Interventions to Improve Cognitive Presence and Student Performance in the Age of COVID-19

Madhumita BANERJEE
Sociology Department, University of Wisconsin-Parkside
Kenosha, WI 53141, USA

Joy WOLF
Geography & Anthropology Department, University of Wisconsin-Parkside
Kenosha, WI 53141, USA

Suresh CHALASANI
MIS - Business Department, University of Wisconsin-Parkside
Kenosha, WI 53141, USA

ABSTRACT[1]

With universities offering predominantly online versions of courses in response to the global impacts of COVID-19, this fundamentally altered educational landscape calls for stronger emphasis on improvement of student learning in virtual environments. The Community of Inquiry (CoI) framework is a well-known model that includes three dimensions which influence teaching and learning effectiveness in the online classroom: social presence, teaching presence and cognitive presence. In this paper, strategies to implement and improve cognitive presence are discussed. Quantitative assessments of student performance are presented prior to, and post implementation of strategies intended to enhance cognitive presence. Additionally, implementations of qualitative strategies aimed at developing cognitive presence in the online classroom are presented. Examples of instructional techniques used to help students achieve learning objectives from courses in business, physical science, and social science are examined. The objective of this paper is to present simple yet effective strategies that may be used to promote student engagement and facilitate learning of complex concepts in virtual environments.

Keywords
CoI Model, Online Learning, Cognitive Presence, Student Performance, Interventions, COVID-19

INTRODUCTION

In March 2020, the academic world was confronted with unforeseen challenges as a result of the coronavirus pandemic. The resultant forced shift to remote teaching presented educators with the challenge of reproducing the characteristics of the face to face (F2F) classroom online. Other than issues related to relevance and expanse of course content, and means to deliver the same in a virtual setting, a primary concern of educators was how to keep students engaged in a virtual environment such that student learning outcomes were not compromised by the disruption brought about by the mandatory shift in course delivery mode. In light of the above, faculty across academia had pertinent concerns about how to create and maintain cognitive presence in the online classroom.

At the authors' institution, the pandemic influenced change in circumstances created a sense of anxiety for faculty and students alike. Faculty had two weeks to produce quality online courses, and students were asked to stay home and get ready for online learning. Many educators did not have prior experience with online teaching and hardly had the time and/or resources to discern how to offer hands on activities in a virtual environment. They grappled with how to create and maintain meaningful cognitive presence in the virtual environment or how to develop a learning experience that would simulate face to face learning.

The disruption impacted students as well, as they had to cope with the challenges of adapting to a fully online learning experience at very short notice. Majority of the students at the said institution are not online learners. Many had not taken online classes before and were understandably apprehensive about being thrust into an unfamiliar classroom environment. What ensued was considerable anxiety and confusion.

With the pandemic raging on, creating and maintaining cognitive presence remains a pertinent question in academia. This paper examines the measures and interventions undertaken by the authors to achieve and improve cognitive presence and student performance in the online classroom, based on Garrison, Anderson, and Archer's Community of Inquiry (CoI) framework [1]. Three courses one from Business, one from the Physical Sciences, and one from the Social Sciences were selected based on the authors' field of expertise to discuss steps implemented in order to develop cognitive presence in the online environment.

First, a short description of the CoI framework is presented. Both quantitative analysis of data and qualitative discussions are presented to show the interventions employed to develop and improve cognitive presence and student performance in the virtual environment. The paper concludes with adjustments and interventions that can be employed in course delivery to create and maintain cognitive presence in the virtual classroom.

[1] The authors are grateful to Dr. Helen Rosenberg and Dr. Mary Kay Schleiter of the University of Wisconsin - Parkside for their valuable feedback and proofreading of the manuscript.

CoI FRAMEWORK

The Community of Inquiry (CoI) framework is a well-researched model utilized to gauge learning effectiveness in the online environment [2]. With the proliferation of online education in the post-secondary setting, faculty are challenged to ensure that a meaningful learning experience is created and maintained in the virtual classroom. The CoI framework (Figure 1) represents a process of creating a deep and meaningful (collaborative-constructivist) learning experience through the development of several interdependent elements – social presence, cognitive presence, and teaching presence, the three together making up the educational experience of the learner [1]. Research has shown that there is a relationship between the aforementioned elements of the CoI model and students' perceived learning, satisfaction with the course, satisfaction with the instructor, actual learning, and sense of belonging [3][4][5].

