INVESTIGATING SOCIAL PRESENCE DYNAMICS IN ONLINE EDUCATION

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ABSTRACT

This research study delves into the multifaceted realm of social presence in online education, encompassing the existence and manifestation of social presence indicators in students' engagement with discussion boards within asynchronous online courses. Social presence manifests when individuals perceive themselves to be simultaneously present with others through a communication medium, thereby cultivating a shared sense of togetherness. The dissertation addresses the impact of course disciplines, exploring the significant influence of both STEM and non-STEM courses on the manifestation of social presence indicators. Furthermore, the study delves into the influence of course duration on the social presence level, unveiling critical insights into the challenges posed by prolonged courses on sustaining student engagement and interaction.

This study, randomly selecting sample from Coursera, employed a methodology, encompassing both quantitative and qualitative analysis, to assess social presence within online courses. The approach consisted of five key stages, involving Python-based web crawling, manual keyword identification, data processing, statistical analysis using R, and qualitative exploration. The insights obtained offer valuable suggestions for enhancing social presence in future online educational settings. While acknowledging certain limitations regarding sample size and keyword identification, the study provides valuable contributions to the evolving landscape of online education research, offering practical implications for course design and facilitation in promoting an enriched and engaging online learning environment.

Keywords: social presence, online education, text-based discussions, asynchronous online discussions, mixed method, social presence indicators, python algorithm.

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

Background of the Study

The realm of online education has gained prominence with the advancements in information and communication technology, garnering significant attention across various academic disciplines (Almusharraf & Almusharraf, 2021; Belanger & Jordan, 2000; Chou et al., 2019). An increasing number of students are opting for online courses, a trend that has persisted over the years, as evidenced by the statistics in 2014, where 2.8 million students engaged in fully remote coursework, with an additional 2.97 million students enrolling in select online courses (Allen et al., 2016). The global impact of the COVID-19 pandemic has precipitated a remarkable surge in the enrollment of online students. Educational institutions worldwide swiftly transitioned to online learning platforms during this crisis, significantly amplifying the prevalence of distance education.

Consequently, the imperative for an enhanced scholarly examination of online education, particularly within the context of a pandemic, has intensified. Acquiring a comprehensive understanding of the intricacies of online education has become an indispensable necessity in contemporary educational discourse. Despite the extensive research conducted in the field of online education, there remains a critical gap pertaining to the correlation between social presence and the dynamics of online learning, necessitating further investigation by communication scholars (Anderson et al., 2001; Garrison et al., 2000; Hughes et al., 2007; Rourke et al., 1999; Swan, 2003).

The pivotal construct that distinguishes online educational interactions from their offline counterparts is social presence (Whiteside et al., 2017). Scholars (e.g., Kim et al., 2005; Kruger-Ross & Waters, 2013) have underscored the challenges experienced by both students and instructors in establishing meaningful connections within the realm of online education, leading to reduced student engagement and diminished interest in online coursework. Social presence serves as a potential remedy for this predicament (Whiteside, et al., 2017). In alignment with scholarly discourse, social presence refers to the sense of connectedness experienced during mediated communication (Biocca et al., 2003). Garrison (2016) aptly defines social presence as the feel of have "the ability of participants to identify with a group, communicate openly in a trusting environment, and develop personal and affective relationships progressively by way of projecting their individual personalities" (p.79). Embedded within the fabric of social presence theory is its capacity to illuminate the dynamics of relationship-building within online education, enabling students and faculty to establish meaningful connections. Notably, social presence theory assumes particular significance within the context of asynchronous online education (Lowenthal & Dunlap, 2020). This research is anchored in the social presence theory, aiming to unravel the intricate interplay between social presence and asynchronous online education.

A notable increase in the number of posts was observed on the discussion board following the Covid-19 pandemic (Doe, 2023). This surge in activity was accompanied by an evident escalation in the displayed level of social presence within the discussion board environment (Doe, 2023).

Introduction to Asynchronous Online Education

Asynchronous online education, often referred to as asynchronous learning networks (ALN) in the context of business studies, is defined as a teaching and learning environment integrated within a computer-mediated communication (CMC) system. ALNs are designed for flexible use, enabling participants to engage in learning activities anytime and anywhere through computer networks. These networks consist of virtual communication and workspaces within software frameworks, fostering interaction and collaboration among class members, independent of physical constraints (Hiltz, & Wellman, 1997, p.3). Unlike synchronous online courses, where students and faculty engage in real-time interactions, participants in asynchronous online courses rely on mediated communication that occurs at different times (Liu et al., 2007; Phirangee, 2016).

While asynchronous interactions offer an avenue for the development of social presence, they often yield a lower level of social connectedness compared to their synchronous counterparts (Hiltz, & Wellman, 1997). Platforms facilitating asynchronous courses often provide discussion boards as collaborative tools, where students expect responses from peers and teaching assistants but not necessarily in real-time. These discussion boards primarily serve as forums for student-to-student interaction, presenting an opportunity to explore the nuances of social presence among participants. This study focuses on the examination of social presence development within the discussion board of a chosen online education platform, aiming to enhance the overall asynchronous learning experience for students.

Introduction to the Literature Review on Relevant Studies

Numerous studies have examined the nexus between social presence and online education, revealing the manifold benefits of heightened social connectedness for students' learning experiences. These studies can be broadly categorized into three interrelated areas, as outlined below.

Social Presence and Online Course Dropout Rate

Research conducted by Boston et al. (2009), Reio and Crim (2013), and Rovai (2002) has shown that a robust sense of social presence can mitigate students' feelings of isolation and reduce online course dropout rates. Reio and Crim (2013) emphasized the pivotal role of social presence in preventing student attrition, attributing dropout instances to a perceived disconnect with peers in the virtual learning environment. Furthermore, Reio and Crim (2013) demonstrated a positive correlation between social presence and students' satisfaction with and intent to continue their online coursework.

Social Presence and Students' Satisfaction and Learning Outcomes

Extensive research in the field of education by Borup et al. (2012), Gunawardena and Zittle (1997), Hostetter and Busch (2006), Richardson et al. (2017), Richardson and Swan (2003), and So and Brush (2008) has elucidated the link between heightened social presence and enhanced student satisfaction and learning outcomes. Rourke et al. (2001) underscored the positive impact of social presence on student engagement and involvement in course-related discussions. Similarly, Richardson and Swan (2003) and Hostetter and Busch (2006) highlighted the affirmative relationship between social presence and students' satisfaction with online learning.

Garrison, Anderson, and Archer (2010) underscored the direct academic implications of social presence, with Borup et al. (2012) demonstrating the efficacy of high-level social presence enabling teaching technology, such as video-based platforms, in improving student satisfaction and learning outcomes.

Social Presence and Students' Sense of Belonging

Scholars, including Caspi and Blau (2008), Cobb (2011), Delmas (2017), and Pollard et al. (2014), have emphasized the role of social presence in fostering students' sense of belonging within a virtual study community, mirroring the experience of traditional brick-and-mortar classrooms. Rovai (2002) established social presence as a key factor in cultivating and sustaining a sense of community within the virtual classroom. Likewise, Caspi and Blau (2008) and Delmas (2017) highlighted the positive correlation between social presence and students' identification with their academic cohort. Pollard and Swanson (2014) focused on the instructor's social presence within the community of inquiry framework, revealing its constructive impact on the learning environment and classroom community.

In summary, existing scholarship underscores the pivotal role of social presence in enhancing the online education experience, with its implications extending to enrollment rates, student satisfaction, learning outcomes, and the sense of belonging within the virtual academic community. The current body of research highlights the significance of social presence, signaling its positive influence on online education and underscoring the imperative to delve deeper into the relationship between social presence and the dynamics of online education.

Studies About the Nature of Social Presence in Online Education

Contemporary research examining the relationship between social presence and online education predominantly focuses on the perception of social presence (e.g., Akyol & Garrison, 2008; Garrison et al., 2010; Gunawardena, 1995; Mathieson & Leafman, 2014; Picciano, 2002; Richardson et al., 2016; Russo & Campbell, 2004; Tu, 2002), rather than delving into the intrinsic nature of social presence itself (e.g., Lowenthal & Dunlap, 2020; Lowenthal & Dunlap, 2014, 2018; Rourke & Kanuka, 2009; Swan & Shih, 2005). These two strands of research focus on different aspects—while the perception of social presence studies highlight its influence, the nature of social presence studies emphasize its inherent value.

Studies exploring the perception of social presence offer insights into how various groups, including students, instructors, and researchers, perceive social presence within the realm of online education. This line of research treats social presence as an object of analysis, seeking to understand its features and impact. For instance, Akyol and Garrison (2008) examined the role of social presence in the development of community inquiry over time in an online course, while Gunawardena (1995) investigated the relationship between social presence theory and its implications for interaction and collaborative learning in computer conferences. Similarly, studies by Mathieson and Leafman (2014), Picciano (2002), and Richardson et al. (2016) respectively compared student and instructor perceptions of social presence in online education, explored issues of interaction and presence, and examined instructor presence in online learning environments.

Conversely, studies dedicated to the nature of social presence aim to unravel the inherent characteristics and behavioral aspects of social presence in the context of online education. These studies focus on understanding how social presence develops and manifests in online educational settings. Notably, research by Lowenthal and Dunlap (2020, 2014, 2018), Rourke and Kanuka (2009), and Swan and Shih (2005) sheds light on the indicators and dynamics of social presence within online educational settings, offering nuanced insights into its fundamental nature and complexities.

However, current studies investigating the nature of social presence in online education have limitations regarding their sample sizes and potential biases. Most studies are based on small sample sizes, possibly impacting the generalizability of their findings. Furthermore, several studies are conducted within single institutions, where participants may possess pre-existing social connections, potentially influencing their experiences and thereby skewing research outcomes. Further exploration is necessary to comprehensively understand the nature of social presence in the context of online education.

Building on the prior literature, this study aims to bridge existing gaps by conducting a mixed-method investigation, encompassing both qualitative and quantitative analyses. The research addresses the limitations of previous studies by examining a substantial number of online courses across various disciplines, thereby providing a more comprehensive understanding of the nature of social presence in the online education environment. Furthermore, this study explores how course disciplines, such as STEM and non-STEM fields, influence social presence indicators, and investigates the impact of course duration on the development and manifestation of social presence.

By employing a mixed-method approach and examining a diverse range of courses, this research endeavors to contribute significantly to the understanding of social presence dynamics in the context of asynchronous online education.

Overview of Dissertation Chapters

The dissertation is structured into six chapters. Chapter 1 serves as an introductory chapter, outlining the significance of the study within the context of online education, highlighting the current research gap, and emphasizing the need to explore social presence in this domain.

Chapter 2 provides a detailed review of (tele)presence theory, social presence, and the measurement of social presence, in addition to offering an analysis of relevant theoretical frameworks that inform the research. It also includes an extensive literature review of previous studies on social presence.

Chapter 3 presents the research questions and hypotheses that guide the research process.

Chapter 4 is dedicated to detailing the research design, providing an overview of the methods adopted for the study.

Chapter 5 offers a presentation of the research findings.

Chapter 6 serves as the conclusion, summarizing the key insights and findings derived from the study. This chapter also provides an in-depth discussion of the implications and significance of the findings, along with potential avenues for future research.

CHAPTER 2

THEORETICAL FRAMEWORK

This chapter delves into the theoretical framework that underpins this study, offering a review of social presence theory and its pertinent components. The chapter aims to provide a nuanced understanding of the definition, measurement, and key aspects of social presence theory, emphasizing its role in shaping the study's design. Furthermore, the chapter sheds light on the broader context of (tele)presence theory, elucidating its relevance in comprehending the fundamental principles of social presence. This theoretical exploration lays the foundation for an analysis of the interconnected concepts and theoretical underpinnings that inform the study's approach to understanding social presence within the context of online education.

(Tele)presence Theory

Understanding social presence theory is contingent upon a grasp of the broader (tele)presence theory, where social presence is considered a subset. Therefore, it is essential to examine the definition and various dimensions of (tele)presence for a more nuanced understanding.

Definition of (Tele)Presence

The term "telepresence" first emerged in 1976, with Short, Williams, and Christie discussing their experience in organizational communication. Marvin Minsky also highlighted the concept in 1980, emphasizing the idea of operating equipment remotely while experiencing a sense of direct engagement.

Companies like Cisco introduced the notion of telepresence to the public in the mid-2000s, showcasing advanced conferencing technology that facilitated a sense of physical togetherness despite geographical separation.

Despite the extensive exploration of (tele)presence over the years, a standardized definition remains elusive, with scholars in various fields offering distinct yet interconnected interpretations. Waterworth and Waterworth (2003a) conceptualized presence as the immersive feeling experienced by a conscious organism in an external world, whereas Jacobson (2002) defined it as the engagement with representations within a virtual world.

Lombard and Ditton (1997) underscored the perceptual illusion of non-mediation as a formal definition. Acknowledging the ambiguity, researchers generally concur that (tele)presence signifies a crucial experiential dimension, albeit one characterized by multifaceted interpretations. Lombard and Jones's (2015) meta-analysis of telepresence studies emphasized a common thread: a potential misunderstanding of technology's role in shaping experiences.

The International Society for Telepresence Research (ISPR) conducted an extended electronic discussion in 2000, leading to the development of a shared definition of telepresence, reflecting the scope of this multifaceted concept:

> Presence (a shortened version of the term "telepresence") is a psychological state or subjective perception in which even though part or all of an individual's current experience is generated by and/or filtered through human-made technology, part or all of the individual's perception fails to accurately acknowledge the role of the technology in the experience. Except in the most extreme cases, the individual can indicate correctly that s/he is using the technology, but at "some level" and to "some degree", her/his perceptions overlook that knowledge and objects, events, entities, and environments are perceived as if the technology was not involved in the experience. Experience is defined as a person's observation of and/or interaction with objects, entities, and/or events in her/his environment; perception, the result of perceiving, is defined as a meaningful interpretation of experience (ISPR, 2000).

Understanding presence as defined by Lombard and Ditton (1997) provides a framework that elucidates the processing involved in presence. This definition, in conjunction with the ISPR's practical definition, allows for a more holistic and applicable conceptual system, not limited to specific types of experiences or phenomena. These definitions have evolved from extensive presence studies, such as those based on the three-pole model (Biocca et al., 2003), the environment selection model (Slater & Steed, 2000), the layers of presence model (Riva et al., 2004), the measurement effects conditions model (Wirth et al., 2007), and the capacity-limited cognitive constructionist model (Nunez, 2007). Consequently, employing Lombard and Ditton's (1997) definition of presence offers scholars an in-depth understanding of this concept, as well as practical and thoughtful research guidelines. It also serves as an inspiration for the development of new theories related to the notion of presence.

