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The effect of media literacy on effective learning outcomes in online learning

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Abstract
Nowadays, online learning is already ubiquitous in the education of most countries and is one of the fastest-growing trends in the use of educational technology. However, despite literature on the effectiveness of online learning, little is known about the influence of student media literacy on effective learning outcomes in online learning. The present study tried to fill this research gap by exploring the effect of the four-factor construct of media literacy on effective learning outcomes that were measured by focusing on how students perceived their overall learning outcomes in online learning. Data were collected in a sample of 421 undergraduate students from 32 universities in Vietnam. The results of the structural equation modeling indicated that except for functional prosumption, the remaining three factors of media literacy (functional consumption, critical consumption, and critical prosumption) had significant positive effects on perceived learning outcomes. Critical prosumption was found to be the most powerful significant influence on student learning outcomes in the online learning environment. The findings provide some significant practical implications for stakeholders in setting up strategic plans for increasing the effectiveness of online classes.

Keywords Media literacy · Effective learning outcomes · Online learning · Perceived learning

1 Introduction

The settings for teaching and learning environments are changing at an ever-increasing pace along with the dizzying change in technology. Nowadays, online learning is already ubiquitous in the education of most countries and is one of the fastest-growing trends in the use of educational technology (Bates, 2015; Wei & Chou, 2020).

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Online learning makes learning more flexible (Baber, 2020; Castro & Tumibay, 2021) and it is also a viable alternative to traditional classes that are sometimes unable to be present due to force majeure, such as the Covid-19 pandemic (Xhelili et al., 2021). There are many advantages of online learning, especially in a time of modern technology development like today (Baber, 2020). Some advantages of online learning have been discussed in the literature, such as improving access to education programs, improving educational effectiveness, and reducing costs in education and training (Dumford & Miller, 2018; Panigrahi et al., 2018; Perna et al., 2014). The studies that have compared the effectiveness of online learning with face-to-face learning have been done in a not-so-small number of places. Their results confirmed that online learning delivered results that were not inferior to, or even better than, traditional methods (Bernard et al., 2014; Lockman & Schirmer, 2020). On the contrary, however, some concerns about the reduction of online learner engagement and issues related to the progress of content delivery of online classes have also been mentioned in previous studies (Alshamrani, 2019; Truell, 2012).

Obviously, although online learning is trending and increasingly popular in the age of innovative technology, there was evidence that it was associated with much higher rates of effective erosion than traditional learning (Zacharis, 2011). A number of studies have shown that it is not excluded that there may be certain types of students who can not successfully study in an online environment (Baber, 2020; Boyd, 2004; Zacharis, 2011). The success or failure of online learning which is often considered in terms of student learning outcomes (Alqurashi, 2019; Joksimović et al., 2015; Lim & Richardson, 2021; Yang et al., 2016) or student satisfaction (Jiang et al., 2021; Joo et al., 2011; Kuo et al., 2014; Rodriguez, 2015; Roh, 2015) in many studies has been confirmed to be influenced by several factors. Various factors that have been found to have a diverse impact on the effectiveness of online learning have been reported in many previous studies (Dumford & Miller, 2018; Eom & Ashill, 2016; Kang & Tami, 2013), and student media literacy could be one of them. Overall, there is evidence that students who can do better and be more successful in an online learning environment tend to be richer in media skills (Alqurashi, 2019; Oh & Lim, 2005). However, dispersion and heterogeneity in the construct of media literacy and its impact on the effectiveness of online classes have still been commonly found in existing studies.

Nowadays, educational institutions have been offering more opportunities to take online programs (Alqurashi, 2019) because the number of students participating in online learning yearly is on the rise (Lim & Richardson, 2021). The dramatic increase in the number of online programs in educational institutions has also led to the emergence of numerous studies exploring the factors that have a significant impact on online learning outcomes. However, despite literature on the effectiveness of online learning, little is known about the influence of student media literacy on effective learning outcomes in online learning. In the literature, tests of factors that affect learning outcomes in the online learning environment have mainly focused on a number of typical constructs, such as demographic characteristics (Cai et al., 2017; Rizvi et al., 2019; Wang et al., 2013; Yu, 2021), social presence (Hostetter & Busch, 2013; Joksimović et al., 2015; Richardson et al., 2017; Yang et al., 2016), online interaction (Kang et al., 2009; Kang & Tami, 2013; Moore, 2014),

