

ORIGINAL RESEARCH ARTICLE

The Community of Inquiry framework as learning design model: a case study in postgraduate online education

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Interaction within online educational environments has long been advocated as conducive to learning, whether interaction between the learner and their teacher, the learner and online resources or the learner and their peers. The relationship among these three types of interaction is also receiving increasing attention, with the Community of Inquiry (CoI) framework providing a method of interpreting this relationship in terms of the interplay of teaching presence, cognitive presence and social presence. This case study investigates the use of the CoI framework as a learning design model, showing how it was used to address specific issues in a postgraduate online module. Specifically, the framework informed decisions to strongly link together interaction with the video content, activity on discussion boards and release of new learning materials. Using discussion board posts and video analytics as the primary evidence of learner engagement, the findings show how learner activity significantly increased in both ‘social’ contexts and ‘cognitive’ contexts. More importantly, analysis also revealed strong correlations among participation in discussions, video viewing and module completion. The study suggests that the CoI framework is a robust model for learning design in online environments.

Keywords: online learning; postgraduate; academic professional development; interactive video; conditional release

Introduction

The importance of learner–learner and learner–teacher interaction in online education is well documented (Cherney, Fetherston, and Johnsen 2018; Hrastinski 2008; Salmon 2004). In particular, the formation and cultivation of a community is often explored in work around interactions between learners (Zydney, deNoyelles, and Kyeong-Ju Seo 2012). Interactivity in learning objects has also emerged as a key contributor to engagement and learning gain (Delen, Liew, and Willson 2014). But more recently the community-building impact of all three of these interactions – with peers, with teachers and with learning materials – has received more attention (Costley, Hughes, and Lange 2017; Luo, Zhang, and Qi 2017). This ties directly into core elements of the Community of Inquiry (CoI) framework, namely, social presence, teaching presence and cognitive presence (Garrison, Anderson, and Archer 2010). While CoI is often seen as a framework through which to *investigate* online learning

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events or contexts, the current study argues that it can also be used as a learning design model to *develop* online learning experiences. Examining how CoI influenced changes to videos, to discussions with peers and tutors, and to the interplay between the two in an online postgraduate module, this study provides quantitative evidence that CoI learning design can positively affect learner engagement.

Background

Aimed at staff who are new to teaching, Foundations of Learning and Teaching in Higher Education is a well-established postgraduate module at Durham University, successful completion of which leads to Associate Fellowship of Advance Higher Education (HE), the UK's professional recognition body for teaching in higher education. The module content, discussions and assessment engage participants in theory-informed reflection on their teaching practice, culminating in a portfolio addressing a number of aspects of the UK Professional Standards Framework, upon which Advance HE fellowship is based. In the 2016–2017 academic year, it was decided that this module would be expanded to include a fully online delivery as well as the face-to-face version to give staff who taught on a UK-wide programme validated by Durham University to have the opportunity for development and to achieve Associate Fellow status.

For this new online version, the module leaders and a tutor created video resources, mostly recording their voices over presentations that had been designed for the face-to-face sessions. The videos were captioned and added to a copy of the face-to-face virtual learning environment (VLE) site, where the other resources were rearranged for online delivery. The face-to-face timetable was retained, with each session lasting 1 week. Participants were assigned to two tutor groups at random for the purposes of interaction. Within the resources for each session was a textual prompt to contribute to the group discussion board and to share a draft of the assignment section associated with the session on the group blog. Once all of the sessions were complete, participants had nearly 5 months to compile and submit their summative assessments. Out of a total of 45 participants, 19 submitted summatives, eight did not submit, five deferred, four chose to audit and nine withdrew.

This first delivery of the module in a fully online format was evaluated by means of a module evaluation questionnaire, interviews with participants, data collected from the VLE and tutor observation. CoI was used as a framework against which to test the findings. The issues that emerged as a result of the evaluation are common in online education, as the literature review will show. Briefly, however, the three main issues were as follows.

Participants averaged less than one blog or discussion board post per person per session, although everyone was expected to contribute at least once to the each weekly. This was considered to be a lack of social presence.

Participant feedback in module evaluation questionnaires and interviews strongly indicated that the minimalist approach to tutor discussion board participation could have been one cause of the paucity of interaction. This seemed to demonstrate a lack of teaching presence.

The module evaluation questionnaires and interviews revealed that many participants felt that the videos were too long and unengaging. Viewing analytics for all participants showed that, on average, those who started watching a video only watched 50%, and even those who completed the module viewed an average of just 59% of videos they began watching. This suggested a lack of cognitive presence.

It is the intention of this study to show how common issues in online learning like these (often culminating in just such failures to enable a true CoI) can be addressed by employing CoI as a learning design model.