Different Types of (Tele)Presence

Understanding the various types of (tele)presence is crucial for developing a comprehensive understanding of social presence. Despite the distinctiveness of each form, these types are interconnected, and it is possible for multiple types to manifest concurrently.

With the continuous evolution of presence studies and media technologies, the potential for encountering novel types of presence remains high. Examining these multiple types of presence provides a comprehensive perspective for exploring presence phenomena and paves the way for future research in this domain.

Lombard and Ditton (1997) classified six types of presence, providing the foundation for the taxonomy employed in this study. Subsequently, ten distinctive types of presence will be delineated (Lee, 2004), accompanied by illustrative examples that reflect common presence experiences in everyday life, thereby enhancing the comprehension of each type.

Spatial presence. Spatial presence entails the sensation of being situated within a mediated space, evoking a feeling of physical presence within a virtual environment. For instance, individuals watching a movie depicting a rainy setting might experience an immersive sensation of being present in that environment.

Social presence. Social presence emerges when individuals perceive themselves to be co-present with others through a communication medium, fostering a sense of shared togetherness. For example, a person engaged in a video call might feel as if the other participant is physically present in the same room.

Transportation presence. Transportation presence generates the dual sensation of being transported to a mediated place and perceiving mediated objects as if they were physically present within one's immediate surroundings. For instance, individuals engrossed in a book about a foreign land might feel as though they have been transported to that location, blurring the lines between reality and fiction.

Engagement presence. Engagement presence involves a deep immersion in a medium, leading to an intense absorption that diminishes awareness of the external environment. For instance, individuals engrossed in playing video games might become oblivious to their surroundings due to their intense focus on the game.

Social realism. Social realism reflects the perception that the content portrayed in media faithfully mirrors real-life events, evoking a sense of authenticity and plausibility. For example, witnessing a dramatic event unfold in a movie might evoke a sense of realism, making it seem true to life.

Perceptual realism. Perceptual realism engenders the belief that mediated objects adhere to real-world expectations, prompting an acceptance of the credibility of these objects. Mediated objects appear, sound, and behave in a manner that closely resembles their non-mediated counterparts. For instance, individuals might perceive the social realism of fictional characters as realistic if it aligns with their preconceived notions.

Social actor in medium. Presence as a social actor within the medium involves treating mediated characters as real entities, fostering a sense of parasocial interaction with these characters. For example, individuals might emotionally invest in fictional characters, treating them as if they were real individuals and forming attachments with them.

Medium as social actor presence. Medium as a social actor presence encompasses the perception of media devices as social beings, often attributing emotions or personalities to these inanimate objects. For instance, individuals might anthropomorphize their electronic devices, addressing them as if they were sentient beings.

Self-presence. Self-presence arises when individuals establish an emotional connection with mediated objects, that represent themselves particularly in the context of virtual avatars or characters in role-playing video games. For instance, individuals might experience emotional highs and lows based on the experiences of their avatars in a video game.

Inverse presence. Inverse presence elicits the sensation of an experience feeling unreal in the real world, resembling a scripted portrayal rather than an authentic personal encounter. For example, individuals might feel as if they are part of a scripted scene rather than engaging in an authentic experience when encountering extraordinary events.

These ten types of presence not only offer a comprehensive perspective for understanding the intricacies of presence but also encompass the diverse range of prevalent presence phenomena encountered in everyday life. As technological advancements continue to unfold, there remains substantial scope for ongoing exploration in the realm of presence classifications, encouraging scholars to approach social presence as a complex system rather than an isolated concept. Subsequent sections will delve into the historical trajectory of social presence studies, the development of the social presence definition, and the methodologies employed for measuring and assessing social presence.

Social Presence Theory

Social presence theory serves as the foundational framework for the content research. Over several decades of scholarly inquiry, social presence has been defined as the “sense of being with another” (Biocca et al., 2003, p.456).

An illustration of this concept can be observed when individuals engage in telephone conversations, perceiving themselves as being physically present in the same space, and consequently using body language consistent with in-person, unmediated communication.

> Social presence [is] succinctly [defined] as the “sense of being with another.” This other can be either a human or artificial intelligence. Within human-computer interaction, social presence theory studies how the “sense of being with another” is shaped and affected by interfaces. These others that we experience are primarily technologically mediated representations of other humans or forms of intelligence including mediated representations of remote humans via text, images, video, 3D avatars, and in artificial representations of humanoid or animal-like intelligence including virtual human agents, computers, and robots. (Biocca et al., 2003, p.456).

While the concept of social presence can be extended to non-mediated interactions (Huguet, et.al., 1999; Soussignan & Schaal, 1996), traditional presence studies from various perspectives have primarily applied this term to mediated interactions (Heeter, 1992; Palmer, 1995; Short, Williams, & Christie, 1976). In the context of non-mediated interactions, social presence pertains to the physical location of another person. This has been conceptualized as the actual objective presence or absence of another person in a physical location and has not been contentious. For instance, as stated by Goffman (1959), non-mediated social presence is the “experiencing [of] someone else with one’s naked sense” (p.15). The understanding of social presence as the “sense of being with another” gained significance in the context of mediated communication (Biocca et al., 2003).

Short et al. (1976) initially introduced the theory of social presence in the context of mediated communication, defining it as “the degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationships [...] It is a subjective quality of the communications medium” (p.65). Subsequent to the original social presence studies, scholars have developed different yet interconnected definitions of social presence. Biocca et al. (2003) have demonstrated that these various social presence definitions “cluster around key approaches or dimensions” (p.461). Following their work, this dissertation summarizes the definitions of social presence into three main categories.

Definition of Social Presence Focused on Copresence

The concept of copresence, as described by Goffman (1959), involves the awareness of another individual’s presence or absence. In the non-mediated context, social presence is characterized by experiencing someone directly, as articulated by Goffman (1959) as “experiencing someone else with one’s naked sense” (p.15). In contrast, within the mediated context, social presence denotes a feeling of co-location through mediated communication (Mason, 1994; McLeod et al., 1997; Tammelin, 1998; Sallnas et al., 2000). Mason (1994) defines social presence as “the feeling that the people with whom one is collaborating are in the same room” (p.33), while Sallnas et al. (2000) view it as “the feeling of being socially present with another person at a remote location” (p.462). Scholarly discussions have emphasized the importance of feeling a sense of interaction with others (Culnan & Markus, 1987; Palmer, 1995; Gunawardena & Zittle, 1997; Cuddihy & Walters, 2000; Heeter, 1992), with Heeter’s (1992) work illustrating this understanding of social presence.

> Social presence refers to the extent to which other beings (living or synthetic) also exist in the world and appear to react to you [...]. Social presence may derive from conversing with other human beings, or from interacting with animated characters. Someone or something else that seems to believe that you are there may help convince you that you are there. (p.262)

Previous research characterizes social presence as the sense of shared togetherness (de Greef & IJsselsteijn, 2000; Cho & Proctor, 2001), emphasizing awareness of co-location and mutual interaction. Fundamentally, it entails a feeling of shared physical presence, whether in mediated or unmediated environments, and the perception of interacting with others, as described by Biocca et al. (2003) as "being with another" (p.456).

Definition of Social Presence That Highlights Psychological Involvement

Biocca (1997) emphasized the significance of perceiving access to another person's intelligence. According to him, the psychological sense of others is a crucial aspect of social presence.

The minimum level of social presence occurs when users feel that a form, behavior, or sensory experience indicates the presence of another intelligence. The amount of social presence is the degree to which a user feels access to the intelligence, intentions, and sensory impressions of another. (Biocca, 1997)

Scholars such as Biocca (1997), Huang (1999), and Nowak (2000) argued that the perception of another's intelligence simulates the feeling of being together. This empathetic simulation underscores the likelihood of heightened social presence when an individual is aware of the presence of another intelligence.

The salience of the other has been identified as a pivotal element of social presence (Gunawardena, 1995; Huang, 1999; Rice, 1993; Galimberti & Riva, 1997; Riva & Galimberti, 1998; Tammelin, 1998; Short et al., 1976). Short et al. initially defined social presence as the "salience of the other" in their development of the social presence theory (p.65).

They posited that social presence is a cognitive synthesis of all factors, representing the user's attitudinal dimension and mental set towards the medium. According to them, social presence is a phenomenological variable influenced not only by the transmission of single nonverbal cues but by entire constellations of cues affecting the apparent distance of the other (p.157).

Psychological connection between individuals is deemed essential for social presence (Mehrabian, 1967; Weiner & Mehrabian, 1968; Argyle & Dean, 1965; Argyle, 1969; Savicki & Kelley, 2000), with intimacy and immediacy serving as integral terms in its definition. Immediacy is characterized by the directness and intensity of interaction between two entities (Mehrabian, 1967, p.325). It can be understood as the psychological distance between interactants (Weiner & Mehrabian, 1968). For instance, two best friends communicating over the phone might exhibit a higher level of immediacy than two strangers conversing face-to-face. Despite the greater physical distance between the former, the close psychological proximity results in a heightened sense of social presence compared to the latter. Intimacy underscores the proximity and emotional closeness between interactors, with elements such as proximity, eye contact, smiling, and personal topics of conversation contributing to its definition (Argyle & Dean, 1965, p.95; Argyle, 1969, p.201).

Indeed, mutual understanding is underscored as a critical facet of the social presence definition from the perspective of psychological involvement. It pertains to the psychological ability of individuals engaged in conversation to comprehend each other.

Savicki and Kelly (2000) expounded on this notion, elucidating, "These findings are explained from the point of view of social presence; that is, the ability to make oneself known under conditions of low media richness" (p.817).

They further delve into the intricacies of this concept, emphasizing the importance of effective communication and self-expression in the context of reduced media richness:

> Thus, a communication style has been identified that may be predictive of positive group functioning. One of the key features of this style is social presence; namely, that participants make themselves known in the constrained, text-based medium by virtue of linguistic strategies. Revealing information about one's self, one's ideas, and one's reactions to others in the group seems to have heightened the sense of who participants are in the "cueless" CMC environment. (Savicki & Kelly, 2000, p.821)

In summary, the definition of social presence from the perspective of psychological involvement emphasizes the significance of perceiving others' psychological states. This kind of social presence definition underscores the importance of various elements, including perceived access to another intelligence, the salience of the other, intimacy and immediacy, and mutual understanding. Psychological involvement is identified as a crucial component in the development of the overall "sense of being with another" (Biocca et al., 2003, p.456).

Definition of Social Presence Highlights Behavioral Engagement

The definition of social presence as it pertains to behavioral engagement underscores the critical role of interdependent, multichannel exchanges of behavior. Previous studies primarily focused on textual and other low-bandwidth media, thereby limiting the exploration of behavioral interactions within social presence.

However, as media technology continues to advance, the potential for behavioral engagement in mediated communication has expanded to include various aspects such as eye contact, nonverbal mirroring, and turn-taking (Biocca et al., 2003, p.46). Palmer's (1995) investigation of interpersonal relationships through virtual reality (VR) technology highlights the increasing capacity to study the extent of behavior exchanges. In her research, Virtual reality (VR) enables the experience of "social presence," allowing individuals to effectively negotiate relationships through interconnected, multi-channel behavior exchanges within a virtual environment. (Palmer, 1995, p.291). Therefore, the definition of social presence can encompass behavioral engagement, and the degree of social presence of this kind is evidently influenced by advancements in media technology, such as VR.

In summary, previous studies on social presence have yielded varied definitions, mostly centered around the following key terms: copresence (sensory awareness of embodied others, colocation, interactivity of others, the sense of being together), psychological involvement (perceived access to another intelligence, salience of the other, intimacy and immediacy, mutual understanding), and behavioral engagement (interdependent, multichannel exchange of behavior). Although these definitions differ, they are interconnected and collectively highlight the core concepts of social presence.

For my study, I adopt a concise but inclusive understanding of mediated social presence as the feeling of "we are together," as described by Lombard and Ditton (1997), reflecting the sense of physical togetherness experienced during interactions via the medium.

Social Presence Measurement

Social presence measurement methods vary due to the absence of a universally accepted standard definition. However, this diversity in measurement provides an opportunity to explore social presence from multiple perspectives, while also leaving room for the enrichment, development, and refinement of measurement techniques in future studies.

Building upon the research conducted by Biocca et al. (2003), three primary types of measurements have been employed to assess social presence: (a) subjective self-report measures, (b) behavioral indicators, and (c) psychophysiological measures. Each of these measurement approaches offers unique insights into social presence.

Subjective self-report measures typically involve participants' direct assessment of their own experiences, perceptions, and feelings related to social presence. These measures often include questionnaires, surveys, and interviews that elicit individuals' subjective reflections on their sense of social connectedness and immersion during mediated interactions.

Behavioral indicators encompass the analysis of observable behaviors exhibited during interactions within a mediated environment. Researchers often examine participants' communication patterns, engagement levels, and nonverbal cues to infer the degree of social presence experienced during the interaction.

Psychophysiological measures involve the assessment of physiological responses, such as heart rate variability, skin conductance, and brain activity, to gauge participants' emotional and cognitive engagement during mediated interactions.

These measures provide insights into the physiological correlates of social presence and the underlying psychological processes involved.

Drawing on the foundations of social presence theory and the insights gleaned from existing measurement techniques, I developed a measurement approach tailored to the objectives of my study. This measurement is designed to capture the multidimensional aspects of social presence and provide a nuanced understanding of participants' experiences within the context of online education.

Social Presence Measurement Using Subjective Self-Report

The subjective self-report measures of social presence can be classified into three distinct categories, as suggested by Biocca et al. (2003): 1, subjective social richness of the medium; 2, involvement, immediacy, and intimacy; and 3, social judgments of the other.

Perceived Social Richness of Medium. The early inquiries into social presence theory primarily centered on the attributes of the communication medium. Essentially, these early studies considered social presence as a singular quality of the communication medium. Short et al. (1967) employed a self-report measurement to assess the "subjective quality of the communications medium" (p.65) as a means to gauge social presence. This measurement approach primarily focuses on the quality of the medium itself. As Biocca and his colleagues (2003) argued, the use of indicators that ask the respondent to assess the "experience" rather than the "medium" is more typical of presence measures.

In the Short et al. measure, the respondent is asked to directly pass judgment on the medium itself. […] The equivalent approach for a presence measure would be to ask, "How realistic is this medium?", as opposed to, "How realistic was the experience?" (p.465).

