Chapter 7
Students' Use of Social Media and Critical Thinking: The Mediating Effect of Engagement

Asad Abbas, Talia Gonzalez-Cacho, Danica Radovanović, Ahsan Ali, and Guillermina Benavides Rincón

Introduction

Initially, during the time of the COVID-19 pandemic, the continuation of education seemed a difficult undertaking with the use of formal methods of teaching and, as a result, most of the students and their studies suffered due to the transformation of the learning process (Bhardwaj et al. 2021). This rapid transformation in traditional modes of learning forced educational institutions to establish Information and Communication Technology (ICT)-based educational policies (Haq et al. 2021). The adoption of new policies and the implementation of a new education system require basic digital literacy related to the knowledge and skills of available tools (Balasooriya et al. 2018). Digital literacy can also be achieved through informal learning such as social media. Radovanovic et al. (2015) stated that digital literacy

A. Abbas (✉)
Writing Lab, Institute for the Future of Education, Tecnológico de Monterrey, Monterrey, Nuevo Leon, Mexico

School of Government and Public Transformation, Tecnológico de Monterrey, San Pedro Garza García, Nuevo Leon, Mexico
e-mail: asad.abbas@tec.mx

T. Gonzalez-Cacho
School of Architecture, Art, and Design, Tecnológico de Monterrey, Monterrey, Nuevo Leon, Mexico

D. Radovanović
Department of Technology Systems, University of Oslo, Oslo, Norway

A. Ali
School of Economics and Management, Zhejiang Sci-Tech University, Hangzhou, China

G. B. Rincón
School of Government and Public Transformation, Tecnológico de Monterrey, San Pedro Garza García, Nuevo Leon, Mexico

D. Radovanović (ed.), *Digital Literacy and Inclusion*,
https://doi.org/10.1007/978-3-031-30808-6_7

can also be achieved through social media and for younger generations Facebook was their introduction to the Internet.

Kaeophanuek and others (2018) state that the use of social media can enhance digital literacy through the development of three competencies: (1) information skills (searching, interpreting, evaluating, and synthesizing information), (2) digital tools usage (ability to use software applications, manage personal information on networks and ethics), and (3) digital transformation (producing new forms of information, creating new knowledge, and producing digital innovation). For the deployment of these competencies, students must use critical thinking. Moon and Bai (2020) analyze the use of social media for promoting political and civic engagement in youth and concluded that although time spent on social media does not guarantee engagement, designing social media-based activities in an online learning context promotes engagement, and as a consequence, the development of critical thinking skills by developing media literacy. In digital contexts, critical thinking is needed to filter the flux of digital information (Moon and Bai 2020).

Dabbagh and Kitsantas (2012) define social media as a broad concept that makes reference to a variety of network tools or technologies that focus on the social use of the Internet for communication, collaboration, and creative expression. Social media include can be used for resource sharing, the creation of collaborative workspaces, social networking sites, and collaborative work using web-based office tools (Dabbagh and Kitsantas 2012). This research focuses on the students' use of Facebook, Instagram, Twitter, LinkedIn, and YouTube. Recent trends in published literature provide evidence related to the rapidly increasing use of social media in society (Malik et al. 2020). Social media tools can be used to develop students' soft skills and also can have an effect on current education systems and teaching methods (Al-Rahmi et al. 2015; Mafarja et al. 2022). At the same time, social media allows students to continue their learning processes and also enables opportunities for them to engage with their peers to collaborate within or outside of the institution (Clark et al. 2017). The literature review showed that the informal use of technology for pedagogical purposes can encourage students to engage in interdisciplinary course activities (Bedenlier et al. 2020).