Literature review

Conceptual framework

Developed in the context of asynchronous online discussions in higher education, the CoI framework posits that the three key presences that sustain such a community – teaching presence, social presence and cognitive presence – are interrelated, working dynamically and in tandem throughout the educational experience. So, while teaching presence originates in what the teacher does to structure the learning, it interacts with cognitive presence in selection of learning content and social presence in setting the community climate. Cognitive presence and social presence meanwhile determine the community's discourse. This is illustrated in Figure 1.

Engagement in online discussion

Past research mirrors many behaviours that were observed during the module pilot. For example, the steady decline in discussion board activity after the first session could have represented a vicious circle in which participants were discouraged from contributing because of the lack of contribution from others (Kurucay and Inan 2017; Lee, Kim, and Hackney 2011; Luo, Zhang, and Qi 2017; Nerantzi and Gossman 2015). This was very likely compounded by minimalist tutor engagement. Some research does support tutor restraint (Kahn *et al.* 2017; Zydney, deNoyelles, and Kyeong-Ju Seo 2012), but there is also evidence to the contrary (Chen and Jang 2010; Garrison, Anderson, and Archer 2010; Jones and Issroff 2005; Parks-Stamm, Zafonte, and Palenque 2017). Finally, learners need to perceive concrete reasons for participating (Jones and Issroff 2005);

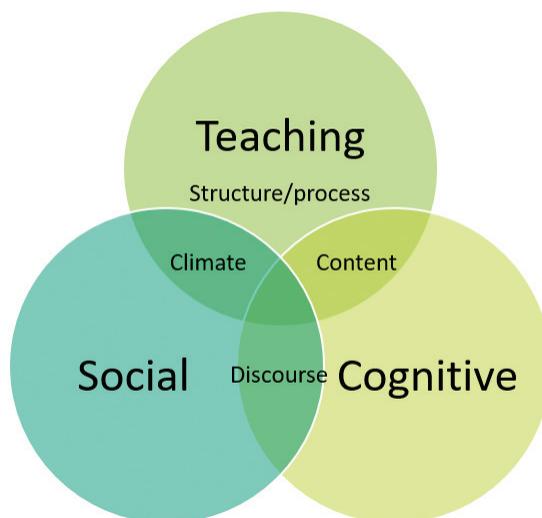


Figure 1. Community of inquiry framework.

perhaps the relatively intangible benefit of a better understanding of the course material through discussion and the reward of receiving feedback on drafts of an assignment that was not due for 5 months were not sufficient motivations for many participants.

How to demonstrate the immediate and long-term benefits of interaction to learners is a difficult question. Going on the basis that, fundamentally, discussion is beneficial (Salmon 2004; Zydney, deNoyelles, and Kyeong-Ju Seo 2012), the question then becomes how to encourage learners to experience the benefits and thus create a positive perception. Perhaps an obvious method is to associate marks with quantity and/or quality of discussion board contributions. While this has been considered to be too invasive (Gulati 2008) and to some degree counter-productive (Lee, Kim, and Hackney 2011), it has proven successful in some cases. Gafni and Geri (2010) found that postgraduate students who participated in graded online forum assignments performed significantly better in the examination at the end of the module versus those for whom forum participation was optional. When comparing undergraduates in an online course, some of whom were assigned to work in groups to produce summative assessments and some of whom worked independently, Kurucay and Inan (2017) found that the former achieved significantly higher marks. Luo, Zhang and Qi (2017), in their study of online discussion boards in a professional education context, concluded that some kind of incentivisation to participate could contribute towards creating a sense of community. And Kovanović *et al.* (2015) invoked the CoI model to look specifically at the cognitive presence aspect of online discussion board engagement within a group of postgraduates, concluding by advocating a flexible approach to accommodate different types of learners, including motivational support – -such as working in groups – for those less inclined to participate. Thus, for a context involving mature learners' summative marking would not necessarily be appropriate, but a light-touch method of compulsory contribution could be effective.

In reference to tutor activity in discussions, it has been shown that teaching presence can have a positive effect on both cognitive and social presence (Garrison, Anderson, and Archer 2010). However, it is often difficult to determine how and how many tutors should participate in online interactions with students (Moule 2007; Parks-Stamm, Zafonte, and Palenque 2017; Zydney, deNoyelles, and Kyeong-Ju Seo 2012). There is some evidence that points towards a direct correlation between tutor and student engagement (Parks-Stamm, Zafonte, and Palenque 2017), and to the positive effect of personalised tutor–student interaction on need satisfaction and thus learning outcomes (Chen and Jang 2010). It is also clear that the *type* of tutor engagement is critical. In terms of content, Palincsar (1998) found that tutor participation is beneficial when the talk is interpretive rather than descriptive and pushes the discussion forward. In terms of timing, Ouyang and Scharber (2017) advocate a dynamic balance among tutor roles rather than simply assuming that 'more is better', while Moule (2007) supports an increase in tutor facilitation as the discussion activities move from instructivist to constructivist. These findings therefore pointed towards increased tutor activity on the discussion boards, not for the sake of quantity alone but to respond to participant threads in a context-appropriate, interpretive way.

