Implementing Sociograms in Online Learning:
Examining their Influences on Community of Inquiry Elements

Introduction

The global pandemic has expedited the shift to Computer-Supported Collaborative Learning (CSCL) environments, presenting a host of new challenges and opportunities in education. Asynchronous settings have emerged as a vital component of these environments, providing flexibility to geographically dispersed learners (Herman & Nilson, 2023; Koszalka et al., 2021). However, these asynchronous learning settings are not without issues, such as reduced participation, ineffective collaboration, and reduced learning performance (Daniel, 2020; Kreijns et al., 2013; McFarland et al., 2019). One particular concern is the lack of deep engagement in asynchronous online discussions, as students often engage superficially with others' ideas rather than co-constructing knowledge.

Theoretical Framework

The Community of Inquiry (CoI) framework conceptualizes an online learning community as a group of individuals engaged in critical discourse and reflection. Within this model, three interrelated presences - cognitive, teaching, and social - form the basis for meaningful online educational experiences (Garrison & Akyol, 2013). This study builds upon this framework, examining the use of sociograms as an instructional tool to enhance learner engagement in CSCL environments.

Sociograms, graphical representations of social networks, can visually represent the dialogic relationships within a learning community. They offer a comprehensive view of the interactions within an online discussion, aiding in the assessment of student engagement and participation (Borgatti et al., 2009; Bakharia & Dawson, 2011). Past research has demonstrated the utility of sociograms in predicting student performance, guiding the design of learning interventions, and providing insights into group dynamics (Saqr et al., 2018; Ghadirian et al., 2018; Bennett & Lockyer, 2011; Romero et al., 2013). However, despite their potential, little research has explored how learners perceive sociograms when used as instructional tools. Understanding students' perceptions is crucial, as the successful interpretation of sociograms requires some network literacy to discern the nuances in the data (Lockyer et al., 2013). This study seeks to fill this gap, exploring student perceptions of sociograms as an instructional tool in CSCL environments, thereby deepening our understanding of their potential to enhance engagement and learning outcomes in asynchronous online discussions.

The aim of this study is to find out how sociograms, which are visual ways of showing social networks, can affect how much students participate in online group discussions. We want to know how students feel about their online groups, how they perceive sociograms, how sociograms may influence their participation, and why they might decide to use or not use sociograms in their discussions.

Methods

Participants

The study included 136 students volunteered from a large university majoring education or communication. The participants were from five different online courses. Surveys not 80% completed were excluded from the final dataset, leaving 106 students. The number of responses to optional open-ended questions varied.

Instruments

A post-course Qualtrics survey was used to gauge students' perceptions of sociograms, engagement within the Community of Inquiry (CoI) framework, and overall course satisfaction. The survey combined 10-point Likert scale questions and open-ended questions for quantitative and qualitative data respectively.

The survey had three sections:

1. Learning Community: Assessed students' perception of their learning community through two Likert scale items and one open-ended question. Cronbach's alpha reliability was .85.
2. Sociograms: Explored students' perceptions of sociograms via six Likert scale items and three open-ended questions. Cronbach's alpha reliability was .89.
3. Community of Inquiry (CoI) Presences: Measured students' perceptions of Teaching, Social, and Cognitive Presences using items adapted from Albaugh et al. (2008) and modified by Lee & Clariana (2021). Cronbach's alpha values were .95, .93, and .97 respectively.

Results

Perceptions of the Learning Community

To explore students' perceptions of their online learning communities, both quantitative and qualitative methods were used. Analysis of responses on a 10-point Likert scale showed high regard for online learning communities ($M=8.64$, $SD=2.09$), with most students recognizing their courses as such ($M=8.27$, $SD=2.15$). A strong correlation suggests that as students' appreciation for online learning communities increases, so does their view of their course as a part of it (Spearman's $rho=.704$, $p<.001$). Thematic analysis highlighted four key factors influencing learners' perceptions: peer interaction, diversity of viewpoints, technology and course structure, and individual learning experiences (Table 1). The results underline the critical role of social interactions, technology utilization, engaging course design, and instructor engagement for a positive online learning experience.