self-regulation (Broadbent & Poon, 2015; Cho et al., 2017; Kara et al., 2021), self-efficacy (Alqurashi, 2019; Bradley et al., 2019; Joo et al., 2013; Papasratorn & Wangpipatwong, 2006; Shea & Bidjerano, 2010), task value (Joo et al., 2013; Lee et al., 2020), etc. In addition, even though there have been many previous studies highlighting the importance of student media literacy in the online learning environment (Crosby, 2019; Hidayat, 2021; Kahne et al., 2012; Ugurhan et al., 2020), the studies that examined the effect of media literacy on effective learning outcomes, especially the impact of the four-factor structure of media literacy on effective learning outcomes, have received limited empirical attention. With the spread of online learning, an analysis of the relationship between students' media literacy and their effective learning outcomes will provide stakeholders with vital information to set up strategic plans for increasing the effectiveness of online programs. In this light, the purpose of this study was to explore the associations between students' media literacy and their effective learning outcomes that were measured by focusing on how students perceived their overall learning outcomes in online learning. The present study can help educational administrators in developing a better context for ways in which the student experience with online learning environment might be improved.

2 Theoretical framework

2.1 Media literacy

Media literacy is a concept and encompasses a range of critical skills needed for living and working in the mediated and participatory cultures of the twenty-first century (Koc & Barut, 2016). Several theoretical perspectives on media literacy could be found in the existing literature (Datu et al., 2021). While contemporary models have focused on operationalizing media literacy (Koltay, 2011; Livingstone, 2014), others have focused on the social skills required to consume and produce media contents (Chen et al., 2011; Pfaff-Rüdiger & Riesmeyer, 2016).

Along with the changing media environment, there have been many changes in the way media literacy characteristics are described. Instead of focusing solely on how conventional media are approached, recent studies increasingly emphasize the social affordability of new media (Lee et al., 2015). The first attempt to conceptualize new media literacy (NML) in related literature was made by Chen et al. (2011). The authors proposed a theoretical model to unpack the notion of NML based on rethinking the concept of media literacy and decoding the technical and socio-cultural characteristics of new media. In this model, NML consisted of four components namely functional consuming, functional prosuming, critical consuming, and critical prosuming. The components of NML are delivered along two continuums: from consuming to prosuming media literacy and from functional to critical media literacy. Consuming media literacy refers to the capacity to access media messages and proficiency in the use of media while prosuming media literacy, on top of consuming skills, refers to the capacity to produce media content (Chen et al., 2011).

Towards the goal of refining the theoretical framework developed by Chen et al. (2011), Lin et al. (2013) provided a more comprehensive explanation and division of

NML in response to the new era of media engagement. Same as Chen et al. (2011), Lin et al. (2013) kept a four-factor construct of NML but they proposed ten fine-grained indicators to reflect these four factors of media literacy (Fig. 1).

In the framework of new media literacy refined by Lin et al. (2013): (i) Functional consuming is reflected by consuming skill and understanding indicators. Focusing on the ability to access, gather information and use different modalities of media, the consuming skill refers to technical skills necessary to consume media contents. Understanding indicator refers to the ability to grasp the meaning of the media contents at a literal level; (ii) Critical consuming is reflected through three indicators: analysis, synthesis, and evaluation. Unlike understanding, analysis indicator refers to the ability to deconstruct media contents through the perception of authorship, format, and audience. The synthesis indicator refers to the ability to remix and reconstruct media contents by integrating individual perspectives. Evaluation indicator that is considered to be of much higher importance than analysis and synthesis includes the ability to question, criticize, and challenge the reliability and credibility of media contents; (iii) Functional prosuming is reflected through three indicators: prosuming skill, distribution, and production. Prosuming skills refer to a set of technical skills (e.g., setting up an online communication account, using software, programming) required for the creation of media artifacts. The distribution indicator focuses on the ability to search for, synthesize, and disseminate information at hand to others on media platforms. The production indicator involves abilities to duplicate, rearrange, or combine media contents into different formats; (iv) Critical prosuming that is considered the most complex and crucial media literacy (Koc & Barut, 2016) is reflected by participation and creation indicators. The participation

