Applications of Research to Practice

The "Asynchronish" Classroom: Supporting Belonging in Math Education Courses

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Abstract

This article explores the integration of "asynchronish" learning, blending synchronous and asynchronous elements to foster community and engagement in online education, particularly in mathematics education. Leveraging Garrison's Community of Inquiry (CoI) framework, the study examines the use of Slack to bridge traditional classroom dynamics with digital learning, aiming to create an authentic online environment. By analyzing collaboration strategies, the research highlights their impact on community building, focusing on the perspectives of asynchronous pre-service teachers. The findings offer insights into designing online courses that enhance social presence, belonging, and active participation, contributing to effective online pedagogy.

Introduction

The COVID-19 pandemic has accelerated online education, necessitating engagement strategies that align with Garrison's CoI framework (Garrison, Anderson, & Archer, 1999). This study introduces an "asynchronish" model using Slack (an online communication platform) to facilitate active participation in teacher education and mathematics courses, bridging traditional and digital learning environments. This article presents the concept of "asynchronish" design, aimed at smoothly blending synchronous components within asynchronous online learning environments. As online enrollment surges (Selvaraj et al., 2021), fostering community in virtual settings becomes crucial (Lee et al., 2020). We examine how collaboration strategies contribute to community development from students' perspectives (Martin & Borup, 2022), addressing gaps in literature regarding the CoI framework and student mental health in online settings (Garrison, 2022; Perrotta, 2020).

Our "asynchronish" design integrates synchronous elements into asynchronous learning, using a two-pronged approach: creating a Slack-based collaborative space for instructors and enhancing the student experience. Slack is an online platform designed to promote informal collaborative communication between students. Key components include a designated platform, motivation for participation, and clear guidelines. Slack facilitates inclusive interactions and discussions, and aids instructors in cultivating genuine remote conversations, addressing challenges in modern education across traditional and online settings and supporting current and aspiring online instructors. The incorporation of such platforms in mathematics instruction can offer a contribution to the evolving landscape of digital education (Garrison & Arbaugh, 2007).

In this article, we explore three key aspects of online education: building a sense of community among students, promoting social and emotional learning in online environments, and implementing effective collaboration strategies. Drawing from Garrison's CoI framework (Garrison & Arbaugh, 2007), we aim to uncover how these elements interact and influence the learning process. Specifically, we will analyze their application in the field of mathematics education to offer practical insights.

After exploring these themes, we will engage in a thorough discussion, connecting our findings to broader considerations for online education. As virtual learning continues to evolve, it's crucial to utilize established models

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like the CoI to inform effective teaching and learning practices. Our research contributes to ongoing conversations about inclusivity in online education, emphasizing the importance of student engagement, emotional well-being, and collaborative learning in today's digital landscape.

Framing Community: Community of Inquiry in Online Learning

The CoI framework, initially proposed by Garrison et al. (1999), delineates three fundamental presences: Cognitive, Social, and Teaching. Cognitive presence pertains to the participants' ability to construct meaning through sustained communication. It involves stages such as triggering events, exploration, integration, and resolution. Social presence revolves around learners projecting their individual characteristics, fostering a sense of genuine interaction within the community. Teaching presence encompasses the design, facilitation, and direction of cognitive and social processes to achieve meaningful learning outcomes. The framework highlights the critical role of intentional course design in creating a conducive learning environment (Bakir & Phirangee, 2021).

Emotional presence has been proposed as a potential fourth element of the CoI and pertains to the outward expression of emotion and affect in the context of a CoI (Swan et al., 2008). This aspect explores how emotions intersect with online learning and interact with the other presences within the CoI framework. Emotional presence adds a nuanced layer to our understanding of the dynamics within online learning communities, particularly in relation to the role of instructors and learners in managing emotional experiences (Khazaei & Arefi, 2023).

