Board 239: Community as "Surroundings" in a Classroom Ecosystem

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Abstract

In this paper, we preliminarily examine the notion of the "surroundings" in an engineering classroom. We posed an open-ended reflection question to engineering undergraduates at a large US university about their classroom surroundings and its impact on their learning and comprehension. The reflection prompt defined surroundings as the "*conditions and objects that surround you."* This reflection question was part of an NSF-funded study on the use of weekly reflection in a flipped fluid mechanics course to drive metacognitive development and lifelong learning skills. During class, students were encouraged to collaborate with their peers during problem solving to achieve collective understanding and interact with the instructor. Based on an inductive, emergent content analysis of the reflection data with two analysts, we obtained an unexpected result. Specifically, the most-frequently mentioned positive classroom "surroundings" was "*peers"* (46% of responses). We had initially expected less-positive responses related to the physical surroundings, such as classroom layout, size, furniture, infrastructure, etc. Although students identified the classroom's physical attributes as surroundings that had both negative and positive influences on their learning, a second unexpected positive response emerged with the *instructor* and *in-person instruction* as part of the "surroundings." Upon searching the literature to understand these results, we adopted the Community of Inquiry (CoI) framework. This model consists of three interacting components of cognitive presence, social presence, and teaching presence, which enable educational experiences and learning. When combined, the Community of Inquiry elements (i.e., peers, instructor, and in-class instruction) were discussed in 55% of the reflections as positive "surroundings." Within the classroom ecosystem, feelings about positive CoI "surroundings" balanced 54% of respondents who discussed the physical room attributes as non-supportive to learning. Interestingly, when students identified their CoI as a type of surrounding, they less-frequently identified physical attributes of the classroom as non-supportive. Thus, the presence of a Community of Inquiry may have diminished the perception or impact of physical room features. Overall, our results preliminarily suggest the positive influence that an interactive flipped classroom structure can have on students' perceptions of their "surroundings."

1. Introduction

In the realm of ecology, an ecosystem consists of a community of interacting organisms and their physical environment. Upon reflection, our flipped Fluid Mechanics classroom during the fall 2021 at a large southeastern university was analogous to an ecological ecosystem. Our classroom was characterized by students interacting with one another as well as the instructor during the in-class problem solving as part of the flipped classroom. All were located within the surroundings of a face-to-face physical classroom during this post-COVID semester. This preliminary paper describes how in our classroom ecosystem, students predominantly identified their *Community of Inquiry*, which included their peers and instructor, as part of their positive "surroundings," alongside the physical and environmental features that one might more readily identify as the surroundings. Students identified this aspect of their surroundings as part of weekly reflection activity within a larger NSF-funded study to assess the impact of frequent and systematic reflection on students' metacognitive skills development (NSF Award Nos. 2020504 & 2019664).

However, perhaps these results regarding the "surroundings" should not surprise us. A survey conducted in 2016 provided evidence that students did not prefer specific physical features of their learning spaces other than the presence of (nearby) eating venues (Beckers et al., 2016). Students may tend to emphasize teaching and learning over the physical facilities, with concerns over teaching and learning potentially even "crowding out" any environmental issues (Temple, 2008). Weimer highlighted classroom spaces for the "great and magical things" that happen there and pointed to classrooms as going beyond their physical aspects, for example as spaces that should be psychologically safe and respectful to all (Weimer, 2016).

2. Background and Literature Review

The *Community of Inquiry (CoI)* framework guides instructional activities in pursuit of deep and meaningful learning through collaboration and discourse (Garrison & Akyol, 2009). This learning experience occurs through the integration of the three CoI elements of cognitive presence, social presence, and teaching presence (Garrison et al., 2000; Garrison & Akyol, 2009). *Cognitive presence* is the ability of a student to construct meaning through discussion and reflection (Garrison et al., 2000; Law et al., 2019). *Social presence* is the ability of a student to relate to their classmates, communicate with them, and develop productive relationships that support collaboration (Garrison & Akyol, 2009). Peers are known to be highly important to students' motivation and sense of belonging, with enhanced motivation resulting from companionship, help, and emotional support (Muenks et al., 2021). *Teaching presence* entails facilitating and directing instruction for meaningful learning within the Community of Inquiry (Garrison & Akyol, 2009). In a related manner, Situated Learning Theory (SLT) holds that knowledge resides in a community of practice and that learning is a transaction between a student and the social environment through participation in a community of practice (Lave & Wenger, 1991; Kolb & Kolb, 2006).