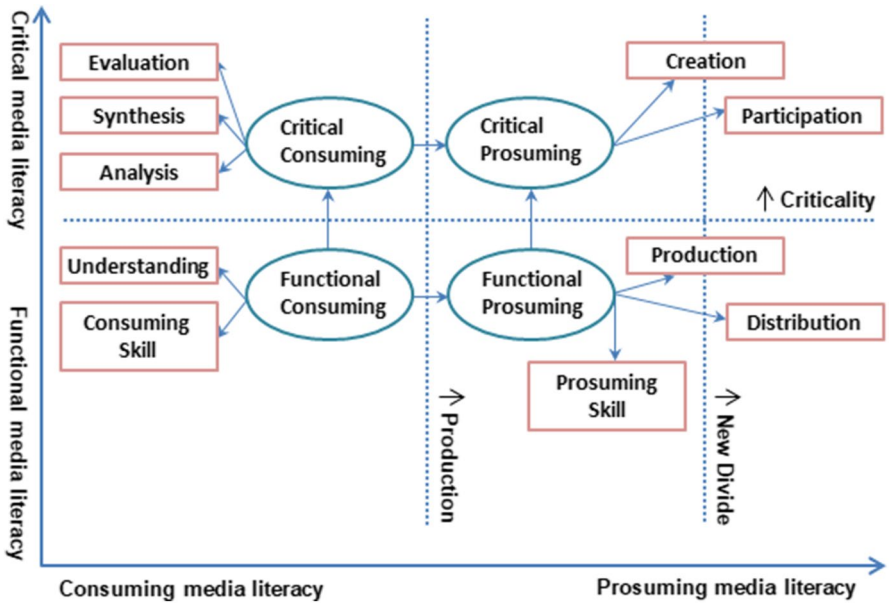


Fig. 1 A refined framework of new media literacy (Lin et al., 2013, p.163)

indicator requires more criticality from individuals, it refers to individuals' abilities to participate in constant engagement, bi-lateral interaction, and criticism in new media environments. This indicator also requires individuals to own social skills for communicating and collaborating on new media platforms. Emphasizing individual initiative rather than bi-lateral interaction, creation indicator refers to abilities to create original media content with considerable attention to embedding or combining socio-cultural values and ideological issues.

Based on the theoretical framework of Lin et al. (2013) explained earlier, Koc and Barut (2016) developed and validated a comprehensive scale for measuring new media literacy called new media literacy scale (NMLS). The NMLS consists of 35 items that were measured by multiple Likert type distributed in four factors: Functional consumption, Critical consumption, Functional consumption, and Critical consumption. With a further emphasis on the measurement aspects of digital media content production and criticism, the tool can be used to measure individuals' new media competencies. At the time of its appearance, the scale developed by Koc and Barut (2016) promises to advance studies on NML from the conceptual level to the empirical one.

The present study adopted the four-factor model of new media literacy (NML) which was developed by Lin et al. (2013) and the new media literacy scale (NMLS) which was developed by Koc and Barut (2016) to explore the associations between students' media literacy and their effective learning outcome.

2.2 Effective learning outcomes in online learning

In online learning, effective learning outcomes can be evaluated from several aspects (Yang et al., 2016) or framed in different measures. When examining the impact of student interactions in online learning environments on student learning outcomes, Ekwunife-Orakwue and Teng (2014) measured learning performance in terms of learners' subjective and objective learning outcomes. These two components of learning performance were also found in the study conducted by Yang et al. (2016). In both of these works, the subjective learning outcomes were assessed by the learner's performance and their satisfaction while the objective learning outcomes were assessed on the results from the process assessment which was carried out throughout the learner's component activities (Ekwunife-Orakwue & Teng, 2014; Yang et al., 2016). Also carrying out research related to measuring student learning outcomes in online learning, Eom and Ashill (2016) looked at assessing student learning outcomes on three dimensions placed in the comparison between online learning and face-to-face learning, including the academic quality of online learning, the amount of information gained from online and the quality of the learning experience in online learning. Taking another approach, variables of online learning performance in the study of Rockinson-Szapkiw et al. (2016) was considered including both the scores obtained from the blackboard grade book and the perceived learning outcomes. Aspects of effective learning outcomes in online learning environments are indeed a dense jungle in the existing literature.

In the literature, traditional learning outcomes and perceived learning outcomes are two terms that are often mentioned when referring to student learning outcomes in the online learning environment. There are many researchers who have chosen traditional learning outcomes, such as the final grade or grade point average, as a variable for student learning outcomes in studies related to online learning (Bernard et al., 2004; Hao, 2016; Lu et al., 2003; Wei & Chou, 2020). In addition, with an emphasis on traditional learning outcomes, some researchers have even criticized the construct of perceived learning outcomes as not being as valid or critical as traditional learning outcomes when comparing the construct of these two variables (Richardson et al., 2017). However, this view will also be easily shaken when entangled with a measuring tape that has to be pulled out to compare learning outcomes across disciplines and across instructors. In this case, perceived learning outcomes may be a better measure than traditional learning outcomes measures. The argument that traditional measures can be problematic in cross-comparison cases has been reported by some previous researchers (Arbaugh, 2005; Richardson et al., 2010, 2017; Rovai et al., 2009). Obviously, sometimes perceived learning outcomes are the more appropriate measure for a particular research context, and they can be an accurate representation of what students have achieved from online learning programs where complex involvement of different components is present. In addition, student self-report data also has the potential to provide useful information as learning outcomes perceived by students can also reveal their satisfaction (De Hei et al., 2018).