Engagement with videos

A number of common bad practices in the implementation of online educational video emerge in the literature, and the videos in the pilot were guilty of several. Firstly, they were much longer than is generally recommended for online educational videos. There is a large amount of evidence in the literature to suggest that the longer

the online video, the more likely viewers are to stop watching (Costley, Hughes, and Lange 2017; Geri, Winer, and Zaks 2017; Guo, Kim, and Rubin 2014). Guo, Kim and Rubin (2014) concluded that online educational videos should be no longer than 6 min, as drop-off tends to increase after the 3-min mark. This study looked at videos on Massive Open Online Courses (MOOCs), however, which are informal, non-credit-bearing courses. Costley, Hughes and Lange (2017) found much better drop-off rates for videos on credit-bearing higher education modules, in contrast to much of the literature, but do not report the average length of the videos provided. As the videos in the current study were an average of 30 min long, with the most lengthy at 55 min, and as students had commented negatively on the video length, the evidence still seemed to support reducing the length of the videos in some way.

It has also been shown that even very basic interactivity options in video can have a significant effect on learning gain and student satisfaction (Zhang *et al.* 2006). Delen *et al.* (2014) demonstrated that students who were provided with interactive video retained learning better and were more likely to remain engaged, and Geri, Winer and Zaks (2017) found that interactivity had the potential to increase learners' attention spans (and thus decrease drop-off rates). These studies all looked at simple forms of interaction, many of which are achievable on standard video streaming platforms.

Presence through the interplay of content and discussion

Just as the three different types of presence in the CoI model work in tandem to create a community (Garrison, Anderson, and Archer 2010), so do the different elements involved in what the community does. Costley, Hughes and Lange (2017) suggest that the students in their study may have engaged more with video content because of an awareness 'of their responsibilities as part of a community of inquiry' (p. 201). They conclude that clear expectations around when videos will be watched and which activities (e.g. discussions) will follow on from the videos increase engagement with both the videos and the course as a whole. And while they did not invoke the CoI model *per se*, Luo, Zhang and Qi (2017) found that student–student and student–instructor interaction had a significantly stronger effect on students' sense of community when they also showed higher engagement with the content.

Thus, much literature does successfully employ the CoI framework to analyse a variety of online educational scenarios. There is less evidence, however, of the framework being used as a design model to connect discrete elements of learning together in a structured, dynamic way to foster community in the first place. This study therefore attempts to show how specific interventions were designed to work together within the CoI framework to bring about observable improvements in student engagement.

Methodology

Learning design

Four key changes were made to the design of the module in light of the evaluation and literature review. The first was fairly obvious: the online module would no longer follow the face-to-face timetable, but rather each session would run for 3 weeks instead of one.

Secondly, a low-stakes way of signalling to participants that, while the discussions were not summatively assessed, they were a core part of the learning was devised.

This took the form of a ‘reward’ system: participants needed to contribute to the current session’s discussion board at least once to see the next session’s content on the date it was released (or immediately, if they contributed after the next session had begun).

This method avoided issues of both quantitative surveillance and qualitative judgement (Gulati 2008) – in fact there was no manual gatekeeping at all. The type or length of the post did not matter; there was no time constraint on posting; and working ahead was not an option regardless of discussion board activity (which also encouraged participants to work through the module as a group rather than independently). It was recognised that one danger of this method would be ‘monologue’ posting (i.e. participants posting their own work without engaging with previous or subsequent discussion), as Gafni and Geri (2010) found. However, their study also revealed that students for whom contribution was compulsory still evidenced significantly more learning gain than their peers for whom discussion contribution was optional, even when they did not engage in the discussions.

The third change was to increase tutor involvement. Participants were prompted to post everything on the discussion board and the tutors aimed not only to increase their engagement as far as number of posts was concerned, but also to take an adaptive approach, supporting, encouraging, challenging or hanging back as needed.

The final change was to the video content. There was neither time nor resource to record new, bespoke videos and to produce captions. But there was capacity to divide each video into two or three shorter videos, interspersed with other course materials. Then, on the basis that learners are more likely to engage when prompted, but not forced (Delen, Liew, and Willson 2014), short questions were inserted into the videos at intervals of 10 min or less. The questions were all open-ended, requiring the participants to think, reflect and make notes and it was explicitly stated that the notes would later be used to contribute to the discussion boards. Participants were then given the option to click ‘Done’ if they had completed the task or ‘I’ll do it later’, after which the video would continue to play. This allowed them to take as little or as much time as they wanted, and also gave an indication of whether participants were engaging with the questions. The discussion prompts which followed the videos then made direct reference to one or more of the embedded questions, encouraging participants to use the notes that they had made during the videos to write their discussion board posts. Figure 2 shows how this completed the loop for each session.

This cycle also illustrates how, at the start of the module, it was possible to roughly align each type of CoI presence with the main activities, as shown in Figure 3.