Figure 1. Community of Inquiry (CoI) Framework [1]

Social presence is described as the ability to project one's self and establish personal and purposeful relationships [6]. In an online setting, it may be described as the ability of learners to emotionally and socially project themselves, thereby being perceived as "real people" in mediated communication [7][8]. The key elements of social presence include affective expression, open communication and group cohesion. In affective communication, learners share personal expressions of emotion, feelings, beliefs, and values. In open communication, learners build and sustain a sense of group commitment and in group cohesion, learners interact around common intellectual activities and tasks [5]. The interplay of the three categories of social presence allow for risk free expression and encourage collaboration, thus creating social presence in the online classroom. As such, social presence in the online classroom may be established by icebreakers, introduction and weekly check in videos with personal anecdotes, self-referencing for examples, encouraging students to share related anecdotes, acknowledgement, and collaborative activities [5].

Teaching presence is described as the design, facilitation, and direction of cognitive and social processes for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes [1]. It comprises of: (a) instructional design and organization; (b) facilitation of discourse; and (c) direct instruction. Teaching presence is a significant determinate of student satisfaction, perceived learning, and sense of community and it is through effective teaching presence that meaningful and desired learning outcomes are attained [6]. Teaching presence in the virtual classroom may be established by facilitating robust discussion board activities, providing timely and supportive feedback, and providing explicit instructions for all course activities [5].

Cognitive presence is based on Dewey's notion of scientific inquiry whereby a worthwhile educational experience is achieved through the process of reflective inquiry [9]. To that effect, cognitive presence is defined as the extent to which learners are able to construct and confirm meaning through sustained reflection and discourse [10]. Rooted in Dewey's Practical Inquiry Model (Figure 2), cognitive presence unfolds in four distinct phases: (a) a triggering event which identifies an issue for further inquiry; (b) the exploration of the issue through critical reflection and information exchange; (c) integration of thought through connection of ideas whereby new meaning is constructed; and (d) resolution of the issue whereby learners are able to apply the newly gained knowledge. The vertical axis reflects the integration of thought and action, reflection and discourse and the horizontal axis represents its interface. The extremes of the horizontal axis are points of insight and understanding and represent analysis and synthesis [1].

Figure 2. Practical Inquiry Model [10]

COGNITIVE PRESENCE INTERVENTIONS IN THE VIRTUAL CLASSROOM

Cognitive presence may be established in a few different ways in a virtual classroom. Identifying seminal ideas for students to take away from a course and developing course activities around the assessment of those outcomes, providing frequent opportunities for feedback, providing avenues for multiple representation of knowledge, and providing varied activities for practicing desired skills are some ways of creating cognitive presence [5].

A module introduction video, posing a question with the intent of creating a sense of puzzlement, is an example of a triggering event. To introduce survey research design in a Sociology Research Methods course (SOCA 295), an example of a sense of puzzlement could be achieved by posing a question -- "How would you gather data to determine the relationship between social class and religiosity?" or "What demographic characteristics affect birth control use among unmarried women?" For an MBA marketing course, an example of a triggering event would be a question that asks, "Have you wondered how targeted advertisements appear on your screen after you have visited a few websites?" Information exchange and problem solving through synchronous class discussions,

discussion board activities, and video office hours whereby the instructor facilitates scaffolding of knowledge to connect ideas that lead to integration of thought, are prime ways of achieving cognitive presence. In the Research Methods course, providing opportunities for self-testing, peer reviews, and offering interactive activities for skill development and convergent thinking such as framing hypotheses statements helped in integration of course concepts. Representation of knowledge in more than one format, multiple activities for practicing desired skills, encouraging risk free experimentation, and consideration of multiple perspectives through discussions can also allow for integration and resolution of information. In the Physical Geography course (GEOG 100), exploring one's immediate surrounding in the absence of a planned field trip due to COVID-19, coupled with instructor video and synchronous discussion sessions facilitated reflection and discourse. Regular and frequent video office hours helped provide feedback on assignments in the Technologies for Business Decision Making course (MBA 720). This, in turn, enabled instructor facilitated analysis and synthesis of business problems that led to enhanced cognitive presence. The upshot was improved student learning outcomes and improved student performance.

Quantitative and qualitative assessments and interventions of cognitive presence are discussed next in context of the courses in which they were applied (Table1).

