concretizes what was previously just theoretically posited—the relationship of GASE to CUSE, IISE, and LMSSE, and the relationship of CUSE, IISE, and LMSSE to OLSE. We believe this improves the current body of literature by opening the avenues for interventions on the improvement of OLSE among learners by positively affecting CUSE, IISE, and LMSSE. We ultimately aimed to contribute to the Philippines educational sector's understanding of what influences online learning self-efficacy. In order of the largest to smallest effect size, we found out that higher academic self-efficacy positively predicts computer use-, information seeking- and LMS self-efficacies. We also found out that LMS self-efficacy was the strongest predictor of online learning self-efficacy, followed by information seeking- and computer use self-efficacy. In this study, we have proven that the variables were statistically significant predictors of online learning self-efficacy. We hope that this model guides academic administrators, curricular leaders, educators, and policymakers towards enhancing online learning self-efficacy. The model presents a relatively large effect size while being statistically significant in predicting OLSES, which offers proof of the capability of PLS-SEM in testing relationships of often complex conceptual models.

In this light, we believe this model can be used in a national or international level in analyzing OLSE, as a springboard to online learning improvement, especially at the current time, where the COVID-19 pandemic has significantly opened the conversation on the widespread adaptation globally of online learning. Educational leaders can improve online learning self-efficacy by enhancing computer use-, learning management systems-, and internet and information-seeking self-efficacies. The inextricable nature of these three other domain-specific self-efficacies can drastically influence how adult learners perceive their ability to learn online successfully. The enhancement of adult learners' online learning self-efficacy can broaden the practice and research opportunities for online and distance education strategies and technologies.

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## Declarations

**Conflicts of interest** No conflicts of interest to disclose.

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