

Title

Facebook and Moodle integration into instructional media design courses: A comparative analysis of students' learning experiences using the Community of Inquiry (CoI) model

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Abstract

Despite the educational potential of Facebook and Moodle, there are still unanswered questions about their impact on the student learning experience in a well-defined instructional design framework. This study aimed to compare the learning experiences of students who used Moodle (control group) and Facebook (experimental group), in terms of Community of Inquiry presence indicators, i.e., cognitive, teaching, and social presence. Several learning activities for the development of learning environments were carried out by 97 students who were enrolled in instructional media design courses. Findings from quantitative and qualitative analysis indicated that students using either Moodle or Facebook as their learning platform had similar perceptions of teaching and cognitive presence; however, Facebook users had a better social presence in the Community of Inquiry than their Moodle counterparts. Another point worth noting is that the experimental group's female participants had better teaching presence, cognitive presence, and overall learning experience than their male peers.

Keywords: Community of Inquiry, Student experience, Facebook, Moodle, Instructional media design

Introduction

Instructional design courses are fundamental for nascent scholars and educational practitioners who study in Higher education (HE), as they provide them with expertise in the design and development of processes, systems, services, and instruction for delivery in K-12 of high/middle education that effectively integrate pedagogy and technology. Instructional design is based on theoretical and practical research in the areas of cognition, educational psychology, and problem-solving (Merrill, 2002). More specifically, it is focused on the creation of an instructional environment and learning materials that will bring learners from the state of not being able to accomplish certain tasks to the state of being able to accomplish them.

The evolution of Web 2.0 over the last decade has presented an opportunity for educators and instructional technologists to rethink their way of teaching and improve the quality of instructional design courses in HE through innovation in teaching and learning. Instructional media design involves discovering learning objectives and requirements of a specific educational course and designing, creating, and testing resources that satisfy these objectives by using various media sources, such as slide presentations, video, text, screencasts, web pages, audio files, or open educational resources (OER). The latter are teaching, learning, and research materials in any medium that reside in the public domain or have been released under an open license that permits their free use and re-purposing by others. As the design of the content shifts from “*teacher initiative, control, and responsibility to shared initiative, control, and responsibility*” (Reigeluth, 1999, p. 19), new interactions are created (Koutsabasis et al., 2011; Reiser, 2002): (a) between learners and instructional content, (b) between learners and the instructor, and (c) among learners themselves. Therefore, instructional media design courses

need to assist students in achieving their learning objectives not only effectively, but also efficiently by supporting their effort of understanding in a faster and more purposeful way.

However, instructional media design students are faced with various instructional and technological obstacles that can affect their performance. From an instructional-pedagogical perspective, the most indicative are: a) lack of the main instructor's support in training sessions using contemporary web-based sources (Liaw, 2008), and b) lack of technological infrastructure for users' interaction in a digital-oriented environment. This situation may have a negative impact on the students' participation without utilising a-/synchronous communication tools (Zawacki-Richter, 2015). Other typical problems that inhibit the successful interaction of teachers in utilising online digital communities are the following: a) lack of active membership contributions to online discussions (Brindley, 2009), b) lack of users' incentives (Ally, 2016), and c) lack of trust and interaction, which can hinder communication among users in online communities (Cristóbal et al., 2017). Furthermore, the lack of interactivity in lecture-based learning is becoming a growing phenomenon in online courses. For example, many of these courses simply provide video recordings of an instructor's lectures for students to study in isolation and passively absorb the content (Knight & Wood, 2005). While the leisure of not having to attend class meetings and being able to learn something seems to be nice, it takes away from the interpersonal skills that students need to acquire along with their education. This trend of non-continuous participation is attributable to external causes, such as busy study schedules, lack of time, or lack of access to the Internet (Blasco-Arcas et al., 2013). Overall, the aforementioned problems lead instructors and educators to expect a negative effect on student learning experience and performance.

In addition to the above challenges, educators also need to prepare students with the knowledge and literacy skills they will need to succeed in work, life, and citizenship in the information age, e.g., the ability to create, evaluate, and effectively utilise information, media, and technology. One way to help students acquire those 21st-century skills is the assimilation of experiential knowledge through the use of social networking sites (SNS) (e.g., Facebook) and virtual learning environments (VLE) (e.g., Moodle). The latest developments of Internet technologies have led universities to invest considerable resources in e-learning systems that not only support teaching and learning but also enhance student performance (Deng & Tavares, 2013; Patrão & de Figueiredo, 2011). Moodle, which is commonly used in 234 countries around the world today, is a VLE that contains several features for distributing courses over the Internet and supports online collaboration among distributed users¹. The most indicative potential of this platform in education paves a pathway to (Deng & Tavares, 2013; Petrovic et al., 2004): a) facilitate educator-to-student communication, b) track student progress and securely share course content online, c) support and improve learning and teaching processes, d) provide better quality in learner-centred teaching, and e) use blended or fully online course delivery methods, which are tailored to the students' needs and demands.