The Relationship between Perceptions of Sociograms and CoI Elements

In analyzing the relationship between respondents' perceptions of sociograms and their understanding of the CoI components - Social Presence (SP), Cognitive Presence (CP), and Teaching Presence (TP) - several significant correlations appeared (Table 2). Familiarity with sociograms displayed weak but meaningful correlations with some elements of SP, CP, and TP. This indicates that familiarity with these graphic representations may enhance a student's perception of the core components of the CoI framework. When students felt that sociograms

supported their learning process, a strong connection was observed, revealing moderate to strong correlations with all aspects of SP, CP, and TP. This highlights the potential role of sociograms in strengthening these presences within an online learning community. The perception that sociograms contribute to a sense of community also showed moderate to strong correlations with all CoI framework dimensions, emphasizing the potential of sociograms to augment community feeling, a critical aspect of online learning environments.

However, the perception that sociograms would influence overall thoughts about the course and change participation in discussions demonstrated weaker yet significant correlations with certain CoI framework elements. This might suggest that while sociograms can influence perceptions and participation somewhat, their impact might not be as robust or as consistent across all areas. Lastly, the willingness to use sociograms in other course discussions showed significant correlations ranging from weak to strong across all CoI framework presences. This implies that students who recognize the benefit of sociograms in one context may be more likely to perceive the social, cognitive, and teaching presence in other course discussions.

General Perceptions of Sociograms

To examine students' perceptions of social networks in their courses, we analyzed open-ended responses to the question, "What does this network tell you about the discussion?" We created primary codes that we then organized into main themes: familiarity of sociograms, cognitive engagement, social interaction, and pedagogical sociograms (Table 3). We further refined these themes and incorporated survey data when a theme correlated with specific Social Network Perception (SNP) questions (Table 4).

Two themes emerged from responses regarding sociogram familiarity: a lack of understanding (network literacy) and skepticism about usefulness. From 64 responses, 14 exhibited negativity, showing either a misunderstanding of the maps or doubting their practicality. We utilized quantitative analysis to gauge these sentiments' extent across the respondents, analyzing Likert scale data related to sociogram familiarity (SNP1), specifically, "I am familiar with this kind of social network map." The responses showed a wide range of familiarity levels. Interestingly, 18.1% of the students showed zero familiarity, while 20% displayed full familiarity.

Under cognitive engagement, knowledge building and engagement with ideas appeared. Students felt that sociograms stimulated thought and identified discussion patterns, and viewed sociograms as tools exposing who most frequently responded, the extent of discussion spread, and how diverse viewpoints influenced their beliefs. However, our analysis of the SNP2 question, "I feel this social network map would support my learning," revealed wide-ranging perceptions regarding sociograms' efficacy in supporting learning, with a mean of 5.70. Notably, 28.3% of the students showed neutrality, 15.1% showed strong confidence in their learning utility, and 7.5% perceived no learning value in the sociogram.

Our analysis of "Perceived Social Interaction" highlighted three sub-themes: Network Engagement and Interaction, Group Dynamics, and Self-Reflection on Participation. Students noted sociograms' ability to illustrate classmate engagement and interaction, with some indicating that the map guided them towards the most engaging discussions. In terms of self-reflection, some students used the sociogram to assess their engagement and interaction levels,

and for some, the map underscored the need to enhance engagement. The SNP2 question scored a moderately positive mean of 5.70, supporting the qualitative findings about learning support. SNP3 had a slightly higher mean of 6.04, reinforcing the qualitative findings about fostering community.

In the pedagogical dimension of sociograms, students recognized the value of sociograms in visualizing online discussion structure and flow. The visual layout clarified the progression of class conversations and the overall organization of the discussions. Students also noted the instructor's visible role within the sociograms and saw this active participation as facilitating the conversation. The instructor's presence in the sociograms signaled their guiding role and commitment to supporting learning, a factor that students recognized and appreciated.

Perceptions of Sociograms on Student Participation

In exploring the influence of sociograms on students' intentions to participate in discussions, responses to the open-ended survey question varied significantly. About 44% of students (n=27) showed skepticism that a sociogram would alter their participation, mainly due to unfamiliarity with the tool or the belief that the map would not significantly influence their level of participation. They expressed concerns that the sociogram could lead to forced or less meaningful discussions. Conversely, around 50% of students (n=31) expressed optimism that a social network map might positively impact their discussion participation. They felt the sociogram could encourage interaction with different people, stimulate competitiveness, and provide an overview of their current participation status. Some students suggested that visualizing the discussion dynamics might make them more responsible for creating better discussions and learning experiences.