In such instances, the measurement of social presence that emphasizes the subjective social richness of the medium primarily evaluates the quality of the medium to assess social presence. This form of measurement gauges a "stable 'mental set' towards the medium" (Short et al., 1976). In assessing subjective social richness of the medium, scholars have employed the semantic differential technique (Osgood, Suci, & Tannenbaum, 1957). This technique utilizes bipolar terms, including unsociable-sociable, insensitive-sensitive, cold-warm, and impersonal-personal, as a tool for evaluating social presence by appraising the quality of the medium. As highlighted by Short and his team (1976), media with a high degree of Social Presence are deemed as "warm, personal, sensitive, and sociable" (p.66). Additionally, the aesthetic appeal terms, such as small-large, closed-open, colorless-colorful, and ugly-beautiful, have also been employed as indicators of social presence, as indicated by Short et al. (1976). Over the years, various scales, such as the seven-point Likert scale, have been used by scholars to apply the semantic differential technique in their research, as seen in the study by Lee and Nass (2001).

Involvement, immediacy, and/or intimacy. The assessment of involvement, immediacy, and/or intimacy is closely linked to the social presence theory, emphasizing individuals' psychological engagement.

Researchers in the field of social presence (e.g., Argyle & Dean, 1965; Weiner & Mehrabian, 1968) have indicated that involvement, immediacy, and/or intimacy represent "the qualities of social interaction that media high in social presence could evoke during a mediated social interaction" (Biocca et al., 2003, p.465). Consequently, in order to comprehend social presence, researchers have focused on measuring media users' psychological factors. The initial measurement of involvement, immediacy, and/or intimacy originated in the realm of face-to-face communication to explore interpersonal relationships. For instance, when strangers were brought together in the same room for an interaction, scholars gauged their perception of their interaction partner to delve into their experience of social presence (e.g., Burgoon & Hale, 1988).

The measurement of psychological involvement in social presence studies has extended beyond in-person communication to encompass non-physical communication. Nowak (2000) pioneered the application of this measurement in the context of mediated communication within virtual environments. Biocca (2003) argued,

> To the extent that interactivity fosters social presence and/or social presence is one marker of interactivity, these measures—which include constructs such as involvement, identification, and multiple facets of mutuality (connectedness, similarity, receptivity, and coordination) — may tap into dimensions of social presence. Other communication qualities, such as composure, spontaneity, positivity, richness, and evaluation may represent not social presence itself, but rather markers of the quality of communication that transpires when social presence is realized or not. (p.467)

The most commonly used measurement tool for evaluating involvement, immediacy, and/or intimacy is again the semantic differential technique, which utilizes bipolar terms and Likert scales. These terms are specifically designed to assess individuals' perceptions regarding the level of engagement, interest, and emotional investment of their interaction partners (Nowak, 2000).

Social judgments of the other. In addition to examining the quality of media and individuals' involvement, scholars, such as Nowak (2000), have emphasized the significance of social judgments of the other. According to social presence theory, understanding these social judgments is crucial to comprehending the social presence experience. Consequently, assessing individuals' perceptions of objects in virtual environments plays a central role in measuring social judgments of the other. For example, in the context of my study, evaluating students' social judgments of their fellow students taking the same online course is essential to exploring their online course social presence experience. Studies often employ the concept of homophily (McCroskey, Richmond, & Daly, 1975) to assess perceived similarities. Homophily is used to determine whether media users perceive a sense of similarity with objects in some capacity. Moreover, it aims to gauge the extent to which they feel this similarity, such as via shared likes or dislikes. For instance, measuring the degree of homophily among students taking the same online course in my study can facilitate an understanding of their social presence experience.

Scholars frequently utilize a seven-point metric to measure homophily (McCroskey, Richmond, & Daly, 1975), incorporating questions designed to explore the extent to which individuals perceive the other person or mediated avatars as “a friend,” “similar to them,” or someone they “want to have more interactions with,” among other pertinent aspects (Nowak, 2000).

Behavioral Indicators

Behavioral indicators are primarily employed in research concerning face-to-face interactions (Coker & Burgoon, 1987). These indicators entail the observation of verbal and/or nonverbal cues to infer individuals' feelings of social presence. For instance, according to Coker and Burgoon (1987), the display of emotional facial expressions might suggest a heightened sense of social presence in an individual. While the measurement of behavioral indicators is not extensively utilized in contemporary studies on mediated social presence, it is occasionally employed as a supplementary tool to corroborate self-reported social presence (Biocca et al., 2003, p.368).

Psychophysiological Measures

The utilization of psychophysiological measurements, such as skin conductance and heart rate, has been instrumental in examining individuals' social psychological responses (Blascovich, 2000). However, their application in mediated social presence studies presents significant challenges. Biocca and his colleagues (2003) have argued that establishing a causal relationship between an individual's psychological response and their social presence experience is complex. The underlying reasons for a person's psychophysiological response are multifaceted, making it difficult to attribute specific physiological signatures to evaluate a person's psychophysiological response to the experience of mediated communication. For instance, an elevated heart rate could signify various emotional states, including fear, happiness, or potentially an existing heart condition. Consequently, inferring an individual's mediated social presence experience solely from specific physiological indicators proves challenging.

As noted by Blascovich (2000), “a one-to-one correspondence between specific behaviors and unitary physiological responses rarely exists...invariant indexes, whether subjective or objective, of social psychological constructs often prove elusive because target constructs: for example, risk-taking, love, prejudice, self-concept, themselves prove difficult to define” (p.119-120). Psychophysiological measurements can be useful as secondary indicators.

Social Presence Measurement of This Study

Grounded in antecedent research, my study introduces a measurement paradigm that underscores the nuanced examination of individuals’ sentiments pertaining to involvement, immediacy, and/or intimacy, alongside their social judgments of others. Within the methodological framework of this investigation, a deliberate effort has been made to identify specific textual content believed to hold the potential to authentically represent participants’ lived experiences of social presence.

These identified textual segments are slated to function as integral components within the context of a content analysis. This analytical endeavor is conceived as a systematic and in-depth exploration, wherein the identified textual content will be meticulously scrutinized to extract nuanced insights regarding the intricate nature of social presence in the studied context.

Garrison et al. (2000) delineated subcategories within social presence, comprising emotional expression, open communication, and group cohesion. Concurrently, several scholars (Anderson et al., 2001; Garrison et al., 2000; Hughes et al., 2007; Rourke et al., 1999; Swan, 2003) have identified specific indicators for each subcategory of social presence, such as the use of humor and self-disclosure, which have been rendered measurable in text-based online platforms.

While these indicators have not been extensively utilized to analyze students' social presence within asynchronous discussion boards, Lowenthal and Dunlap's (2020) categorization of social presence indicators in online education (Appendix A) provides a fundamental reference point for my research. In the course of my sample, I investigated the array of social presence indicators delineated by Lowenthal and Dunlap (2020) within the domain of Coursera's discussion board.

The objective was to gain insights into the nuanced process of social presence development in the context of online education. In this way, my study aims to fill this gap by delving into the nuances of social presence within the context of an asynchronous discussion board.

Social Presence Theory in the Context of Distance Education

Social presence theory, a cornerstone in the field of distance education, investigates the extent to which students perceive and experience a sense of connectivity and interaction within virtual learning environments (Russo, 2000). Students' perspectives on the experiences and impacts of in-person instruction versus synchronous and asynchronous online courses reveal nuanced insights separate from the concept of social presence. In-person courses provide immediate physical proximity and direct interpersonal engagement, while synchronous online courses emulate real-time interaction in a virtual classroom setting. Conversely, asynchronous online courses offer a flexible timeframe and self-paced learning, promoting autonomy and independent exploration.

Student feedback on these diverse learning modes emphasizes the convenience and flexibility of online courses, while also highlighting concerns about potential limitations, including perceived constraints in establishing immediate connections and personal engagement. These insights underscore the multifaceted nature of student experiences and underscore the critical role of social presence in facilitating effective online learning environments.

In the undergraduate context, the average class size typically ranges from 20 to 40 students, depending on the specific institution and academic program, with variations contingent upon course dynamics, disciplinary considerations, and pedagogical methodologies (Russo, 2000).

Recent trends in online education reflect a significant evolution, characterized by a growing integration of advanced technology, interactive learning platforms, and adaptive instructional strategies. This transformation has seen a pronounced emphasis on the integration of sophisticated virtual tools, collaborative learning environments, and multimedia resources to enhance student engagement and foster a more robust sense of social presence in the digital realm. Furthermore, the incorporation of emerging technologies, such as virtual reality and augmented reality, has played a pivotal role in reshaping the dynamics of online education, contributing to a more immersive and interactive learning experience over time.

Despite the growing body of research exploring the nexus between social presence and distance education experiences, significant gaps in understanding persist. This study seeks to address these gaps by focusing on the nuanced development of students' social presence within the realm of distance education. Additionally, the existing social presence measurements employed in online education warrant further refinement, prompting this study's objective of developing a more fitting social presence measurement tailored for text-based platforms. By refining these measurements, this study aims to contribute to the evolution of social presence theory.

This research investigates the potential influence of course disciplines and course duration on the level of social presence. Several previous studies (e.g., Lowenthal, & Dunlap, 2020) have delved into the influence of course disciplines and course duration on the level of text-based social presence within online course discussion boards. These studies have consistently highlighted the significant impact of these factors on the depth and quality of interactions among students, thereby underscoring the critical role of disciplinary context and temporal considerations in shaping the dynamics of online learning environments. For instance, research in diverse disciplines such as STEM and non-STEM fields has revealed varying patterns of engagement and communication styles, suggesting the presence of distinct discourse norms and communication preferences unique to each discipline.

Similarly, investigations into the effects of course duration have revealed temporal nuances that impact the development and sustainability of text-based social presence within online discussions (e.g., Swan, 2003).

Studies have indicated that longer course durations tend to foster a more in-depth and nuanced exchange of ideas, providing students with ample time to cultivate meaningful interactions and contribute to a more comprehensive understanding of course content.

In contrast, shorter course durations have been associated with more concise and time-sensitive interactions, highlighting the need for efficient communication strategies and concise knowledge dissemination within a limited time frame.

In this context, the present study's exploration of the correlation between course disciplines, course duration, and the level of online course discussion board text-based social presence holds significant implications. By building upon the existing body of research, this study aims to contribute to a more nuanced understanding of the intricate interplay between disciplinary contexts, temporal dynamics, and the manifestation of social presence within the online learning environment.

The findings of this study are expected to offer valuable insights into the optimization of online course design and instructional strategies, facilitating the development of tailored pedagogical approaches that effectively promote and nurture text-based social presence across diverse disciplinary contexts and course durations.

An understanding of how social presence evolves in the landscape of online education not only facilitates the improvement of cognitive and teaching presence but also enhances the overall quality of online educational offerings. The study's process of updating, refining, and adapting social presence indicators will also contribute to the advancement of contemporary social presence and online education theories.

CHAPTER 3

RESEARCH QUESTIONS

This study endeavors to provide valuable insights into the complex interplay between social presence, course disciplines, and course duration within the context of asynchronous online learning environments, thereby fostering a nuanced understanding of the multifaceted nature of online student engagement and interaction.

Research Question 1a delves into the fundamental query of the extent to which social presence is evident in students' utilization of discussion boards in asynchronous online courses. This inquiry seeks to establish an understanding of the prevalence and magnitude of social presence, shedding light on its pervasive influence within the virtual learning environment. Complementing this exploration, Research Question 1b aims to decipher the nuanced manifestations of social presence within the realm of discussion board usage, providing insights into the diverse forms and expressions through which social presence is conveyed and perceived.

Considering the critical role of disciplinary contexts in shaping online interactions, Research Question 2 scrutinizes the impact of course disciplines, distinguishing between STEM and non-STEM fields, on the prevalence and dynamics of social presence indicators. By discerning the disciplinary nuances that influence the manifestation of social presence, this inquiry contributes to an understanding of the contextual intricacies that shape student engagement and interaction within asynchronous online courses.

Research Question 3 addresses the temporal dimension of social presence, focusing on the significant implications of course duration on the overall level of social presence within a given course.

Recognizing the temporal constraints and opportunities inherent in online learning, this investigation aims to unravel the temporal factors that influence the development and sustenance of social presence within asynchronous online courses, thereby enriching the scholarly discourse on effective online instructional design and pedagogical strategies.

Research Question 1a: To What extent Does Social Presence Exist in Students' Use of a Discussion Board in an Asynchronous Online, Self-directed, Non-institutional, Public Course?

The research question seeks to establish the social presence within the context of an asynchronous online course discussion boards. Specifically, this study focuses on a distinct type of online course, characterized by its asynchronous nature, which encompasses unfamiliar students and teachers, a lack of instantaneous communication between participants, and minimal direct interaction between students and instructors. Given these constraints, the manifestation of social presence within the asynchronous online course setting appears to be a complex undertaking. However, delving into the intricacies of social presence development within this context is crucial for several reasons.

First, unraveling the trajectory of social presence in an environment inherently less conducive to fostering social engagement is paramount for comprehending the fundamental nature of social presence.

Contrasted with social presence nurtured in more congenial settings, such as synchronous online courses, the development of social presence in this less accommodating milieu may provide a clearer representation of the essence of social presence itself.

Second, research has suggested that heightened levels of social presence can positively influence students' academic outcomes. Therefore, enhancing the social presence experience within asynchronous online courses is likely to have a beneficial impact on students' learning achievements.

Third, the current landscape of literature reveals a preponderance of studies that investigate social presence within the context of synchronous online courses, highlighting a discernible gap in the scholarship concerning the manifestation of social presence in asynchronous online courses. Consequently, the study not only aims to address this gap but also endeavors to inspire further research into the development of social presence within asynchronous online learning environments.

Despite the inherent challenges posed by the asynchronous online course environment, various factors present opportunities for the cultivation of social presence. Notably, the discussion board serves as a pivotal platform facilitating student-to-student interaction. Despite the lack of synchronous communication, participants engage in discussions centered around shared topics, including course materials, queries related to the curriculum, and collaborative endeavors for group assignments. Given these circumstances, it is both reasonable and pertinent to hypothesize the presence of social engagement within the discussion board, prompting an exploration of this phenomenon.

Should compelling evidence surface affirming the existence of social presence, it would significantly contribute to an enhanced understanding of the multifaceted nature of social presence. Furthermore, such findings have the potential to serve as a catalyst for inspiring future research inquiries into the intricacies of social presence and its implications within the realm of asynchronous online learning environments.

Research Question 1b: How Does Social Presence Manifest in Students' Use of Discussion Boards in An Asynchronous Online, Self-directed, Non-institutional, Public Online Course?