Of all social networking site users, 79% of adult Internet users have an account and extensively use Facebook (Pew Research Internet Project, 2016). Particularly in Greece, Facebook use is relatively high; however, persistent differences among gender, racial, and socioeconomic lines in technology adoption and use, have been noted to create various disparities in using web-based transactions (Giota & Kleftaras, 2014). Nonetheless, Facebook remains the most popular SNS with a huge margin in front of Twitter, Instagram, or LinkedIn (Błachnio et al., 2013; Doleck & Lajoie, 2017). Previous studies (Kirschner & Karpinski, 2010;

¹ <https://moodle.net/stats/>

Junco, 2015; Tess, 2013) have suggested that Facebook can have a significant effect on student performance. It is more user-friendly compared to educationally-approved learning management systems such as Blackboard, has a vast number of users worldwide, and contains many features available to both students and instructors that can potentially improve the teaching and learning processes (Öztürk, 2013). For instance, its provision of synchronous (video calls, chat, notifications) and asynchronous (voice/text messages, posts) communication tools allows users to interact with their peers, participate in discussions, provide peer feedback, watch educational videos, reflect on the status of their personal learning goals and outcomes, share information, and ask questions without being bounded by time and location constraints. These interactions are fundamental for creating a sense of collaborative learning community and developing an identity (Brandtzæg et al., 2010), as they help overcome problems such as the feeling of student isolation or the fear of public speaking (Chiroma, 2016). With that in mind, instructional designers who develop a pedagogical approach that utilises this platform could likely ensure 21st-century readiness for every student in regard to information, media, and technology skills.

Aiming to use computer-mediated communication (CMC) as a means to improve the learning experience, Garrison et al. (2000) developed the theoretical model of the Community of Inquiry (CoI). CoI model is grounded in the theory developed by Lipman (2003), which combines the concept of learning community with that of a social activity, and allows instructional researchers to analyse user interactions in a digital environment. More specifically, this model can provide detailed descriptions of user interactions in collaborative and constructivist-oriented learning processes via online environments. CoI aims at designing and analysing educational activities in online environments that focus on the development of a community of inquiry. It includes three interdependent elements: i) the content, ideas, arguments,

or opinions of members (cognitive presence), ii) the interaction among members (social presence), and iii) the users' roles and teaching initiatives from the instructor (teaching presence) to conduct with his/her trainee users. The meaningful knowledge acquisition is delivered within a collaborative climate among all members. More specifically, several studies (Garrison et al., 2010; Shea & Bidjerano, 2011) have suggested the following scheme for utilising the CoI model: Teaching presence (TP) is a significant determinate of student satisfaction, sense of community, and perceived learning; it is defined as *“the design, facilitation, and direction of cognitive and social processes to support meaningful and educational worthwhile learning”* (Anderson et al., 2001, p.5). Social presence (SP) represents the interactive participation of all members and is valued as a means to share ideas, express views, and collaborate; it *“facilitates achieving cognitive objectives by instigating, sustaining, and supporting critical thinking in a community of learners”* (Garrison & Anderson, 2003, p. 67), and is the basis of collaborative learning (Akyol et al., 2009). Cognitive presence (CP) is regarded as the core of the constructivist learning process and it is focused on the outcome of the investigation through an ongoing argument that affects the entire community.

The CoI model is regarded as one of the most effective instructional frameworks that can enhance users' collaboration while reducing the instructional-organisational complexity during their first-time entry in a SNS or VLE. Up to date, HE students can achieve better learning outcomes not only by utilising technologically advanced environments, but also by implementing learning scenarios in well-designed instructional settings. The integration of innovative digital environments in HE can provide purposeful aspects to the teaching and learning processes that follow constructivist-oriented instructional frameworks. Recent papers on the effectiveness of learning in online environments, such as Facebook (Kucuk & Sahin, 2013) and Moodle (Parker,

2016), have used the CoI model presence indicators as components of a theoretical framework for the development of an organisational-instructional design framework with positive learning outcomes.

Despite the fact that the CoI model has been used in several online learning processes (Garrison et al., 2010; Joo et al., 2011), the verification, development, and acceptance of this model when used to analyse users' interaction with Moodle and Facebook remain unknown. These issues are fundamental for students' participation and engagement because they can positively influence their acquisition of motor and verbal skills, as well as improve retention and transfer of these skills beyond the initial learning situation. Although several institutions have delivered blended and online training through many different methods, which include the use of Moodle and Facebook (Petrovic et al., 2016), the added value and effectiveness of these methods on the learning experience has yet to be determined.

