

# **Exploring Blended Learning Designs for Community College Courses Using Community of Inquiry Framework**

## **Exploration de la conception de cours hybrides pour les cours des collèges communautaires à l'aide du cadre de référence de la communauté d'enquête**

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Résumé de l'article

L'objectif de cette étude utilisant des méthodes mixtes convergentes et en une seule phase était de comparer les différences dans l'efficacité des présences de la communauté d'enquête (CE) d'un modèle d'enseignement hybride en blocs d'un collège communautaire avec son homologue dans la modalité présentielle. Les données ont été recueillies à partir d'un sondage sur la communauté d'enquête, des rapports tirés du système de gestion de l'apprentissage Blackboard et des sondages d'évaluation des cours. Les résultats indiquent que les étudiants ont eu une meilleure expérience globale avec le cours hybride. Le modèle de blocs hybrides offrait de la flexibilité tout en atteignant les objectifs du cours. De plus, les résultats révèlent des différences dans les trois présences de la CE entre les deux modalités de cours, les étudiants étant plus conscients des présences dans le cours en présentiel.

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## Exploring Blended Learning Designs for Community College Courses Using Community of Inquiry Framework

### Exploration de la conception de cours hybrides pour les cours des collèges communautaires à l'aide du cadre de référence de la communauté d'enquête

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#### Abstract

The goal of this single-phase and convergent mixed methods study was to compare the differences in the effectiveness of the Community of Inquiry (CoI) presences of a community college blended block instructional model with the in-person counterpart. Data were gathered from the Community of Inquiry Survey, Blackboard LMS reports, and course evaluation surveys. The results indicate that students had a better overall experience with the blended course. The blended block model provided flexibility while achieving course goals. Further, findings reveal differences in all three CoI presences between the two course formats with more student awareness of the presences in the in-person course.

**Keywords:** blended learning; community college; community of inquiry; teaching presence; social presence; cognitive presence; mixed methods

#### Résumé

L'objectif de cette étude utilisant des méthodes mixtes convergentes et en une seule phase était de comparer les différences dans l'efficacité des présences de la communauté d'enquête (CE) d'un modèle d'enseignement hybride en blocs d'un collège communautaire avec son homologue dans la modalité présentielle. Les données ont été recueillies à partir d'un sondage sur la communauté d'enquête, des rapports tirés du système de gestion de l'apprentissage Blackboard et des sondages d'évaluation des cours. Les résultats indiquent que les étudiants ont eu une meilleure expérience globale

avec le cours hybride. Le modèle de blocs hybrides offrait de la flexibilité tout en atteignant les objectifs du cours. De plus, les résultats révèlent des différences dans les trois présences de la CE entre les deux modalités de cours, les étudiants étant plus conscients des présences dans le cours en présentiel.

*Mots-clés* : apprentissage hybride ; collège communautaire ; communauté d'enquête; présence pédagogique ; présence sociale ; présence cognitive; méthodes mixtes

## Introduction

Evidence suggests that blended learning provides more satisfaction and engagement (Taliaferro & Harger, 2022; Vaughan et al., 2013), results in similar examination scores to in-person courses (Jafar & Sitther, 2021; Shand et al., 2016), and positively impacts students' performance (Broadbent, 2017; Vo et al., 2017). Cleveland-Innes and Wilton (2018) identified several key benefits of blended learning, including increased learning skills, greater access to information, improved satisfaction and learning outcomes, and opportunities to learn with and teach others.

Brown (1992) argued that research should be undertaken in real classrooms with real students and teachers. Research has shifted to explore blended learning, outcomes, teacher factors, and Community of Inquiry (Yin & Yuan, 2022). While blended learning is appealing because it can encompass the best of both distance and in-person education (McKenna et al., 2020; Rovai & Jordan, 2004; Young, 2002), blended learning can potentially mix the least effective elements of both in-person and technology-mediated learning. The challenge is effectively combining both instructional designs with matching learners' characteristics and abilities (Drachler & Kirschner, 2012; Garrison & Kanuka, 2004; Garrison & Vaughan, 2008).

This study systematically explored blended and in-person instructional models with the CoI teaching, cognitive, and social presences (Garrison, 2007) to support meaningful approaches to online teaching and learning (Vaughan et al., 2013). It adds to the body of mixed methods research in distance education, the least used approach, according to Bozkurt et al. (2015).

## Literature Review

### Defining Blended Learning

Blended learning is “a thoughtful integration of classroom face-to-face learning ... with online experiences” (Garrison & Kanuka, 2004, p. 3). Bonk and Graham (2005) described blended learning systems as a combination of in-person and computer-mediated instruction for the same students studying the same content in the same course. Horn and Staker (2011) defined blended learning as “any time a student learns at least in part in a supervised brick-and-mortar location away from home and at least in part through online delivery with some element of student control over time, place, path, [and] pace” (p. 3).

## Models of Blended Learning

Beyond definition, the design of blended learning instruction must be one that reflects the particular educational setting in order for it to be successful. Educational institutions have adopted various blended designs. O'Connell (2016) as cited in Cleveland-Innes & Wilton (2018) offered seven configurations:

- **blended face-to-face class:** This model is based in the classroom, while online activities supplement in-person classes.
- **blended online class:** The class is primarily conducted online, with some required in-person activities.
- **flipped classroom:** Students watch a short lecture video online and come into the classroom to complete activities such as group work.
- **rotation model:** Students in a course rotate between various modalities, one of which is online learning.
- **self-blend model:** This is a program-level model. Learners are enrolled in a school but take online courses in addition to traditional in-person courses.
- **blended MOOC:** This form of the flipped classroom uses synchronous, video-based online, meetings to supplement a massive open online course.
- **flexible-mode courses:** All instruction is offered in-person and online, and students choose how to take their course.