The impact of technology on learning within different disciplines has been reviewed in several studies (Radovanović et al. 2020; Le et al. 2022). The results suggest that students prefer technology for learning because it makes the learning experience more pleasant or enjoyable (Radovanović et al. 2020; Le et al. 2022; Ahmad et al. 2021; Armstrong and Georgas 2006). Further, the studies also show that technology in learning improves attitudes towards learning such as motivation, engagement, and commitment (Ahmadi 2018). Nevertheless, a non-formal study has been conducted to review the degree to which engagement might mediate the relationship between social media and critical thinking among students of higher education (Sherman 2013). To explore the social media-based activities and engagement of students to virtually interact with their peers and share useful information or share knowledge through social media platforms which help them to improve their soft skills (Gonzalez-Cacho and Abbas 2022). To achieve the objectives of this empirical research, we conducted an online survey among undergraduate students

from Architecture and Civil engineering programs and statistically analyzed collected data using the Jamovi R-based software application. The purpose of our research is to understand the mediating role of engagement between the use of social media and its linkage with the ability of students to think critically by deploying digital literacy skills such as searching, analysis, synthesis, evaluation, interpretation, creation, usage, communication, collaboration, among others (Kaeophanuek et al. 2018).

The layout of this book chapter consists of several sections. The first section, "literature review and development of hypotheses," defines each variable and discusses relevant published studies. Hypotheses were then developed based on evidence from the literature. In the next section, "methods," we thoroughly explain the participant selection process, the study procedures (including survey design), and the statistical data analysis techniques. In the next section, "discussion," result statements are presented with the support of existing relevant literature. And finally, "conclusion," will cover the research outcomes of this study that were attained through empirical results and the literature review.

Literature Review and Development of the Hypotheses

Use of Social Media and Critical Thinking

In higher education, critical thinking is defined as the student's ability to think, whether individually or in a group, and analyze, synthesize, and evaluate available information to make better decisions. In the digital era, the ability to think critically plays an important role in evaluation accumulation (Shcheglova et al. 2019). Bedenlier et al. (2020) found that Facebook-based activities increased the critical thinking abilities of students in social media learning environments when compared to face-to-face settings. Digital environments or spaces develop digital literacy skills and online engagement (Peters and Romero 2019) by having students search, analyze, and process information to then collaborate and share and finally disseminate, create, and innovate through digital tools. All these soft skills are directly linked to critical thinking (Kaeophanuek et al. 2018). Digital management skills help to engage and manage information, and improve theoretical knowledge and practical skills to overcome future challenges in a person's career (Janssen et al. 2019; Toplak et al. 2017). Social media platforms can enable students to develop their critical thinking by using digital literacy skills and vice versa in the digital era.

Use of Social Media and Engagement

In digital educational settings, learning platforms should be accessible and flexible such that all students can easily gain knowledge and improve their learning skills (Alghizzawi et al. 2019). In past years, social media has been transformed into a

learning platform and is also used as an informal and formal channel of communication between individuals and groups of users. From an educational perspective, social media allows students to perform synchronous and asynchronous course activities. Facebook is an example of a social media platform that is used as a learning tool in the academic community (Knowles and Dixon 2016). The use of social media in online courses helps students to develop their soft skills through active collaborations and interactions (Gonzalez-Cacho and Abbas 2022). This collaboration and interaction can also be achieved through engagement. In an online classroom environment, students can engage with each other through social media-based activities. Educators are responsible for the design of online activities that contribute to the development of practical and theoretical skills of students. As a result, students will use creative activities for knowledge sharing and creation within a flexible learning space (Khoo 2019; Ilin 2021).