Research evidence suggested that self-reports of learning, or perceived learning, can be a valid measure of learning (Alqurashi, 2019; Kang & Tami, 2013; Lim & Richardson, 2021; Waheed et al., 2016). Rockinson-Szapkiw et al. (2016) showed that perceived learning outcomes are a significant predictor of students' final course grades. Furthermore, as being adults with considerable educational experience, college students can accurately estimate the quantity and quality of what they learn and thus their estimates are at least as good as teacher-provided subjective scores in classes or on tests (Richmond et al., 1987; Rovai et al., 2009). In this study, effective learning outcomes in online learning were measured by focusing on how students perceived their overall learning outcomes as a form of self-report style questionnaire. In online learning, perceived learning outcomes that could be defined as learners' self-report judgments about their learning (Kara et al., 2021) consist of several aspects: (i) Sense of reaching understanding and new insights; (ii) Experiences and feelings during the learning process; (iii) Extent to which the learner enjoys interpersonal learning-related interactions (Baturay, 2011; Blau et al., 2020; Rockinson-Szapkiw et al., 2016).

3 Research questions

This study aims to explore the effect of media literacy on effective learning outcomes in online learning (Fig. 2). The four factors (functional consumption, critical consumption, functional prosumption, and critical prosumption) in the model of Lin et al. (2013) were adopted as the construct of media literacy, while effective learning

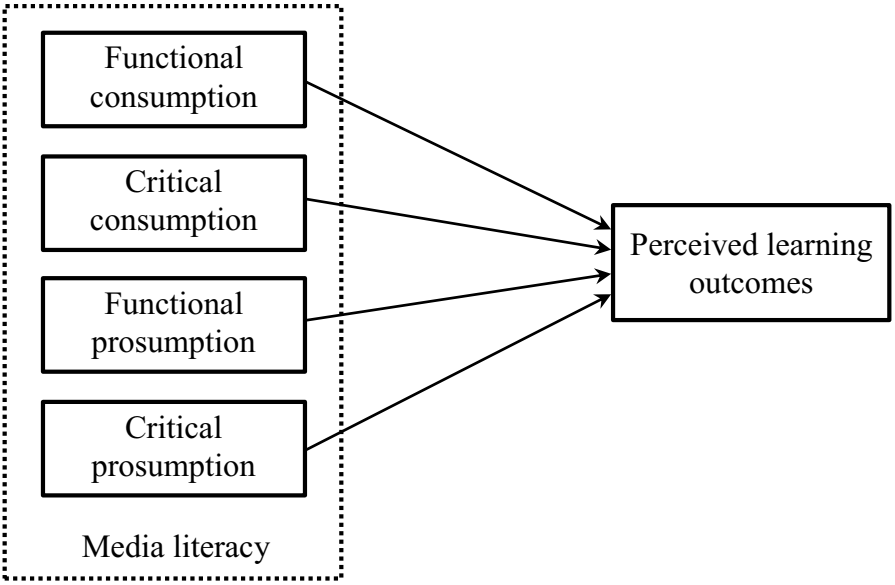


Fig. 2 Proposed research framework

outcomes were measured by focusing on student perceived learning outcomes in online learning. Therefore, the research questions of this study were as follows:

RQ1. How does students' functional consumption (FC) predict their perceived learning outcomes (PLO)?
RQ2. How does students' critical consumption (CC) predict their perceived learning outcomes (PLO)?
RQ3. How does students' functional prosumption (FP) predict their perceived learning outcomes (PLO)?
RQ4. How does students' critical prosumption (CP) predict their perceived learning outcomes (PLO)?

4 Methodology

4.1 Participants and procedures

In this study, the participants were 421 undergraduate students from 32 universities in Vietnam. The demographics of the participants are shown in Table 1. According to Table 1, of the 421 participants, 165 (39.2%) were male, and 256 (60.8%) were female, 22 (5.2%) were freshmen, 190 (45.1%) were sophomores, 126 (29.9%) were juniors, and 83 (19.7%) were seniors. The proportion of participants from public universities (65.8%) was approximately twice as many as those from private universities (34.2%). 158 (37.5%) participants had absolutely no previous experience

Table 1 Demographic statistics of participants

	Item	Frequency	Percentage (%)
Gender	Male	165	39.2
	Female	256	60.8
Year in university	Freshman	22	5.2
	Sophomore	190	45.1
	Junior	126	29.9
	Senior	83	19.7
Type of university	Public	277	65.8
	Private	144	34.2
Experiences with online courses	Never	158	37.5
	1 – 2	201	47.7
	3 – 5	23	5.5
	Over 5	39	9.3

related to online learning, 263 (62.5%) participants had experienced with other online courses before falling into a forced situation due to the Covid-19 pandemic.