Universities are pursuing new, evidence-based teaching structures to increase student motivation, engagement, retention, collaboration, and learning. Examples of these pedagogical methods include the flipped classroom, peer-led instruction, and problem based learning. In a flipped classroom, students are typically provided with video lectures prior to class, which are accessible at any time to allow for pre-class learning and preparation (Clark et al., 2018). This allows time for group collaboration and problem solving activities during class time. The teaching presence in a flipped classroom is characterized by the instructor as a knowledge facilitator who interacts with students and addresses difficult topics. A study with three different engineering schools that flipped the same numerical methods course found (via an open-ended survey question) that 41% of participants felt the flipped classroom enhanced their learning or learning process, and 34% reported having benefitted from the pre-class preparation, professional behaviors, and engagement during class (Clark et al., 2018). Twenty-three percent (23%) said the alternative use of class time (i.e., group work, peer interactivity and support, active learning, support through questions, etc.) was beneficial (Clark et al., 2018).

3. Methodology

3.1 Course Description

The Fluid Mechanics course in this study is taken by junior and senior level mechanical engineering students at a large university in the southeastern region of the U.S. The course covers topics such as hydraulic pressure, conservation of energy, Bernoulli's equation, and introduction to the Navier-Stokes equations. During the fall 2021, the Fluid Mechanics course was structured as a face-to-face flipped classroom, where students were encouraged to watch video recordings of the course content before class. In-class time was then dedicated to a variety of items, including discussion of this content, student questions, examples, and topics challenging to conceptualize. Before the end of every class session, an ungraded in-class assignment was provided, and students were encouraged to work with their peers to complete the assignment before leaving. The classroom atmosphere revolved around the interactions between students and the instructor and the collective understanding of the course material.

3.2 Student Participants

At the beginning of the fall 2021 semester in our flipped course, students were given the option to participate in a research study related to the use of systematic, frequent reflection. This reflection was primarily related to their in-class problem solving. Our goal was to enhance and investigate their metacognitive skills development. An average of 109 of the 128 enrolled students (85%) submitted weekly reflections as part of the larger study. The weekly reflections were worth 10% of their course grade. For the "surroundings" reflection question, which is the topic of this article, n=118 submitted a reflection. The fall 2021 semester was the first in-person semester at this university after the onset of the COVID-19 pandemic.

3.3 Reflection Prompt and Content Analysis

Throughout the semester, we collected weekly reflection data from the students using the Canvas LMS. The weekly reflection prompts were open-ended questions resulting in responses consisting of several sentences to small paragraphs. They were primarily written by students outside the classroom. One of the reflection questions asked students to consider their classroom surroundings and its impact on them. This reflection prompt was as follows:

> *"Surroundings in a classroom are believed to have effects on student learning. These include the conditions and objects that surround you. What impact, if any, are the surroundings in this Fluids classroom having on YOUR learning and comprehension? In your reflection, please include why the surroundings are impacting you in these ways."*

The motivation for asking this reflection question was to assess students' perceptions of their physical surroundings and the impact on their learning experiences. Thus, the expectation was for the responses to be related (primarily) to the quality of the physical classroom, furniture, layout, acoustics, temperature, etc. However, an unexpected positive aspect to their "surroundings" emerged from the reflections and served as the basis for this article.

Emergent Content Analysis. To ensure inter-rater reliability, two analysts (i.e., the first and third authors) independently coded the students' reflections about their surroundings using a content analysis and an emergent coding scheme (Neundorf, 2002). The coding scheme was developed inductively by the first author by initially reading all reflections and identifying the recurrent

themes or patterns in the data. Using the coding scheme, the first author coded all reflections, and the third author coded approximately 17% of the reflections as a check (Neuendorf, 2002; Geisler & Swarts, 2019). They achieved strong inter-rater reliability of Cohen's $\kappa = 0.89$ (Norusis, 2005). Subsequently, the codes assigned by the first author were adopted as the final codes for the content analysis. This analysis quantified the prevalence of prominent themes and uncovered a division of responses between positive and deficits-based (i.e., negative) aspects of the classroom surroundings with respect to learning and comprehension.