The Mediating Role of Engagement with the Use of Social Media and Critical Thinking

In the twentieth century, the concept of engagement among students started with Ralph Tyler and a new approach regarding the relationship between learning curricula and student learning (Axelson and Flick 2010; Manu et al. 2021). Since then, engagement is an important element in higher education and plays a central role in the learning processes (Ouyang and Dai 2022). Students develop/promote three types of engagement: behavioral, emotional, and cognitive. Different activities among students can promote behavioral engagement, whereas emotional engagement is based on reactions that appear during specifically designed activities, and finally, cognitive engagement clarifies complex ideas (Fredricks et al. 2004). Therefore, different types of engagement, similar to an individual's disposition, are made up of student emotions, cognition, and behavior (Kahu 2013) and it is important to understand this set of engagement elements. Engagement involves students in academic activities that result in high-quality outcomes in their studies (Mehdinezhad 2011). Therefore, students' attitudes of disposition, desire, and compulsion drive them to actively participate in learning activities (Mbodila et al. 2014) on social media. It is important for teachers to design innovative social media-based course activities to promote and enhanced the relationship between students' attitudes and academic achievements (Eastman et al. 2011). Social media provides an intellectual environment that can actively engage students and develop their critical thinking abilities. These learning activities allow teachers to monitor student engagement in activities related to academic commitments (Eom et al. 2016). Continuous engagement in students' intermediate social media activities relates to their personal interest in developing their soft skills, i.e., critical thinking (Sinatra et al. 2015; Uchidiuno et al. 2019).

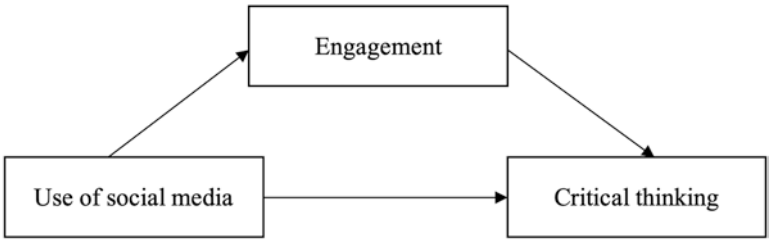

Fig. 7.1 Research model

Proposed Hypotheses

Based on the literature review, we proposed the following hypotheses:

H1: Use of social media is positively associated with critical thinking.
H2: Use of social media is positively associated with engagement.
H3: Engagement is positively associated with critical thinking.
H4: Engagement mediates the relationship between use of social media and critical thinking (Fig. 7.1).

Methods

Participants and Procedure

In this study, participants were undergraduate Architecture and Civil engineering students of Tecnologico de Monterrey, Puebla Campus of Mexico. This research is in line with the institutional COVID-19 policy of digital learning, known as HyFlex+Tec, which has the objective of helping students to continue their education through e-learning (Membrillo-Hernández et al. 2021). Tecnologico de Monterrey was the first Mexican University that suspended campus classes on March 17, 2020. From March 17 to 21, 2020 nearly 10,000 professors were trained in the use of digital platforms. Under the HyFlex+Tec on March 23, 2020, more than 90,000 students were able to continue their semester fully online. In Mexico, face-to-face classes were suspended at all educational levels since March 2020 with a gradual return to on-site classes in August 2021 (TEC 2022). Puebla campus is one of 26 campuses of Tecnologico de Monterrey, Mexico. In May 2021, via convenience sampling, we circulated a Google Form survey among students enrolled in the undergraduate Architecture and Civil engineering program. We used the university's official LMS platform, that is, Canvas (https://experiencia21.tec.mx) to distribute the survey. Survey respondents were already engaged in several social media-based course activities. During the COVID-19 pandemic, teachers designed a set of social media-based course activities to help students interact with their peers and share

knowledge remotely. The objective of these social media-based academic activities is to promote critical thinking by deploying digital literacy skills to meet the future need for problem-solving and to improve decision-making.