The manifestation of social presence within the discussion boards of asynchronous online courses is characterized by the discernible display of affective response, interactive response, and cohesive response indicators, each contributing to the overall dynamics of virtual interactions. Through an in-depth exploration of these indicators, this research question seeks to uncover the distinct patterns and prevalence of each type of social presence within the discussion boards, shedding light on the predominant manifestations as well as the nuanced variations that exist within the online learning environment.

First, by examining the level of each type of social presence indicator, this research question aims to identify the most prevalent type of social presence, thereby elucidating the dominant mode of engagement and interaction among students within the asynchronous online course setting. Additionally, the identification of the least common type of social presence serves to highlight the less frequently observed modes of engagement, offering insights into the nuanced variations in student participation and interaction within the virtual learning community.

Second, this research question endeavors to unravel the underlying patterns that govern the manifestation of each type of social presence, exploring the recurrent themes and communication styles that define the prevalent modes of engagement within the discussion boards.

By examining the distribution and frequency of each social presence indicator, this study seeks to discern the distinctive patterns that characterize the prevalence and dynamics of affective response, interactive response, and cohesive response within the asynchronous online learning environment.

Third, this research question delves into an in-depth analysis of the most common indicators within each type of social presence, aiming to uncover the predominant modes of communication and interaction that define the overarching patterns of affective response, interactive response, and cohesive response within the discussion boards. By elucidating the prevalence and significance of each indicator within its respective category, this research endeavors to provide an understanding of the distinct manifestations and communicative nuances that underlie the multifaceted dynamics of social presence within the asynchronous online course environment.

Research Question 2: Do Course Disciplines Significantly Impact the Level and Nature of Social Presence in an Asynchronous Online, Self-directed, Non-institutional, Public Course?

In recent years, there has been a distinct shift in the educational landscape, with courses being increasingly categorized into two broad groups: STEM (Science, Technology, Engineering, and Mathematics) and non-STEM courses.

This separation serves several important purposes. First, it acknowledges the fundamental differences in subject matter, methodologies, and learning objectives between these two categories. STEM courses, driven by empirical evidence, logical reasoning, and problem-solving, emphasize technical skills and the pursuit of innovation.

Non-STEM courses, encompassing fields like the humanities and social sciences, prioritize critical thinking, creative expression, and the understanding of human society and culture. This differentiation is crucial as it allows students to choose educational paths that align with their individual interests, aptitudes, and career aspirations.

Second, distinguishing between STEM and non-STEM courses has broader societal implications. It highlights the unique needs of industries and professions within each category, helping policymakers and educators tailor curriculum development and resource allocation.

Third, this differentiation also underscores the importance of interdisciplinary collaboration and encourages students to explore the intersection of STEM and non-STEM disciplines, fostering a holistic approach to problem-solving and innovation.

In the context of these distinctions, it is valuable to learn whether the experience of social presence may vary between STEM and non-STEM online courses or not. Understanding these differences is crucial for educators and institutions to develop effective online learning environments. By investigating how social interaction and engagement differ in these two categories, educators can adapt teaching strategies to enhance the learning experience, ensuring that students in both STEM and non-STEM fields can benefit from the advantages of virtual learning while addressing their unique requirements and challenges.

In conclusion, the separation of courses into STEM and non-STEM categories serves both the individual's educational interests and the broader societal needs, and the study of social presence within these distinct domains is essential for optimizing online education across diverse disciplines.

Research Question 3: Does The Duration of a Course Significantly Affect the Course's Social Presence Level and Nature in Asynchronous Online, Self-directed, Non-institutional, Public Course?

In this study, the investigation into the potential influence of course duration on the course's social presence level and nature is a critical focal point. Each course in the sample spans a minimum duration of 7 weeks, enabling an analysis of the evolving dynamics of social presence over an extended temporal trajectory. By examining the potential fluctuations in the level of social presence indicators across the duration of the course, this research question seeks to identify any significant variations or trends that may emerge over the weeks, thereby shedding light on the intricate interplay between temporal dynamics and the manifestation of social presence within the online learning environment.

This study endeavors to discern the specific ways in which each type of social presence responds to the changes in the course duration. Through a nuanced analysis of the fluctuations in the prevalence and nature of affective response, interactive response, and cohesive response indicators over the course's duration, this research question aims to uncover the underlying factors that contribute to the observed changes.

By examining the potential reasons behind these changes, including the impact of evolving course content, pedagogical approaches, and student engagement patterns, this research question seeks to provide valuable insights into the complex interrelationships between temporal dynamics and the multifaceted dimensions of social presence within the asynchronous online course setting.

The exploration of the varying patterns of social presence indicators over the course's duration serves to illuminate the nuanced shifts in student engagement and interaction within the virtual learning community. By uncovering the distinct ways in which the social presence level and nature evolve over the weeks, this research aims to offer an understanding of the temporal dynamics that shape the trajectory of online student participation and communication within the asynchronous online learning environment. Through an analysis of the interplay between course duration and social presence, this research question seeks to provide valuable insights into the dynamic nature of online student engagement and interaction, thereby contributing to the ongoing discourse on effective online instructional design and pedagogical strategies.

CHAPTER 4

METHOD

Introduction of Study Method

The methodology employed in this study encompasses an approach, incorporating both quantitative and qualitative content analysis, to assess the intricacies of social presence within online courses. Through sampling techniques, scoring protocols for social presence indicators, and robust data analysis procedures, this research aims to provide a nuanced understanding of the multifaceted dimensions of online student engagement and interaction. By integrating a systematic and rigorous methodological framework, this study contributes to the ongoing discourse on effective online instructional design and pedagogical strategies.

Sample

This section delineates the sampling method employed in this research, assesses the representativeness of the sample, and outlines the data preparation process to derive the final dataset.

Coursera

Coursera, established in 2012 by Stanford University computer science professors Andrew Ng and Daphne Koller, is a widely recognized online platform that revolutionized the landscape of education by providing universal access to world-class learning. By collaborating with leading universities and organizations, Coursera offers a diverse range of courses, certifications, and degree programs spanning various disciplines.

With a mission to empower individuals worldwide to achieve their career aspirations, Coursera has become a prominent hub for learners seeking flexible, high-quality educational opportunities that cater to diverse learning styles and schedules. Through innovative technology and a global community of educators and learners, Coursera has established itself as a pioneering force in the realm of accessible, lifelong learning (Coursera, 2023).

The selection of Coursera as the primary study sample is representative of the asynchronous online course model. A key distinguishing factor within this context is the relative unfamiliarity among students who enroll in the same Coursera course. Unlike conventional in-person classes where students often have pre-existing connections, the lack of prior acquaintance among Coursera participants underscores the significance of any observed social presence on the discussion board. Notably, the absence of external social connections beyond the course setting accentuates the potential relevance and authenticity of the communication dynamics observed on the discussion board, providing valuable insights into the nature of social presence in asynchronous online courses.

First, the individual choice of students in selecting specific Coursera courses, as opposed to institutional mandates in traditional education settings, plays a pivotal role in shaping their motivations and contributions on the discussion board. Unlike scenarios where participation might be compulsory for program requirements, Coursera students engage in discussion board activities driven primarily by personal interests and preferences. Consequently, any indications of social presence within this self-directed context provide valuable insights into the inherent nature and dynamics of social interaction in an asynchronous online course environment.

Second, the asynchronous nature of the Coursera learning experience, with pre-recorded lectures and limited opportunities for direct, real-time interactions with instructors or peers, further underscores the pivotal role of the discussion board as a primary platform for fostering communication among students. Given the absence of synchronous communication channels, the discussion board serves as the principal avenue for fostering peer-to-peer engagement and observation of social presence dynamics. As a result, investigating social presence within this unique educational context promises to yield nuanced insights into the intricacies of social interaction and communication among students in an asynchronous online learning environment. Owing to the distinctive attributes of Coursera, it is pertinent to delineate the specific characteristics of the sample in this study. The participants are drawn from asynchronous online courses characterized by a self-directed learning approach, situated outside the purview of institutional structures, and made publicly accessible.

Coursera Discussion Board

The data for this study were gathered from the discussion boards associated with each individual course on Coursera. Notably, each course on Coursera features multiple start dates, and students enrolled in a particular course gain access to its corresponding discussion board. This structure allows students to actively engage by posting, responding to others' contributions, and participating in interactions with fellow students who are enrolled in the same course.

It is essential to highlight that the discussion board functionalities are consistent across all courses on Coursera. This uniformity ensures that students, irrespective of the course they are enrolled in, can utilize the discussion board to post textual content, employ paralanguage, and share images, thereby facilitating diverse and comprehensive modes of communication and interaction.

Sampling

Out of a total of 1053 free courses in English spanning 11 subjects on Coursera (Coursera, 2023) as of May 2023, A systematic web crawling approach utilizing Scrapy (version 2.7.*) (Scrapy. PyPI, n.d.) was employed to randomly select 42 free courses. After data cleaning, a sample of 36 free English courses was used for coding purposes. The titles of all the sample courses are provided in Appendix B for reference. Web crawling, often referred to as web scraping, is an automated process used to extract large amounts of data from websites.

This approach involves the use of specialized software tools, known as web crawlers or spiders, which navigate through web pages, systematically gathering and organizing information from various online sources. These tools can access and extract data from multiple web pages, collecting text, images, links, and other relevant content based on predefined parameters and criteria.

By leveraging web crawling techniques, researchers can efficiently collect and compile extensive datasets from online sources, facilitating the analysis of digital content and the exploration of various online phenomena. The web crawling downloads all the posts from the discussion board of my selected courses.

Due to the speed limitations imposed by the Coursera website, a 2-second interval was adhered to between each screen request within the web crawling system. The simultaneous use of four computers streamlined the crawling process, allowing the system to run continuously for 5 hours a day. Despite the extended duration, the data collection process spanned four months, ensuring coverage and data acquisition. Subsequently, data records that could not be effectively analyzed were excluded, resulting in a final sample of 36 courses, comprising 182,645 data records.

Coursera Discussion Board Data Duration

Coursera retains data from its discussion boards for an extensive period of ten years. The majority of courses included in the sample for this study have been available for an extended duration. Specifically, four courses were offered in 2015, six in 2016, three in 2017, and four in 2018. Notably, more than half of the sampled courses were made available prior to 2020, underscoring the inclusion of longstanding courses in the analysis. Additionally, four courses within the sample were offered as recently as 2023, showcasing a range of temporal availability that enhances the diversity of the dataset. (see appendix C). This temporal spread contributes to a comprehensive examination of social presence dynamics across courses with varied durations of existence on the Coursera platform.

Representativeness of the Sample

The sample of 36 courses maintains a strong representation of the broader population of 1053 courses. The principle of random sampling, foundational to statistical inference, ensured that each course within the population had an equal likelihood of being included in the sample, thereby mitigating any selection biases.

The collected social presence indicator data from the sample conforms to a normal distribution, a statistical pattern commonly observed in natural phenomena, including human behaviors.

The p-values from the Shapiro-Wilk test for each social presence indicator fell within the range of 0.127 to 0.511. These p-values all exceeded the 0.05 significance level, indicating that the data for these social presence indicators can be reasonably assumed to follow a normal distribution.

These statistical findings affirm the pervasive nature of social presence in students' engagement with discussion boards in asynchronous online courses. This normality implies that the sample's central tendencies (mean, median, mode) are likely to mirror those of the larger population.

Despite the population's relatively small size of 1053, the normal distribution exhibited by the sample data suggests its potential to offer valuable insights into the population's characteristics.

The sample deliberately encompassed a diverse array of characteristics and variations, reflecting the breadth and depth of the 1053 courses selected for the study. Courses were chosen from all 11 subjects offered on Coursera, ensuring an equitable representation, and enhancing the sample's ability to capture the population's heterogeneity.

Sample Cleaning

To ensure the creation of an analyzable sample, a meticulous selection process was employed. Following data collection from the crawling system, a data examination was conducted.

Courses with insufficient data (e.g., only one discussion topic in a course), courses containing irregular characters (e.g., three courses in Spanish and one course in Arabic), courses with missing posts (e.g., 10 courses with posts for only two study weeks), and those unsuitable for analysis were systematically excluded. As a result of this rigorous cleaning process, the study's sample ultimately consisted of 36 courses.

Sample Database

The sample under investigation comprises 36 courses, each exhibiting a distinct number of posts, with post counts spanning a range from 244 to 63,301. In aggregate, the sample encompasses a substantial corpus of 257,066 posts, resulting in an average of approximately 7,141 posts per course. Additionally, the page counts for these courses exhibit variability, with page numbers ranging from 25 to 640, summing up to a total of 26,180 pages, and an average of around 721 pages per course. Overall, the dataset from the 36 courses contains a total of 182,645 individual data records, reflecting the extensive nature of the analyzed content.

Score Social Presence Indicators

Upon downloading all posts from the discussion boards of the selected sample courses, this study employed specific keywords to identify and score each social indicator. Implementing a Python algorithm, I assigned a score of one to an indicator whenever a relevant keyword was detected. Python, a versatile and user-friendly programming language, has gained substantial popularity in the fields of software development, data analysis, and scientific computing. It is renowned for its simplicity, readability, and extensive support for various libraries and frameworks, making it an ideal choice for both beginners and experienced programmers (Rossum, 2003).

The total score for each social presence type within individual courses and across all courses was subsequently calculated by summing the scores of the corresponding social presence indicators.

This section elucidates the social presence indicators employed in this study, their respective definitions, the method employed for their evaluation and coding, as well as the selected keywords for coding purposes.

Consistent with previous research (Hughes et al., 2007; Lowenthal & Dunlap, 2020; Rourke et al., 1999; Swan, 2003), the primary social presence indicators utilized in this study can be categorized into three overarching types of communicative responses:

Affective Response: This category encompasses indicators related to emotional expressions and responses within the online course discussions.

Interactive Responses: Interactive responses pertain to indicators reflecting engagement and interaction among participants in the online course environment.

Cohesive Response: Cohesive responses encompass indicators indicative of the degree of unity and coherence within online course discussions (Rourke, 2004).

Key Word Selecting

I reviewed the entirety of the discussion board posts within my selected sample courses, carefully examining each post's contextual nuances to identify various types of social presence indicators. In cases where a post exhibited indication of social presence, I specifically pinpointed the words within the post that represented the corresponding social presence indicators. These identified words were subsequently used as key descriptors of social presence indicators for the purpose of this study.

During the data analysis phase, my algorithm systematically attributed scores to each social presence indicator based on the frequency of occurrence of the key words. Specifically, when a key word related to a particular social presence indicator appeared within a post, the algorithm assigned a score to that specific indicator accordingly. Every key word has the same weigh. The total score for a particular indicator is determined by summing the frequencies of its corresponding key words.