The emergent coding scheme related to the positive aspects of the classroom surroundings as identified by the students is given in Table 1. Based on this coding scheme, four categories emerged related to positive aspects of the classroom surroundings. They were peers, instructor, in-person instruction, and good room conditions, with the first three associated with the *Community of Inquiry* (CoI) framework. Definitions or descriptions for the categories are provided as well.

Table 1: Emergent Coding Scheme for Positive Aspects of Classroom Surroundings

Positives	**Peers**	Peers help one another to learn; Fellow students are focused or motivated and promote these qualities in others; Peers generate or ask questions in class;
	Instructor	Instructor is supportive; Instructor is engaging or interesting; Instructor is easy to follow or understand; Instructor answers questions in class; Discussions with instructor during class;
	In Person	In-person instruction in the classroom and the ability to be in-person with the instructor;
	Good Room Conditions	Good lighting; room well lit; Good acoustics; Good sound level; Large projector screen; Good room size; Traditional room for learning; Clutter-free walls; Good temperature; Seating/layout promotes visibility, audibleness, or comfort; Ability for student to be well-positioned physically in the classroom, including in same seat; Ability for student to sit in desired seat, including first row or upfront; Decent room in general;

Those who discussed peers as a positive aspect of their surroundings highlighted them as asking questions in class and helping each other, which contributed to learning the complex material. Also, the focus and motivation exhibited by peers promoted similar qualities in other students. Students also reflected that the in-person experience with the instructor was an important aspect of their learning, particularly promoting an engaging and supportive ambiance in the classroom. Good room conditions with a positive influence included physical characteristics such as lighting, acoustics/sound, room size, temperature, seating, and layout.

Conversely, Table 2 provides the emergent coding scheme for the deficits-based aspects of the classroom surroundings. Seven "negative" aspects of the classroom surroundings emerged,

consisting of physical or environmental features related to noise/disturbance, furniture, lighting, size of the space, temperature, and room aesthetics.

Table 2: Emergent Coding Scheme for Deficits-Based Aspects of Classroom Surroundings

Deficits	**Furniture**	Furniture in disrepair or old; Desktop tilted; Seats uncomfortable; Furniture not ergonomic; Furniture not preferable (in general);
	Noise or Disturbance	High noise level in class (e.g., others talking); Disturbance or disruption that interferes with learning or attention;
	No Windows or Lighting Issue	Lack of windows not desirable; Lighting not good, either not enough light or too bright;
	Space too Small	Classroom is *not* large enough; Cramped or crammed conditions, including given COVID concerns or lack of mask wearing; Small writing surface (i.e., small desktop); Small seats; Not enough seats;
	Want Smaller Space	Smaller, more personal space is desirable; Classroom is too large;
	Temperature	Room temperature not optimal, in particular too warm;
	Aesthetics	Look and feel of the room; Paint color; Age of room;

4. Results

4.1 Positive Classroom Surroundings

Figure 1 quantifies the positive aspects of the classroom surroundings as identified by students in their reflections. The most prevalent positive classroom "surroundings" was that of one's *peers*, identified by 46% of respondents (n=118). Thus, approximately one half of the open-ended reflections mentioned peers as a "surroundings" that positively impacted learning and comprehension, including helping each other to learn, generating questions for all to hear, and inspiring motivation within the community of inquiry (i.e., fellow engineering students).

The consideration and prioritization of peers as "classroom surroundings" was an unexpected result. It suggests that engineering students may view their peers as the leading "surroundings" that impact their learning. Although physical room conditions comprised the next leading category at 20% of the responses, the remaining categories identified additional social aspects as "surroundings" that positively impacted the learning. These included instructor interactions and qualities (16%) and in-person instruction (14%). These results suggested that the social environment may be the leading aspect of the "surroundings," with both peers and the instructor considered part of the classroom "surroundings." When combined, the Community of Inquiry elements identified in the reflections (i.e., peers, instructor, and in-class instruction) were discussed as positive classroom "surroundings" in 55% of the reflections.