The Online Survey

The online survey was based on four sections, (1) Demographic information of respondents i.e., age, gender, major, scholarship, and social media usage hours per day, (2) Use of social media, (3) Engagement, and (4) Critical thinking. The first section covers the confidentiality statement and includes questions related to age, gender, major, and the daily use of social media. The purpose of the confidentiality statement is to let respondents know the purpose of the research and also to inform them of their rights to privacy and security of their personal information. The second section contains four, five-point Likert-scale questions related to "use of social media" (Ali-Hassan et al. 2015). The third section includes four, five-point Likert scale questions related to "engagement" which were adopted from the work of Chan et al. (2020). The last section has six, five-point Likert-scale questions related to "critical thinking" which were adapted from research done by Gonzalez-Cacho and Abbas (2022). The questions of the survey were based on the different components of the RED Model of critical thinking developed by Pearson which is based on recognizing assumptions, evaluating arguments, and drawing conclusions (Chartrand et al. 2013).

Data Analysis

Data analysis was conducted using an open R-based statistical software, Jamovi. Jamovi software provides an advanced level of statistical testing options that can be used to analyze complex quantitative data. Before starting data analysis, we exported the Microsoft Excel dataset file to the Jamovi (.omv) file format. Then we assigned a label to each variable and a code to each registered response. The first step of data analysis was to apply a descriptive test to collect demographic information of each registered survey respondent. In the second step, we applied Pearson's r correlation test to verify the correlation between variables. Lastly, we applied a mediation test using the "medmod" module to test the mediating effects between variables. Therefore, our results are determined via statistical analyses, which will prove or disprove the proposed hypotheses.

Results

Descriptive Statistics

The following presents the study participant demographics of undergraduate Architecture and Civil engineering students. Fifty-four (80.6%) respondents were between the ages of 18–22 years, and the 13 remaining students were (19.4%) over the age of 22. Considering gender, 36 (53.7%) females and 31 (46.3%) males participated in the survey. Forty-nine (73.1%) students were majoring in Architecture and the remaining 18 (26.9%) students were majoring in Civil engineering. Forty-five (67.2%) of 67 students obtained a scholarship, and the remaining 22 (32.8%) were self-financed or without scholarship. Thirty-two students (47.8%) reported their social media usage as being 3–6 h per day, 30 (44.8%) students reported their usage as being less than 3 h a day, and the remaining five (7.5%) students reported their social media usage as being above 6 h a day.

Correlation Matrix

In Table 7.1, the correlation matrix shows that a relationship exists between the variables: use of social media, engagement, and critical thinking. Results of the Pearson's r correlation analysis suggest that "use of social media" has a positive correlation with "critical thinking" ($r = .687$, $p < .001$) and "engagement" is also positively correlated with "critical thinking" ($r = .732$, $p < .001$). Correlation values also suggest that the "engagement" variable is highly correlated with "critical thinking" when compared with "use of social media.".

Table 7.1 Correlation matrix

		Use of social media	Engagement	Critical thinking
Use of social media	Pearson's *r*	–		
	p-value	–		
Engagement	Pearson's *r*	0.762***	–	
	p-value	<.001	–	
Critical thinking	Pearson's *r*	0.687***	0.732***	–
	p-value	<.001	<.001	–

Note. Level of significance: ***$p < .001$

Testing the Mediation Effects

In mediation tests, we verified the direct, indirect, and total effects of variables. "Use of social media" is an independent variable, "critical thinking" is a dependent variable, while "engagement" is a mediator or mediating variable.

The first relationship test was between the independent variable, "use of social media, " and the dependent variable, "critical thinking" (see Table 7.2 and Fig. 7.2a). The results of the analysis confirm that the estimated value of the total effects of variables is significant (Estimate = 0.558, $p < .001$) and with a lower and upper limit of 95% confidence interval (C.I) is in the range between (0.4152–0.700), which confirms that relationship between the independent and dependent variables is significant. Therefore, the results support our first hypothesis, i.e., *H1: Use of social media is positively associated with critical thinking*.