Social-Emotional Learning During Online Experiences

The mental health of higher education students has garnered significant attention in the post-pandemic era. The impacts of lockdowns and quarantines have elevated mental health challenges, with estimates suggesting that up to three in five students now face diagnosable mental disorders (Lipson et al., 2022). Recognizing and addressing these challenges is paramount, as they directly influence the academic success and well-being of students (Pascoe & Parker, 2019).

Online learning communities play a pivotal role in supporting the social-emotional well-being of students. Effective communication and collaboration within learning management systems are vital components of building a strong digital community. However, it is imperative to consider the limitations of current Learning Management Systems (LMS) such as Canvas, Blackboard, or Moodle, as some may lack intuitive features for fostering collaborative learning environments (Mendoza et al., 2021; Santiago et al., 2021). Additionally, the emotional experiences of students in online environments can vary widely, encompassing positive emotions like joy and pride, as well as negative emotions such as fear and stress (Swan et al., 2008).

Self-reflection is a crucial component of social-emotional learning, enabling individuals to gain a deeper understanding of themselves and their motivations. It fosters empathy, which is integral for building positive relationships and respectful interactions within online communities. Empathy plays a pivotal role in online interactions, promoting cooperation and unity among participants (Konrath et al., 2011). By encouraging self-reflection and empathy, instructors can contribute to creating a more supportive and inclusive online learning environment.

Collaboration Strategies for Instructors in Online Courses

Instructors employ various collaboration strategies to enrich online learning, aiming to promote deeper understanding. These include discussion boards, group projects, virtual teamwork, and collaborative document creation. Problem-solving tasks, where students collaborate to find solutions, foster critical thinking and essential teamwork skills (Collaborative Learning Builds Deeper Understanding, 2012). Discussion boards enable reflective discourse and peer-to-peer learning, enhancing engagement and comprehension (Perrotta, 2020). Group projects cultivate skills like leadership and decision-making, while virtual teamwork platforms bridge distances, fostering real-time collaboration (Jony & Serradell-López 2019). Collaborative document tools, such as wikis, promote co-authorship and inclusive learning (Meza et al. 2020). These strategies are crucial for creating dynamic, inclusive online environments that cater to diverse learning styles and prepare students for success in the digital age (Chung et al. 2022).

Applications of and Reflections on Asynchronish Learning for a Sense of Belonging

We will be discussing two applications of Asynchronish Learning. In Application 1, integrating asynchronous elements into a STEM literacy course altered students' initial expectations of a purely synchronous online format. Slack, as a versatile platform, facilitated interactive discussions and fostered a cohesive learning environment through weekly engagement and student-driven channels, enhancing a sense of connection and support among learners. Meanwhile, Application 2 delves into the deliberate blend of synchronous and asynchronous components in a Math Education Master's course. Embracing agile platforms like Slack reshaped students' perceptions of online learning, fostering increased connectivity, a supportive team dynamic, and a deeper understanding of content. This was done through collaborative efforts, showcasing the transformative impact of decentralizing learning environments.

Application 1: Fostering Engagement and Building Community in Asynchronish Learning Environments