Table 1: Examples of Cognitive Presence

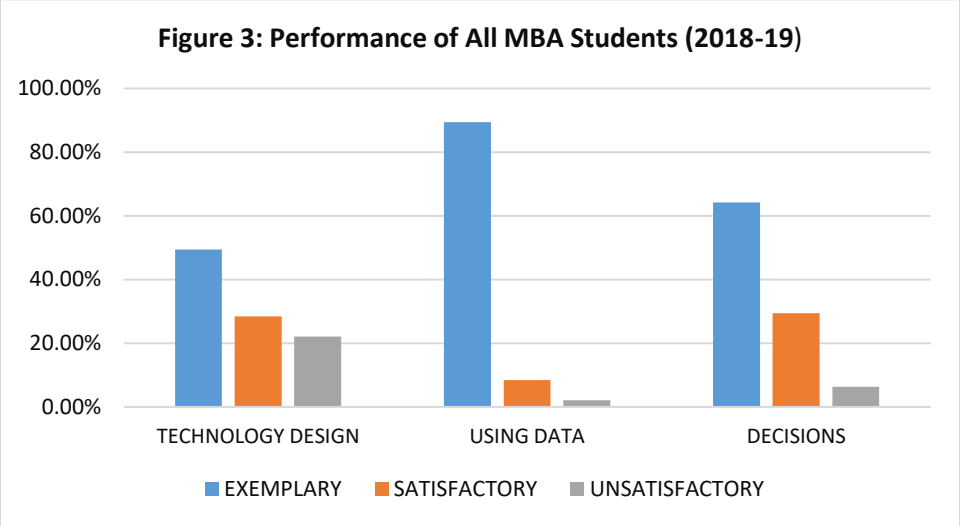
Elements	Categories	Indicators	Intervention	Program/Courses/Examples
Cognitive Presence	Triggering Event	Sense of Puzzlement	• Module/Unit Introduction Videos • Synchronous Discussion	GEOG 100, MBA 720, SOCA 295
	Exploration	Information Exchange	• Module/Unit Introduction Videos • Synchronous Discussion, Discussion Board • Video Office hours	MBA 720, SOCA 295: Synchronous exchange and office hours via Collaborate Ultra
	Integration	Connecting Ideas	• Module/Unit Introduction Videos • Synchronous Discussion, Discussion Board • Video Office hours • Summary Videos	GEOG 100: Recorded Video Class Lecture SOCA 295: Weekly synchronous discussions and office hours via Collaborate Ultra MBA 720: Office Hours via Collaborate Ultra/Zoom
	Resolution	Apply Ideas for Problem Solving & New Scenarios	• Synchronous Discussion, Discussion Board • Video feedback explaining common mistakes in exam/quiz • Video Office hours	HIMT 380: https://youtu.be/TEPgfl_BOhQ

Quantitative Analysis – MBA 720 (2018-19)

In the academic year 2018-19, a total of 95 students completed MBA 720 (Technologies for Business Decisions Making); 48 of these students were enrolled in the Masters of Business Administration Online (MBAO) program, while 47 were enrolled in the F2F MBA program. Their performance was measured and compared for the data analytics competency. Several assignments were given and students were evaluated consistently along three rubric dimensions: a) Technology Design, b) Using Appropriate Data, and c) Making Decisions Based on Data Analysis. In the remainder of this paper, these dimensions will be referred to as "Technology Design," "Using Data," and "Decisions". Student performance was categorized as follows: Exemplary (90% or higher); Satisfactory (>=75% and < 90%); Unsatisfactory (<75%). Students were asked to construct databases and utilize spreadsheet information to arrive at business decisions. Table 2 and Figure 3 depict the number of students and percentages of students for each rubric dimension graphically and in tabular format.

Table 2: Data Analytics Competency Across Dimensions: 2018-19

F2F Students – Percentages (N=47)	Exemplary	Satisfactory	Unsatisfactory
Technology Design	51.06%	25.53%	23.40%
Using Data	87.23%	8.51%	4.26%
Decisions	55.32%	42.55%	2.13%
Online Students – Percentages (N=48)	**Exemplary**	**Satisfactory**	**Unsatisfactory**
Technology Design	47.92%	31.25%	20.83%
Using Data	91.67%	8.33%	0.00%
Decisions	72.92%	16.67%	10.42%
Total Students – Percentages (N=95)	**Exemplary**	**Satisfactory**	**Unsatisfactory**
Technology Design	49.47%	28.42%	22.11%
Using Data	89.47%	8.42%	2.11%
Decisions	64.21%	29.47%	6.32%



Although both F2F and online students performed well in "Using Data" and "Decisions" category, an average of 22% were in the unsatisfactory category for the "Technology Design" rubric. It was apparent that many of the MBA students, whether they are enrolled as F2F students or online students, do not come with any significant technology background.

Independent Samples t-Tests with unequal variances were conducted on student performance to compare F2F and online students in each of the three dimensions. For these tests, the null hypothesis was formulated as follows:

H_0: The means of scores for the F2F and Online students are the same for the dimension under consideration.