Cleveland-Innes and Wilton (2018) discussed several blended learning models for higher education:

- **blended presentation and interaction model:** This form has classroom engagement as its primary component, with support from online exercises.
- **blended block:** In this model, a sequence of blocks is used to incorporate both in-person learning and online study, usually considering both pedagogical goals and practical constraints.
- **fully online model:** While not usually considered blended, if it incorporates both synchronous learning (e.g., online tutorials) and asynchronous activities (e.g., discussion forums), it is sometimes referred to as blended.

Finally, in the HyFlex and Here or There (HOT) models, both on-site and remote students can attend learning activities in real-time (Raes et al., 2020; Zydney et al., 2019).

## Effectiveness of Blended Learning

The effectiveness of blended learning, as identified in scholarly literature, includes student grades, satisfaction, flexibility, and retention. Studies found that final grades are similar in blended designs and in-person courses (Groen et al., 2020; Melton et al., 2009; Smith, 2013). Owston et al.

(2013) reported that students with higher grade point averages prefer online courses and performed equally well with content acquisition, regardless of the mode of delivery (Cavanaugh & Jacquemin, 2015; Smith, 2013; Tang & Byrne, 2007).

Students report higher satisfaction in blended courses (Larson & Sung, 2009; Taliaferro & Harger, 2022; Tseng & Walsh, 2015), which may be mediated by advanced course design (Patwardhan et al., 2020). Learner-content interaction is the most important predictor of satisfaction, considering that all three kinds of interaction (learner-learner, learner-instructor, and learner-content) positively affect learning (Kuo et al., 2009).

Higher perceptions of a learning community may result in more satisfaction with blended than in-person courses (Daigle & Stuvland, 2021). Students report that the opportunity to interact with other learners beyond the physical classroom is a positive feature of the blended approach (Cornelius et al., 2019).

In addition, students' personalities, age, and attitudes are vital factors in blended designs (Broadbent & Fuller-Tyszkiewicz, 2018; Kintu et al., 2017). Students prefer the flexibility of blended learning and faculty recognize the potential of blended learning to increase teacher-student interaction but acknowledge the need for more support in course redesign and training (Taylor et al., 2018). Student retention appears to be greater in blended as opposed to traditional courses (Groen et al., 2020).

## **Community of Inquiry**

Developed by Garrison et al. (2000), the CoI has been one of the most extensively used frameworks to guide instruction and research in online education (Bozkurt et al., 2015; Castellanos-Reyes, 2020; Kim & Gurvitch, 2020; Martin et al., 2022; Stenbom, 2018). The CoI includes three components: teaching presence, social presence, and cognitive presence. Teaching presence is the design, facilitation, and direction of cognitive and social processes to realize personally meaningful and educationally worthwhile learning outcomes (Anderson et al., 2001). Social presence is “the ability of participants to identify with the community, communicate purposefully in a trusting environment, and develop inter-personal relationships by way of projecting their individual personalities” (Garrison, 2017, p. 25). Cognitive presence is the extent to which learners can construct and confirm meaning through sustained reflection and discourse (Garrison et al., 2001).

The CoI framework influences online teaching internationally. Arsenijevic et al. (2022) found differences in all three presences among six countries (Serbia, Croatia, Bosnia and Herzegovina, Slovenia, Romania, and Russia) during the COVID-19 pandemic, concluding that results depend on the educational context. Parrish et al. (2021) used the CoI to test a team-based approach to online learning with synchronous sessions in the USA. In Norway, Krzyszkowska and Mavrommati (2020) used the CoI model to recommend improving online learning designs to promote learning in the community. In the United Arab Emirates, Meda and ElSayary (2021) explored ways to establish all three presences during emergency remote teaching.

The CoI survey (Community of Inquiry, n.d.), validated by Swan et al. (2008), examines learning experiences and compares different learning contexts (Redstone et al., 2018; Stenbom, 2018).

## Research Methods

This single-phase convergent mixed methods study aimed to compare the influence of the CoI in two community college courses: a blended block model and an in-person course. Convergent mixed methods design is a one-phase design where both qualitative and quantitative data are collected and analyzed within the same timeframe (Creswell & Creswell, 2017). Three research questions guided the study design and analysis:

1. What are students' perceptions of community of inquiry in in-person and blended courses?
2. What practices are associated with effective blended learning?
3. Was the chosen model of blended learning appropriate for college courses?

Qualitative and quantitative data were collected in parallel, analyzed separately, and merged. Quantitative data described students' perceptions of all three presences in the CoI framework. Open-ended data supplied different perspectives on course design features. Blackboard Learn 9.1 Analytics provided additional insights into learners' activity.

The instructor was also the primary investigator in the study; therefore, a student researcher collected data to avoid a perception of possible conflict of interest. The community college Research Ethics Board approved all measurement instruments used in the study.

## Participants and Context

The study participants were a convenience sample of Canadian community college students enrolled in an elective physics course in Fall 2019 (Table 1).

**Table 1**

*Characteristics of Study Participants*

Total number of students	Gender		Program		
	Female	Male	Post-graduate certificate	Diploma	Advanced diploma
84	11	73	11	39	34

For most students, this was their first exposure to blended learning. The registration system did not mention the mode of delivery of the two courses, so students did not register for sections based on their preferred blended or in-person course delivery. The same instructor taught both the in-person and blended courses. Assessments were the same for both courses.

The blended block model (Cleveland-Innes & Wilton, 2018) was used to redesign the current in-person course, so the content was the same for both courses. The in-person sessions for the blended course were every other week, starting in week 1. During in-person sessions, students were introduced to a new topic and practiced new concepts individually and in small groups. During distance weeks,

students investigated online modules which included readings, videos, quizzes, simulations, self-assessment activities, and online asynchronous discussion forums on the Blackboard LMS.

Inclusive course design with accessible content and appropriate technology promotes widely known principles of good practice in education (Chickering & Gamson, 1987). Consultation with an instructional designer and Universal Design for Learning coach was integral to the whole study, considering the unique needs of community college learners.