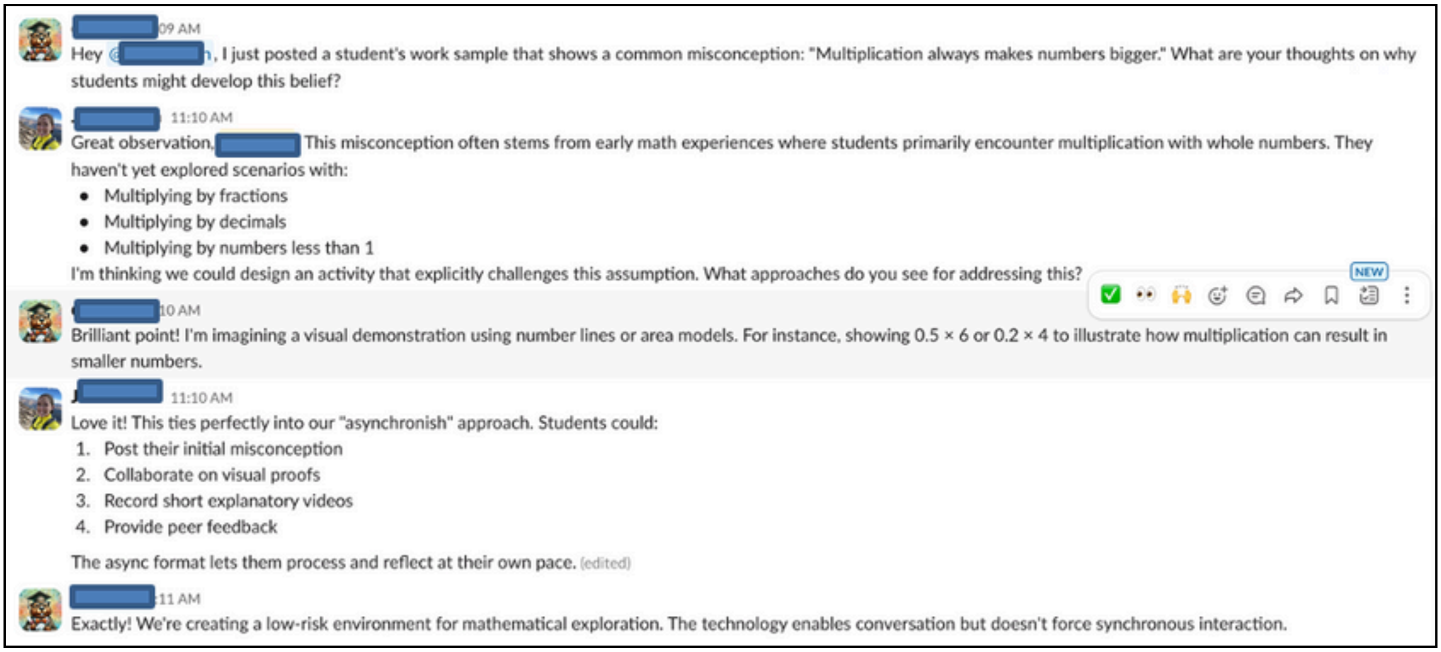
Over the past four years, we have introduced asynchronous activities into a STEM literacy course for pre-service teachers. Initially, students expect a fully synchronous online format. However, after reviewing the course design, they realize that it is intentionally structured with both synchronous and asynchronous components. These include regular virtual small group sessions, weekly live meetings with the instructor, individual self-paced coursework, peer reviews, and informal interactions facilitated through the Slack Learning Management System (LMS) platform.

Slack has served as a hub for content storage, asynchronous discussions, and weekly synchronous conversations. These live discussions occurred for 25 minutes each week, during which students engaged in directed topics while being actively present on Slack. Figure 1 shows a conversation between two students around a misconception of a mathematical term. The channel feature in Slack aids in organizing the class by week and fosters genuine conversations through threaded responses encompassing text, video, audio, emojis, gifs, etc. Moreover, students can create their own channels, promoting informal connections. Establishing a general channel for casual check-ins further enhances connectivity. Additionally, direct messaging allows swift and informal communication between students and the instructor.

The "Asynchronish" Classroom *(continued)*

Figure 1

Sample Slack Conversation between Students



Students have reported that while adapting to a new technology can be initially challenging, this informal mode of communication has made them feel more engaged with the class compared to other online courses. They highlight the significance of organization and seamless communication, attributing these factors to feeling supported and part of a cohesive team. As one student noted in a Slack discussion from Figure 1 about mathematical misconceptions, "The async format lets them process and reflect at their own pace," highlighting how the platform enables both individual reflection and collaborative learning. Furthermore, students express how they initially felt anxious about taking an online course due to previous negative experiences, but this format has reshaped their perspective on the benefits of online learning. As illustrated in Table 1, we systematically mapped how each component of our course design supported the three presences of the CoI framework through specific implementations and platform features, leading to measurable outcomes in student engagement and learning.