The data collection was conducted at a time when all educational institutions in Vietnam were lockdown due to the Covid-19 pandemic (the end of December 2021). This is the most appropriate time to collect data related to the present research topic in Vietnam as all universities were involved in online classes. The data utilized for this study was gathered through an online survey, which was administered to participants, and participation was voluntary. The questionnaire was built through Google forms, and then an electronic link to the questionnaire was circulated to participants. Participants knew that they were entitled to withdrawal at any time before submitting the questionnaire and they indicated their consent to participation by completing and submitting the questionnaire. Initially, the questionnaire was only sent online to students at a Vietnamese university. Then, the snowball-sampling method was adopted to enlarge the sample, which means those previously identified participants were requested to refer to other suitable participants. Therefore, the participants were students of different disciplines such as education, engineering, physical sciences, etc. They were also from both public and private universities. The questionnaire was made public for 2 weeks after which response data were collected and analyzed. During the 2 weeks of data collection, a total of 438 questionnaires were collected, out of which 17 responses were not included due to their invalidity. Finally, 421 questionnaires were utilized for analysis data.

4.2 Measures

Except for the demographic information of respondents, the questionnaire included the constructs of NML and perceived learning outcomes. All measures were adopted from existing instruments with good validity and reliability based on earlier studies. However, some minor modifications to the descriptions of items in these instruments were also made to fit the current research context.

4.2.1 Media literacy

The Vietnamese version of the new media literacy scale (NMLS) that was developed by Koc and Barut (2016) was used to measure participants' degree of functional consumption, critical consumption, functional prosumption, and critical prosumption. This scale includes four factors with 35 items, in which functional consumption includes 7 items, critical consumption includes 11 items, functional prosumption includes 7 items, and critical prosumption includes 10 items. Items were rated using a 5-point Likert scale, on which value 1 referred to "strongly disagree" and value 5 corresponded to "strongly agree".

4.2.2 Perceived learning outcomes

Student perceived learning outcomes were measured by adapting the CAP perceived learning scale that was developed by Rovai et al. (2009). This scale assesses student perceived learning on three domains (cognitive, affective, and psychomotor) with nine items (nine CAP perceived learning scale items). In addition, an item that was adapted from the perceived learning scale of Eom and Ashill (2016) was also added to the questionnaire. This item was "I feel that the knowledge I gained from online classes was as good as face-to-face classes". On a 7-point Likert scale, ranging from 0 (not at all) to 6 (very much so), participants chose a response that best reflected their experiences with the online learning.

4.3 Data analysis

First, to examine the construct validity and internal reliability of the instrument for the particular context of this study, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were conducted. EFA was analyzed through a principal component analysis (PCA) with a promax rotation. The Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity to verify whether the sample was appropriate for such analysis. To ensure consistency and validity, the items with a factor loading smaller than 0.50 or with many cross-loadings would be removed during the EFA (Hair et al., 2010).

Second, CFA was applied to validate the factors to be extracted EFA and examine the fit of the measurement model. The fitness model in CFA was evaluated by the comparative fit index (CFI), the goodness of fit index (GFI), the normed fit index (NFI), the Tucker-Lewis index (TLI), the root mean square error of approximation (RMSEA) and the chi-square/degree of freedom (χ^2/df). In addition, to examine the discriminant and convergent validity of the independent variables and dependent variables, composite reliability (CR), average variance extracted (AVE), the square root of the AVE (SQRTAVE) were also examined.

Finally, to answer four research questions, a structural equation modeling (SEM) to evaluate the hypothetical structural model was employed. The SEM was chosen because it was the most suitable approach to examine the strength of relationships among latent constructs (Kline, 2015).

5 Results

5.1 Measurement model

To examine the validity and reliability of the instrument in this study, the factorability of the 45 items was examined by using EFA. However, one item loaded smaller than 0.50 (CC11: I manage to fend myself from the risks and consequences caused by media contents). Therefore, the EFA was repeated after omitting this item. The results were presented in Table 2. According to the results in Table 2, the factor loadings of the 44 items were all above 0.50, ranging from 0.694 to 0.864, which indicated the adequacy of all the items in the instrument. The KMO measure of sampling adequacy was well above the accepted level of 0.50 (KMO = 0.977) and Bartlett's test of sphericity ($\chi 2 = 12{,}688.592$, df = 946, $p < 0.001$) suggested the measures for the constructs are interdependent (Hair et al., 2010). In addition, according to the results in Table 2, a two-factor construct on 10 items of perceived learning outcomes was also confirmed. They were labeled as Perceived learning outcomes – Affective (PLOa) and Perceived learning outcomes – Cognitive & Psychomotor (PLOcp). PLOa included 3 items: PLO4 (I have changed my attitudes about the course subject matter as a result of the online classes), PLO6 (I feel more self-reliant as the result of the content learned in the online classes), and PLO9 (I feel that I am a more sophisticated thinker as a result of the online classes). PLOcp included the remaining 7 items.