## Data Collection

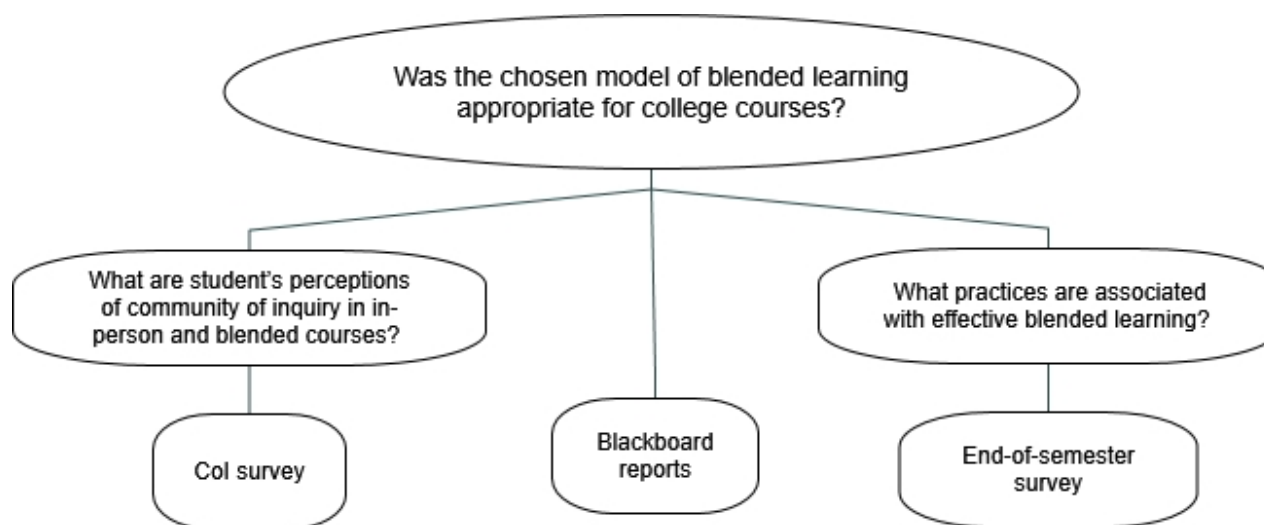
To answer research questions, three data collection processes were used (Figure 1):

- **CoI survey** (Arbaugh et al., 2008): Thirty-four questions using a Likert-type scale (1 = *strongly disagree* to 5 = *strongly agree*) to measure teaching, cognitive, and social presences.
- **End-of-semester survey**: Open-ended questions to evaluate design features and one question about overall learning experience on a Likert-type scale (1 = *poor* to 5 = *great*), as well as a question asking how much time the course required per week.
- **Blackboard reports analysis**: To provide additional insights on learners' activity and help evaluate course designs (le Roux & Nagel, 2018), we examined these three reports:
  - *All User Activity Inside Content Areas* displays a summary of activity inside content areas students use the most and the least.
  - *Overall Summary of User Activity* displays student activity for all course pages, including activity dates, times, and frequencies.
  - *Course-at-a-Glance* summarizes a comparison to other courses in the same department.

The research team administered the CoI survey and end-of-semester survey at the end of the semester. Twenty-eight anonymous students in the in-person class and 24 in the blended section completed all surveys, yielding a response rate of 62%. Blackboard reports were generated in the middle and end of the semester to gain additional insights into students' activity and behaviour online.

**Figure 1**

*Research Questions and Data Collection Methods*



## Data Analysis

First, CoI survey data were organized in a spreadsheet for further analysis. Descriptive statistics calculated the mean and standard deviation for each CoI survey item. Also, a hypothesis test produced summative values for each CoI presence. Second, the end-of-semester survey open-ended data analysis included a word count (Leech & Onwuegbuzie, 2007), content analysis for common themes, and word cloud visualization (McNaught & Lam, 2010). The word count function in Microsoft Word calculated the total number of words in each response group. Even though word count can decontextualize a word to a point where it is not understandable (Leech & Onwuegbuzie, 2007), we believe that word frequency provides a good indication of meaningfulness because most of the responses were in the form of a short phrase.

A text visualization content analysis of the overall text (Bhowmick, 2006) compared the two sets of textual data. The iterative process of revisiting data to ensure accuracy strengthened authenticity and validity. Textual data for both courses were coded for common themes. The qualitative textual data were uploaded to NVivo (Version 12, Lumivero, 2022) to generate word clouds. Words from the same families (e.g., experiment and experiments) were considered one word. Tables with word frequencies generated by NVivo were analyzed to get the usage rate of each word. Usage rate is word frequency divided by the total number of words (Leech & Onwuegbuzie, 2007).

## Results

### Community of Inquiry Survey

Summarized respondents' ratings for the three presences were calculated (Table 2). Mean responses for the 34 items ranged from 3.39 (item 16, blended section) to 4.82 (item 6, in-person section); standard deviations were highest for item 22 ( $SD = 1.28$ ; blended section) and lowest for item



6 ( $SD = 0.40$ ; in-person section). Mean ratings across the three presences exceeded 4.0 (on a 5-point scale) and presented general agreement that CoI was evident in an in-person class. In the blended section, the mean exceeded 4.0 for teaching and cognitive presences but not for social presence. A two-tailed two-sample  $t$ -test with alpha set to 0.05 confirmed a significant difference between in-person and blended classes for social presence.

**Table 2**

*Descriptive Statistics for CoI Presences*

CoI presence	In-person <sup>1</sup>		Blended <sup>2</sup>		$p$ -value
	$M$	$SD$	$M$	$SD$	
Teaching	4.57	0.46	4.53	0.49	0.765
Social	4.20	0.64	3.58	0.72	0.002
Cognitive	4.33	0.68	4.03	0.67	0.116

*Note.* <sup>1</sup>  $N = 28$ ; <sup>2</sup>  $N = 24$ .