While there is little evidence on the consequences of using mainstream VLEs and SNS such as Facebook in HE, particularly in regard to student performance in instructional media design courses, some studies (Junco, 2015; Mazman & Usluel, 2011; Öztürk, 2013; Yu et al., 2010) have reported a relationship between Facebook use, socio-cognitive background, engagement, and academic performance. Also, according to Du et al. (2017), additional research is required to investigate more extensively the mediating relationship of interactivity and communication of web-based media transactions in online learning among student groups. Educators and scholars, such as Mazman et al. (2011), McCarthy (2010), and Junco (2013) have identified the need to conduct a thorough research of learners' socio-cognitive background differences, specifically in regard to gender, in this mediating relationship, by using web-based transactions. Accordingly, learning practitioners would be benefitted by qualitative studies

investigating: a) online learners' perspectives about what online collaboration means to them in their specific learning contexts, such as instructional media design, and b) if gender can play a significant role in student engagement and academic performance when using VLEs and SNS as collaborative learning environments. Based on that, the present study utilises the CoI model to identify if the use of Moodle or Facebook on blended courses in HE settings has an impact on the student learning experience. It also tries to determine whether using Facebook as a platform for various learning activities (e.g., project development, peer communication, dissemination of educational content, etc.) is more effective than Moodle. The overarching research questions are the following:

RQ1: Is there any relationship between the students' gender and their learning experience with the CoI model when Moodle or Facebook are used as collaborative learning environments?

RQ2: Does the adoption of Moodle or Facebook as a collaborative learning environment affect the learning experience according to the CoI model?

During the past few years, there has been an increasing interest in the impact of the CoI model on the learning experience via Facebook (Kucuk & Sahin, 2013; Lin et al., 2016) or Moodle (Mouzouri, 2016; Parker, 2016). Therefore, the purpose of this study is to evaluate the students' learning experience when the CoI model is used to facilitate interpersonal and interactive relationships among users via Moodle or Facebook. With that in mind, specific activities were developed to ascertain the effectiveness of Moodle or Facebook in instructional media design courses; the CoI model's presence indicators served as components of the instructional model.

Findings of this study will provide educators with empirical evidence and valuable

information on how the CoI model's presence indicators are affected when using Facebook or Moodle in the learning process. Additionally, the results can give insight into the appropriateness and applicability of the CoI framework in instructional media design courses.

Background

The CoI model develops a view of teaching within a constructive–collaborative framework, which encircles the close relationship between the personal construction of meaning and society's influence on the configuration of the educational relationship (Garrison et al., 2000). The interaction between individual meaning and socially constructed knowledge is considered a crucial parameter for knowledge acquisition inside a community of inquiry (Garrison et al., 2000). For instance, Buraphadeja and Dawson (2008) have suggested three models for the analysis of users' interactions in order to describe educational processes, by utilising online digital environments: i) the model of content analysis of Newman, Webb, and Cochrane; ii) the model of Interaction Analysis of Gunawardena, et al.; and iii) the CoI model of Garrison, Anderson, and Archer. The same authors consider the CoI model as the most appropriate for analysing users' interactions for the following reasons: a) the relevant literature has recognised the contribution of the CoI model, in terms of creating a valid organisational-pedagogical framework for the investigation of user interactions in communities (Arbaugh et al., 2008); b) previous models have been focused only on the analysis of users' endogenous interactions, but not on how students and instructors have tried to acquire and share the knowledge respectively in well-organized instructional contexts, contrary to Garrison's et al. (2000) model; and c) previous models did not amplify teaching and learning activities based on theoretical underpinnings of contemporary learning theories for creating deep and meaningful (collaborative-constructivist) learning experiences (Pellas & Kazanidis, 2014). Furthermore,

Cooper and Scriven (2017) have found that the theoretical adequacy of the CoI model can be answered by reference to Sterman's (1991) requirements of a good mode, which state that assessment should be based upon utility with the purpose of supporting the convergence of the learning experience of on-campus and on-line students.

In recent years, there have been several studies about the use of the CoI model in SNS and VLE. More specifically, its usage for analysing educational activities in e-learning environments focuses on the development of a community of inquiry. As mentioned earlier, CoI is based on three interrelated presence indicators (Garrison & Anderson, 2003): CP (content of messages, ideas, arguments and opinions or statements), SP (interaction between members) and TP (sharing roles and initiatives emanating from other peers in collaborative settings and from the instructor). In regard to SNS, Kucuk and Sahin (2013) examined the development of students' academic success, satisfaction, SP, CP, and TP in face-to-face and blended learning environments assisted by Facebook use. The results of their research showed that instructional design based on the CoI framework had played an important role in deep and meaningful learning. Findings from Villiers's and Pretorius's (2013) evaluation of a collaborative learning environment on a Facebook forum indicated that inter-personal relationships were fostered between distance learners, and academic value arose from peer learning and social negotiation through the use of Facebook. In a similar case study, Lin et al. (2015) found that, in relation to the three elements of CoI, TP is critical to a successful student learning experience when Facebook is adopted as a learning environment. Annamalai et al. (2016), who also investigated the experience of students with an online narrative platform based on Facebook, concluded that CoI's SP was evident in the students' interactions with the learning environment.