As the cycle continues over time, however, we would expect these categorisations to blur – both because the activities are designed to be interrelated and because the types of presence themselves are interrelated. For example, video interaction involves teaching presence and cognitive presence, but increasingly also social presence as the participants begin to anticipate sharing their responses on the discussion board. The time- and activity-dependent release of module content certainly begins with teaching presence, but encourages social presence by creating a shared rhythm of learning, which, in turn, cultivates cognitive presence.

Participants

Data associated with a total of 77 participants were analysed, 45 from the 2016 to 2017 delivery of the module (cohort 1) and 32 from the 2017 to 2018 delivery (cohort 2). This represents all registered participants who logged into the VLE at least once. Participation in the module was optional, although some participants

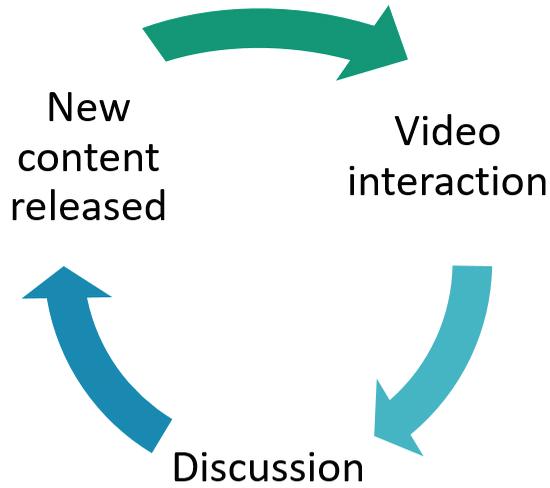


Figure 2. Cycle of session activity.

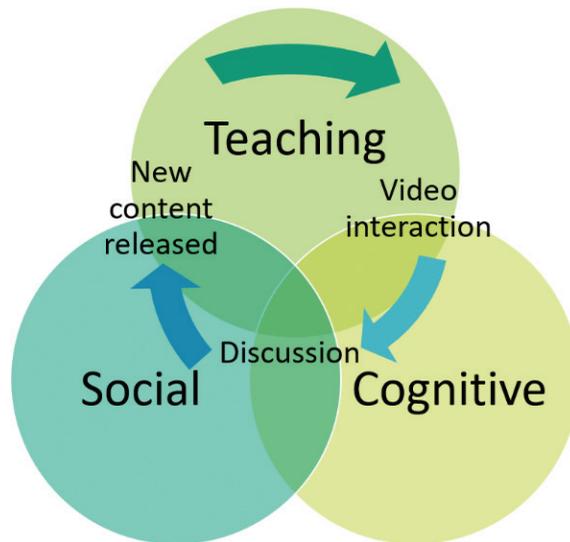


Figure 3. Initial mapping of the three CoI presences onto the cycle of session activity.

were required or encouraged to complete the module by their employers. As only a limited amount of demographic data was available, and as the small sample sizes made it unlikely that demographic correlations would be statistically significant, demographic data were not collected.

Tutor activity on discussion boards was also included in the analysis. One tutor facilitated group A in cohort 1 and another group A in cohort 2; a third tutor facilitated group B in both 2016–2017 and 2017–2018.

Frame of analysis

Because the CoI framework was used as a high-level design model (rather than a prescriptive formula), it also provided a theoretical framework for analysis without the risk of asking circular questions. Thus, the research questions are:

- Did the changes that were introduced have an impact on cognitive and social presence?
- Was the impact (if any) evident *across* presences?

Measures of presence

Several quantitative and qualitative measures were used as indicators of teaching, social and cognitive presence. While these measures by no means tell the whole story of individual or group presence, they were chosen to reflect the original issues that were identified in the 2016–2017 pilot, namely, lack of activity in discussions and video format.

The first measure, linked to social presence, was number of online posts (Kurucay and Inan 2017; Parks-Stamm, Zafonte, and Palenque 2017), which was then broken into *new posts* (answering a prompt without reference to others' posts) and *replies* (direct responses or references to others' posts). For cohort 1, both discussion board posts and blog posts and comments were counted (as the tasks that were done on the blog in 2016–2017 and moved to the discussion board the next year had not changed, this was deemed to be a consistent comparison). To ensure that the change in tutor engagement (a measurable form of teaching presence) had been significant, number of tutor posts, as well as numbers new tutor posts and replies, were also measured.

Similarly, several quantitative measures were used as indicators of a form of cognitive presences, namely, engagement with the videos (Geri, Winer, and Zaks 2017; Guo, Kim, and Rubin 2014), including average proportion of videos watched and whether participants reported completing the interactive elements in 2017–2018. One advantage to using the same video content was that the only differences between the first and second module deliveries were the changes to the learning design described above, making it more likely that any significant differences in watching behaviour were due to these changes.