In further analyses, we introduced the "engagement" variable as a mediator between "use of social media" and "critical thinking" (see Table 7.3 and Fig. 7.2b). In mediation tests, we found the first relationship between the independent variable "use of social media" and the mediation variable "engagement" is positively significant (Estimate = 0.787, $p < .001$), and second relationship between the mediation variable "engagement" and the dependent variable "critical thinking" is also positively significant (Estimate = 0.392, $p < .001$). Thus, the results from data analysis support our two hypotheses *H2: Use of social media is positively associated with engagement,* and also *H3: Engagement is positively associated with critical thinking*. As seen in Table 7.2, the value of indirect effects (Estimate = 0.308, $p < .001$) supports our hypothesis, *H4: Engagement mediates the relationship between the use of social media and critical thinking*. We can say that after introducing the mediator "engagement," we noticed that the value of direct effects changes to become ~~in~~significant. Because of this, our results show that partial mediation exists.

Table 7.2 Testing of mediating effects

Type	Effect	Estimate	SE	95% C.I. (a)		β	z	p
				Lower	Upper			
Total	Use of social media ⇒ Critical thinking	0.558	0.0727	0.4152	0.700	0.687	7.67	<.001
Indirect	Use of social media ⇒ Engagement ⇒ Critical thinking	0.308	0.0825	0.1466	0.470	0.380	3.74	<.001
Direct	Use of social media ⇒ Critical thinking	0.249	0.0998	0.0538	0.445	0.307	2.50	0.012

Note. Confidence intervals (C.I.) computed with method: Standard (Delta method)
Note. Betas are completely standardized effect sizes
Note. Level of significance: *$p < .05$, **$p < .01$, ***$p < .001$

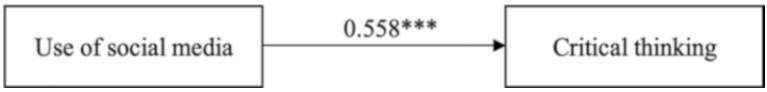

Fig. 7.2a Path estimate (total effects)

Table 7.3 Path estimate

Effect	Estimate	SE	95% C.I.		*z*	*p*
			Lower	Upper		
Use of social media → Engagement	0.787	0.0817	0.6268	0.957	9.63	<.001
Engagement → Critical thinking	0.392	0.0966	0.2023	0.581	4.05	<.001
Use of social media → Critical thinking	0.249	0.0998	0.0538	0.445	2.50	0.012

Note. C.I. Confidence Interval
Note. Level of significance: **p* < .05, ***p* < .01, ****p* < .001

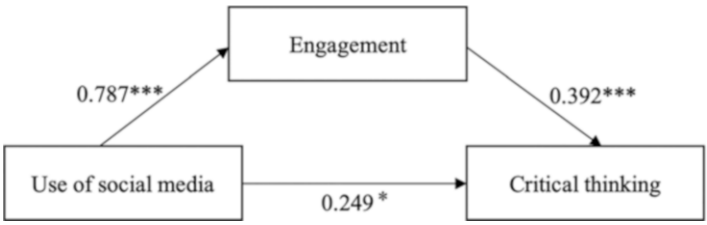

Fig. 7.2b Path estimate (indirect and direct effects)

Discussion

The purpose of this empirical study was to analyze the mediating role of engagement in the use of social media for the development of critical thinking abilities in undergraduate Architecture and Civil engineering students. To achieve this, we developed a theoretical research model and a list of proposed hypotheses. In this discussion section, we present, with the support of published literature, the results of this study.

The first finding of this study highlights the significant positive association that exists between the use of social media and students' critical thinking abilities as total effects. In the digital learning environment, students in higher education act as active learners whereby they use social media as a learning platform for active communication during the online activities of their courses. Students do this to exchange their ideas, share relevant skills, and knowledge with both peers and teachers (Pattanapichet and Wichadee 2015). Erdogdu (2022) mentioned in his research that effective use of an ICT-driven interactive platform provides a learning environment for the students to attain academic achievement along with improvements in their skills such as critical thinking.