Validation of Key Words as Indicators of Social Presence

The process of selecting key words as indicators of social presence is robust and justifiable. The validation of these key words as effective measures of social presence can be supported by several key points:

Comprehensive Review. The exhaustive examination of discussion board posts across 15 sample courses indicates a thorough understanding of the context in which these key words are used. This suggests that the selected key words are reflective of the nuanced aspects of social presence within the online learning environment.

Contextual Relevance. Building upon the research by Hughes et al. (2007), Lowenthal and Dunlap (2020), Rourke et al. (1999), and Swan (2003), the identification of key words was guided by their contextual relevance to specific indicators of social presence. Upon reviewing the sample data, each key word was selected based on its contextual association with the manifestation of social presence. Subsequently, a cross-validation process was conducted, comparing the chosen key words with the aforementioned studies to ensure their appropriateness and alignment with established research, without any omission or alteration of the selected terms.

Algorithmic Integration. The incorporation of an algorithmic scoring system, which calculates the total score of each indicator based on the frequency of related key words, contributes to the validation process. This approach ensures that the selected key words are not arbitrarily chosen but are instead quantitatively grounded in their frequency of occurrence, providing a measurable and verifiable validation of their significance in representing social presence.

By utilizing an approach that encompasses review, contextual relevance, and algorithmic validation, the selection of these specific key words as indicators of social presence demonstrates a robust methodology that ensures the validity and reliability of the chosen measures, distinguishing them from other potentially less effective alternatives.

Affective Response

Affective response pertains to an individual's reaction to an emotionally charged situation. For instance, in the context of discussion board posts, a post that conveys the writer's feelings, whether they are happy or sad, serves as an indicator of affective response. Previous studies by Hughes (2007) and Lowenthal and Dunlap (2020) have identified five key indicators for affective responses: 1) emotions, 2) use of humor, 3) paralanguage, 4) self-disclosure, and 5) value.

Emotion: The emotion social presence indicator encompasses words that directly reflect people's emotions. I identified words that explicitly convey feelings such as happiness or sadness, as well as words that convey a person's tone and attitude, which can signify their emotions (e.g., love, guilty).

Based on an analysis of discussion forums from sample courses, the following words were identified as key indicators that directly convey emotions: appreciative, blissful, contented, ecstatic, elated, glad, happy, joyful, jubilant, merry, respectful, sweet, serene, upbeat, vivacious, angry, disenchanted, distressed, glum, gloomy, grumpy, grouchy, miserable, mad, moody, nervous, sad, sadistic, selfish, sour, accepting, calm, confident, cool, earnest, easy, evenhanded, indifferent, neutral, nostalgic, passive, reserved, satisfied, sentimental, surprised, amazed, attractive, bold, brave, bubbly, cheerful, comfortable, delightful, excited, festive, free, jolly, optimistic, proud, wonderful, aggravated, awful, chilly, dejected, dirty, dreadful, heavy, irritated, pessimistic, tearful, tense, terrible, tired, ugly, weak, anxious, awestruck, bashful, cautious, composed, easygoing, horrified, intelligent, numb, political, quizzical, ravenous, reluctant, settled, shy.

The following words were selected to represent people's tone: agreeable, animated, bright, clever, encouraging, fresh, gentle, hopeful, kind, loving, open, pleased, supportive, sympathetic, warm, annoyed, bitter, disgruntled, disgusted, evil, guilty, hostile, hurtful, nasty, obnoxious, oppressive, overbearing, resentful, sarcastic, sardonic, acerbic, ambivalent, ardent, candid, cautionary, conciliatory, knowledgeable, mysterious, pragmatic, regretful, resigned, satirical, secretive, solemn, strong.

In summary, this study has identified the aforementioned words as indicators of the "emotion" social presence category. When the algorithm used in this research encounters any of these words, it assigns a score for the "emotion" indicator. For example, in a post from the discussion forum of the Financial Markets course, a student wrote, "Hi, my name is […] from Guatemala. I'm a first-year Industrial Engineering student at Universidad del Valle, and I'm happy to be sharing this experience with you all. Best of wishes!" (MA, 2021). This post included the keyword "happy," leading the algorithm to assign one score for the "emotion" indicator. Similarly, in a post from the Stanford Introduction to Food and Health course with the title "so happy 😂" (GI, 2020), the keyword "happy" contributed to a score for the "emotion" indicator.

Use of Humor. The use of humor in written communication can be challenging to identify since it often relies on context and tone. It may not be apparent solely by analyzing individual words. Some individuals explicitly express humor by using common online acronyms such as LOL, LMAO, or ROFL. To account for this, the algorithm employed in this study considers LOL, LMAO, and ROFL (regardless of case sensitivity) as key indicators of the "use of humor" social presence category.

If a person uses paralanguage, as discussed in the next section, it is also considered an indication of using humor. Consequently, keywords associated with paralanguage are assigned scores for both the "use of humor" and "paralanguage" social presence indicators.

For instance, consider a post from the Successful Negotiation: Essential Strategies and Skills course: "Hi […], I am […]. Guess I don't need to say where I am from, lol" (ME, 2019). In this post, the writer attempted to inject humor by using the abbreviation "lol," which is a recognized keyword for the "use of humor" indicator. Consequently, this post was categorized as employing humor, with the key term "lol" contributing one score to the "use of humor" indicator.

Paralanguage. Paralanguage in written communication encompasses elements that go beyond formal syntax and serve to convey emotions or expressions. To identify paralanguage in the text, this study employed an algorithm that recognized both emoji and emoticons. This algorithm utilized publicly available databases of emoji text and symbols (Text emoji, n.d.) as well as emoticons (Wikipedia contributors, 2007). My algorithm also used the “emoji” library in Python. “emoji” is a third-party library and dataset that provide information about emoji, including their names and Unicode representations. Whenever a post contained emoji or emoticons, the algorithm assigned scores for the “paralanguage” social presence indicator.

For instance, consider a post from the discussion forum of the Financial Markets course: “Hi classmates, [...] I hope you all have a fruitful learning experience and be able to learn just as much as Phoebe! <3 <3” (RC, 2023). In this post, the presence of “<3 <3” as a paralanguage key term conveyed the writer’s happiness and affection toward Phoebe, who was mentioned in the post. As a result, this post included two paralanguage key words, then it was attributed two scores for the “paralanguage” social presence indicator.

Self-disclosure. Self-disclosure involves individuals sharing personal information, experiences, thoughts, feelings, preferences, ambitions, hopes, and fears. Through manual analysis of sample courses, this study’s algorithm identified specific keywords indicative of “self-disclosure.” These keywords encompass a range of expressions, including personal information (e.g., “I am,” “My name,” “I come from”), educational background (e.g., “university,” “college,” “high school,” “degree”), personal status (e.g., “married,” “single,” “daughter,” “son”), and more. All the keywords are: I am, my name, I come from, live, this is, I speak, work, I graduated from, university, college, high school, degree, education, years old, woman, man, mother, daddy, married, single, daughter, son, dog, cat, fish, pet, girl, boy, location, home, personal, girlfriend, boyfriend, I want to, I will, suggest, advice, prefer, I think, help, share, hopes, ambitions, fears, feel, interest, life, current, I don't know, understand, confused, dream, I bet, family, house, career, experiences, as a, enjoy, hate, hopeful, helpful, handy, bored, share, like, love, dislike, agree, disagree, comfortable, uncomfortable, motivation, finding, impression, missing, intern.

For example, a post from the discussion forum of English Composition I reads: My name is […]. I speak 3 different languages. French is my primary language and English is my secondary language. I am a Pharmacy intern. I finished college in my country. It took me quite some time to go back to college in the United States because I wanted to make sure that I fully understand the professors' explanations. I worked on that by taking some ESL courses, but I still have my foreign accent. (RT, 2020)

This post contains extensive personal information, including mentions of "my name," "I speak," "intern," "college," "I wanted to," and "I worked." Consequently, it receives six scores for the "self-disclosure" social presence indicator.

Value. The "value" indicator pertains to content that reflects the writer's values, beliefs, understandings, and attitudes. After manually examining the sample courses, this study identified a set of keywords indicative of "value." These keywords encompass expressions such as expressing opinions (e.g., "I think," "I don't think," "I agree," "I disagree"), sharing personal perspectives (e.g., "My opinion," "From my"), and indicating understanding or lack thereof (e.g., "Understand," "I don't understand"). Additionally, expressions related to reasoning and justification (e.g., "Because," "The reason") and participation in discussions (e.g., "Contribute," "Participant") were considered as indicators of "value." All the keywords are: I think, I don't think, I agree, I disagree, my opinion, I suggest, from my, understand, I feel, I believe, accept, I guess, right, wrong, I see, I am able, I can, I cannot, value, because, the reason, contribute, participant, demonstrate, explore, result, I am sorry.

For instance, consider a post from the discussion board of the Writing in the Sciences course: "I am sorry I don't understand this: If a drug is not harmful, it means it is safe, right? The drug cannot do harm to humans, so it is safe. The precondition is 'not believing a drug is harmful,' why are you talking about 'evidence'? So, I don't think it changes the meaning." (ZJ, 2020). In this post, the writer expresses confusion and seeks clarification from classmates while indicating a willingness to engage in discussion. Several keywords from the "value" indicator, including "I am sorry," "I don't understand," and "I don't think," are present in this post. Consequently, this post is assigned three scores for the "value" indicator.

In summary, affective response encompasses individuals' emotional reactions, which are represented through five distinct indicators: 1) emotions, 2) use of humor, 3) paralanguage, 4) self-disclosure, and 5) value. Scores for each of these indicators are assigned by my algorithm, taking into account specific keywords, and relevant emoji data from public databases. The cumulative score across these five indicators constitutes the overall score for the "affective response" category of social presence indicator.

Interactive Responses

Interactive responses encompass individuals' communicative behaviors that indicate active participation in a communication context. According to Martins and Braga (2009), the crux of the interactive dimension lies in the demonstration of involvement in the shared principles of a community. Building on the research of Hughes (2007), Lowenthal and Dunlap (2020), Rourke (1999), and Swan (2003), this category of social presence incorporates 11 distinct indicators:

Continuing a Thread. Continuing a thread within the context of online discussions refers to the sustained engagement and active participation of students in response to an original post. It entails the ongoing exchange of ideas, opinions, and insights that stem from the initial discussion prompt, fostering a dynamic and collaborative discourse within the virtual learning environment. As students respond to the original post and subsequently engage in subsequent interactions, the continuity of the thread signifies a collective commitment to nurturing and advancing the discussion, thereby contributing to the cultivation of a vibrant and interactive online learning community. By examining the quantifiable aspects of students' response posts within this context, an insightful evaluation of their willingness to sustain and enrich the ongoing thread can be achieved.

Acknowledgement. In the context of online discussions, "acknowledgement" refers to the recognition and validation of an original post or contribution within a virtual learning community, typically demonstrated through various forms of engagement, such as students' response posts and the allocation of "likes."

It signifies a collective appreciation of the ideas, perspectives, and insights put forth by the original poster, fostering a sense of inclusivity and respect within the online discourse.

Building upon the notion of acknowledgement, the quantitative analysis of students' response posts and the count of "likes" received by an original post serves as a robust metric for evaluating the degree of acknowledgment garnered by individual contributions. The number of response posts signifies the extent of engagement and interaction generated by the original post, reflecting the level of interest and active participation among students. Similarly, the count of "likes" received by an original post represents the collective endorsement and validation of the ideas expressed, underscoring the perceived value and relevance of the contribution within the online learning community.

By integrating the quantitative assessment of students' response posts and the tally of "likes," educators and researchers can effectively gauge the extent to which students' contributions are acknowledged and valued within the virtual learning environment. This approach not only facilitates an understanding of the dynamics of acknowledgment but also enables the cultivation of a supportive and inclusive online learning culture that fosters meaningful engagement and collaborative knowledge.

Referring to and/or Quoting from Others' Messages. This indicator encompasses instances where writers incorporate content directly related to the posts of other participants. It includes both explicit references or quotations from others' posts and cases where a writer's content demonstrably relates to others' contributions.

These three interactive behaviors are collectively considered as the "interactive behavior" indicator in this study. The algorithm identifies all posts that have received replies, calculates the total number of response posts for each original post, and aggregates the total number of "likes" received as well. The combined sum of response posts and "likes" contributes to the "acknowledgement" social presence indicator. For example, in the context of the discussion forum for the "Innovation Through Design: Think, Make, Break, Repeat" course, a post garnered 1 "like" and 227 replies (Coursera, 2023), resulting in a total score of 228 for the "interactive behavior" social presence indicator.

Asking Questions and Invitation. The indicators of asking questions and invitations share a common characteristic, namely, the pursuit of information or engagement. These two indicators have been amalgamated under the category of "asking questions" for the purpose of this study. The foundational keywords employed to identify this indicator include: why, what, when, who, and how. Additionally, the presence of a question mark "?" serves as a coding keyword.

For instance, consider a student's contribution to the discussion forum of the "Learning to Program: The Fundamentals" course: "Why doesn't the first option work?" (CK, 2022). This post overtly signifies the author's inquiry and incorporates two pertinent keywords, "why" and "?". Consequently, our algorithm assigns a total of two scores for the "asking question" social indicator in relation to this post.

The response provided by a mentor to this post also contains a keyword relevant to the "asking question" social indicator, warranting a score. The mentor responded by offering a demonstration of the coding process and inquired, "Have you tried it in the Shell?" (PD, 2022). This response post includes the key symbol "?", thus qualifying as a manifestation of the "asking question" indicator.

Complimenting and Expressing Appreciation. The indicators encompassing complimenting and expressing appreciation share a common theme, which is the utilization of language to create a positive emotional atmosphere and bolster the self-esteem of individuals engaged in the communication process. To maintain clarity and analytical precision, these two indicators have been consolidated under the umbrella term "complimenting."