The third measure was that of correlation between number of discussion board posts, proportion of videos watched and submission of the summative assessment. This follows Garrison, Anderson and Archer (2010) in postulating interconnections between teaching, social and cognitive presence, resulting in increased participant engagement.

As shown above, it was anticipated that changes to one element of the module could very well influence engagement with another element. Therefore, it was not deemed appropriate to attempt to measure whether discussion changes affected social presence, or whether video changes affected cognitive presence, but whether all of the interventions taken together had an impact on these aspects of module engagement.

Data collection and analysis

Discussion board and blog data were collected from the VLE (Blackboard) via the built-in analytics tools and by manual categorisation of posts. Video data were collected from the video platform (Kaltura) analytics tool. There was no missing data, although analytical data for two videos were omitted from this study completely as

the videos were shared with students taking another module. All data were anonymised upon download and stored securely throughout analysis.

Excel was used to organise the data and produce descriptive statistics and SPSS for analysis. As the data were not normally distributed (as per the Kolmogorov–Smirnova test for normality), non-parametric independent samples tests (Mann–Whitney *U* and Kruskal–Wallis) were run to compare the two cohorts. Likewise non-parametric correlation tests (Spearman) were used to identify possible relationships.

Results and discussion

Completion and attrition

Withdrawals, deferrals and non-submissions were not significantly different between the two cohorts. It should be noted that, as the population in both cases was taken to be *all* participants who had logged into the VLE, calculated averages are potentially misrepresentative. (For example, participants who withdrew early would not be expected to continue contributing to the discussion board or watching videos.) As far as comparing the two cohorts is concerned, however, the data are consistent.

Discussion boards

Tutor engagement

It was first necessary to ensure that tutor interaction with participants had indeed increased as per the intended changes to the learning design. A weighted average of tutor replies was therefore compared to the total number of participant posts. A significant increase ($p < 0.001$) in tutor replies in 2017–2018 was found, as shown in Table 1.

Number of total posts

There was a significant increase ($p = 0.016$) in the number of participant posts from 2016–2017 to 2017–2018, with cohort 1 averaging 6.33 posts per participant, while cohort 2 averaged 12.75. Figure 4 shows how number of posts per participant compared session by session.

This suggests that the changes made did have an effect on discussion engagement. Combined with the significant increase in tutor replies to participant posts, these findings are similar to those of Parks-Stamm, Zafonte and Palenque (2017) in terms of a relationship between tutor and student participation in small groups.

New posts and replies

When posts were divided into two categories, new posts and replies to others' posts, a significant increase in both new posts ($p = 0.022$) and replies ($p = 0.031$) was also

Table 1. Tutor replies to participant posts.

	Total participant posts	Tutor replies	Average tutor replies per participant post
Cohort 1	285	37	0.13
Cohort 2	408	172	0.42

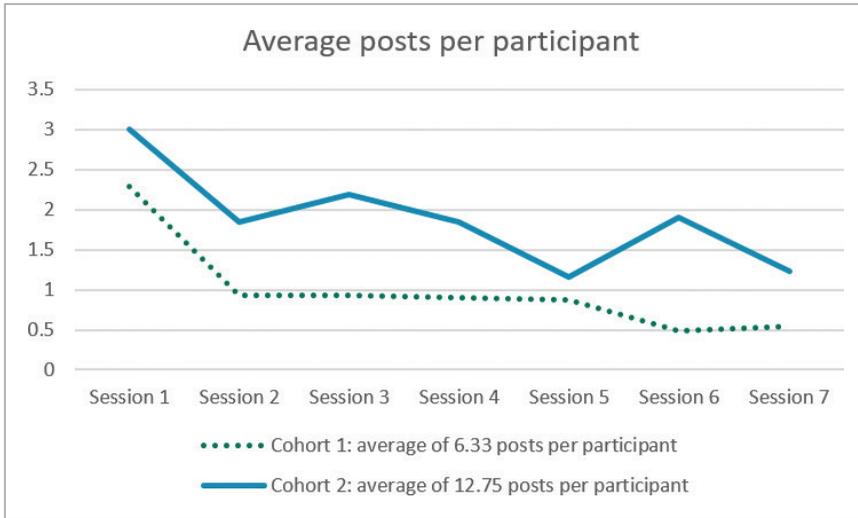


Figure 4. Average number of posts per participant by session.

Table 2. Average number of new posts, replies and total posts per participant by session.