Reflecting on Garrison's Community of Inquiry (CoI) model across eight semesters of implementation, we have observed how the three core presences—teaching, social, and cognitive—interact within our asynchronish learning environment. Teaching presence manifested through structured weekly discussions and clear guidelines, while social presence emerged through students' authentic interactions in both formal and informal Slack channels. Cognitive presence developed as students engaged in sustained discourse, moving from initial exploration to integration and resolution of ideas. In mathematics education specifically, this sustained discourse proved particularly valuable as students worked through complex mathematical concepts, sharing multiple solution strategies and constructing understanding collaboratively. Traditional Learning Management Systems often fall short in facilitating these presences simultaneously, particularly in supporting the kind of fluid, multi-modal interactions that foster authentic social presence. This limitation is especially pronounced in mathematics courses, where the ability to share mathematical notation, diagrams, and real-time problem-solving processes is crucial.

The "Asynchronish" Classroom *(continued)*

Table 1

CoI Framework Implementation in STEM Literacy Course

CoI Presence	Asynchronish Implementation	Platform Features	Observed Outcomes
Teaching Presence	• Weekly 25-minute live discussions • Structured weekly topics • Clear participation guidelines	• Organized weekly Slack channels • Direct messaging for instructor support • Content storage capabilities	Enhanced instructor accessibility and consistent guidance
Social Presence	• Student-created channels • Informal check-in spaces • Multi-modal communication	• Threaded responses • Emoji/GIF support • Audio/video sharing	Increased peer connections and community building
Cognitive Presence	• Self-paced coursework • Peer reviews • Small group discussions	• Asynchronous discussion threads • Document sharing • Collaborative workspaces	Deeper content engagement and knowledge construction

Our findings align with Garrison and Arbaugh's (2007) assertion that successful online learning communities require intentional integration of all three presences. The significance of cultivating such a comprehensive classroom community extends beyond mental well-being, directly supporting the cognitive development process through collaborative knowledge construction. This collaborative construction is particularly powerful in mathematics education, where students benefit from seeing multiple approaches to problem-solving and engaging in mathematical discourse with peers. Student feedback consistently highlighted how the platform's ability to support both immediate and reflective interactions enhanced their learning experience, demonstrating the symbiotic relationship between social presence and cognitive development in the CoI framework. Students specifically noted how the ability to post mathematical questions, receive timely responses, and engage in extended mathematical discussions helped deepen their understanding of complex concepts. This observation reinforces recent research suggesting that emotional presence may indeed constitute a fourth crucial element of the CoI model (Swan et al., 2008), as students' sense of connection and belonging directly influenced their willingness to engage in deeper learning processes, particularly important in mathematics where anxiety and confidence issues often create barriers to learning.

The "Asynchronish" Classroom *(continued)*

Application 2: Embracing Agile Platforms and Cultivating Collaborative Learning Communities

In our online Math Education Master's course, we utilized Slack to purposefully blend synchronous and asynchronous elements. Threads of a discussion board were broken down into informal conversation where students were able to share their experiences either while all were online, or when students had a chance to reply later in the week. This decision was rooted in the CoI framework which highlights the importance of social presence (Garrison et al., 1999).

The course structure encompassed various components such as weekly discussions, live whole-class meetings, self-paced work, and peer reviews. However, at the heart of the design was the utilization of the Slack platform. We deliberately set up different channels within Slack to cater to diverse needs, including course content, discussions, informal chat, and student-generated topics. To ensure active participation, students were expected to engage in discussions, guided by provided grading rubrics. As shown in Table 2, we organized these course elements according to the CoI framework, documenting how each asynchronish strategy was implemented and its subsequent impact on student learning and engagement.