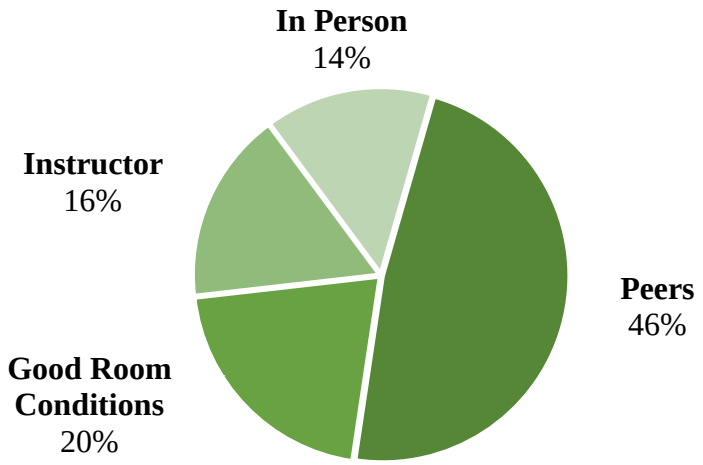

Figure 1: Positive Aspects of Classroom Surroundings

4.2 Deficits-Based Classroom Surroundings

The classroom surroundings identified as negatively impacting learning and comprehension are given in Figure 2. Several of the prevalent deficits-based categories pertained to physical aspects of the classroom, including small spaces (20%) and uncomfortable temperatures (19%). Interestingly, a limited number of respondents (3%) desired a decrease in the classroom size to increase the personal feel. As a potential negative consequence of the *social presence* and interactions in the classroom, 24% of the reflections discussed the increased volume levels in the classroom or other disturbances. Unfortunately, some students found the noise in the classroom due to the communications as a hindrance to their learning. Overall, 54% of the reflections discussed one or more physical room features that were non-supportive surroundings to learning. Negative physical characteristics were expected to dominate the reflections. However, as seen previously, an equal percentage of the reflections (55%) discussed one or more elements of the Community of Inquiry as supportive "surroundings."

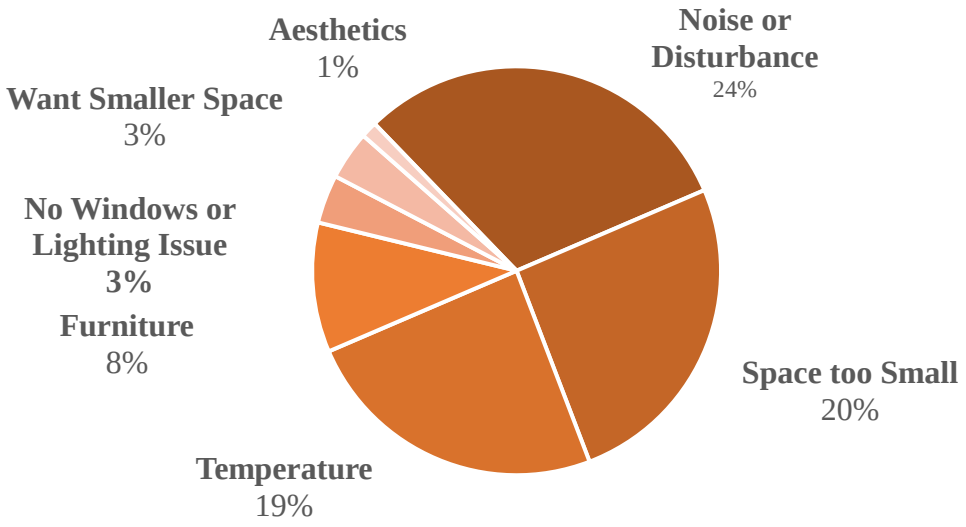

Figure 2: Negative Aspects of Classroom Surroundings

Further, when one or more elements of the Community of Inquiry was identified as a positive "surrounding," only 34% of these reflections also discussed non-supportive physical room conditions. However, when elements of the Community of Inquiry were *not* identified by students as a type of positive "surroundings," 79% of these reflections discussed non-supportive physical room conditions. Thus, the presence of a Community of Inquiry within the classroom may have diminished the perception or the impact of non-supportive physical room conditions.