Session	Cohort 1 averages per participant			Cohort 2 averages per participant		
	New posts (3.31 total)	Replies (3.07 total)	Total posts (6.33 total)	New posts (5.78 total)	Replies (6.97 total)	Total posts (12.75 total)
1	1.80	0.49	2.29	1.71	1.29	3.00
2	0.54	0.39	0.93	0.90	0.94	1.84
3	0.39	0.54	0.93	0.90	1.29	2.19
4	0.34	0.56	0.90	0.68	1.16	1.84
5	0.27	0.61	0.88	0.45	0.71	1.16
6	0.27	0.22	0.49	0.68	1.23	1.90
7	0.24	0.29	0.54	0.65	0.58	1.23

found, as shown in Table 2. The greater number of replies in cohort 2, both compared to cohort 1 and to cohort 2’s new posts, indicates that participants did not appear to be ‘monologue’ posting (Gafni and Geri 2010), which would have been evident if there were a larger number of new posts than replies. The fact that, on average, participants contributed more posts than they needed to reveal new content also indicates engagement with the discussion beyond the minimum requirements.

Forum structure

One unexpected finding emerged when comparing the two tutor groups within each cohort. In 2016–2017, there was a significant difference between the two tutor groups’ levels of engagement: group A had significantly more total posts ($p = 0.002$), new posts ($p = 0.002$) and replies ($p = 0.002$) than group B, even though group membership numbers were comparable. A possible explanation for the differences was that the group A tutor only created one starter thread, meaning that participants took it

upon themselves to create new threads within each session’s forum, whereas the group B tutor created starter threads for each session, and participants limited their posts to these threads. Thus, group A also had significantly more discussion board threads ($p < 0.001$). In 2017–2018, the two tutors took the same approaches as the year before, and while the difference in *number of posts* was not statistically significant, group A again created significantly more *threads* than group B ($p = 0.019$). A summary of the results is shown in Table 3.

This inverse relationship between tutor-created discussion threads and participant engagement goes against some previous findings (Salmon 2004; Zydney, deNoyelles, and Kyeong-Ju Seo 2012). One explanation could be that mature learners who teach mature learners themselves are confident in taking control of discussions early on: the requirement to post on the discussion board is sufficient scaffolding, and so autonomy on the board itself is more conducive to discussion (Gulati 2008).

Video

Proportion of videos watched

Ninety-one per cent of participants in cohort 2 began watching at least one core video, a relative increase over cohort 1 – only 71% of whom started watching any videos. Video drop-off rates (the proportion of video content watched once the video is played) increased significantly for core videos in 2017–2018 ($p = 0.001$). While cohort 1, on average, watched 50% of a core video once started, cohort 2 had an average drop-off rate of 63%. Figure 5 shows a comparison of drop-off rates in four clusters.

This is a strong indication that the changes made to the module design did encourage the participants to remain engaged for longer. This also supports Geri, Winer and Zaks (2017) finding that interactivity may increase learners’ attention spans and Delen, Liew and Willson (2014) conclusion that interactive options could help learners’ persistence and engagement.

Interactivity

Cohort 2’s responses to the questions that appeared during the videos showed that they reported engaging with the prompts 77% of the time, as detailed in Table 4. This increased dramatically from the first video to the second. This could have been caused by the wording of the prompts: the session 1 prompt asked participants to *post* on the discussion board, whereas the subsequent prompts asked participants to *make note* of their thoughts to post on the discussion board later. Removing the outlying first video, reported completion of the rest of the questions was 83%. This is another indication that the changes made to the module had a real effect on participants’ engagement.

Table 3. Total threads and posts by cohort and group.

	Cohort 1		Cohort 2	
	Group A	Group B	Group A	Group B
Total threads	70	10	58	14
Total posts	191	34	287	124
Average posts per thread	2.73	3.4	4.95	8.86

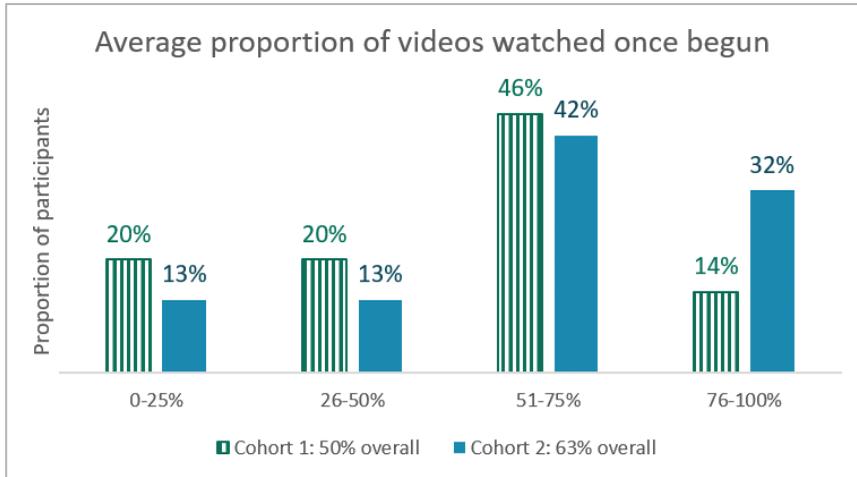


Figure 5. Average proportion of videos watched once played (drop-off rate).

Table 4. Proportion of viewers reporting whether they completed activities by session.