Regarding the fit of the measurement model, the results from the CFA (see Table 2) confirmed that the measurement model had suitable reliability and validity ($\chi^2/df = 1.137 < 2.00$; CFI = 0.990 > 0.90; GFI = 0.903 > 0.90; NFI = 0.923 > 0.90; TLI = 0.989 > 0.90; RMSEA = 0.018 < 0.08) (Hair et al., 2010). Moreover, AVEs of all constructs ranged from 0.521 to 0.635 (above 0.50), CRs of all constructs ranged from 0.831 to 0.938 (above 0.70) (see Table 2), and the square roots of the AVEs of all constructs were greater than the correlations between constructs (see Table 3) which showed that the measurement model had good discriminant and convergent validity (Hair et al., 2010; Schumacker & Lomax, 2015).

5.2 Structural model

To answer research questions, a SEM was employed to examine the relationships between constructs. The results showed that a good fit was achieved in the structural model, the indices matched the data well ($\chi^2/df = 1.167 < 2.00$; CFI = 0.988 > 0.90; GFI = 0.901 > 0.90; NFI = 0.921 > 0.90; TLI = 0.987 > 0.90; RMSEA = 0.020 < 0.08). The path coefficients of the structural model were shown in Table 4 and Fig. 3.

The results indicated that functional consumption and critical prosumption had significant positive effects on perceived learning outcomes, including both perceived learning outcomes – cognitive & psychomotor and perceived learning outcomes – affective. Critical consumption had a significant positive effect on perceived

Table 2 Results of confirmatory factor analysis

Constructs	Item	Loadings	CA	CR	AVE
Critical prosumption (CP)	CP1	0.749	0.938	0.938	0.604
	CP2	0.814			
	CP3	0.791			
	CP4	0.735			
	CP5	0.722			
	CP6	0.768			
	CP7	0.796			
	CP8	0.778			
	CP9	0.817			
	CP10	0.794			
Critical consumption (CC)	CC1	0.706	0.928	0.929	0.568
	CC2	0.761			
	CC3	0.823			
	CC4	0.785			
	CC5	0.759			
	CC6	0.745			
	CC7	0.767			
	CC8	0.695			
	CC9	0.755			
	CC10	0.730			
Functional prosumption (FP)	FP1	0.763	0.915	0.916	0.610
	FP2	0.822			
	FP3	0.785			
	FP4	0.776			
	FP5	0.758			
	FP6	0.786			
	FP7	0.773			
Functional consumption (FC)	FC1	0.731	0.882	0.884	0.521
	FC2	0.715			
	FC3	0.745			
	FC4	0.714			
	FC5	0.700			
	FC6	0.736			
	FC7	0.712			

Table 2 (continued)

Constructs	Item	Loadings	CA	CR	AVE
Perceived learning outcomes – Cognitive & Psychomotor (PLOcp)	PLO1	0.814	0.922	0.924	0.635
	PLO2	0.814			
	PLO3	0.795			
	PLO5	0.780			
	PLO7	0.863			
	PLO8	0.807			
	PLO10	0.694			
Perceived learning outcomes – Affective (PLOa)	PLO4	0.797	0.828	0.831	0.621
	PLO6	0.768			
	PLO9	0.799			

χ^2/df	GFI	CFI	NFI	TLI	RMSEA
1.137	0.903	0.990	0.923	0.989	0.018

Loadings: Factor loadings; CA: Cronbach's alpha; CR: Composite reliability; AVE: Average variance extracted