Despite mixed perceptions, when discussing the potential application of sociograms in future course discussions, the large group of participants (61%, n=35) indicated a willingness to use a sociogram. This willingness was primarily linked to the belief that sociograms could enhance their self-awareness in discussions, improve communication skills, and encourage diverse interactions. Participants also appreciated the visualization benefits of sociograms, asserting it simplified understanding group dynamics. However, this group voiced concerns about privacy, competitiveness, and the overall impact on authentic participation. However, 32% (n=18) of students indicated they would not want to use a sociogram in future course discussions. Their main reasons were the perceived lack of benefits, the irrelevance of sociograms to their participation, and general discomfort with group discussions. A small number of participants (7%, n=4) expressed neutrality towards sociogram usage in future course discussions, indicating neither strong acceptance nor rejection of the tool.

Scholarly Significance of the Study

This study aimed to explore the relationship between students' perceptions of sociograms, their understanding of the Community of Inquiry (CoI) framework, and their intentions toward discussion participation. The findings suggest sociograms can enhance the CoI framework, encourage a sense of community, and potentially boost student engagement in online discussions.

Students generally held a high regard for their online learning community, linking this appreciation to recognizing their own courses as learning communities. These results support previous research underscoring the importance of community in online learning (Rovai, 2002; Shea, 2006). Influential factors for perceiving a strong learning community were found to include peer interaction, viewpoint diversity, effective use of technology, well-structured courses, and active instructor involvement. Moreover, positive correlations were observed between students' perceptions of sociograms and the CoI elements, suggesting that sociograms can potentially bolster the CoI framework. This aligns with past research advocating for visualization tools to strengthen a sense of community and connectedness (Bakharia & Dawson, 2011). However, the degree of correlation varied across different elements, indicating the complex and non-uniform impact of sociograms.

The implications of this study for asynchronous online learning design stress the importance of fostering a strong online community and incorporating graphical tools like sociograms. However, students' varying levels of familiarity with sociograms highlight the need for clear instructions and support. Limitations include the study's reliance on a single snapshot of sociograms rather than cumulative data, preventing the observation of social interactions and perceptions evolution over time. Future research could benefit from multiple data points and correlating students' actual social networks with their perceptions, enabling a more nuanced understanding of community dynamics. In conclusion, the study offers significant insights into the potential role of sociograms in online learning communities, underscoring the need for further exploration to fully understand and leverage such tools to enhance online learning experiences.

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Table 1. Students' perceptions of the learning community in the online course

Themes	Definition	Example Quotes
Value of Online Learning Communities and Peer Interaction (SP)	Students value their ability to develop an online community with peers and professors, citing these connections as crucial for fostering meaningful learning interactions.	*"Throughout the semester... online learning would be far more difficult and less productive if we could not reflect and discuss class topics with our peers in our online community."*
Value of Collaboration and Diverse Perspectives (SP>CP)	Students appreciate the diversity within their online learning communities, and how interacting with different perspectives enriches their understanding and expands their learning.	*"I value interacting with other students and also the opportunity to learn about viewpoints from different perspectives."*
Role of Technology, Course Format, and Instructor Involvement (TP>SP)	Students acknowledge the importance of proficiency with Learning Management Systems (LMS), a well-structured course, and active instructor engagement in creating an effective online community.	*"Navigating the online tools was a bit challenging at first, … The professor's guidance and active participation in the online discussions made me feel more connected to the course and motivated me to participate."*
Personal Learning Experiences and Preferences (SP>CP, SP>TP):	Individual learning experiences and preferences intersect with social, cognitive, and teaching presences in the online learning environment, influencing their perceptions and engagement within the online learning community.	*"Navigating the online tools was a bit challenging at first... The professor's guidance and active participation in the online discussions made me feel more connected to the course and motivated me to participate."*

Table 2. Correlation Coefficients between Social Presence, Cognitive Presence, Teaching Presence, and Sociogram Perception Variables