With respect to VLE, Rubin et al. (2011) provided evidence that the technology used for teaching did affect the learning outcomes and that faculty use of teaching tools, which supported communication, feedback, and integrated course content had a significant effect on student satisfaction, TP, and CP. More specifically, faculty that used more tools ended up having more satisfied students who engaged with the concepts and felt that the teacher was more supportive of their learning. The fact that students were satisfied with the teaching tools positively influenced their satisfaction with the course, as well. Moreira et al. (2013) pointed out the relevance of the CoI model presence indicators and their potential to promote competence in terms of active learning, initiative or learning autonomy. Taghizadeh and Vaezi (2014), who investigated the extent to which SP existed in virtual learning environments, argued that the Open Communication was the SP factor that appeared more frequently in virtual classes, with phatic expressions, quoting messages in conversations, and expressing agreement being its most common indicators. The research findings of Garth-James's and Hollis's (2014) study on CoI's SP principles revealed that the interesting nature of adapting to the CoI (as defined by technology-based course design and faculty learning experience) and the insights of this instructional model could change the mostly negative views educators have about distance learning. However, the lack of required communication and interaction in a hybrid virtual format indicate that there are still opportunities for improvement regarding TP. Finally, Makri et al.'s approach (2015) provides evidence of the educational potential of employing elements of the CoI framework as tools both for designing and evaluating the contents, structure, and activities of an e-learning course.

The CoI model is the most well-documented model for instructional support in online and blended instructional settings using either VLEs or 3D virtual worlds (Pellas & Kazanidis, 2014).

Although its educational potential though, it has received criticism for its limitations according to a substantial body of literature (Burgess et al., 2010; Cooper & Scriven 2017; Öztürk, 2013). Firstly, CoI has been questioned about its theoretical adequacy in regard to learning outcomes based on different disciplines, as well as about whether the relationships between its constituent components among users' interactions (instructors and students) in blended and online instructional settings have merit in learning. Secondly, it is debatable whether the CoI model instrument can give clearly picture on the learning procedure by remarking only quantitative data results. For example, this model is not focused on students' socio-cognitive background, gender and previous knowledge that need to be extended and included in learning presence, as it assumes that all students have the same cognitive background. Thirdly, there are doubts about CoI's suitability as an instructional framework to give insights in educational research and practice. This means that the contextual framework of CoI model is composed of presence indicators are identified students' interactions and relationships in a digital-oriented learning community may not be enough on their own terms to understand the learning gain.

To summarise, the CoI model seems to foster the construction of a common knowledge for different educational disciplines when Facebook (Lin et al., 2016) or Moodle (Mouzouri, 2016) are used in the learning process, with SP and TP being the most important indicators for developing interpersonal and interactive relationships among users.

Method

Research design

The present study used a nonequivalent control group design with pretest and posttest measures, which has been described as "*one of the most commonly used quasi-experimental designs in educational research*" (p. 283, Cohen et al., 2007). The nonequivalent control group design with pretest and posttest is represented as:

Experimental Group:	NR	O1	X	O2
Control Group	NR	O1		O2

In this design, NR represents non-randomisation, O1 represents pretests (i.e., questionnaires or tests that participants are required to complete prior to the implementation of a treatment), X represents the implemented treatment (i.e., the Facebook adoption), and O2 represents posttests (Cohen et al., 2007). While both the control and the experimental (aka treatment / intervention) group complete a pretest and posttest, the experimental group is the only group that receives the research treatment. Although a comparison group should be as alike as possible in as many dimensions as possible, the assignment of participants in the two groups was deliberately not randomised. This decision was deemed necessary by the authors in order to avoid bias in the study results (Slavin, 2007).

This study has followed a mixed-method research approach (Jick 1979), in which quantitative and qualitative data were combined to a) bring the strengths of research forms in favour of validating results from a case study; b) enrich the study results in ways that one form of data does not allow; and c) consolidate different yet complementary data that otherwise may be neglected or lacked by a single method. Using quantitative data from a CoI model-focused survey, this study intended to measure the CoI model's views of the learning experience as a function of the relationship between the following three elements: SP, TP, and CP. A series of focus group discussions were conducted so as to gather qualitative data about trainee users': a) overall experience and evaluation of all sub-units of the course; b) learning outcomes and achievements; and c) abilities and difficulties when studying collaboratively with their peers.

Participants

Ninety-seven ($n=97$) students aged between 19 and 23 ($M=20.27$, $SD=31.49$) volunteered to participate in the experiment, which compared their learning experience when using Moodle and Facebook for learning. Although most the participants were male (77 males and 20 females), the sample was regarded as acceptable, since this gender ratio is typical in Greek ICT-focused higher education departments and a balanced sample would be either too small or unattainable. The students were split into two groups according to their answers on the pretest, in order for the two groups to be considered similar. The two groups differed on the tool that was adopted as their main learning and communication platform: Moodle for the control group (CG), which consisted of 47 participants (males, $n=37$, females, $n=10$), and Facebook for the experimental group (EG), which contained 50 participants (males, $n=40$, females, $n=10$).