The keywords employed to ascertain the "complimenting" indicator encompass words and phrases that overtly convey admiration and appreciation. The selection of these keywords was derived from a manual analysis of discussion forums in sample courses. All keywords are: considerate, co-operative, determined, enthusiastic, friendly, funny, generous, helpful, honest, humble, insightful, intelligent, loyal, observant, organized, patient, positive, proactive, responsible, sincere, thorough, thoughtful, understanding, welcome, wise, amazing, awesome, brilliant, delightful, excellent, fabulous, fantastic, fine, first-class, good choice, gorgeous, great, interesting, impressive, lovely, marvelous, nice, outstanding, superb, smashing, splendid, stunning, terrific, tremendous, wonderful, Able, accepting, accommodating, accomplished, adept, admirable, admiring, adorable, agreeable, applauding, appreciative, astute, benevolent, better, bold, bountiful, brave, bright, bubbly, buoyant, calm, capable, charismatic, charitable, charming, chaste, chatty, cheerful, cheery, chivalrous, clever, colorful, commendable, composed, conscious, considered, contagious, content, courteous, creative, dazzling, dedicated, deserving, detailed, diplomatic, disciplined, effervescent, elevating, enchanting, encouraging, engaging, favorable, flattering, fun, gallant, genuine, gifted, glorious, goal-driven, gracious, grateful, happy, impeccable, incredible, inspiring, kind, kindly, laudable, likable, lucky, magnificent, measured, mindful, momentous, motivated, neat, noticeable, optimistic, opulent, ordered, perceptive, perfect, polite, principled, prompt, prudent, punctual, quick, respectful, sensible, sharp, special, super, supportive, trustworthy, unparalleled, upbeat, valued, virtuous, warm, wholesome, witty, worthy, zealous, thank you, thanks.

In addition to single-word expressions, multi-word expressions such as "thank you" also fall within the purview of the "complimenting" indicator. As an illustrative example, consider a student's commentary in the discussion forum of the "Health Behavior Change: from Evidence to Action" course: This post signifies the student's deep appreciation for the course, evident through the use of the keyword "helpful." Consequently, the algorithm assigns a single point for the "complimenting" social presence indicator to this post.

Expressing Agreement and Approval. The indicators encompassing "expressing agreement" and "approval" share a common essence, which is the explicit alignment of the writer's perspective with the ideas presented by others. The identification of keywords for these indicators resulted from an exhaustive manual analysis of discussion forums in the sample courses.

These keywords encompass expressions such as "agree," "agreement," "yes," "right," "of course," "no doubt," "ok," and "good." Both of these indicators have been consolidated under the unified category of "expressing agreement" for analytical simplicity.

For instance, consider a student's response within the discussion forum of the "Data Management for Clinical Research" course: "I agree. You're right…" (EA., 2016). This response unequivocally conveys agreement, featuring the keywords "agree" and "right." Consequently, the algorithm assigns two points to this post for the "expressing agreement" social presence indicator.

Expressing Disagreement. The "expressing disagreement" indicator pertains to content that manifests the writer's divergence of opinion from the ideas espoused by others. The identification of relevant keywords was conducted through a review of the sample courses and includes expressions such as disagree, disagreement, can't agree, no, wrong, I am sorry, but, I don't, I can't, and I am not sure.

For instance, a student posted a response within the discussion forum of the "Innovation Through Design: Think, Make, Break, Repeat" course, asserting, "the idea of studying hard and for so long to get good grades I totally disagree with, and I was studying as little as 1 hour a day, just a week before the exam, and I got the highest grade in my class compared to my classmates who used to study for 4 hours every day" (Br., 2022). In this case, the student explicitly expresses disagreement with others' viewpoints, featuring the keyword "disagree." Consequently, this post is assigned one score for the "expressing disagreement" social presence indicator.

Personal Advice. The "personal advice" indicator pertains to content in which the writer imparts their personal perspectives and recommendations. The determination of keywords for this indicator aligns with the methodology used for the "value" indicator within the affective response category, drawing upon manually coded keywords.

For instance, upon revisiting the previously mentioned example focusing on the "value" indicator, ZJ's discussion board post from the Writing in the Sciences course provided an articulated disagreement with a particular viewpoint on drugs. This specific post accumulates a total of three scores, reflecting its relevance to both the "value" and "personal advice" indicators within the context of the study.

In summary, the category of interactive responses signifies active participation in communication and encompasses a total of 11 indicators. This study consolidates certain indicators and employs manually derived keywords to assign scores to these six indicators: 1) interactive behaviors, 2) asking questions (encompassing both asking questions and invitations), 3) complimenting (inclusive of both complimenting and expressing appreciation), 4) expressing agreement (encompassing both expressing agreement and approval), 5) expressing disagreement, and 6) personal advice. It should be noted that the measurement approach for the interactive behavior indicator differs from that of the other indicators, rendering it distinct in the evaluation process. The assessment of interactive behavior indicators is based on the quantification of reply posts and the count of "likes" received by the original posts. In contrast, the evaluation of other indicators relies on the frequency analysis of keywords across all posts. The cumulative score across the remaining indicators constitutes the overall score for the interactive response category.

Cohesive Response

Cohesive response pertains to interactions that signify individuals' affiliation with a group, embodying actions that construct, cultivate, and uphold group dynamics simultaneously (Martins &Braga, p.31). Drawing upon previous research (Hughes et al., 2007; Lowenthal & Dunlap, 2020; Rourke et al., 1999; Swan, 2003), this social presence category encompasses three key indicators: 1) greetings and salutations, 2) vocatives, and 3) group reference.

Greetings and Salutations. The "greetings and salutations" indicator signifies that the author extends greetings to others within the communication context. For this indicator, our study has identified specific keywords, including: hi, hello, dear, good morning, good evening, good afternoon, greetings, hi there, greetings from, to whom it may concern, and say hi.

For instance, within the discussion forum of the "Introduction to Psychology" course, numerous students initiate their posts with greetings, such as "Hello, my name is [...]" (JR., 2020). These posts prominently feature the keyword "hello," warranting a one-score attribution for the "greetings and salutations" social presence indicator.

Vocatives. The "vocatives" indicator is characterized by the use of an individual's name within a post. However, this indicator poses a potential privacy concern as it involves divulging personal information. In an effort to safeguard individuals' privacy, this study refrains from assessing the "vocative" social presence indicator.

Group Reference. "Group reference" implies that students treat others as part of a collective entity. Key terms identified for this indicator encompass our, we, us, as one part of, and our group.

For instance, a participant in the “Introduction to Psychology” course discussion forum expressed, “Hi everyone! Excited for our lesson” (AH., 2020). This post incorporates the keyword “our,” signifying the “group reference” social presence indicator, and consequently, it is attributed a score of one for this indicator.

In summation, the cohesive response social presence category reflects individuals’ inclination to acknowledge fellow students as part of a larger group. This assessment is undertaken through two indicators in this study: 1) greetings and salutations, and 2) group reference. These indicators are quantified utilizing the manually identified keywords, and the cumulative score across these two indicators constitutes the cohesive response indicator.

I have compiled a summary table labeled as Table 1.1 and Table 1.2 to delineate the identified keywords corresponding to each social presence indicator. These tables serve to illustrate examples of keywords associated with each specific social presence indicator. Additionally, the table includes examples demonstrating how each social presence indicator manifests on the online discussion board.

Table 1.1 *Social Presence Indicator Keywords of This Study*

Social presence indicator type	**Social presence indicator**	**Identified Keywords**	**Example**
Affective response	Emotion	e.g., appreciative, blissful, contented, ecstatic, elated, glad, happy etc.	"I'm happy to be sharing this experience with you all" (MA, 2021).
	Use of humor	LOL, LMAO, and ROFL	"Hi […], I am […]. Guess I don't need to say where I am from, lol" (ME, 2019).
	Paralanguage	e.g., 😊, <3, etc.	"I hope you all have a fruitful learning experience and be able to learn just as much as Phoebe! <3 <3" (RC, 2023).
	Self-disclosure	e.g., I am, my name, I come from, live, I speak, work, I graduated from etc.	"My name is […]. I speak 3 different languages. French is my primary language and English is my secondary language" (RT, 2020).
	Value	e.g., I think, I don't think, I agree, I disagree, my opinion etc.	"I don't think it changes the meaning." (ZJ, 2020)

Table 1.2 *Social Presence Indicator Keywords of This Study*

Social presence indicator type	**Social presence indicator**	**Identified Keywords**	**Example**
Interactive response	Continuing a thread	These three interactive behaviors are collectively considered as the "interactive behavior" indicator in this study.	Measured by the sum of the original post's relies and "like" number.
	Acknowledgement		
	Referring to and/or quoting from other's messages		
	Asking questions	why and ?.	"Why doesn't the first option work?" (CK, 2022).
	Complimenting	e.g., considerate, co-operative, determined, enthusiastic, friendly etc.	"[The course content] is specific, relevant, attainable, measurable, and time-measured, and in my opinion, very helpful for stress reduction" (MA, 2023).
	Expressing agreement	e.g., agree, agreement, yes, right, of course, no doubt, ok, etc.	"I agree. You're right…" (EA., 2016).
	Expressing disagreement	e.g., disagree, disagreement, can't agree, no, wrong, etc.	"The idea of studying hard and for so long to get good grades I totally disagree with…" (Br., 2022).
	Personal advice	Same key words as value	
Cohesive response	Greeting and salutations	e.g., hi, hello, dear, good morning, good evening, etc.	e.g., "Hello, my name is [...]" (JR., 2020).
	Vocative	Individual's name	
	Group reference	our, we, us, as one part of, and our group.	"Hi everyone! Excited for our lesson" (AH., 2020).

Preparing Data for R Analysis

To ensure the reliability and validity of the study, I have undertaken a standardization process for social presence indicator scores and addressed special cases.

Standardization of Social Presence Indicator Scores

The frequency of each social presence indicator is influenced by the total number of posts within a course. Courses with a higher volume of posts are more likely to contain keywords representing these indicators, potentially resulting in inflated social presence scores. To mitigate the impact of variations in post numbers among different courses, this study has standardized each indicator score. This standardization involves calculating the ratio between the social presence indicator score and the total number of posts for that course, with this ratio serving as the indicator's value for subsequent statistical analysis.

Special Cases

The "interactive behavior" indicator, comprising the combination of "continuing a thread," "acknowledgement," and "referring to and/or quoting from others' messages," presents a unique case for analysis. Unlike other social presence indicators evaluated based on keyword frequency, the "interactive behavior" indicator is assessed using the number of "reply" and "like" interactions. Although I have standardized the score for this indicator, it is not statistically meaningful to directly compare it with other indicators. In light of this, I have conducted a separate analysis of the "interactive behavior" indicator as an individual variable.

In summary, my study establishes a robust framework for assessing social presence in diverse online educational courses. It encompasses three overarching categories: Affective Response, Interactive Response, and Cohesive Response.

Affective Response, focusing on emotional engagement, involves five indicators: emotions, use of humor, paralanguage, self-disclosure, and value. Each indicator is defined by specific keywords and data sources.

Interactive Response, reflecting participation behaviors, encompasses 11 indicators. These include continuing a thread, acknowledgement, quoting from others' messages, asking questions, complimenting, expressing appreciation, agreement, disagreement, invitation, approval, and personal advice.

Cohesive Response, indicating group affiliation, comprises three indicators: greetings and salutations, vocatives, and group reference. Privacy concerns exclude the assessment of vocatives.

To ensure data reliability and validity, rigorous score standardization addresses the influence of post volume. The "interactive behavior" indicator is treated separately due to its unique measurement approach.

This methodological framework provides a concise yet comprehensive basis for examining social presence's role in online learning environments, facilitating nuanced analyses of student engagement and communication dynamics.

Qualitative Content Analysis

In this study, a qualitative content analysis approach was employed to discern and elucidate the intricate nuances underlying the development of social presence within the online learning environment. The analysis entailed a review and interpretation of the discourse encompassing the sample courses, focusing on the patterns indicative of social presence dynamics.

Through an in-depth examination of the interactions and exchanges within the discussion boards, this analysis sought to uncover the multifaceted manifestations of social presence and its inherent complexities within the specific context of the online courses under scrutiny.

CHAPTER 5

RESULTS

This chapter presents the quantitative and qualitative results from the investigation into the presence of social interaction within students' utilization of a discussion board in an asynchronous online course. The quantitative analysis encompasses statistical findings, including detailed statistical analyses, tables, and charts, providing an empirical understanding of the phenomenon. The qualitative aspect focuses on context-based content analysis, offering an in-depth exploration of the nature and context of the social presence. The research questions examined include the extent of social presence (RQ1a), the manifestation of social presence (RQ1b), the influence of course disciplines on social presence (RQ2), and the impact of course duration on the nature of social presence (RQ3). This chapter aims to provide an objective and comprehensive overview of the research findings.

Research Question 1a: To What extend Does Social Presence Exist in Students' Use of a Discussion Board in an Asynchronous Online Course?

The quantitative analysis thoroughly examined the various facets of social presence indicators within the sample courses. The data revealed that each social presence indicator was consistently present. Moreover, the standardized scores indicated a normal distribution pattern for each presence indicator across the sample courses. The p-values from the Shapiro-Wilk test for the affective response type of social presence indicator was 0.13, for the interactive response type was 0.42, and for the cohesive response type were 0.08.

All these p-values failed to surpass the 0.05 significance level, failing to support the null hypothesis of the test and suggesting that the data for these social presence indicators could be considered to follow a normal distribution.

These statistical findings confirm the pervasive nature of social presence in students' engagement with discussion boards in asynchronous online courses.

Supplementing the quantitative results, the qualitative content analysis provided a narrative of the social presence phenomenon. Examining individual posts within each sample course revealed various expressions, interactions, and engagement strategies, affirming the diverse and nuanced nature of social presence. For instance, the analysis demonstrated that posts discussing "greeting" topics in each sample course reflected students' willingness to share personal information, including their hometown, educational background, areas of interest, and even personal photos. Replies to these self-introductions showcased students' enthusiasm to communicate and establish social connections with their peers, highlighting a high level of social presence. These qualitative insights underscore the multifaceted nature of social presence and its integral role in shaping the online learning experience.

By triangulating both quantitative and qualitative findings, this study offers a robust and comprehensive perspective on the existence of social presence in the context of students' utilization of discussion boards in asynchronous online, self-directed, non-institutional public courses.

Research Question 1b: How Does Social Presence Manifest in Students' Use of Discussion Boards in An Asynchronous Online Course?

Both the quantitative and qualitative content analyses indicated discernible trends and patterns in the manifestation of the three types of social presence indicators within students' use of discussion boards. The quantitative analysis revealed the frequency patterns of the three social presence types, while the qualitative content analysis identified three distinct scenarios, each indicating a high level of social presence within the online course discussion boards. Furthermore, the qualitative analysis delved into the underlying reasons contributing to these observed instances of heightened social presence.

Result of Quantitative Analysis

After standardizing the scores for each social presence indicator by calculating the ratio between the indicator score and the total number of posts for each course, I conducted a statistical analysis in R to examine how these indicators are observed and expressed within the online course discussion boards. The quantitative analysis results revealed specific trends and patterns associated with the manifestation of various social presence indicators.