For the "Technology Design" dimension, the null hypothesis was supported. There was no significant difference in the scores for F2F students (M=108.72, SD=38.94) and online students (M=116.08, SD=24.40) with a p value of 0.2742. For the other two dimensions, namely "Using Data" and "Making Decisions", the null hypothesis was rejected based on the t-Test results (Tables 3 and 4) implying there was a statistically significant difference in the mean scores of F2F and online students for "Using Data" and "Making Decisions" rubric dimensions. F2F students performed better (with statistical significance) compared to online students.

Table 3: "Using Data" Dimension: F2F vs Online

	F2F	ONLINE
Mean	73.62	67.85
Variance	235.59	8.89
Observations	47	48
Hypothesized Mean Difference	0	
df	49	
t Stat	2.53	
p (T<=t) one-tail	0.007	
t Critical one-tail	1.677	
p (T<=t) two-tail	0.0148 (p<=0.05)	
t Critical two-tail	2.009	

Table 4: "Making Decisions" Dimension: F2F vs Online

	F2F	ONLINE
Mean	71.78	62.85
Variance	325.39	151.78
Observations	47	48
Hypothesized Mean Difference	0	
df	81	
t Stat	2.809	
p (T<=t) one-tail	0.003	
t Critical one-tail	1.664	
p (T<=t) two-tail	0.006 (p<=0.01)	
t Critical two-tail	1.989	

It may be surmised that in the F2F mode, the professor leads the students in completing hands-on exercises. Though online students can go through the same hands-on exercises via the professor's videos, the video resources are asynchronous, which means that students do not have the opportunity to ask questions in real time. It was also noted that F2F students better utilized professor's availability during scheduled office hours by visiting more often and asking more questions, when compared to online students who utilized virtual office hours conducted through web conferencing, infrequently.

Interventions to Improve Cognitive Presence

Several interventions were employed to improve student performance in the "Technology Design" dimension.

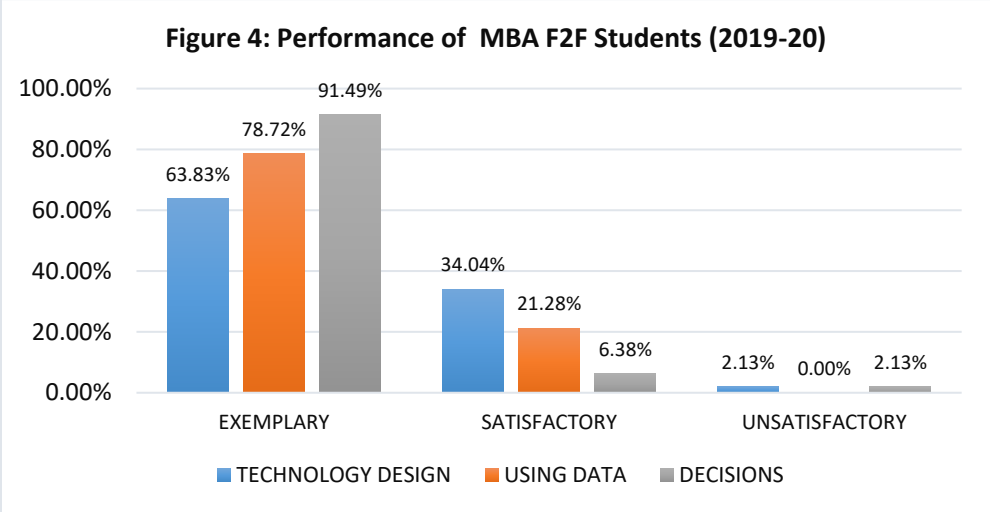
a) The professor conducted more office hours in 2019-20 specifically for this class compared to 2018-19. A total of two hours per week via video were devoted to this class alone (one hour on weekday evenings and another on weekends). In addition, ad-hoc office hours were provided for students who needed help while working on assignments.