Survey results are shown in the Appendix. Examination provides a more detailed picture of learners' perspectives. Teaching presence was strongly felt via course design, organization, and facilitation. Even though all ratings were higher than 4.0, items related to developing a sense of community and providing feedback were among those with the lowest rating, indicating less agreement about the degree to which this behaviour was present. However, items related to feedback were rated higher in the blended section.

The survey results for social presence yielded some interesting differences between the two types of course delivery. Affective expression items rated above 4.0 for the in-person sections. However, only about half the students surveyed perceived web-based communication as a suitable medium for interaction. Open communication was perceived as successful when interacting with other students ( $M > 4.0$ ) but not online, including in online discussions (in the blended class, the mean was about 3.9). Learners in both courses felt that they could "disagree with other participants" and "their point of view was acknowledged" ( $M > 4.0$ ).

Data for cognitive presence items shows unanimous agreement that this presence was present in the in-person course ( $M > 4.0$  for all items). Students in the blended section had mixed feelings: "problem posed" did not always create interest and motivation to explore further, but course activities "piqued curiosity." In the blended section, students felt strongly about the integration phase ( $M > 4.0$  for all items); however, they were less sure that they had developed solutions applicable in practice ( $M = 3.96$ ). Also, blended learners felt that "online discussions were valuable" in helping them "appreciate different perspectives" ( $M = 4.04$ ).

## End-of-Semester Survey

There were six questions in the survey, four of which were open ended. Data indicated that meaningful inclusion of technology has learning value for college students and helps increase engagement with course materials.

### Question 1

When asked about overall learning experience (Table 3), answers revealed a higher rating for the blended section. Additionally, final grades were slightly different in both courses (Table 4).

**Table 3**

*Means and Standard Deviations of the Overall Learning Experience*

In-person		Blended	
<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
4.43	1.00	4.50	0.70

**Table 4**

*Means and Standard Deviations of Final Grades on a 100% Scale*

In-person			Blended		
<i>M</i>	<i>SD</i>	Range	<i>M</i>	<i>SD</i>	Range
92.3	6.00	31.7	89.4	10.2	51.9

Next, findings for the four open-ended questions are presented. As shown in Table 5, the number of words in responses varied for each open-ended question. Tables 6, 7, 8, and 9 further analyze these eight sets of textual data. It is worth mentioning that in word clouds, the size of words can be used to compare ideas in one image only. Tables with usage rates are provided to assist with comparing two sets of data.

**Table 5**

*Number of Words in Student Responses to Open-Ended Survey Questions*



Question	Number of words	
	In-person	Blended
2	107	69
3	98	45
4	145	84
5	85	51

## Question 2

When asked what activity they liked the most, students in both courses most often mentioned demonstrations and experiments (Table 6). However, in the in-person section, students mentioned these activities twice as often. Various in-class activities were also among their favourite activities. Also, students reported watching other people doing experiments as fun and educational.

**Table 6**

*Frequency of Word Use in Response to the Question: Which Activity Did You Like the Most?*

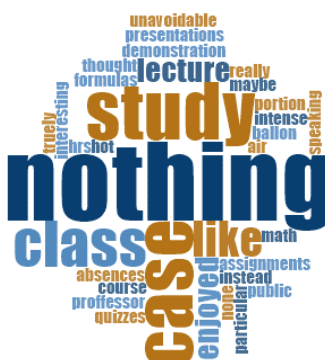

In-person	Blended		
Word clouds			
			
Usage rate of most popular words			
Word	Usage (%)	Word	Usage (%)
Demonstrations	16	Demonstrations	7
Experiment	7	Experiments	7
Class	7	Class	6
Project	5	Group	4
Case studies	2	Project	4

## Question 3

Table 7 presents responses to question 3 which concerned the least liked class activity. Interestingly, the answer “nothing” appears in both sets but more frequently in the in-person section. In the blended class, online activities (“online” and “discussions”) were the most frequent responses.

**Table 7**

*Frequency of Word Use in Response to the Question: Which Activity Did You Like the Least?*

In-person		Blended	
Word clouds			
			
Usage rate of most popular words			
Word	Usage (%)	Word	Usage (%)
Nothing	7	Online	13
Case	5	Discussions	11
Study	5	Material	5
Class	4	Case study	2
Enjoyed	2	Quizzes	2
Math	1	Nothing	2

#### **Question 4**

This question asked students what supported their learning of the course material (Table 8). In addition to in-class related activities (e.g., “class”, “demonstration”, and “lecture”), students in the in-person section mentioned “google” and “teacher” being supportive of their learning. Students in the blended class appreciated material designed for distance classes.

### Table 8

*Frequency of Word Use in Response to the Question: What Helped You Learn the Course Material?*

In-person		Blended	
Word clouds			
Usage rate of most popular words		Usage rate of most popular words	
Word	Usage (%)	Word	Usage (%)
Class	4	Online	6
Case	2	Material	5
Demonstrations	2	Class	4
Lectures	2	Reading	4
Studies	2	Demonstration	2
Experiments	1	Teacher	2

### Question 5

College students are diverse in background, prior knowledge, and personal and job situations. In addition, due to the nature of general education courses, students have different course loads. As shown in Table 9, answers to a question about what prevented the participants from learning varied from the timetable and work-related issues to course design features. It is worth noting that students in the in-person class mentioned “personal problems”, and “motivation” was mentioned in the blended section.

### Table 9

*Frequency of Word Use in Response to the Question: What Prevented You from Learning?*

In-person		Blended	
Word clouds			
Usage rate of most popular words			
Word	Usage (%)	Word	Usage (%)
Early	4	Online	4
Class	4	Read	4
School	2	Lack	2
Time	2	Lazy	2
Personal problems	2	Motivation	2

*Note.* The most frequent answer in both sections, “nothing” (12% of the total number of words) was removed from the analysis.