	SNP1	SNP2	SNP3	SNP4	SNP5	SNP6
SP1	.268**	.585**	.582**	.484**	.361**	.540**
SP2	.240*	.493**	.491**	.371**	.148	.318**
SP3	.369**	.641**	.604**	.595**	.465**	.617**
SP4	.224*	.448**	.531**	.434**	.222*	.432**
SP5	.177	.378**	.442**	.364**	.162	.454**
SP6	.169	.440**	.447**	.385**	.204*	.459**
SP7	.259**	.443**	.383**	.334**	.171	.407**
CP1	.296**	.595**	.557**	.425**	.346**	.497**
CP2	.195*	.567**	.535**	.437**	.312**	.528**
CP3	.360**	.558**	.517**	.466**	.342**	.501**
CP4	.296**	.544**	.523**	.389**	.273**	.431**
CP5	.238*	.583**	.565**	.443**	.293**	.525**
CP6	.295**	.591**	.522**	.391**	.293**	.492**
CP7	.272**	.570**	.496**	.423**	.332**	.511**
TP1	.099	.440**	.541**	.363**	.243*	.411**

TP2	.077	.327**	.424**	.295**	.197*	.344**
TP3	.091	.326**	.448**	.305**	.136	.341**
TP4	.211*	.462**	.642**	.491**	.252**	.461**

Note. ** (p<.001); * (p<.05)

Table 3. Students' Perceptions and Interpretations of Sociograms in Online Learning Communities

Themes	Subthemes	Definition	Example Quotes
Familiarity of Sociograms	Lack of Understanding	Reflects unfamiliarity or confusion about sociograms	*"I have no idea how to read this map."* *"I have never heard of a social network map."*
	Skepticism about the Usefulness	Displays doubts about the practical value of sociograms	*"I can manage my real-life networks without a graphic, I don't really see a need for one virtually other than it's interesting to look at."* *"It can show which members are participating the most. What it doesn't show is the content or whether the participation is relevant or insightful."*
Cognitive Engagement	Knowledge Building	Indicates how sociograms foster thinking and understanding	*"It was successful at provoking thought."* *"The network map helped me to see patterns in our discussions that I hadn't noticed before."*
	Engagement with Ideas	Reflects the capacity of sociograms to promote engagement with concepts	*"The map gives an overview of the depth and variety of discussions that took place."* *"It can show which members are participating the most. What it doesn't show is the content or whether the participation is relevant or insightful."*
Social Interaction	Network Engagement and Interaction	Describes how sociograms reveal patterns of engagement between participants	*"It tells me who receives the most comments or had the most engagement from other classmates."* *"It shows the interactions that are taking place and lets me see discussions that I would like to participate in that I otherwise may not have seen."*
	Group Dynamics	Highlights perceived social groupings within sociogram	*"In a way, this map makes me feel as though some are outsiders, as though there are cliques."* *"There are smaller groups that are formed inside the network. Maybe they share similar background experiences."*
	Self-Reflection on Participation	Captures insights about personal participation gained through sociograms	*"The network map highlights that I was more focused on responding to others than initiating new conversation threads, which is something I want to change moving forward."*

			"I can see that I mostly interacted with a specific group of people, and I should try to engage with others in future discussions."
Pedagogical Sociograms	Organization and Structure	Refers to how sociograms help visualize the structure and flow of conversations	*"It diagrams where the interactive conversations went."* *"The layout of the network map makes it easy to see the flow of conversation."*
	Facilitation and Direct Instruction	Reflects perceived role of the instructor as shown in sociograms	*"It's clear from the map that the instructor provided direction and feedback during the discussions."* *"The instructor's presence in the network map shows that they were guiding and supporting our learning process."*

Table 4. Descriptive Statistics for Sociogram Perception Items

	N	Min	Max	Mean	Std. Deviation
SNP1 - I am familiar with this kind of social network map.	105	0	10	5.04	3.554
SNP2 - I feel this social network map would support my learning.	105	0	10	5.70	2.889
SNP3 - A social network map makes me feel more like a member of a learning community.	106	0	10	6.04	2.953
SNP4 - A social network map like this will influence my overall thoughts about this course.	106	0	10	5.38	3.311
SNP5 - If given a social network map, my participation in the discussion would change.	104	0	10	5.24	3.158
SNP6 - Would you like to have a social network map in your other course discussions?	106	0	10	6.26	3.367