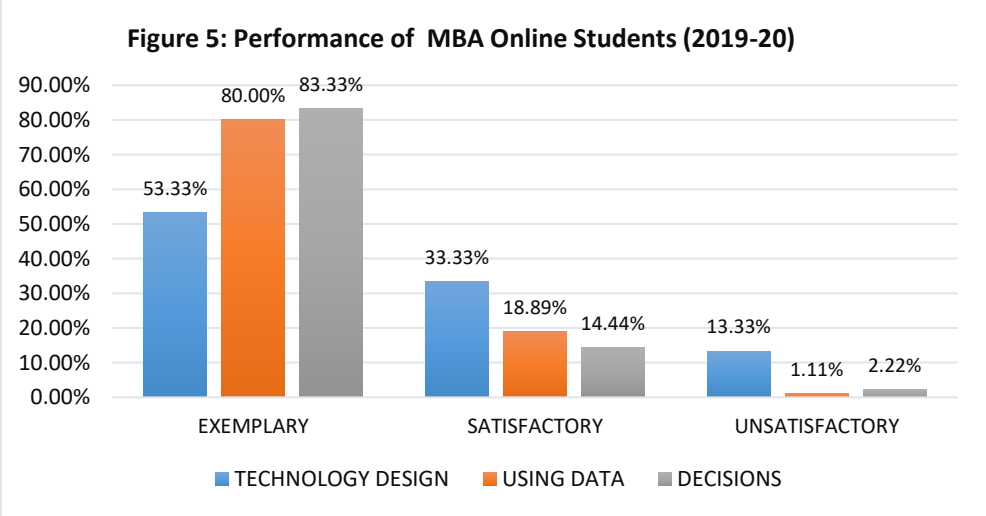
b) After initial grading for module 2 technical assignment ("Technology Design"), students were allowed to revise and resubmit their work based on feedback for additional credit. This practice helped students to master the concepts by reworking portions of the assignment and enabled them obtain a better score.

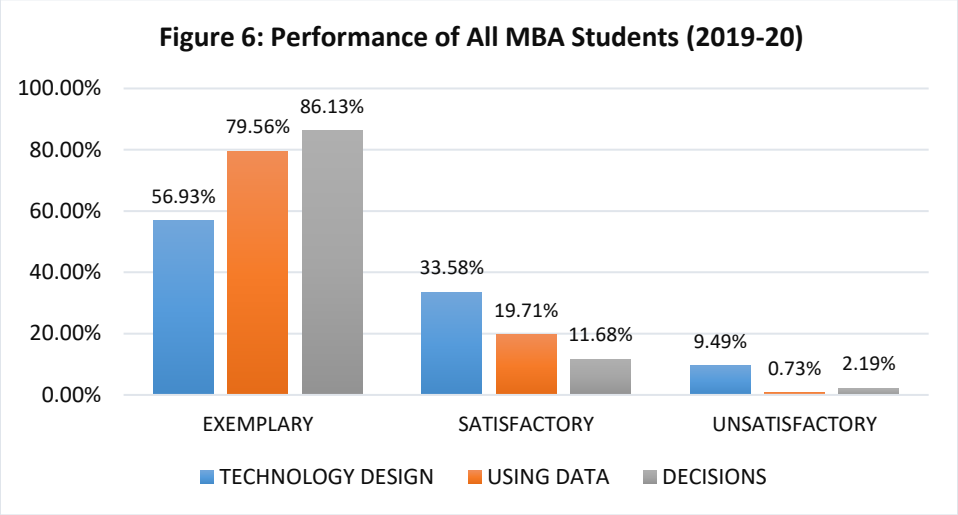
Quantitative Analysis – MBA 720 (2019-20)

Table 5 and Figures 4, 5, and 6 show the number of students and percentages of students for each rubric dimension for 2019-20.

Table 5: Data Analytics Competency Across Dimensions: 2019-20			
F2F Students – Percentages (N=47)	**Exemplary**	**Satisfactory**	**Unsatisfactory**
Technology Design	63.83%	34.04%	2.13%
Using Data	78.72%	21.28%	0.00%
Decisions	91.49%	6.38%	2.13%
Online Students – Percentages (N=90)	**Exemplary**	**Satisfactory**	**Unsatisfactory**
Technology Design	53.33%	33.33%	13.33%
Using Data	80.00%	18.89%	1.11%
Decisions	83.33%	14.44%	2.22%
Total Students – Percentages (N=137)	**Exemplary**	**Satisfactory**	**Unsatisfactory**
Technology Design	56.93%	33.58%	9.49%
Using Data	79.56%	19.71%	0.73%
Decisions	86.13%	11.68%	2.19%







As is evident from Table 5, overall student performance improved significantly compared to the prior year. For the "Technology Design" dimension, overall unsatisfactory rates improved from 22.1% to 9.5 %. For the other dimensions, the 2019-20 unsatisfactory rates were also lower with "Using Data" improving from 2.1% to 0.7% and "Making Decisions" improving from 6.3% to 2.2%.