Table 3 Inter-construct correlations

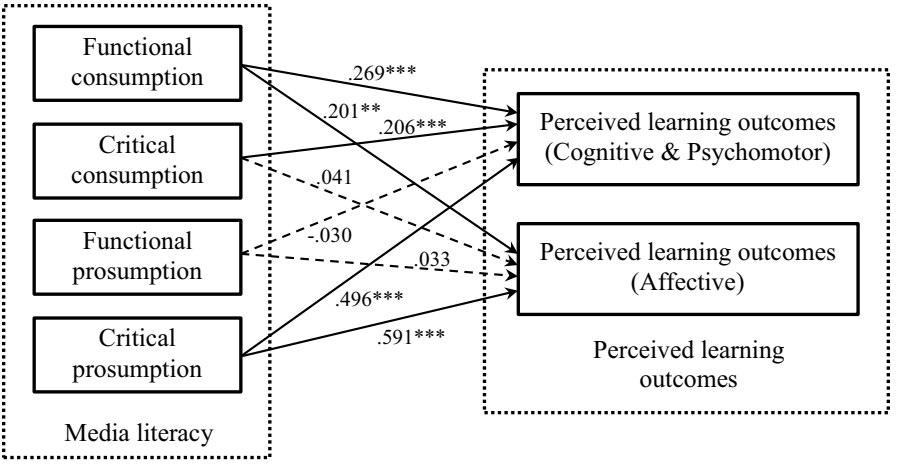
	CP	CC	FP	FC	PLOcp	PLOa
CP	**0.777**					
CC	0.701***	**0.753**				
FP	0.766***	0.745***	**0.781**			
FC	0.621***	0.700***	0.636***	**0.722**		
PLOcp	0.776***	0.719***	0.674***	0.696***	**0.797**	
PLOa	0.760***	0.615***	0.645***	0.607***	0.769***	**0.788**

Diagonal elements in bold are the square root of the AVE; *** $p < 0.001$

Table 4 Results of the structural model

Path	Unstandardized estimate	Standardized estimate	SE	*p*
CP PLOcp	0.615	0.496	0.081	0.000
CC PLOcp	0.219	0.206	0.065	0.000
FP PLOcp	-0.038	-0.030	0.081	0.638
FC PLOcp	0.354	0.269	0.073	0.000
CP PLOa	0.645	0.591	0.084	0.000
CC PLOa	0.038	0.041	0.069	0.580
FP PLOa	0.037	0.033	0.087	0.669
FC PLOa	0.233	0.201	0.075	0.002

SE: Standard error; *p*: *p*-value



(→ : Significant path; ⇢ : Non-significant path; *** p < .001; ** p < .01)

Fig. 3 The structural model with standardized estimates

learning outcomes – cognitive & psychomotor, but had no significant positive effect on perceived learning outcomes – affective. In addition, the results also revealed that the path coefficient between functional prosumption and perceived learning outcomes, including both perceived learning outcomes – cognitive & psychomotor and perceived learning outcomes – affective, was not statistically significant. Hence, functional prosumption did not have a significant positive effect on perceived learning outcomes.

6 Discussion

The aim of this study was to explore the effect of media literacy on effective learning outcomes that were measured by focusing on how students perceived their overall learning outcomes in online learning. Overall, except for functional prosumption, the remaining three factors of media literacy (functional consumption, critical consumption, and critical prosumption) had significant positive effects on perceived learning outcomes. Critical prosumption was found to be the most powerful significant influence on perceived learning outcomes, including both perceived learning outcomes – cognitive & psychomotor and perceived learning outcomes – affective. An effect with simultaneous two paths that were similar to the paths of the critical prosumption on perceived learning outcomes was also found for the functional consumption. In the case of the critical consumption, a significant positive effect was found only on perceived learning outcomes – cognitive & psychomotor but not on perceived learning outcomes – affective. The findings provide the following implications.

While functional prosumption which is represented by prosuming skill, distribution, and production indicators (Lin et al., 2013) did not have a significant positive effect on perceived learning outcomes, critical prosumption that is represented by participation and creation indicators (Lin et al., 2013) was revealed as the most powerful significant predictor of perceived learning outcomes in the online learning environment. This result implies that students with a higher level of abilities to participate interactively, critically in media environments, and abilities to create media contents, especially with a critical understanding of embedded socio-cultural values and ideology issues, are predicted to have higher learning outcomes in online classes. This finding of the present study complemented the fund of knowledge about the role of critical prosumption in online learning and also supported for a stream of research in media literacy that concentrates on strengthening critical skills (Buckingham, 2015; Feuerstein, 2012; Pfaff-Rüdiger & Riesmeyer, 2016; Pfaff-Rüdiger et al., 2012) and non-cognitive skills such as collaboration and communication (Eshet-Alkalai, 2012; Martens & Hobbs, 2015; Rogow, 2011). Regarding functional prosumption, although basic technology skills are necessary for students' learning activities to run smoothly in an online environment (Alqurashi, 2019; Jan, 2015; Zainab et al., 2017) and were considered as a significant predictor of student engagement (Pellas, 2014; Sun & Rueda, 2012), the present study demonstrated that it is not a significant predictor of student learning outcomes in online learning, in contrast with reports of Joo et al. (2000), Lim et al. (2007), and Wang et al. (2008). This showed that students nowadays have more exposure and access to cutting-edge technology, and they become more confident in performing learning activities in a technological environment, and as a result, mere technology skills are becoming less predictive of student learning outcomes in online learning (Alqurashi, 2019). The results suggest that for an effective online learning environment, students should be supported and given the opportunity to engage critically and actively in new media platforms as well as create original media content that conveys their own socio-cultural values and ideologies (Koc & Barut, 2016). School education should put more focus on skills for creating and critiquing media contents with a critical understanding of embedded socio-cultural values and ideology issues than on mere skills for producing and disseminating pure media contents. In addition, critical prosuming literacy requires individuals to possess social skills to achieve digital communication and collaboration with others (Koc & Barut, 2016; Lin et al., 2013), so good strategies for developing social skills in the digital environment are also an issue that needs to be paid more attention to by educational administrators.