Table 2

CoI Framework Analysis in Math Education Master's Course

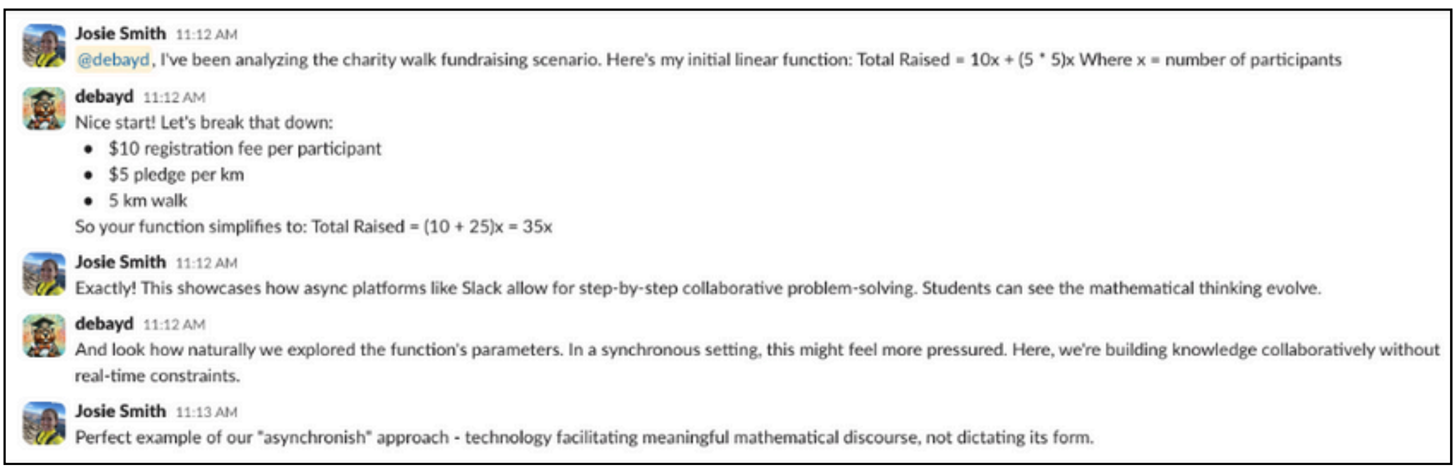
CoI Element	Asynchronish Strategy	Implementation Method	Impact on Learning
Teaching Presence	• Structured weekly prompts • Grading rubrics • Facilitated discussions	• Dedicated content channels • Regular announcement posts • Guided discussion threads	Students reported clearer understanding of expectations and learning objectives
Social Presence	• Informal chat channels • Student-generated topics • Flexible participation times	• Real-time and asynchronous responses • Multi-modal interaction options • Personal sharing spaces	"I felt more connected to my classmates than in other online courses because of the constant
Cognitive Presence	• Peer review activities • Collaborative problem-solving • Extended math discussions	• Threaded technical discussions • Shared resource libraries • Progressive knowledge building	"Discussing the content in Slack really improved my understanding"

The "Asynchronish" Classroom *(continued)*

We opted for Slack due to its user-friendly interface, threaded commenting feature, and versatility in fostering different types of interactions (see Figure 2). Instructors also reported that the Slack platform facilitated more engaging discussions and a stronger sense of community among students compared to traditional LMS tools, particularly in mathematical discourse. The flexible and informal nature of Slack conversations contributed to increased student participation and connectedness, allowing students to work through mathematical concepts at their own pace. For example, when exploring linear functions, students could post their initial equations, share their reasoning step-by-step, and collaboratively refine their mathematical thinking. Our aim was to establish an authentic online community where mathematical discourse could flourish, despite the asynchronous nature of the course. Clear guidelines were distributed to facilitate constructive and respectful discussions among students, with specific attention to mathematical communication norms and notation.