In an analysis of survey data concerning the instructor, it was found that students appreciated material posted on Blackboard, in-class handouts, in-class activities, and good facilitation of classes (Table 10).

### Table 10

### *Instructional Activities That Supported Learning*

Instructional activity	Percentage of students mentioning the activity	
	In-person	Blended
In-person sessions	61	30
Materials on Blackboard	25	73

Instructional activity	Percentage of students mentioning the activity	
	In-person	Blended
Students' demonstrations	64	33
Instructor's demonstrations	29	42

### ***Question 6***

The survey also asked students how much time they spent on online activities each week. Considering that the standard weekly class is three hours, students in the blended course spent less time studying during distance weeks than students in the in-person class. Also, a couple of students in the in-person class suggested reducing class time to two hours. Lastly, according to self-reported time, students spent less than 3 hours per week on activities on Blackboard (Table 11).

**Table 11**

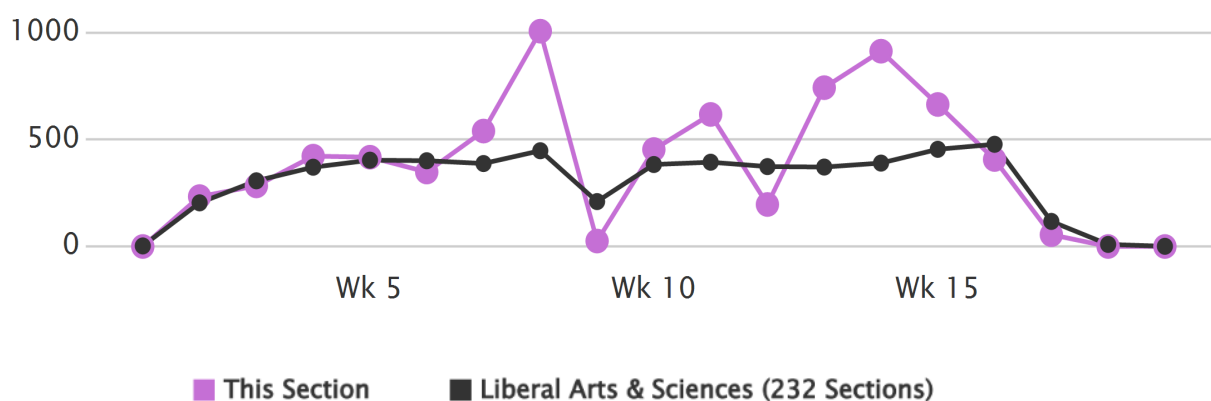
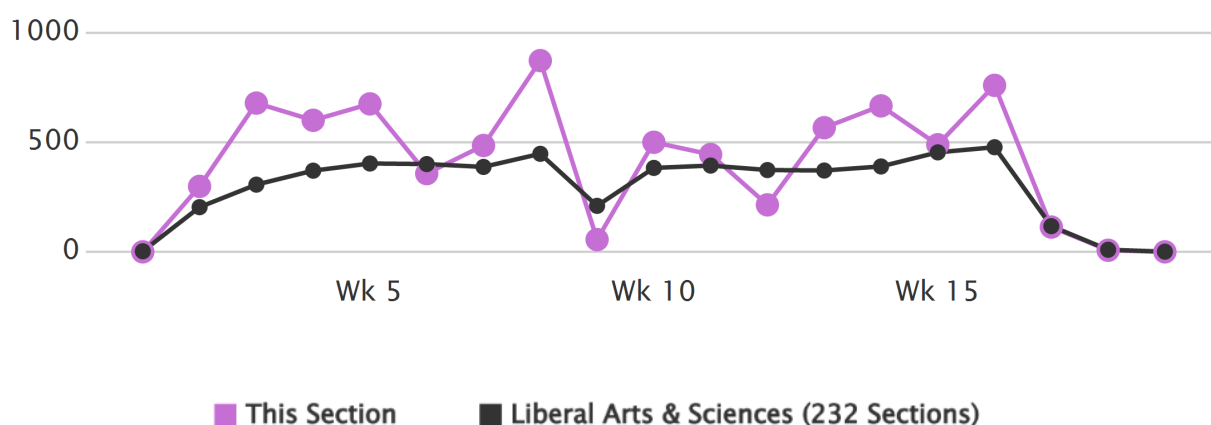
*Number of Hours Spent Each Week on Online Activities*

In-person		Blended	
<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
0.9	0.9	1.3	0.5

### **Blackboard Reports**

#### ***Course-at-a-Glance***

Reports reveal that the blended course had higher access, interaction, and minutes than the in-person course and department averages (Figures 2 and 3). Students in the blended class tended to access Blackboard regularly, whereas in the in-person class, access was mostly during assessment periods (weeks 9 and 14).

**Figure 2***Minutes Spent on Blackboard Weekly: In-Person Course Students**Note.* Wk = week.**Figure 3***Minutes Spent on Blackboard Weekly: Blended Course Students**Note.* Wk = week.***All User Activity Reports***

Data confirm that students in the blended course accessed the content area more often and consistently. Students visited the area with assessment tasks most often. In the blended section, the number of hits was twice the number for the in-person section. Unexpectedly, user activity inside content areas decreased in the second half of the course (Table 12).