It should be noted that for the "Technology Design" dimension for both F2F and MBAO students, MBAO students had significantly higher unsatisfactory rates than F2F students. Even so, the interventions have helped significantly reduce the unsatisfactory percentages in this dimension for both student categories.

This is not surprising because many of the MBA students do not come with any significant background in technology. In MBA 720, with a short ramp-up, students are asked to construct databases and utilize spreadsheet techniques. Furthermore, module 2 technical assignment which is used to measure the "Technology Design" dimension is the most difficult technical assignment in the course. In light of this, the reduction in overall unsatisfactory rates from 22.1% in 2018-19 to 9.5% in 2019-20 is noteworthy.

The differential in the reduction in "unsatisfactory" rates between F2F and MBAO students is an issue that needs further investigation. With limited data spanning 1 year post intervention, if the current differential is not attributable to sample variance, then amelioration via implementation of additional interventions may be considered.

In summary, the reduction in unsatisfactory rates from 2018-19 to 2019-20 across all three dimensions is indicative of the possible effectiveness of the targeted interventions. Attempts to improve student performance through additional/specialized office hours and through additional opportunities to improve initial submission may have contributed to improving the cognitive processes for learning which resulted in better student performance.

Qualitative Assessment – GEOG 100 & SOCA 295

The onset and spread of COVID-19 has brought about sudden changes with the widespread shift to online teaching in institutions of higher education. With both students and faculty struggling to come to terms with the changed and sometimes, confusing circumstances, the challenges associated with transposing the F2F experience to the online classroom so as to ensure effective teaching and learning has been a primary concern of both educators and learners.

This section attempts to shed light on some measures adopted by faculty in effecting a smoother transition from the F2F environment to the digital environment by incorporating strategies and techniques that help develop and maintain cognitive presence. Qualitative observations of faculty are discussed to highlight the approaches undertaken.

GEOG 100: The first case study involves a general education science-based course, Physical Geography and the Environment (GEOG 100). This class had been taught in a traditional F2F format for 15 years before transitioning to online mode. Most of the real-life hands-on experiences had been incorporated in the online format to some degree. As a 4-credit course, the goal was to maintain the individual and group intensive activities that required generous commitments of time and critical thought from students. Students are expected to participate in hands-on activities, instructor facilitated information exchange, interactive lectures, and group / peer-facilitated collaboration.

The class was taught online in Spring 2020. Even in online mode of delivery, the course involved hands-on activities, including outside field trips. With the advent of COVID-19 and the consequent decision taken by the authors' institution to transition all classes online for the remainder of the semester, the immediate challenge lay in how best to facilitate the outside activities that were part of the course when students were mandated to stay at home and maintain social distancing protocols. With all the classes that the students were enrolled in switching to online delivery, the possibility of having computer weary students posed ancillary challenges related to maintaining student engagement. There was a need to adapt the teaching plan to accommodate the changed circumstances so that both learning outcomes as well as student engagement could be maintained.

For instance, in the traditional F2F course, the students are led in groups in the field to learn about biogeography concepts. In order to ensure that learning objectives were met, the field trip

was reimagined as a solo activity as opposed to a group effort. New and detailed field trip instructions were created and provided to students so that students could individually find a nearby park and reflect on the related questions. Due to the pandemic, this activity was modified to more of a micro-scale view of ecosystems that could be accomplished by students visiting their own back yard. Student discussion of their findings with peers and with the professor further allowed for synthesis and learning of concepts that helped develop and maintain cognitive presence. Student reflections were overwhelmingly positive as they discovered the rich variety of information available in their own back yards.

Another example is a modified Rock Type Identification activity. This activity is normally done as a group in the classroom, but now students can individually view an instructor created video of each rock type. This format allows the students the flexibility to study the rocks at their own pace, and discuss with other students how best to answer related questions. Against the backdrop of the pandemic imposed restrictions, this is a solution that accomplishes learning objectives while encouraging student engagement and interaction.

The faculty member had worked with the same teaching assistant during the Winterim 2020, Spring 2020, and Summer 2020 semesters – in essence, the semester leading to, at the outset of, and during the pandemic. In adapting and modifying the course to fit the demands of a changed educational landscape, the professor leveraged the student assistant's perspective and viewpoints in developing a teaching plan geared towards greater student engagement and aimed at developing and maintaining cognitive presence in the classroom.

SOCA 295: The second case study involves a Research Methods course in Sociology (SOCA 295). The F2F course switched to online delivery in the middle of March due to the onset of the global pandemic. This course requires students to be acquainted with the different qualitative and quantitative methods of research in the social sciences. Students are expected to find, organize, and critically evaluate data/information to frame and develop qualitative and quantitative research proposals.