Figure 2

Sample Slack Interaction



Initially, students faced challenges adapting to the new platform; however, they soon recognized the value of the connections and conversations it facilitated, especially for mathematical problem-solving. As demonstrated in a discussion about linear functions, one student noted, "This showcases how async platforms like Slack allow for step-by-step collaborative problem-solving. Students can see the mathematical thinking evolve." Another student observed that "In a synchronous setting, this might feel more pressured. Here, we're building knowledge collaboratively without real-time constraints." These comments highlight how the platform's asynchronish nature particularly benefits mathematics learning, where students often need time to process concepts and formulate responses. From an instructor's perspective, managing discussions on the platform proved to be demanding in terms of time and effort, particularly when monitoring the accuracy of mathematical content and ensuring productive mathematical discourse. Nevertheless, the depth of peer collaboration and exchange indicated a strong sense of social presence within the community, with students actively engaging in mathematical reasoning and problem-solving discussions. Looking ahead, introducing student moderators with strong mathematical backgrounds could alleviate some of the workload and enhance scalability while maintaining the quality of mathematical discourse.

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Limitations

Our design approach has been applied across various educational settings over several years, primarily with graduate students and experienced educators. The student feedback reported in this study was gathered through mid-year and end-of-course evaluations. The responses were analyzed using thematic coding to identify common themes and patterns. While it has also been used in an undergraduate STEM literacy course, introducing this method to other undergraduate or younger student cohorts might present challenges that were not encountered in our previous contexts. The success of this approach has been closely linked to the learners' roles as practitioners in specific scenarios. As a result, extending its applicability beyond adult learners or those in practice-based roles may present limitations.

Discussion

The research findings highlight the transformative potential of asynchronish learning approaches in online education, aligning with Garrison's CoI framework (Garrison et al., 1999). These approaches emphasize the significance of fostering a sense of belonging and community within virtual learning environments. Integrating collaboration strategies such as peer reviews and course discussions (Lee et al., 2020) contributes significantly to the development of a supportive and engaging online learning atmosphere. These findings were evident in Application 1, where students reported feeling more engaged through informal Slack communications compared to traditional online courses. The combination of synchronous virtual small groups and asynchronous components helped create a balanced learning environment, while dedicated Slack channels fostered genuine community building.

The exploration of the CoI framework showcases its relevance to online learning environments, emphasizing cognitive, social, and teaching presences (Garrison et al., 1999). Recognizing the role of emotional presence in this framework adds depth to understanding online learning communities (Swan et al., 2008). Application 2's Math Education Master's course successfully integrated all three presences through guided discussions and peer reviews, while social presence was enhanced through informal channels and student-generated topics. Teaching presence was maintained through clear guidelines and rubrics for participation.

Furthermore, addressing mental health challenges faced by higher education students in the post-pandemic era (Lipson et al., 2022; Pascoe & Parker, 2019) underlines the importance of social-emotional learning online. Both applications demonstrated how intentional platform selection can address these challenges. Students who initially felt anxious about online learning reported feeling supported, while Application 2 showed how informal conversations helped students build stronger peer connections. Effective communication within learning management systems supports students' well-being (Santiago et al., 2021). Encouraging self-reflection and empathy among instructors creates a more inclusive environment (Konrath et al., 2011).

Instructors play a crucial role in implementing various collaboration strategies (Garrison et al., 1999) to facilitate active engagement and critical thinking. This was evidenced through intentional course structuring in both applications. While Application 1 utilized virtual small groups and weekly meetings, Application 2 demonstrated how instructor-guided discussions could facilitate deeper peer collaboration. Both cases showed that the resulting student engagement justified the additional instructor effort required. Understanding these strategies empowers instructors to create dynamic online learning environments (Swan et al., 2008).

Implications

This study emphasize the need for intentional course design that fosters conducive learning environments, prioritizing community-building and collaborative experiences. Leveraging the CoI model and integrating social-emotional learning are essential to creating effective online environments that promote student engagement. Future research should explore the adaptability of the "asynchronish" approach across different educational contexts and investigate the role of emotional presence in online learning communities. These studies could provide valuable insights into enhancing collaborative environments in diverse educational settings.

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