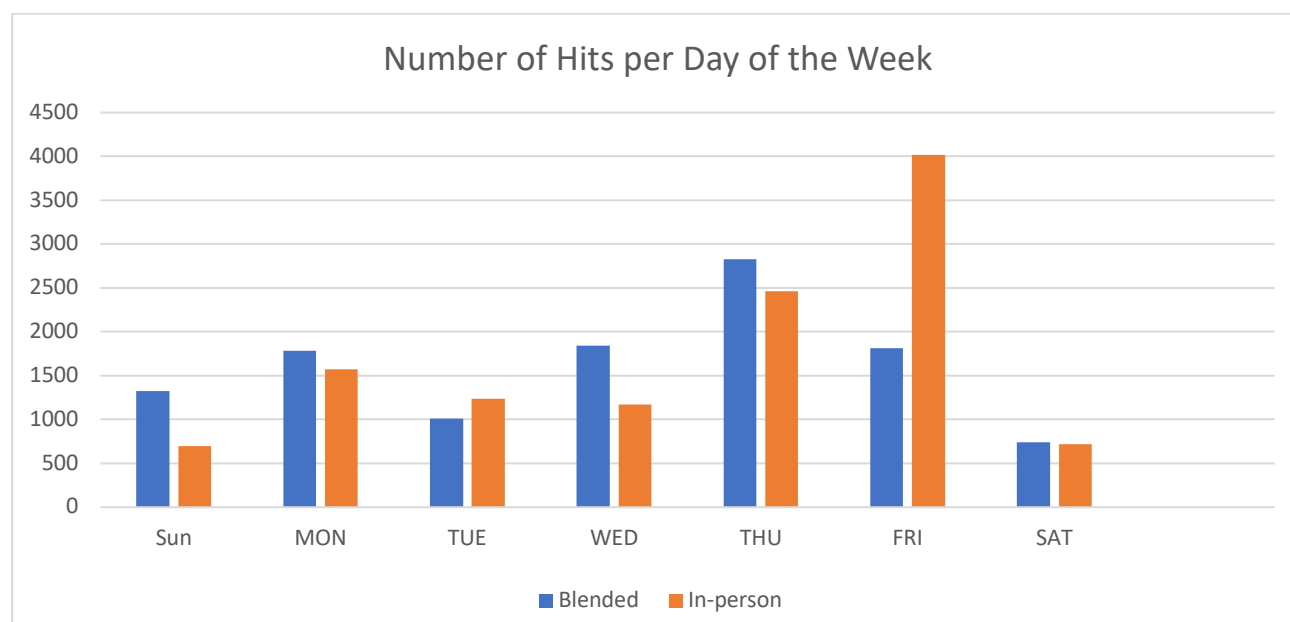


**Table 12***Number of Hits Inside Content Area Per Course Period*

Course period	In-person	Blended
Weeks 1 to 7	1,285	1,334
Weeks 8 to 15	981	889

***Overall Summary of User Activity Reports***

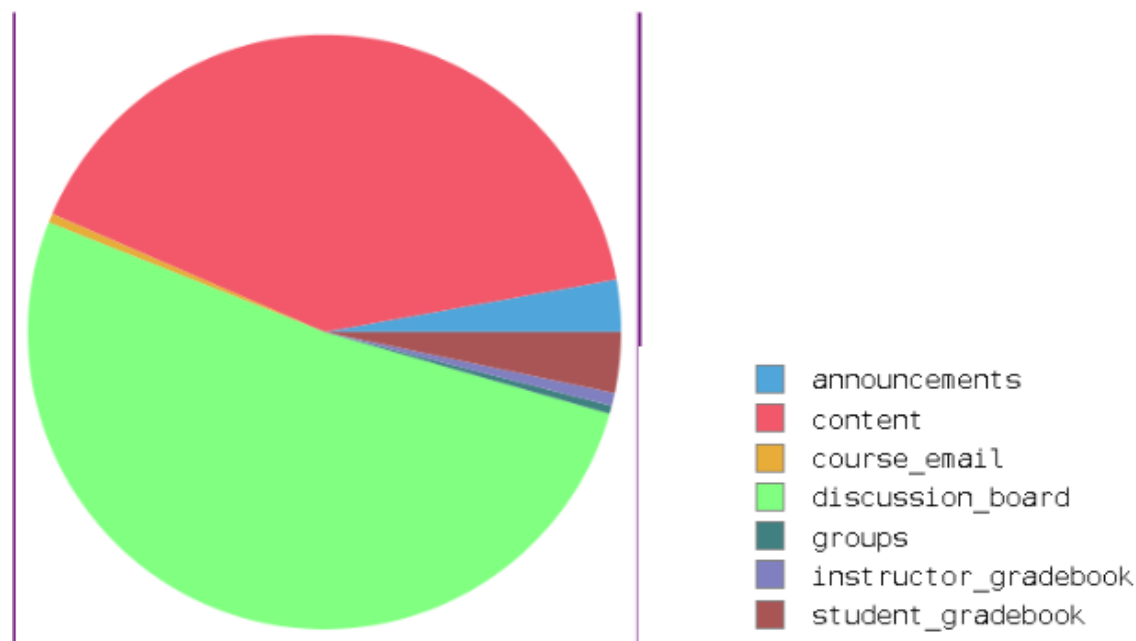
Students accessed the course most often on the day of the class: of all accesses per week, 46% for the in-person section were on Friday and 38% for the blended class were on Thursday. However, students in the blended class demonstrated more consistent activity throughout the week (Figure 4).

**Figure 4***Daily Number of Hits on Blackboard: In-Person vs. Blended*

Blackboard reports also provided insight into assessing course design based on students' online behaviour. Figure 5 illustrates that students in the blended course accessed online discussions more often than the content area. In the in-person section of the course, as might be expected, students most often accessed the course's content area (posted learning materials); there were no discussion forums.

**Figure 5**

*Frequency and Type of Content Accessed by Students in the Blended Course*



### Discussion

Analysis of the CoI survey responses reveals that teaching presence had the highest rating for both courses. Teaching presence is key to establishing and sustaining a community of inquiry (Cornelius et al., 2019; Garrison et al., 2010; Redstone et al., 2018). The most favourite activity in both courses, demonstrations by the instructor and students, was a valuable contributor to the high rating of teaching presence. Access to course materials on demand has been helpful, especially around test times. Planning and organizing materials before and during the course support a strong teaching presence (Courduff et al., 2021; le Roux & Nagel, 2018).