Within the first week of online instruction, it became apparent that traditional lecture style would not work even in a synchronous setting, as many students, new as they were to this mode of learning were not cognitively and emotionally invested. Students did not ask many questions in the online synchronous classroom compared to the previous face to face setting. Some students had their videos switched off. In the absence of a setting which allowed the faculty member to decipher verbal and nonverbal cues that would have otherwise provided inklings of student absorption and engagement, it was difficult to ascertain whether students were benefitting from the instructional format. This meant that the professor was unable to respond to student needs satisfactorily. This was also evident from student queries on assignments as well as responses on submitted assignments. Exploration of concepts through information exchange became challenging because of the limits imposed by the virtual nature of instruction, thereby limiting the scope of cognitive presence in terms of connecting ideas leading to integration of concepts and applying them to achieve desired outcomes.

Upon reflection, the instructional format was changed to incorporate a flipped classroom approach. This allowed the faculty member to prioritize active learning during class time by assigning lecture materials and presentations to be viewed by students at home or outside of class time. Students were asked to read the assigned materials so that the online class hour could be used to synchronously discuss areas they found challenging and/or specific topics identified by the professor that needed elaboration. With careful facilitation, the online classroom became an interactive learning environment where students applied themselves and engaged with the course content. Some of the adjustments made were:

a) Focused Instruction: Instead of standard lectures, the professor provided targeted explanations, help, and assistance based on topics that students found challenging.

b) Skill Centered Approach: The following steps were implemented:
   - Class time was devoted to activities, practicing what students learned, and clarifying concepts they didn't understand such as rewriting hypotheses statements or survey questions.
   - Students completed assigned homework prior to the start of class and discussed problems, solutions, and how to improve initial submission during the synchronous class meeting.
   - Instructor led assignment workshops were instituted to provide students practice in achieving the most essential skillsets via information exchange, connection of ideas, and application of skills.
   - The discussion board feature was used extensively where students posted their work during the week, and provided peer feedback. The faculty member evaluated student posts to look for common errors to address later.

- Peer Review and Feedback mechanism was used to discuss, critique, and improve student learning and attainment of skills.

The flipped classroom method allowed for adaptive instruction based on gaps in knowledge and comprehension, as well as issues and concepts that students found challenging. This, in turn, allowed the professor to provide targeted help. Assignments were modified based on what students needed to practice most. A loosely structured course calendar was implemented that allowed for some class periods to be devoted to interactive information exchange and connection of ideas while others became a venue for group work devoted to hands-on practice, identification and correction of errors, or application of skills to produce the final project. Virtual office hours via video conferencing facilitated one on one learner-instructor interaction that aided integration of concepts, application of knowledge, and problem/issue resolution.

This learner-centered flipped classroom approach allowed for a sustained level of cognitive presence whereby class time was dedicated to exploring and honing in on topics at greater depth, ultimately leading to improved/superior student performance in graded course activities. The synchronous video discussion sessions and the asynchronous discussion boards gave students opportunities to engage in meaningful activities aimed at attaining the important course objectives. As a result, students were actively involved in knowledge construction via connection and implementation of ideas thereby employing cognitive processes of learning.

RECOMMENDATIONS TO CREATE AND SUSTAIN COGNITIVE PRESENCE IN THE ONLINE CLASSROOM

The authors realized that the process of replicating F2F classroom in the virtual environment is a work in progress that will benefit from learned experiences of the authors, guided and aided by feedback from students, evaluation of metrics of student performance, and personal reflection. Preserving the integrity of student learning and maintaining cognitive presence may take a few iterations. The following recommendations may be helpful in creating and sustaining cognitive presence in the online classroom:

- Identify the key learning outcomes that students should have at the end of the course.
- Identify the most challenging and complex concepts that students should master.
- Identify key elements of the classroom structure (lectures, group work, field and lab activities, etc.) that are most essential to achieving the learning outcomes.
- Adjust course content and assignments to meet the essential learning outcomes.
- Commit additional time to facilitate learner-instructor interaction (e.g., synchronous instruction, video office hours).
- Commit to a learner-centered approach.
- Commit to a flexible teaching approach.
- Recognize that developing cognitive presence in an online classroom is a work in progress that may require several iterations and will evolve as instructors adapt to lessons learned.

CONCLUSION

The authors' institution has a mix of traditional (80%), non-traditional, and commuter students (65%). The institution has been expanding online offerings in an effort to improve flexibility in course scheduling. A primary challenge in this regard lies in ensuring that flexibility offered via online delivery is not achieved at the cost of student learning outcomes. Developing and maintaining cognitive presence in the online classroom is one way faculty can ensure that student learning outcomes are not compromised.