Treatment

Following Brooks et al.'s recommendations (2015), 96 participants were split into two groups based on a pretest questionnaire of demographics information questions, which was shared with them before the start of the treatment. Instead of relying on existing state- or national-level estimates to provide the comparison data, this study collected primary data for both the intervention and comparison groups from the same local community of Eastern Macedonia and Thrace Institute of Technology (TEI EMT). The reasoning behind this decision was to reduce the risk of selection bias, as drawing primary data from the same local community can help minimise potential differences between both groups, thus improving the overall quality and rigour of the quasi-experiment comparison group design. Since this study has a non-randomised sample, there were key concerns about methods of conscious control of implicit attitudes between male and female participants. For example, calling attention to gender may

increase unconscious or implicit bias, even if the purpose of making gender salient was to get participants to avoid that gender influence (gender discrimination). Despite the gender-imbalanced sample, this study complied with the internal rule of the institutional operation that requires a ratio of 1 female to 5 males in all research projects (20%). Finally, to avoid having groups mainly comprised of either high or low achievers, which could potentially limit the diversity of the participants' opinions, the instructors ensured heterogeneity by including in each group participants who scored across all ranges in the pretest.

The posttest was based on the CoI model questionnaire (Arbaugh et al., 2008). The latter was translated into Greek and given to all students at the end of the experiment to evaluate their learning experience anonymously.

The experiment lasted for six (6) weeks. All participants were undergraduate students enrolled in the course "*Instructional and Learning Theories*" offered by the Informatics Department of TEI EMT. The objectives of this course were to help students develop a basic understanding of key learning theories, engage critically with relevant concepts, principles, theories, and international best practices, and apply new ideas and approaches in practice using specific educational tools while working in groups of 4-5 people. Communication among group members and between students and their instructor was facilitated through Moodle for the CG and Facebook for the EG, respectively.

One week before conducting the experiment (Week 0), all participants completed a demographic questionnaire. Students were then divided into the control and the experimental group by their instructor, who tried to ensure that the participants' characteristics (i.e., age, gender, familiarity with ICT) were balanced equally among the two groups. The analysis of the questionnaire results showed that most CG and EG students used Social Network Services (SNS)

daily (85.5% and 86.4%, respectively), visited the institutional VLE a few times per week or more (77.4% and 72.7%, respectively), and owned a smartphone with Internet access and video playback capabilities (96.8% and 97.0%). From these results, one can safely export that students in both groups are capable of using online technologies such as VLE and SNS on their smartphones. Thence, the course material should be easily accessible to almost all enrolled students.

One problem that was expected in more frequency regarded the students' reservations on privacy on Facebook. In the sample of 97 students, only two of them were reluctant to use Facebook for the course and student inter-communication. The first one did not have a Facebook account and the second one had some concerns about privacy. As an answer to their reservations, both of them were allowed to make a new account specifically for this experiment, without publishing any personal data, such as photos. However, only the first student agreed to this compromise and joined the experimental group, while the second one joined the control group instead.

The treatment implementation began the following week (Week 1). Although participants from both groups shared the same course aims and objectives, the EG's adopted platform for communication and file sharing was Facebook, while the CG was Moodle. During the 6-week period, all students had to create an educational video, a presentation, an educational comic, and a blog for a predefined section of their textbook, along with an additional report on the learning theories (e.g., Constructionism, Situated Learning, Activity theory, etc.) they would apply to their projects. During the in-class lessons, students were encouraged to use their phones to send/post messages, ask/answer questions, and add lesson-related content via the Facebook timeline (EG) and Moodle's chat rooms (CG). The instructor, who used both platforms to upload

learning material and post news or coursework announcements, monitored the students' online activity so that he could intervene when needed.

To develop an instructional design framework that will help address the impact of platforms such as Facebook or Moodle on the student learning experience, this study used the CoI presence indicators as follows: In order to support SP, students were asked to create their virtual learning grids by utilising visual artifacts either on Moodle or Facebook for the exchange of ideas, comments, or questions. Additionally, interaction among students was encouraged through team-based assignments, which required cooperation and communication.

CP was promoted through a series of engaging course activities and challenging projects that demanded critical thinking and collaboration. After receiving face-to-face instructions by their instructor, students were asked to create educational content in various forms (e.g., presentations, screencasts, educational videos, animation, comics, etc.) and disseminate it through a blog.

To establish TP, which serves to forge authentic teacher-student relationships, the instructor delivered in-person lab lessons on a fortnightly basis, constantly communicated with the students via Facebook or Moodle's messaging services, and posted assignments, project guidelines, and useful links.

For the duration of the experiment, students had to exchange ideas, organise their work, comment on topics discussed in the class, document their arguments, give peer feedback, and communicate with their peers and instructor using their group's adopted platform. Finally, at the end of Week 6, all participants completed a posttest questionnaire regarding the three presences of the CoI model. Focus groups discussions were also conducted, in order to apply a mixed method approach.