The second set of findings suggests that the use of social media provides an important platform to engage students individually as well as in team-based

course-related activities. In recent times, it has been noted that social media platforms, such as Facebook, YouTube, Twitter, and LinkedIn, provide an intellectual learning environment where anyone can express their ideas and knowledge on specific topics without any constraints (Shawky et al. 2019; Zhang et al. 2022). As such, a set of course-based activities designed by teachers help students to interact with each other during the COVID-19 pandemic, when most in-person educational activities came to a halt (Mershad and Said 2022; Haroon et al. 2020) Therefore, these online activities were helpful in assisting the students with improving their soft skills.

The third set of empirical findings also confirms that engagement is associated with the development of the critical thinking abilities of students. The framework of engagement is associated with academic research and the extracurricular engagement of students and their contributions to class discussions on concepts, issues, and solutions on specific course topics. These elements of the engagement framework are helpful beyond course structure and are also helpful for students in their extracurricular activities (Shcheglova et al. 2019). Online teaching methods are helpful for students wanting to acquire new skills and are desirous of achieving personal development goals as well as higher grades (Schmidt-Wilk and Lovelace 2017).

The final set of empirical findings affirms that engagement is a partial mediator between the use of social media (independent variable) and critical thinking (dependent variable). Anthony and Garner (2016) found that soft skills are attributed to students' learning abilities, which is important for them to improve communication, writing, and presentation skills through engagement in the digital learning environment. Effective use of technology provides flexibility in education and also encourages students to use internet-based applications for searching, collecting, and interpreting relevant information and knowledge for critical thinking (Pérez-Escolar and Canet 2022). Acceptance of and adopting emerging technologies in e-learning settings is beneficial for engagement which, in turn, positively influences student success and also has a long-term impact on their soft skills (Khlaif et al. 2022), which is necessary for successful career development.

Implication of the Study

This research study has valuable implications for policy and practice. Theoretically, this study contributes to the field by highlighting the role and effectiveness of social media in e-learning settings, particularly during the pandemic. As such, social media provides an intellectual space for students to (1) engage with their peers, (2) discuss and share relevant knowledge, and (3) develop skills for solving complex problems on specific topics within set timeframes. The practical implications of this empirical study can be used to guide educational institutions and their policies that seek to shift from in-person learning to online modalities where online course activities enable students to socially interact with each other. Online learning modalities also enable active engagement among students and their peers through the use of

social media and also allow students to concentrate their focus on their studies and enhance their competencies for better academic performance and career development. Another implication is that this study highlights the teacher's role in designing online activities that promote digital literacy with the use of social media related to engagement and the development of soft skills.

Conclusion, Limitations, and Directions of Future Work

Considering the empirical evidence about the mediating role of engagement between use of social media and critical thinking abilities of undergraduate Architecture and Civil engineering students, we can conclude that the use of social media can play an important role in developing digital literacy and critical thinking. Studies show that the sole use of social media does not promote critical thinking but students' engagement through social media can develop critical thinking skills required to filter, analyze, synthetize, communicate, and collaborate effectively using social media platforms. In a time when face-to-face education is transitioning to a hybrid model of instruction, social media is a powerful tool that could be used in formal and informal learning contexts. During the pandemic, many institutions transformed their education systems to online-based learning. As such, most of the degree programs designed their course content based on online activities such as lectures, presentations, and online individual or team-based project activities. The use of social media as a learning platform helps undergraduate students actively participate and engage in course activities by engaging with their peers and teachers. Online learning platforms also assist in the learning process as students share relevant information and knowledge on specific topics. This set of online activities engages students to develop their critical thinking abilities for better decision-making and future career development.

Along with the significant contributions of this study, we also noted limitations. The limitation of this research is that it was conducted among undergraduate Architecture and Civil engineering students on one campus of a university. Possibilities for future research can include multidisciplinary study with a different department of the university or with engineering students from a different campus as it will be helpful to get better insights regarding the role of social media platforms for the development of theoretical and practical skills of students.

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