Statistical analysis was performed for each individual social presence indicator across all sample courses, encompassing the three categories of social presence indicators. Calculations included the determination of the mean, median, and standard deviation (SD) of the standardized scores for each social presence indicator within the 36 sample courses.

The summary of individual social presence indicators within each category was represented by the standardized score of the corresponding category's social presence indicators.

The Statistical Results of Each Individual Social Presence Indicators. Table 2 presents the mean, median, and standard deviation (SD) of the standardized score for each individual social indicator across the 36 sample courses. As the "interactive behavior" set of social presence indicators is measured by the number of posts rather than the frequency of keywords, this set of indicators was not directly compared with others. However, the standardized score of the "interactive behavior" category's social presence indicators was utilized as supplementary data to support the findings of this research.

Table 2 *Mean, Median, and Standard Deviation of Standardized Scores for Individual Social Presence Indicators across 36 Sample Courses*

Social presence indicator	**Mean**	**Median**	**SD**
Emotion	0.147	0.132	0.086
Self-disclosure	0.738	0.707	0.366
Use of humor	0.000	0.000	0.001
Paralanguage	0.000	0.000	0.001
Value	0.155	0.157	0.076
Asking Questions	0.157	0.172	0.072
Compliment	0.319	0.292	0.130
Agree	0.174	0.174	0.080
Disagree	0.361	0.375	0.158
Advice	0.155	0.157	0.080
Greeting	0.503	0.492	0.171
Group reference	0.174	0.174	0.080
Reply numbers	32.214	6.444	58.270
Like numbers	2.249	0.693	4.115

The mean standardized score for individual social presence indicators across the 36 sample courses ranged from 0.000 to 0.738. Both the “use of humor” and “paralanguage” social presence indicators were infrequently observed within the online course discussion board, with a standardized score of 0.000, indicating minimal occurrences.

Consequently, these two indicators were excluded from the “affective response” type of social presence in this study. After excluding these indicators, the last frequency individual social presence indicator, “emotion,” had a mean standardized score of 0.147. The standard deviation (SD) of the “emotion” social presence indicator’s standardized score was 0.086, suggesting slight variations in frequency across courses.

In contrast, the “self-disclosure” social presence indicator emerged as the most frequently occurring individual social presence indicator among the sample courses, with a standardized mean of 0.783, approximately seven times higher than the standardized mean of the least frequent individual social presence indicator, “emotion” (mean = 0.174). The standardized score median of the “self-disclosure” social presence indicator was 0.707, indicating a relatively symmetric distribution, with the mean slightly higher than the median. This suggests a balanced distribution of the standardized scores, with the majority of values centered around the mean.

However, the relatively high standardized deviation of 0.366 indicated notable variability or dispersion within the data. In addition to the most frequent and least frequent individual social presence indicators, the “greeting” indicator (mean = 0.503, SD = 0.171), “disagree” indicator (mean = 0.361, SD = 0.158), and “compliment” indicator (mean = 0.319, SD = 0.130) also exhibited a notable level of frequency within the 36 sample courses. Conversely, the “value” indicator (mean = 0.155, SD = 0.076), “asking questions” indicator (mean = 0.157, SD = 0.072), “agree” indicator (mean = 0.174, SD = 0.080), “advice” indicator (mean = 0.155, SD = 0.076), and “group reference” indicator (mean = 0.174, SD = 0.080) demonstrated a comparatively lower level of frequency compared to the other social presence indicators across the 36 sample courses.

Statistical Significance of Three Social Presence Indicator Groups. The three groups of social presence indicators, namely “affective response”, “interactive response” (excluded “interactive behavior”), and “cohesive response”, exhibit statistically significant differences. A one-way ANOVA was conducted to assess the values of these groups. Table 3 presents the ANOVA results, indicating a p-value less than 0.001. This outcome suggests that the distinctions observed among the three groups are statistically significant, providing further validation that the means of these groups are not a result of random chance.

Table 3 *Results of One-Way ANOVA for Social Presence Indicator Groups*

	Df	**Df Sum Sq**	**Mean Sq**	**F value**	**Pr(>F)**
Group	2.00	23.30	11.65	77.64	<2e-16 ***
Residuals	105.00	15.76	0.15		

Note. ‘***’ indicates $p<0.001$, ‘**’ indicates $p<0.01$, ‘*’ indicates $p<0.05$.

The prevalence of the “interactive response” type of social presence surpasses that of other types within the online course discussion board. Upon comparing the standardized means of the three social presence types, the “interactive response” type indicator demonstrates the highest mean standardized value. As described in the method chapter, the score for the “interactive response” type excludes the count of “reply” and “like,” which serve as evaluative metrics for the “continuing a thread,” “acknowledgement,” and “referring to and/or quoting from others’ messages” social indicators. These three interactive behaviors collectively form the “interactive behavior” indicator in this study, which is distinct from other indicators.

The data presented in Tables 4 and Figure 1 indicate that the mean standardized score of “interactive response” is 1.167, exceeding that of “affective response,” which holds a standardized mean of 1.040. In contrast, the “cohesive response” type exhibits the smallest mean standardized value of 0.086.

As a result, the “interactive response” type emerges as the most prevalent social presence indicator, while the “cohesive response” type stands out as the least commonly observed social presence indicator within the online course discussion board.

The statistical results of the “interactive behavior” set of social presence indicators further support the prevalence of the “interactive response” type of social presence indicator within the sample courses. The “social behavior” indicator encompasses the components of “continuing a thread,” “acknowledgment,” and “referring to and/or quoting from others’ messages” social indicators. These components are all derived from the “interactive response” type of social presence indicator. Thus, a high level of “interactive behavior” set of social presence indicators suggests a correspondingly high level of the “interactive response” type of social presence indicator. As shown in Table 4, the standardized mean of the “interactive behavior” type of social presence indicator is 34.363. Meaning that, the total sum of “reply” and “like” instances is approximately 34 times the total number of posts for that course. This considerable volume of “reply” and “like” activity serves as a strong indicator of heightened “social behavior.”

Despite a high mean standardized value, the high standard deviation of the standardized score of the “interactive behavior” social presence indicator (SD=59.127) suggests the presence of outliers within the sample courses, which significantly deviate from the major standardized mean values. However, the predominant mean standardized value for the “interactive behavior” social presence indicator remains high when accounting for these outliers. Even without integrating the “social behavior” indicator into the “interactive response” type of social presence, the prevalence of the “interactive response” type is apparent in the online discussion board. The significant volume of the “social behavior” indicator further reinforces this assertion.

Table 4 *Mean, Median, and Standard Deviation of Social Presence Indicators for Affective Response Category, Interactive Response Category, and Cohesive Response Category, and Interactive Behavior Set*

	Affective Response	**Interactive response**	**Cohesive response**	**Interactive behavior**
Mean	1.040	1.167	0.068	34.363
Median	0.988	1.170	0.659	7.137
SD	0.500	0.410	0.229	59.127

The post-hoc Tukey’s HSD analysis was conducted to examine pairwise differences between the mean values of the three types of social presence indicator “affective response,” “interactive response,” and “cohesive response.” As Table 5 showed, the analysis revealed statistically significant differences ($p < 0.05$) between all pairs of dimensions, indicating distinct variations in the levels of these constructs within the examined dataset.

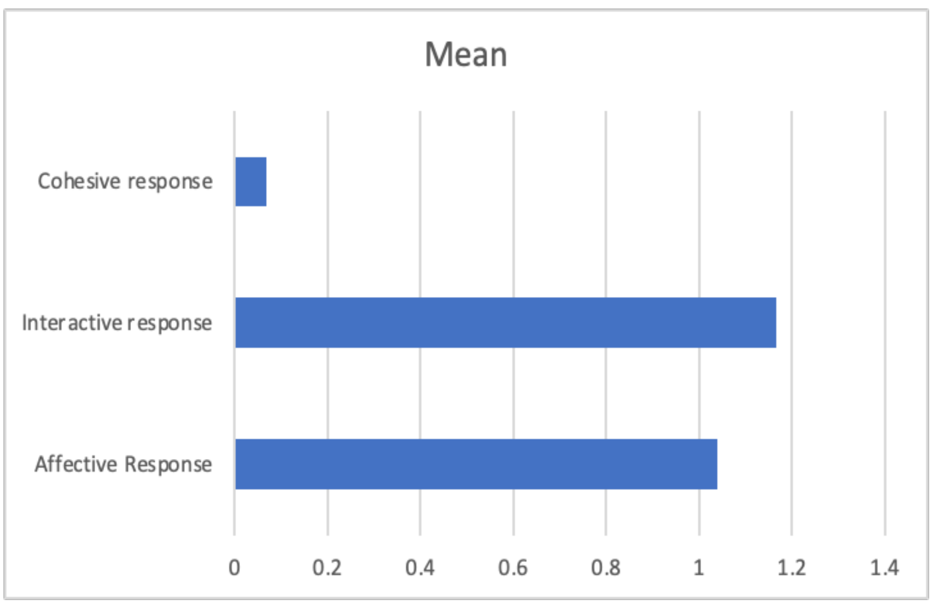
The Tukey’s HSD result suggested that the mean scores for “affective response” set of social presence indicator significantly differ from those of “interactive response” and “cohesive response.”

The mean scores for “interactive response” set of social presence indicator were found to be significantly different from those of “cohesive response.” These findings imply that these three types of social presence indicators manifest distinct and discernible patterns within the sample courses under investigation.

Table 5 *Post-Hoc Tukey’s HSD Analysis Results for Social Presence Indicators*

	Affective v.s. Interactive	**Affective v.s. Cohesive**	**Interactive v.s. Cohesive**
p-value of Tukey HSD	5.2e-10 ***	5.09e-07 ***	2.88e-10***

Figure 1 *Comparison of Standardized Mean for Affective, Interactive, and Cohesive Response Categories of Social Presence Indicator*



Analysis of "Affective Response" Category Social Presence Indicator. The mean values for social presence indicators classified within the "affective response" type exhibit statistically significant differences. The outcome of the one-way ANOVA with the mean values of the standardized scores of "affective response" category social presence indicator highlighted significant disparities among the "emoticon," "self-disclosure," and "value" social presence indicators. As indicated in Table 6, the ANOVA's p-value for these three social presence indicators within the "affective response" category approaches zero, underscoring a robust and meaningful distinction between these indicators.

Table 6 *Results of One-Way ANOVA for The Standardized Value of "Affective Response" Social Presence Indicators.*

	Df	**Df Sum Sq**	**Mean Sq**	**F value**	**Pr(>F)**
Group	2.000	6.940	3.470	76.420	<.001 ***
Residuals	105.000	4.768	0.045		

Note. '***' indicates p<0.001, '**' indicates p<0.01, '*' indicates p<0.05.

The "self-disclosure" social presence indicator stands out as the most prevalent among the indicators within the "affective response" type. Table 7 presents the statistics, indicating a mean standardized value of 0.738 and a standardized deviation of 0.366 for the "self-disclosure" indicator, both surpassing the corresponding values for the "emotion" (mean=0.147, SD=0.086) and "value" (mean=0.155, SD=0.076) indicators.

Table 7 *Statistical Results of Induvial Social Presence Indicators within the "Affective Response" Group*

	Emotion	**Self-disclosure**	**Value**
Mean	0.147	0.738	0.155
Median	0.132	0.707	0.157
SD	0.086	0.366	0.076

Analysis of "Interactive Response" Category Social Presence Indicator. The social presence indicators within the "interactive response" category exhibit statistically significant differences. The outcomes of the one-way ANOVA with the standardized values reveal significant distinctions among the indicators of "asking questions," "compliment," "expressing agreement," and "expressing disagreement."

As presented in Table 8, the p-value obtained from the ANOVA is close to zero, signifying a high level of significance. This result highlights the notable differences observed within the social indicators belonging to the "interactive response" group.

Table 8 *Results of One-Way ANOVA for The Standardized Value of "Interactive Response" Social Presence Indicators.*

	Df	**Df Sum Sq**	**Mean Sq**	**F value**	**Pr(>F)**
Group	4.000	1.663	0.416	47.620	<.001 ***
Residuals	175.000	1.528	0.009		

Note. '***' indicates $p<0.001$, '**' indicates $p<0.01$, '*' indicates $p<0.05$.

In addition to the "social behavior" indicator, the analysis indicated that "expressing disagreement" is the most prevalent social presence indicator within the "interactive response" category.

According to Table 9, the mean standardized value of "expressing disagreement" stands at 0.361 (SD = 0.158), surpassing the frequencies of other indicators within the same group. Notably, the frequency of the "compliment" indicator (mean = 0.319, SD = 0.13) is slightly lower than that of "expressing disagreement," although both indicators exhibit significantly higher frequencies compared to other indicators in the "expressing disagreement" social presence category.

Table 9 *Statistical Results of Induvial Social Presence Indicators within the "Interactive Response" Group*

	Asking Questions	**Compliment**	**Agree**	**Disagree**	**Advice**
Mean	0.157	0.319	0.174	0.361	0.155
Median	0.172	0.292	0.174	0.375	0.157
SD	0.072	0.130	0.080	0.158	0.080

Analysis of "Cohesive Response" Category Social Presence Indicators. The social presence indicators within the "cohesive response" category exhibit statistically significant differences. The results from the one-way ANOVA indicate that the mean of social presence indicators of "greeting and salutation" and "group reference" are most likely different from each other in the population. Table 10 highlights the outcomes of the one-way ANOVA, emphasizing the significance of these differences between the social presence indicators within the "cohesive response" group.

Table 10 *Results of One-Way ANOVA for The Standardized Value of "Cohesive Response" Social Presence Indicators.*

	Df	**Df Sum Sq**	**Mean Sq**	**F value**	**Pr(>F)**
Group	1.000	1.330	1.330	101.700	<2e-15 ***
Residuals	70.000	0.919	0.013		

Note. '***' indicates p<0.001, '**' indicates p<0.01, '*' indicates p<0.05.

The “greeting and salutation” social presence indicator emerges as the most prevalent within the “cohesive response” category of social presence. Table 11 illustrates that the mean value for the “greeting and salutation” indicator is 0.503, with a standard deviation of 0.171, surpassing that of the “group reference” indicator (mean = 0.174, SD = 0.08). This finding underscores the prominence of the “greeting and salutation” indicator in the context of the “cohesive response” social presence type.