Instrument and data collection tool

Previous research has established the validity and reliability of CoI surveys in various languages (Arbaugh et al., 2008; Swan et al., 2008; Diaz et al., 2010; Yu & Richardson, 2015), with the framework being operationalised as a multi-institutionally validated survey in 2007. To establish a reliable measurement for CoI's three presence indicators, the present study employed a revised version of Arbaugh et al.'s (2008) CoI survey instrument, which was translated into Greek and modified to better suit the experiment's research questions about Facebook and Moodle. The survey instrument was administered to students in class using an online survey tool and consisted of 34 items split into three distinct parts: 13 items for teaching presence, 9 items for social presence, and 12 items for cognitive presence. All items were measured on a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). Statistical analyses of the data were performed using SPSS (ver. 24).

To test the reliability of each factorial structure for the three parts of the instrument (i.e., to ensure that the various items measuring the different constructs deliver consistent scores), Cronbach's Alpha (α) index was used to calculate the rates of presence indicators. The internal consistency reliability of the 34 items was high, with Cronbach's Alpha (α) being 0.81 for teaching presence, 0.769 for social presence, 0.748 for cognitive presence, and 0.854 for the overall learning experience (Blunch, 2008).

Results

Socio-demographic characteristics of participants

The first intention was to describe the socio-demographic results from the students' e-profiles, as Table 1 summarises.

Table 1. Frequency and percentage of the demographic characteristics

		Control Group (CG)		Experimental Group (EG)		Total	
		N	%	N	%	N	%
Gender	Male	37	78.7%	40	80.0%	77	79.3%
	Female	10	21.3%	10	20.0%	20	20.6%
Total		47	100.0%	50	100.0%	97	100.0%
Facebook Usage	Never	1	2.1%	0	0.0%	1	1.0%
	Rarely	2	4.3%	2	4.0%	4	4.1%
	Few times per month	2	4.3%	1	2.0%	3	3.1%
	Few times per week	4	8.5%	5	10.0%	9	9.3%
	Daily	38	80.9%	42	84.0%	80	82.5%
Total		47	100.0%	50	100.0%	97	100.0%
Moodle usage	Never	1	2.1%	3	6.0%	4	4.1%
	Rarely	3	6.4%	0	0.0%	3	3.1%
	Few times per month	8	17.0%	12	24.0%	20	20.6%
	Few times per week	31	66.0%	31	62.0%	62	69.9%
	Daily	4	8.5%	4	8.0%	8	8.2%
Total		47	100.0%	50	100.0%	97	100.0%
Smartphone with Internet access	No	2	4.3%	1	2.0%	3	3.1%
	Yes	45	95.7%	49	98.0%	94	96.9%
Total		47	100.0%	50	100.0%	128	100.0%

Data analysis

The three CoI model presence indicators were used as dependent variables, whereas the two groups were used as independent variables. The overall reliability of the three-factorial test was calculated using Cronbach's Alpha, with values greater than the recommended 0.7, indicating an acceptable level of reliability (Blunch, 2008).

Table 2 shows that the reliability analysis of Cronbach's Alpha has a satisfying internal consistency for the overall learning experience for both the control ($\alpha=.772$) and the experimental group ($\alpha=.716$).

Table 2: Cronbach's Alpha for Each Element of the Community of Inquiry (CoI)

CoI model presence indicators	N	Cronbach's Alpha for combined groups	Cronbach's Alpha for CG students' answers (Moodle)	Cronbach's Alpha of EG students' answers (Facebook)
Overall	34	.854	.772	.716
Teaching presence	13	.810	.840	.761
Social presence	9	.769	.781	.729
Cognitive presence	12	.748	.780	.719

*Cronbach's Alpha requires a reliability of .70 or higher to obtain a sustainable sample N, the number of items.

To determine whether females had better CoI factors compared to their male counterparts, a t-test was conducted upon both groups combined. However, no significant differences were found related to gender, neither in the overall learning experience [$t(95) = -.424$, $p > .05$] nor in any of the three CoI presences [TP: $t(95) = -.661$, $p > .05$; SP: $t(95) = -.179$, $p > .05$; CP: $t(95) = -.841$, $p > .05$].

Independent-samples t-tests at the level of significance ($p < .05$) were also performed on the CG. These were preceded by Levene's homogeneity test, according to which the F value was equal to 0.006 ($p = .941 > .05$) for overall learning experience, .502 ($p = .482 > .05$) for TP .252 ($p = .618 > .05$) for SP and .019 ($p = .890 > .05$) for CP. These results indicated that the homogeneity test had not achieved statistical significance, and therefore t-test could be applied. As previously, the results from the t-tests did not indicate any statistically significant differences between male and female students in their overall learning experience [$t(45) = 1.350$, $p > .05$] or on any of the CoI presence indicators [TP: $t(45) = .918$, $p > .05$; SP: $t(45) = 1.157$, $p > .05$; CP: $t(45) = .663$, $p > .05$] (Table 3).

Table 3. CoI presence indicators of the independent-samples t-tests in classes using Moodle

CoI model presence indicators	Control group	N	Mean	SD	t	df.	Sig.
Overall	Male	37	3.518	.687	1.350	.45	.184
	Female	10	3.186	.703			
Teaching presence	Male	37	3.378	.991	.918	.45	.364
	Female	10	3.066	.782			
Social presence	Male	37	3.554	.666	1.157	.45	.254
	Female	10	3.283	.613			
Cognitive presence	Male	37	3.418	.808	.663	.45	.511
	Female	10	3.225	.869			

* p<.05

N, the number of items; M, Mean; SD, Standard Deviation.