Session (video number)	'Done' (77% overall) (%)	'Later' (23% overall) (%)
1 (3)	21	79
2 (1)	74	26
3 (1)	94	6
3 (2)	97	3
4 (1)	73	27
4 (2)	82	18
5 (1)	88	12
5 (2)	86	14
6 (1)	73	27
7 (2)	78	22

Taken together, these results indicate that the first research question can be answered in the affirmative: the changes that were introduced did have an impact on cognitive and social presence as measured by engagement with discussion boards and videos.

Interrelatedness of discussion, video viewing and module completion

Correlations were found among discussion board and blog posting, video viewing and summative assignment submission for both cohorts. Total video viewing time and total number of posts were strongly correlated ($p < 0.001$), as were total video viewing time and module completion ($p < 0.001$). Number of discussion board and blog posts was also strongly correlated to submission of the final assessment ($p < 0.001$). An overview is provided in Table 5. While these correlations reveal that discussion and video engagement were related to each other and to module completion just as strongly in 2016–2017 as in 2017–2018, they also confirm the value of encouraging engagement with these two dimensions of the module. This is especially valid as, in both cases, it was possible to submit a summative assignment without

Table 5. Correlations among key metrics.

	Correlations between total video viewing time and total posts		Correlations between total video viewing time and module completion		Correlations between total posts and module completion	
	Cohort 1	Cohort 2	Cohort 1	Cohort 2	Cohort 1	Cohort 2
Correlation coefficient (Spearman's rho)	0.787	0.810	0.560	0.707	0.560	0.707
Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000
N	45	32	45	32	45	32

having contributed to the discussions or watched the videos at all. These significant relationships between module activity and assignment completion support Kurucay and Inan's (2017) results, indicating that frequency of online interaction is related to achievement, and to Zhang *et al.*'s (2006) findings that video with interaction is linked to learning gain. Moreover, they point to a certain degree of success in iteratively developing social and cognitive presences through teaching presence. The second research question can therefore be addressed: the impact of the changes was evident across teaching, social and cognitive presence.

Conclusion

This study showed how the CoI framework was used to address issues with engagement in a postgraduate online module. Teaching presence in the form of an enhanced learning design linked together input elements (video), discursive elements (discussion boards) and access to new materials to encourage cognitive and social presence. The impact of these changes was measured using discussion and video analytics, on the basis that increased activity would be indicative of increased presence. Findings confirmed that there were significant increases in number of discussion posts and in proportion of videos watched, and showed that putting the impetus on participants to create their own discussion threads was linked to increased activity. Correlations between discussion activity and watching videos, and between both of these and submission of the summative assessment, were also identified. This showed that these module elements were indeed closely related, thus suggesting a strong interplay among teaching, social and cognitive presence.

Limitations

This study looked at a small population which may not be representative of students in online modules generally, and which made it difficult to confirm statistical significance when comparing two cohorts or groups. While it was unlikely that, given the small population size, demographic data would have revealed significant differences, it could have better situated the participants in this study within their cohorts and within wider population of students in online courses. There were also limitations in data collection. Cohort 2 participants were not available for interviews or focus groups which could have provided a more qualitative, nuanced perspective on their approach to online video and discussion. Coding or otherwise qualitatively analysing discussion posts might also have given a deeper picture of *how* participants were interacting online.

Further research

This study demonstrated the potential benefits of further research into conditional release of online content based on student contribution – there is evidence that this is an effective way to increase engagement, but it has not often been addressed in the literature. As interaction within video becomes increasingly ubiquitous in higher education settings, broader evaluation of types of interaction and learner engagement would also be valuable. Finally, survey instruments to explore the CoI framework in online and blended contexts have emerged in recent years (Stenbom 2018), which could provide a fuller picture of student experience through the CoI lens.