In this context, the onset of COVID-19 and the forced change in delivery mode has afforded authors the opportunity to attempt implementation of various instructional techniques that help facilitate development of cognitive presence in the online classroom.

Gleaning insights from the results of such practices and culling important lessons have helped the authors identify a set of approaches, as laid out in the recommendations, that may be implemented in online courses even after the pandemic recedes as this will help in successful adoption of the online learning paradigm. The authors intend to continue to attempt different instructional methods iteratively, and evaluate the efficacy of such approaches via detection of patterns in assignment scores as well as shifts in writing and critical thinking skills.

Based on the well-researched CoI model, this paper examined cognitive presence in online courses. The research brought qualitative and quantitative results from a breadth of disciplines ranging from business to physical geography to sociology. Building cognitive presence and enhancing cognitive aspects of student learning are perhaps the most difficult aspects of teaching in the virtual classroom [11][12][13]. However, as the findings demonstrate, cognitive presence can be enhanced through implementation of well-designed and thoughtful strategies that promote learner engagement and critical thinking. The paper provided examples of instructional techniques, videos, and other multimedia that can help promote cognitive presence in synchronous and asynchronous settings by triggering student curiosity, assisting students with exploration and integration of varied concepts, providing students with the tools needed for critical thinking, and thereby helping students apply knowledge to new scenarios.

This research is relevant during the current COVID-19 crisis, as institutions of higher education shoulder the responsibility of meeting societal and workforce needs for education. By cultivating cognitive presence in the classroom, educators can achieve their core mission of serving students well, despite enrollment declines in traditional programs, revenue and budget reductions, and significant changes in program delivery.

REFERENCES

[1] D. R. Garrison, T. Anderson, & W. Archer, "Critical inquiry in a text-based environment: Computer conferencing in higher education", **The Internet and Higher Education**, Vol.2, No. (2-3), 2000, pp. 87-105.

[2] D. R. Garrison & J. B. Arbaugh, "Researching the community of inquiry framework: Review, issues, and future directions", **The Internet and Higher Education**, Vol. 10, 2007, pp. 157-172.

[3] Akyol, Z., & Garrison, D. R. The development of a community of inquiry over time in an online course: Understanding the progression and integration of social, cognitive and teaching presence**. Journal of Asynchronous Learning Networks**, Vol. 12, No. (3-4), 2008, pp. 3-22.
[4] Arbaugh, J. B. Does the community of inquiry framework predict outcomes in online MBA courses? **International Review of Research in Open and Distance Learning**, Vol. 9, 2008, pp. 1-21.
[5] Richardson, J. C., Arbaugh, J. B., Cleveland-Innes, M., Ice, P., Swan, K. P., & Garrison, D. R. (2012). **Using the community of inquiry framework to inform effective instructional design. In The next generation of distance education.** (pp. 97-125). Springer, Boston, MA., 2012.
[6] Garrison, D. R. Online community of inquiry review: Social, cognitive, and teaching presence issues. **Journal of Asynchronous Learning Networks**, Vol. 11, No. 1, 2007, pp. 61-72.
[7] Gunawardena, C., & Zittle, F. Social presence as a predictor of satisfaction within a computer mediated conferencing environment. American Journal of Distance Education, Vol. 11, No. 3, 1997, pp. 8−26.
[8] Short, J., Williams, E. & Christie, B. **The Social Psychology of Telecommunication**. London: Wiley., 1971.
[9] Garrison, D. R., Anderson, T., & Archer, W. The first decade of the community of inquiry framework: A retrospective. The internet and higher education, Vol. 13, No. (1-2), 2010, pp. 5-9.
[10] Garrison, D. R., Anderson, T., & Archer, W. Critical thinking, cognitive presence and computer conferencing in distance education. American Journal of Distance Education, Vol. 15, No. 1, 2001, pp. 7-23.
[11] M. A. A. Celani, & H. Collins, "Critical thinking in reflective sessions and in online interactions", **AILA Review**, Vol. 18, 2005, pp. 41-57.
[12] D. R. Garrison & M. Cleveland-Innes, "Facilitating cognitive presence in online learning: Interaction is not enough", **American Journal of Distance Education**, Vol. 19, No. 3, 2005, pp.133-148.
[13] J. L. Moore & R. M. Marra, "A comparative analysis of online discussion participation protocols", **Journal of Research on Technology in Education**, Vol. 38, 2005, pp. 191-212.