Table 4 shows the effect the Facebook intervention had upon the overall learning experience and each CoI presence indicator between the EG's male and female students. Before employing the t-test, Levene's homogeneity test was conducted. The result showed the F value was equal to 1.018 ($p=.318 > .05$) for the overall learning experience, .185 ($p=.669 > .05$) for TP, .087 ($p=.769 > .05$) for SP and 1.081 ($p=.304 > .05$) for CP. Since the homogeneity test had not achieved statistical significance, t-test could be applied. Independent samples of the t-test indicated a statistically significant difference in the overall learning experience [$t(48)=-2.499$, $p<.05$], the TP [$t(48)=-2.289$, $p<.05$], and the CP [$t(48)=-2.017$, $p<.05$] for female students. However, there was no significant difference found in the SP indicator [$t(48)=-1.885$, $p>.05$]. This suggests that females have a better learning experience, and higher teaching and cognitive presence when using Facebook as their collaborative learning platform compared to their male peers .

Table 4. CoI presence indicators of the independent-samples t-tests in classes using Facebook

CoI model presence indicators	Experimental group	N	Mean	SD	t	df.	Sig.
Overall	Male	40	3.518	.559	-2.499	.48	.016*
	Female	10	3.986	.366			
Teaching presence	Male	40	3.491	.784	-2.289	.48	.027*
	Female	10	4.100	.588			
Social presence	Male	40	3.670	.499	-1.885	.48	.066
	Female	10	3.999	.464			
Cognitive presence	Male	40	3.368	.765	-2.017	.48	.049*
	Female	10	3.891	.570			

* p<.05

N, the number of items; M, Mean; SD, Standard Deviation.

An independent-samples t-test at the level of significance ($p < .05$) was performed on each group to identify possible significant differences in the three presences and the learning experience between them. Similar to the aforementioned results, before employing t-test Levene's homogeneity test was conducted; in all cases p was greater than .05 and therefore t-test could be applied. The t-test indicated statistically significant difference for the SP factor ($p = 0.046 < 0.05$) between CG and EG (Table 5).

Table 5. Independent-samples t-tests scores between groups' mean scores.

CoI model presence indicators	Group	N	Mean	SD	t	df	Sig.
Overall	CG	47	3.447	.697	1.288	95	.201
	EG	50	3.612	.556			
Teaching presence	CG	47	3.312	.951	-1.707	95	.091
	EG	50	3.613	.783			
Social presence	CG	47	3.496	.658	-2.021	95	.046*
	EG	50	3.736	.506			
Cognitive presence	CG	47	3.377	.815	-.600	95	.550
	EG	50	3.473	.755			

* p<.05

N, the number of items; M, Mean; SD, Standard Deviation.

To get extra insight into the survey results, qualitative research was conducted in the form of two focus groups with a small number of students, featuring questions on peer and student-instructor communication, group collaboration, and usability of the learning platform.

Most the 11 CG students who participated in the first focus group seemed to be generally satisfied with their Moodle experience. Since the latter was the institutional VLE, students were accustomed to it and found it relatively easy to use, particularly as a resource for accessing, organising, and uploading educational materials and assignments. Nevertheless, they appeared reserved about its functionality as a tool for communication and collaboration. Even though the instructor encouraged CG students to use Moodle as their main communication channel, they did not adapt to this. Their preferred choices for exchanging ideas, collaborating, and interacting with their peers were communication in person and via e-mails or instant messaging tools such as Messenger or WhatsUp; Moodle's forums were rarely used, and personal messaging on Moodle was never used. In regard to communicating with their instructor, the focus group's participants mentioned that they often read his notifications late, because they did not log in to the platform daily. As a result, they would rather be notified via email, the institutional web site, or through Facebook. These findings highlight that CG students predominantly used Moodle's non-interactive functions to extract information from the course site and upload coursework to a virtual pigeonhole, but preferred other tools for intercommunication and group collaboration. Finally, all participants attested to the instructor's success as a facilitator both in the classroom and online; his teaching presence provided solid direction, but also allowed students to create new knowledge through their interaction with him. Below are some responses from the first focus group's participants:

- *“Using Moodle as a tool for online assessment and feedback made my life much easier when I wanted to look at previous feedback at a later stage.”*
- *“The use of the Moodle forums allowed me to not only share and gain knowledge but also to reach a deeper understanding of the discussed subject. However, it was only the same few people who were active in the forums.”*
- *“I never used Moodle’s forum or personal messaging, as I found it too much of a hassle. Everybody had Messenger installed on their phones, so I used that to communicate instantly with my classmates.”*