Interestingly, students in the blended course placed greater value on the effectiveness of the instructor's feedback. Online discussions allowed students to contribute meaningfully to the community of learners and instructors to respond promptly to correct misconceptions and direct further learning more effectively based on individual needs. However, facilitation of the overall learning process was rated higher in the in-person class. This may be showing the importance of teacher support in blended courses to keep students motivated to study online due to a wide range of self-regulated learning profiles (Broadbent & Fuller-Tyszkiewicz, 2018; Fryer & Bovee, 2018).

Social presence was significantly lower in the blended course than in the in-person course. A lower rating for social presence is consistent with other studies (Cornelius et al., 2019; Honig & Salmon, 2021; Lacaste et al., 2022; Stewart et al., 2021). Even though students in the blended section visited online discussions more often than the course materials and were comfortable interacting with other participants, they did not feel that they knew other course participants well. Unexpectedly, a

sense of belonging was rated higher in the blended course. One possible explanation could be that online discussions positively affect identifying with the class community by allowing every student to contribute. A higher perception of social presence in the in-person class was anticipated because students were more familiar with in-person experiences and were first-time learners in a blended environment. Communication effectiveness in online environments is still an important area of inquiry (Kim & Gurvitch, 2020). Group cohesion was rated similarly for both courses. This shows that blended learning allows to build relationships due to the in-person component and online discussions even though students meet less often than in the in-person course. Since social presence has a connection to teaching and learning elements (Garrison et al., 2010), paying particular attention to connections between in-person and online components of blended learning may support the development of social presence.

Course design considered Meyer's (2003) and Vaughan and Garrison's (2005) suggestion that the triggering event and exploration phases were preferably done in person. Results reveal the difference between all cognitive presence categories and integration and resolution phases were more active in the in-person course whereas, in the blended course, only the integration phase was most active. Such a difference in the triggering event phase between the two classes was unexpected. The blended course was designed to introduce new concepts in the in-person weeks and then allow students to master them during online weeks. The explanation could be that in-person sessions in the blended course resulted in more cognitive load and faster exploration of new concepts, while distance weeks required more self-regulation. Also, students had mixed perceptions about activities during distance weeks in the blended course; some felt online materials and online discussions supported learning, and at the same time, online discussions were among the least favourite activities. Lower ratings for the cognitive presence in the blended course may be connected to the lower ratings for social presence, confirming that cognitive presence and social presence reinforce each other and have a two-way dynamic (Redstone et al., 2018).

Learner activity on Blackboard is an essential source of information about learning and course interactions that can shed light on course design features. In this case, reduced activity in the second half of the semester may be due to course design; less posted content and more assessment activities compared to the first half of the course.

Final grades demonstrate a wider range for the blended section. Adaptation to blended learning environments may be a factor as they are known to be required for students (Cleveland-Innes & Garrison, 2010). According to Blackboard reports, blended designs foster more significant interaction with course material and with peers, and the development of digital literacy. Consistent with Bates' (2019) idea about teaching in a digital age and skills students should acquire, we can conclude that blended learning provides an opportunity to develop valuable digital, collaboration, and communication skills. Promoting self-regulated strategies in blended college courses would help students gain new skills required to be effective online learners (Wandler & Imbriale, 2017).

## Limitations and Further Research

The convenience sample used for data collection and relatively small classes could be considered limitations. Future studies can overcome these limitations by exploring the benefits and challenges of blended learning using another sampling method. Also, replication of this study with another instructor teaching both in-person and blended courses in a different educational setting, but using the same model, may provide additional insights. Since there are many ways to create blended learning environments, this study provides some insights into the possible design of general education STEM courses.

Further, policymakers and practitioners need research-based information about the conditions and practices under which online and blended learning are effective. Additional research is required to explore the CoI framework as a tool for creating effective blended environments for community college learners with different motivation levels and ways of adapting to online/blended learning environments.

## Conclusion

This study explored the blended block model for community college courses. Results indicate that this model was as effective as an in-person course in meeting learning outcomes with the benefits of flexibility for students. However, the findings should be generalized with caution due to variables such as a specific model for blended learning, students' characteristics, the nature of instructional goals, and learning resources. One of the significant contributions of this research is the examination of the CoI framework in blended courses in a community college setting. In addition, we should not forget about skills that students need to develop for success in a digital age and in the VUCA (volatile, uncertain, complex, and ambiguous) world in which we live. Findings support that well-designed blended learning is an excellent opportunity to practice these skills in a safe environment for community college students. All in all, blended courses have the potential to create enhanced opportunities for teacher-student interaction, added flexibility in the teaching and learning environment, and opportunities for continuous improvement (Vaughan, 2007).

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## Appendix

### Community of Inquiry Presences Survey Results

Indicator	In-person								Blended						
	<i>M</i>	<i>SD</i>	% <div><div></div></div>					<i>M</i>	<i>SD</i>	% <div><div></div></div>					
			1	2	3	4	5			1	2	3	4	5	
TEACHING PRESENCE															
Design & Organization															
1. The instructor clearly communicated important course topics.	4.61	0.96	0	0	11	21	70	4.58	0.72	0	4	0	29	67	
2. The instructor clearly communicated important course goals.	4.61	0.57	0	0	4	32	64	4.54	0.59	0	0	4	38	58	
3. The instructor provided clear instructions on how to participate in course learning activities.	4.64	0.68	0	4	0	25	71	4.71	0.55	0	0	4	21	75	
4. The instructor clearly communicated important due dates/time frames for learning activities.	4.79	0.42	0	0	0	21	79	4.71	0.55	0	0	4	21	75	
Facilitation															
5. The instructor was helpful in identifying areas of agreement and disagreement on course topics that helped me to learn.	4.68	0.55	0	0	0	25	71	4.62	0.78	0	0	17	25	58	
6. The instructor was helpful in guiding the class towards understanding course topics in a way that helped me clarify my thinking.	4.82	0.40	0	0	0	18 <sup>a</sup>	81 <sup>a</sup>	4.50	0.66	0	0	8	33	58	
7. The instructor helped to keep course participants engaged and participating in productive dialogue.	4.57	0.74	0	4	4	25	68	4.54	0.59	0	0	4	38	58	
8. The instructor helped keep the course participants on task in a way that helped me to learn.	4.61	0.63	0	0	7	25	68	4.5	0.59	0	0	4	42	54	
9. The instructor encouraged course participants to explore new concepts in this course.	4.64	0.56	0	0	4	29	68	4.63	0.58	0	0	4	29	67	
10. Instructor actions reinforced the development of a sense of community among course participants.	4.32	0.82	0	4	11	36	50	4.29	0.81	0	0	21	29	50	