5. Discussion

As part of a reflection exercise within a larger study on metacognition, students identified aspects of their surroundings that helped or hindered their learning and comprehension during class time. The physical features of the classroom were expected to dominate the responses, but over half of respondents mentioned items and themes within the Community of Inquiry framework.

The social presence within the Community of Inquiry (i.e., peers in the classroom) dominated the positive (i.e., helpful to learning) responses at 46%. Students indicated that their fellow students motivated them and helped them to learn. However, one substantial hindrance to learning identified by students in this classroom was the increased noise due to student discussions and interactions. With 24% of respondents identifying noise or disturbances as non-supportive to their learning, a balance must be met to ensure student collaboration does not negatively interfere with the goal of learning and comprehension.

The instructor (i.e., as part of the teaching presence) may be able to promote this balance between productive discussions and the ability to learn and comprehend in a flipped classroom. The instructor was identified as a positive aspect of the classroom surroundings by 16% of the respondents. The instructor, as a component of the teaching presence with the Community of Inquiry, was characterized as a supportive, engaging, and easy-to-follow resource who answered

students' questions and had discussions with them during class. Given this was the first fully in-person semester after the COVID pandemic, students identified the in-person teaching and learning experience as supportive to learning (14% of responses).

Our unexpected results that highlighted the Community of Inquiry as positive "surroundings" stood in contrast to what we originally anticipated, namely responses highlighting only physical or environmental items. A total of 54% of the responses identified the physical room conditions or features as non-supportive to learning. In addition to noise or disturbance (24%), the remainder of these features or conditions included the smallness of the space and uncomfortable temperatures. Specifically, 20% identified cramped conditions, non-sufficient classroom size, and small writing surfaces, while 19% stated non-optimal (i.e., warm) temperatures. Approximately 8% discussed furniture deficits, including desks that were old or in disrepair as well as uncomfortable seats. However, when students associated their Community of Inquiry with their surroundings, they less frequently identified physical features of the classroom as non-supportive, thus potentially dampening any negative impacts. Among students who identified elements of the classroom's CoI as part of their positive "surroundings," only 34% discussed non-supportive physical room conditions. Among students who did *not* identify elements of the CoI as comprising their positive "surroundings," 79% discussed non-supportive physical room conditions.

Students who perceived the physical surroundings as supportive to their learning and comprehension (20%) discussed a collection of items, including seating arrangement/layout, room size, temperature, projector screen size, lighting, and sound/acoustics. Thus, the perspective towards and impact of the classroom's physical features and conditions (i.e., whether supportive or not to learning) differed from student to student.

6. Conclusions

Our preliminary research on perceived "surroundings" in the classroom is part of a larger study of the impact of systematic, repeated reflection on the development of metacognition, self-regulatory skills, and academic performance in engineering education. We plan to continue our investigation of students' reflections regarding their "surroundings" as part of our larger research study. Upon conducting a focus group with these students one year later, their notion of peers and instructor as "surroundings" persisted. In fact, these students further named the "vibe" in the classroom as their "surroundings," with the vibe defined by the energy of the people and social environment. They indicated that they value their Community of Inquiry in the classroom and its "vibe" to a greater degree than the physical items and conditions that surround them. To the students, physical items such as the desks, other furniture, and temperature were not as important as the vibe that "surrounded" them. The students in the focus group clearly wanted to view themselves as a community, and this appeared to have been influenced by their experiences during the COVID pandemic. The students in the focus group were not surprised that 55% of their reflections from the previous fall were associated with their Community of Inquiry - although we initially were! As part of future work within the larger research study, we plan to investigate giving the students greater agency with respect to reflection, including allowing them to "engineer" their own reflection questions and conduct their reflection in more community-based, social ways.

Acknowledgments

This article is based upon work supported by the National Science Foundation under Grant Numbers 2019664 and 2020504. Any opinions, findings, and conclusions, or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

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