All in all, functional consumption that is represented by consuming skill and understanding indicators and critical consumption that is identified by the analysis, synthesis, evaluation indicators (Lin et al., 2013) were also revealed as a significant predictor of learning outcomes in online learning environment although a significant positive effect of critical consumption was found only on perceived learning outcomes – cognitive & psychomotor but not on perceived learning outcomes – affective. Students who are predicted to have higher learning outcomes in online learning have a higher level of abilities to gather information, grasp

the meaning of the media contents, deconstruct media messages, remix and reconstruct media contents by integrating their own viewpoints, and criticize, challenge the credibility of media contents. This indicates that to be successful in the online learning environment, students must have critical thinking and decision-making skills, as well as the ability to evaluate media contents to seek out that which is appropriate and accurate (Tang & Wei, 2013). This finding complements the reports of Zhu et al. (2011), Tang and Wei (2013), and Shen (2018) who found the positive effect of competencies in information seeking on students' academic performance. Improving and developing students' functional and critical consumption literacy to increase learning outcomes in online learning is an obvious direction to take for educators and educational administrators, however, a mirror view implies that instructional designs in online learning must aim to catch up and fill as much as possible students' functional and critical consumption literacy should also be taken into account. A bottom principle is to pay attention in this case, no matter what type of instruction is offered, it should be designed for tailoring itself to students' interests, putting them in a suitable territory in which they can pick down appropriate and accurate media contents by their struggles (Tang & Wei, 2013). It is important to provide enduring access to the media contents students use to build understanding (Humrickhouse, 2021). Regarding an interesting finding that showed that the critical consumption had a significant positive effect on perceived learning outcomes – cognitive but not on perceived learning outcomes – affective, this study speculates that there could be the influence of the diverse disciplines of participants on their critical consumption, and it made the aforementioned difference. Note that this speculation is not synonymous with excluding influence of the discipline on the remaining constructs of media literacy in the present model. Nevertheless, this speculation was not formally investigated in this study, so future research is needed to fully understand why difference in perceived learning outcomes was found when placing a binocular on critical consumption of media literacy.

There are several limitations to this study. First, although the characteristics of the participants and sample size in this study were considered appropriate from a research perspective, inadequate control over the students across disciplines as well as the distribution of university locations may make the results not fully representative of students across disciplines and other locals. Students from diverse disciplines of universities that are spread across purposefully-selected locations could be invited to participate in order to achieve better generalization. Second, in this study, effective learning outcomes in online learning were measured focusing on how students perceived their overall learning outcomes as a form of self-report style questionnaire, which may weaken the reliability of the results. Future research may consider the combination of perceived learning outcomes and traditional learning outcomes for the variable of effective learning outcomes in the model of the present study. In addition, similar to learning outcomes, student satisfaction has also been considered as an indicator of the quality and effectiveness of online learning. Hence, future research could replicate and adapt the present model with the addition of the student satisfaction variable for a further understanding of the effect of media literacy on online learning.

7 Conclusion

This study was conducted to gain an understanding of the relationship between students' media literacy and their effective learning outcomes. The four factors (functional consumption, critical consumption, functional prosumption, and critical prosumption) in the model of new media literacy were adopted as the construct of media literacy while effective learning outcomes were measured focusing on student perceived learning outcomes in online learning. Evidence for the significant positive impact of functional consumption, critical consumption, and critical prosumption on effective learning outcomes in online environment was found whereas similar evidence was not found for functional prosumption. The present study enriched the understanding of factors that play an important role in academic performance in the online learning environment. In addition to the theoretical contributions, this study provides some significant practical implications for stakeholders in setting up strategic plans for increasing the effectiveness of online classes in the context of the growing number of online programs in higher education. This study also contributes meaningful information that can help administrators in developing a better context for ways in which the student experience might be improved in the online learning environment.

Data availability The datasets analysed during the current study are available from the corresponding author on reasonable request.

Declarations

The author has no relevant financial or non-financial interests to disclose.

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