The second focus group comprised of 12 students from the EG. Respondents believed that the selection of Facebook as a learning platform was a good choice, since all of them were already familiar with it and the use of Messenger on their mobile phones allowed for instant communication with their peers, thus fostering a sense of community between them, increasing their engagement with the learning material, and making their collaborative efforts more effective. Six participants indicated that they had created Facebook chat groups, while all of them used the course’s Facebook group page as a kind of forum, where they posted course-related material and exchanged ideas and suggestions. Although all students agreed that they were happy with their instructor and peers uploading course-related files and links on Facebook, two of them mentioned that the amount of those posts was overwhelming. For that reason, they would prefer to replace Facebook with Google Drive, Dropbox, or Moodle for file exchange in the future. Some responses from the second focus group’s participants are as follows:

- *“The use of Facebook as a communication tool improved team working. I could see when and who had read my messages, which was a positive thing.”*

- *“Reading and replying to my classmates’ Facebook posts allowed me to share and gain knowledge.”*
- *“By the end of the course, there were so many coursework-related file links posted on Facebook, that it was hard to find what I was looking for. I had to scroll for ages to find posts that were only 3 weeks old!”*

Discussion and conclusion

The objective of this study was to compare the learning experience between two student groups that used Moodle (CG) and Facebook (EG) as their respective learning platforms, in regards of the three CoI presence indicators, i.e., cognitive presence (CP), teaching presence (TP), and social presence (SP). For that purpose, ninety-seven ($n=97$) instructional media design students carried out several learning activities on the design and development of learning environments. Although classes were taught by the same instructor and were designed to deliver the same learning content to all participants, findings from quantitative and qualitative analyses indicated that students who used Facebook had a better social presence than Moodle users, while the teaching and cognitive presence was similar for both groups. Another point worth noting is that female participants from the experimental group had better teaching presence, cognitive presence, and overall learning experience than their male peers.

Despite the controversial results by using either Facebook or Moodle, the CoI model seemed to have assisted in the construction of knowledge resulting from teamwork among active participants in learning communities, in which: a) they interact with other peers and their instructor (CP); b) they implement constructivist-oriented scenarios that reflect as an educational plan to an online environment (TP); and c) they try to enhance their socio-cognitive skills in a

collaborative climate that can be implemented through online or blended instructional formats (SP).

The CoI framework is an instructional model able to support both the practice on online instruction and online learning research, which combines the constructs of teaching, cognitive, and social presence in order to create a meaningful learning experience for students through collaboration and discourse. This model has been well-documented by a large body of literature (Arbaugh et al., 2008; Cleveland–Innes et al., 2007) due to its contribution to the creation of a valid organisational-pedagogical framework for the investigation of user interactions in online communities via digital environments. According to Joo (2011), social, organisational, and cultural factors of the learning context using the CoI model are the most important elements for an effective use of VLEs. The present study suggests that while Facebook is not a traditional VLE, it has the potential to support the teaching and learning processes in instructional media design courses. Findings of this study are also consistent with Akyol and Garrison (2010) who have indicated that activities in online learning environments are not successful unless there is a proper instructional framework, which in turn requires familiarity with this technology. Even though the data came from a relatively small sample size and only two classes, and might, therefore, be deemed insufficient for drawing generalizable conclusions about the CoI model, the findings are consistent with previous studies (Annamalai et al. 2016; de Villiers & Pretorius, 2013; Kucuk & Sahin, 2013) and suggest that Facebook offered flexibility with no loss of learning experience according to the CoI indicators. By using Facebook as both a communication and a learning tool, students have increased their engagement in the virtual community and improved their learning satisfaction. This seems to happen because students are keen on using Facebook as a communication platform. As they use it almost daily for their personal needs, they

were happy to also use it for their course needs. In addition, on Facebook students received instant notifications for course assignments/news, and they exploited the comments mechanism on their Facebook walls to exchange ideas and comment upon them, which created a sense of community and camaraderie among them and increased their engagement with the course.

On the other hand, students used Moodle forums only in exceptional circumstances, as they considered them a more formal type of communication compared to the Facebook group that was created. Consequently, it is safe to conclude that the adoption of Facebook as a learning platform can enhance the overall student experience, promote collaboration, strengthen relationships among students, and potentially improve learning performance.

In conclusion, the present study has contributed to the instructional design education by providing empirical evidence of the CoI model's potential to support teaching and learning. The results of this study offer new insight to researchers in regard to what effect the use of CoI in SNS and VLE may have on the students' learning experience.

Limitations and directions for future research

This study has the following limitations:

- a) Although two to three months are required for more concrete scientific findings, the duration of this study was limited to six weeks;
- b) There was a gender imbalance in the used sample (predominantly male), which limits the external validity of the study. Furthermore, the sample was taken from one institution only. Therefore, the range of some of the demographic data (e.g., location or professional

occupation of the participants) is not representative of the general population, which is a fact that limits generalisability.

Future experiments may use additional discussion forum tools, which would allow students to post individual questions and participate in discussions with their peers and instructors, thus developing critical thinking, becoming more actively engaged and evaluating the effectiveness of the CoI model.

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