Indicator	In-person								Blended						
	<i>M</i>	<i>SD</i>	% <div><div></div></div>					<i>M</i>	<i>SD</i>	% <div><div></div></div>					
			1	2	3	4	5			1	2	3	4	5	
Direct Instruction															
11. The instructor helped to focus discussion on relevant issues in a way that helped me to learn.	4.57	0.57	0	0	4	36	61	4.38	0.70	0	0	13	38	50	
12. The instructor provided feedback that helped me understand my strengths and weaknesses relative to the course’s goals and objectives.	4.18	0.82	0	4	14	43	32	4.42	0.78	0	0	17	25	58	
13. The instructor provided feedback in a timely fashion.	4.46	0.64	0	0	7	39	54	4.63	0.58	0	0	4	29	67	
SOCIAL PRESENCE															
Affective Expression															
14. Getting to know other course participants gave me a sense of belonging in the course.	4.39	0.89	0	4	14	21	61	4.58	1.00	4	4	29	42	21	
15. I was able to form distinct impressions of some course participants.	4.14	0.93	0	4	25	25	46	3.79	0.98	4	0	33	38	25	
16. Online or web-based communication is an excellent medium for social interaction.	4.07	1.01	0	11	14	32	43	3.39	1.27	9	17	22	30 <sup>b</sup>	22 <sup>b</sup>	
Open Communication															
17. I felt comfortable conversing through the online medium.								3.96	0.95	4	0	21	46	29	
18. I felt comfortable participating in the course discussions.	4.25	0.65	0	0	11	54	36	4.12	1.09	4	4	13	29	50	
19. I felt comfortable interacting with other course participants.	4.39	0.63	0	0	7	46	46	4.33	0.70	0	0	13	42	46	
Group Cohesion															
20. I felt comfortable disagreeing with other course participants while still maintaining a sense of trust.	4.18	0.77	0	0	21	39	39	4.21	0.59	0	0	9	63	29	
21. I felt that my point of view was acknowledged by other course participants.	4.36	0.68	0	0	11	43	46	4.29	0.69	0	0	13	46	42	

Indicator	In-person							Blended						
	<i>M</i>	<i>SD</i>	% 1 2 3 4 5					<i>M</i>	<i>SD</i>	% 1 2 3 4 5				
22. Online discussions help me to develop a sense of collaboration.								3.92	1.28	8	4	21	21	46
COGNITIVE PRESENCE														
Triggering Event														
23. Problems posed increased my interest in course issues.	4.29	0.69	0	0	18	36	46	3.75	1.07	4	4	21	42	25
24. Course activities piqued my curiosity.	4.18	0.86	0	7	7	46	39	4.12	0.96	0	8	13	33	46
25. I felt motivated to explore content related questions.	4.25	0.93	0	7	11	32	50	4.00	0.59	0	4	13	58	25
Exploration														
26. I utilized a variety of information sources to explore problems posed in this course.	4.36	1.03	4	4	7	25	61	3.83	1.01	4	4	21	46	25
27. Brainstorming and finding relevant information helped me resolve content related questions.	4.36	0.91	0	7	7	29	57	4.13	0.80	0	4	13	50	33
28. Online discussions were valuable in helping me appreciate different perspectives.								4.04	1.00	4	0	21	38	38
Integration														
29. Combining new information helped me answer questions raised in course activities.	4.61	0.74	0	4	4	36	57	4.17	0.82	0	4	13	46	38
30. Learning activities helped me construct explanations/solutions.	4.23	0.79	0	4	7	32	57	4.29	0.69	0	0	13	46	42
31. Reflection on course content and discussions helped me understand fundamental concepts in this class.	4.21	0.96	0	7	14	29	50	4.17	1.00	4	0	17	33	46
Resolution														
32. I can describe ways to test and apply the knowledge created in this course.	4.54	0.64	0	0	7	32	61	4.13	0.74	0	0	21	46	33
33. I have developed solutions to course problems that can be applied in practice.	4.36	0.87	0	7	4	36	54	3.96	0.86	0	4	25	42	29

Indicator	In-person							Blended						
	<i>M</i>	<i>SD</i>	% 1 2 3 4 5					<i>M</i>	<i>SD</i>	% 1 2 3 4 5				
			1	2	3	4	5			1	2	3	4	5
34. I can apply the knowledge created in this course to my work or other non-class related activities.	4.39	0.92	0	7	7	25	61	4.13	0.80	0	0	25	38	38

*Note.* Empty cells indicate response was not applicable. 1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree.

<sup>a</sup> *N* = 27; <sup>b</sup> *N* = 23.

From *Community of Inquiry Survey*, by B. Arbaugh, M. Cleveland-Innes, S. Diaz, D. R. Garrison, P. Ice, J. Richardson, P. Shea, and K. Swan, n.d., The Community of Inquiry (<https://coi.athabasca.ca/coi-model/coi-survey/>). CC BY-SA.

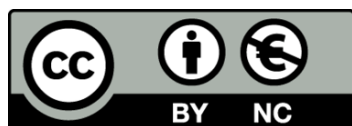
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