References

- Chen, K.-C. & Jang, S.-J. (2010) 'Motivation in online learning: testing a model of self-determination theory', *Computers in Human Behavior*, vol. 26, no. 4, pp. 741–752. doi: 10.1016/j.chb.2010.01.011
- Cherney, M. R., Fetherston, M. & Johnsen, L. J. (2018) 'Online course student collaboration literature: a review and critique', *Small Group Research*, vol. 49, no. 1, pp. 98–128. doi: 10.1177/1046496417721627
- Costley, J., Hughes, C. & Lange, C. (2017) 'The effects of instructional design on student engagement with video lectures at cyber universities', *Journal of Information Technology Education: Research*, vol. 16, pp. 189–207. doi: 10.28945/3728
- Delen, E., Liew, J. & Willson, V. (2014) 'Effects of interactivity and instructional scaffolding on learning: self-regulation in online video-based environments', *Computers & Education*, vol. 78, pp. 312–320. doi: 10.1016/j.compedu.2014.06.018
- Gafni, R. & Geri, N. (2010) 'The value of collaborative e-learning: compulsory versus optional online forum assignments', *Interdisciplinary Journal of E-Learning and Learning Objects*, vol. 6, pp. 335–339.
- Garrison, D. R., Anderson, T. & Archer, W. (2010) 'The first decade of the community of inquiry framework: a retrospective', *Internet and Higher Education*, vol. 13, no. 1–2, pp. 5–9. doi: 10.1016/j.iheduc.2009.10.003
- Geri, N., Winer, A. & Zaks, B. (2017) 'A learning analytics approach for evaluating the impact of interactivity in online video lectures on the attention span of students', *Interdisciplinary Journal of e-Skills and Lifelong Learning*, vol. 13, pp. 215–228.
- Gulati, S. (2008) 'Compulsory participation in online discussions: is this constructivism or normalisation of learning?', *Innovations in Education and Teaching International*, vol. 45, no. 2, pp. 183–192. doi: 10.1080/14703290801950427
- Guo, P. J., Kim, J. & Rubin, R. (2014) 'How video production affects student engagement: an empirical study of MOOC videos', *First ACM Conference on Learning@ Scale conference*, Atlanta, GA, pp. 41–50.
- Hrastinski, S. (2008) 'What is online learner participation? A literature review', *Computers & Education*, vol. 51, pp. 1755–1765. doi: 10.1016/j.compedu.2008.05.005
- Jones, A. & Issroff, K. (2005) 'Learning technologies: affective and social issues in computer-supported collaborative learning', *Computers & Education*, vol. 44, pp. 395–408. doi: 10.1016/j.compedu.2004.04.004
- Kahn, P., *et al.*, (2017) 'Understanding student engagement in online learning environments: the role of reflexivity | SpringerLink', *Educational Technology Research and Development*, vol. 65, no. 1, pp. 15. doi: 10.1007/s11423-016-9484-z
- Kovanović, V., *et al.*, (2015) 'Analytics of communities of inquiry: effects of learning technology use on cognitive presence in asynchronous online discussions', *Internet and Higher Education*, vol. 27, pp. 74–89. doi: 10.1016/j.iheduc.2015.06.002

- Kurucay, M. & Inan, F. A. (2017) 'Examining the effects of learner-learner interactions on satisfaction and learning in an online undergraduate course', *Computers & Education*, vol. 115, pp. 20–37. doi: 10.1016/j.compedu.2017.06.010
- Lee, H., Kim, J. W. & Hackney, R. (2011) 'Knowledge hoarding and user acceptance of online discussion board systems in eLearning: a case study', *Computers in Human Behavior*, vol. 27, no. 4, pp. 1431–1437. doi: 10.1016/j.chb.2010.07.047
- Luo, N., Zhang, M. & Qi, D. (2017) 'Effects of different interactions on students' sense of community in e-learning environment', *Computers & Education*, vol. 115, pp. 153–160. doi: 10.1016/j.compedu.2017.08.006
- Moule, P. (2007) 'Challenging the five-stage model for e-learning: a new approach', *Research in Learning Technology*, vol. 15, pp. 30–50. doi: 10.1080/09687760601129588
- Nerantzi, C. & Gossman, P. (2015) 'Towards collaboration as learning: evaluation of an open CPD opportunity for HE teachers', *Research in Learning Technology*, vol. 23. doi: 10.3402/rlt.v23.26967
- Ouyang, F. & Scharber, C. (2017) 'The influences of an experienced instructor's discussion design and facilitation on an online learning community development: a social network analysis study', *The Internet and Higher Education*, vol. 35, pp. 34–47. doi: 10.1016/j.iheduc.2017.07.002
- Palincsar, A. S. (1998) 'Social constructivist perspectives on teaching and learning', *Annual Review of Psychology*, vol. 49, pp. 345–376. doi: 10.1146/annurev.psych.49.1.345
- Parks-Stamm, E. J., Zafonte, M. & Palenque, S. M. (2017) 'The effects of instructor participation and class size on student participation in an online class discussion forum', *British Journal of Educational Technology*, vol. 48, no. 6, pp. 1250–1259. doi: 10.1111/bjet.12512
- Salmon, G. (2004) *E-moderating*, 2 edn, Routledge, London.
- Stenbom, S. (2018) 'A systematic review of the Community of Inquiry survey', *The Internet and Higher Education*, vol. 39, pp. 22–32. doi: 10.1016/j.iheduc.2018.06.001
- Zhang, D., *et al.*, (2006) 'Instructional video in e-learning: assessing the impact of interactive video on learning effectiveness', *Information & Management*, vol. 43, no. 1, pp. 15–27. doi: 10.1016/j.im.2005.01.004
- Zydney, J. M., deNoyelles, A. & Kyeong-Ju Seo, K. (2012) 'Creating a community of inquiry in online environments: an exploratory study on the effect of a protocol on interactions within asynchronous discussions', *Computers & Education*, vol. 58, no. 1, pp. 77–87. doi: 10.1016/j.compedu.2011.07.009