Table 11 *Statistical Results of Individual Social Presence Indicators within the “Affective Response” Group*

	Greeting	**Group reference**
Mean	0.503	0.174
Median	0.492	0.174
SD	0.171	0.080

In summary, the results of the quantitative analysis demonstrate distinct differences among the three types of social presence indicators: “affective response,” “interactive response,” and “cohesive response.” Notably, the “interactive response” indicator emerges as the most prevalent type within the online course discussion board. Additionally, while the measurement of the “interactive behavior” indicator varies from other indicators, its substantial volume reinforces the prominence of the “interactive response” type in this context.

A closer examination of the specific indicators within each group revealed distinct patterns. The prevalence of the “self-disclosure” indicator within the “affective response” category underscored the significance of personal expression and emotional disclosure within this context.

Similarly, the prevalence of the “expressing disagreement” indicator within the “interactive response” category highlighted the prevalence of constructive debates and discussions, emphasizing the diversity of perspectives in the online learning environment. In parallel, the dominance of the “greeting and salutation” indicator within the “cohesive response” category indicated the pivotal role of fostering a sense of community and belonging among participants.

Conversely, the limited appearance of the “use of humor” and “paralanguage” social indicators emphasized their relatively minimal impact on the overall discourse, signaling a general inclination toward more serious and focused academic interactions within the online course setting.

Through this analysis, it became evident that the nuanced interplay of various social presence indicators significantly shapes the overall tone and tenor of online discussions, underscoring the vital role of personal engagement and interactive communication in fostering a rich and dynamic online learning community.

The qualitative content analysis

The qualitative content analysis conducted in response to Research Question 1b yielded insightful findings. This analysis revealed three distinct scenarios, each indicative of a high level of social presence within the online course discussion boards. Furthermore, a recurring pattern across these scenarios, suggests ways to enhance the social presence levels within online course discussion boards.

Scenario 1: Personal Information Posts and High-Level Social Presence. The qualitative content analysis revealed a compelling pattern within the discussion board posts, highlighting the role of personal information in fostering a high level of social presence. It became evident that posts enriched with personal details exhibited a heightened degree of social presence, thereby increasing the likelihood of meaningful interactions. These posts often pertained to introductory, "greeting "or "meet your classmates" topics, where students willingly shared personal information, signaling their eagerness to connect with their peers. This phenomenon was indicative of self-disclosure and reflected the affective response component of social presence.

These initial posts not only demonstrated a high level of social presence but also acted as catalysts for subsequent interactions. Responses to these posts consistently displayed strong indicators of social presence, as students engaged in conversations driven by shared personal information. These interactions, while often diverging from the course content, revolved around students' personal backgrounds, experiences, and interests. For example, students from the same geographical location sought to establish connections, individuals sharing a common language found comfort in conversing in their native tongue, and those who had previously taken similar courses exchanged valuable insights.

A specific instance from the discussion forum of the "Essential Strategies and Skills" course exemplifies this phenomenon. One student initiated a post discussing their hometown, prompting a fellow student to respond, "Hi […], I am […]. Guess I don't need to say where I am from, lol" (ME, 2019).

This exchange evolved into a conversation built upon their shared location, underscoring their desire to forge a friendship. In such cases, these posts represented a pinnacle of social presence, facilitated by their personal information and the subsequent identification of commonalities.

In essence, posts featuring detailed personal information provided a gateway for students to connect with one another. Shared backgrounds or interests significantly increased the likelihood of responses, resulting in a high level of social presence.

This natural alignment of shared experiences not only fostered a sense of community but also created an environment where students felt closer to those who shared their background.

Some interactions even became exclusive, with a unique camaraderie forming among students with shared experiences or linguistic connections. For example, non-English-speaking students would engage in conversations in their native language, forming an exclusive group that inherently possessed a higher degree of social presence compared to the broader class.

The rationale behind students' inclination to share personal information in their posts was their eagerness to connect with others who had similar backgrounds or experiences rather an instruction or assignment by the teacher. Consequently, posts with more extensive personal information often carried a heightened expectation of social presence, as the authors actively sought connections with their peers.

The level of personal information disclosed directly correlated with the degree of social presence developed, attracting students who shared similar backgrounds or held an interest in the posted information. Whether forging connections with peers who had comparable experiences or capturing the attention of those intrigued by the post's content, entries rich in personal details enjoyed a greater likelihood of eliciting numerous responses, ultimately fostering a profound sense of social presence.

It is important to note that personal information should not be overly targeted at a specific individual, as this approach may deter other students from engaging in the conversation. Consequently, posts should aim to strike a balance between self-disclosure and inclusivity, offering the potential for broader engagement and the cultivation of social presence. When personal information is overly tailored to an individual, it tends to deter responses from others. In essence, posts that are narrowly focused on a specific person do not contribute significantly to the development of social presence.

For instance, in the discussion forum of the Financial Markets course, there exists a lengthy post authored by RC (2023) that provides an extensive account of his relationship with his girlfriend, who is also enrolled in the same course. Within this post, RC elucidates his own background, recounts how he and his girlfriend first met, explains their decision to enroll in the same course, details their collaborative study approach, and expresses his deep affection for her. Although RC's post contains an abundance of personal information and underscores his emotional connection with his girlfriend, it does not foster a welcoming atmosphere for the cultivation of social presence with other participants. Notably, the post receives no "replies" or "likes." It's worth noting that RC also engages in responding to others' posts; however, his replies often maintain a strong focus on his girlfriend, and they, too, remain largely unacknowledged. For example, in response to one post, RC (2023) extends well wishes for the original poster to have a productive learning experience, drawing upon his girlfriend's situation as a point of reference. In this instance, RC's inclination to share his happiness about his relationship with others is evident, but the specificity of his posts directed towards his girlfriend discourages engagement from fellow participants.

This first scenario illuminates how personal information-rich posts play a pivotal role in facilitating social presence on online course discussion boards. The extent of personal information shared directly correlates with the resulting level of social presence, providing students with a platform to connect, share experiences, and build meaningful relationships with their peers. However, it is imperative to avoid posts that are excessively tailored to one person, as they can hinder the development of social presence.

Scenario 2: Posts about Learning Experiences Elicit High Levels of Social Presence. An examination of posts related to learning experiences within the context of the course emerged as another scenario revealing a notable degree of social presence. These particular posts diverge from containing specific course content information and are instead centered on students' personal approaches to learning, their learning experiences, and at times, their grievances about the course. Such posts consistently garnered a substantial number of replies, likes, and, importantly, evoked empathetic responses from fellow students. Often laden with emotional content, these posts encapsulate personal judgments, feelings, and individual recommendations. The responses from other students further underscored their emotional engagement with these posts.

For instance, a post within the “Astronomy: Exploring Time and Space” course detailed a student’s experiences with online learning, recounting the challenges faced in a previous online course and expressing frustration with technical difficulties (JK, 2021). In response, fellow students not only expressed their agreement with JK’s sentiments but also shared their own experiences and voiced concerns regarding their past encounters with online courses. These exchanges are emblematic of the “affective response” social presence, as they encompass emotional communication, the sharing of personal agreements and disagreements, and the expression of individual experiences. The considerable volume of replies and likes garnered by such posts serves as a testament to their elevated level of social presence.

In this context, posts focusing on students’ learning experiences, particularly those that incorporate emotional reflections on the course or online learning in general, exhibited a heightened capacity to engage students and cultivate a more pronounced social presence compared to other types of posts.

An additional post within the “Astronomy: Exploring Time and Space” course, composed by a course mentor, shared their own learning journey with online courses and provided emotional recommendations to enhance students’ learning experiences. In one response to a student’s query about upgrading a course to obtain a certificate, the mentor offered suggestions based on his personal experiences rather than providing an official answer. The mentor’s reply conveyed emotions and a substantial degree of social presence.

An illustrative response by the mentor reads: “Oh, good, don’t waste money! I put a list of courses in a pinned thread in the General Discussion forum; I hope you find something to your liking. There are other platforms too, like EdX, Udemy, Future Learn, with interesting courses” (CR, 2020). The mentor’s responses garnered a significant number of replies and likes, fostering greater engagement among students and inspiring them to share their own learning experiences. Consequently, such posts that encompass individuals’ learning experiences, impart learning strategies, offer course insights, and provide emotional reflections can engender a robust sense of social presence. This is indicative of both “affective response” and “interactive response” social presence indicators, signifying their propensity to instill a heightened level of social presence.

In summary, posts that revolve around individuals’ learning experiences, encompassing learning methodologies, reflections, course assessments, and personalized recommendations, rather than focusing solely on course content, are more prone to stimulating heightened social presence. This trend becomes particularly pronounced when posts encapsulate the emotional sentiments, experiences, and suggestions of the authors. Such posts embody a prominent “affective response” and “interactive response” social presence, rendering them adept at cultivating a heightened sense of social presence within the online course environment.

Scenario 3: Posts on Learning Resources Elicit Enhanced Levels of Social Presence. The third category of posts that has demonstrated a proclivity for receiving a substantial number of replies and likes, thereby fostering an elevated level of social presence, revolves around the introduction of learning resources.

These posts encompass a range of course-related materials, such as readings, videos, and the formation of study groups, and tend to draw more attention compared to other post types.

For instance, within the “Writing in the Sciences” course, a post authored by LC (2018) introduced a selection of books relevant to the course’s content. This post garnered considerable engagement in the form of numerous replies and likes. Responding posts expressed gratitude for the shared resources, provided personal insights on the recommended books, and even extended the discourse to include additional suggested resources.

Consequently, LC’s (2018) post initiated a discussion encompassing various learning materials, facilitating a substantial degree of interaction among participants. These interactions underscored the robust “interactive response” social presence manifested within this thread.

Posts that solicit additional learning resources also exhibit a notable tendency to develop a heightened level of social presence. Individuals who respond to such posts offer their recommendations, engage in discussions concerning the suggested resources, and establish connections with fellow students who share an interest in the same learning materials. For instance, in the “Introduction to Statistics” course, a post authored by GY (2022) introduced the learning resources they utilized to practice course content, and subsequently inquired about additional resources. Responding students shared their experiences with the resources mentioned in GY’s (2022) post and suggested additional resources. This exchange included conversations on the merits and limitations of various resources and culminated in a proposal to form a WhatsApp-based learning group.

This scenario is emblematic of both “interactive response” and “cohesive response” social presence indicators, highlighting the active engagement with post content and the establishment of connections among participants.

When a learning resource is particularly pertinent to a specific group of students, it has the potential to cultivate an even higher level of social presence. Such resources resonate deeply with the targeted group, engendering a sense of camaraderie among students who share similar challenges and employ the same learning materials to address these challenges. This shared background and common learning concerns foster a strong sense of group cohesion, emblematic of an elevated “cohesive response” social presence.

For instance, in the “Writing in the Sciences” course, AJ (2021) wrote in his post: “I’m not a native English speaker and I want non-scientific suggestions to read in English from [...].” Subsequently, students who encountered similar language-learning challenges responded to his post, sharing their experiences, and recommending relevant learning resources.

In this context, students participating in the thread identified themselves as a cohesive group, bound by shared language-learning difficulties and a collective pursuit of resources. This sense of belonging within the group substantially heightened their social presence during interactions within the thread.

In summary, posts featuring learning materials demonstrated a substantial capacity to cultivate an elevated level of social presence. Students express gratitude for shared resources, share their own learning sources, and engage in discussions about various resources. This robust engagement signifies a heightened level of social presence.

When learning resources are tailored to address the needs of specific groups, they engender an even greater sense of social presence within that particular group. These specialized topics facilitate the bonding of students who share common interests, amplifying the level of "cohesive response" social presence among the group.

Common Pattern of The Scenarios. The three scenarios elucidate a recurrent pattern where in the cultivation of high levels of social presence is contingent upon posts that pivot around individuals' personal information, emotions, and needs, as opposed to being exclusively centered on course particulars. This repetitive motif accentuates the pivotal role played by personal connection and engagement within the context of online learning environments.

Research Question 2: Do Course Disciplines Significantly Impact the Level and Nature of Social Presence?

The study found significant differences in all three types of social presence indicators, namely "affective response," "interactive response," and "cohesive response," based on various course disciplines.

The research treated course disciplines as the independent variable and the social presence indicator level as the dependent variable. To investigate the relationship between the independent and dependent variables, the sample courses were initially grouped into two categories: STEM courses (Science, Technology, Engineering, and Mathematics) and non-STEM courses. Subsequently, a linear regression analysis was conducted to assess whether course disciplines significantly influenced the social presence indicators.

In the process of course classification, meticulous scrutiny of each sampled course's syllabus was conducted to ascertain alignment with the STEM (Science, Technology, Engineering, and Mathematics) framework. Courses grounded in STEM disciplines were designated with a label of 1, signifying their affiliation, while non-STEM courses were labeled 0. This categorization approach allows for a precise distinction between courses that inherently emphasize STEM domains and those that do not (see Appendix D for details).

It is noteworthy to highlight the distinction between STEM and non-STEM courses, where STEM courses typically focus on disciplines involving scientific inquiry, technological applications, engineering principles, and mathematical concepts.

In contrast, non-STEM courses encompass a broader range of subjects outside these specific domains. The resultant dataset comprises 13 STEM courses and 23 non-STEM courses, providing a nuanced understanding of the distribution of courses within the sample data based on their academic orientation.

The results of the linear regression analysis demonstrated a substantial disparity in the levels of social presence indicators among different course disciplines. Additionally, the scatter plots provided visual representations of the variations in social presence levels across the diverse course disciplines. These findings emphasize the crucial role of course disciplines in shaping social presence and underline the significance of further exploring the underlying dynamics that contribute to these differences.

Analysis of the Influence of STEM and Non-STEM Courses on "Affective Response" Social Presence Indicators

Examination of the impact of STEM and non-STEM courses on "affective response" social presence indicators revealed significant variation across different course disciplines ($p < 0.0001$). Residual analysis indicated model predictions deviating within the range of -0.45209 to 0.98671. The "Adjusted R-squared" value of 0.4907 suggested that 50.52% of the dependent variable's variability was influenced by the independent variable, underscoring the substantial impact of course disciplines on "affective response" social presence. The F-statistic's notably low p-value (<.001) further emphasized the model's overall statistical significance, indicating the significant contribution of at least one predictor to the model's performance.

Table 12 *Results of Linear Regression for "Affective Response" Social Presence Indicators Across Various Course Disciplines*

Coefficients:				
	Estimate Std.	**Error**	**T value**	**Pr(>|t|)**
(Intercept)	1.28573	0.07216	17.81700	< 2e-16 ***
Course	-0.73643	0.12499	-5.89200	1.19e-06 ***

Note. '***' indicates p<0.001, '**' indicates p<0.01, '*' indicates p<0.05. Residual standard error: 0.3535 on 34 degrees of freedom. Multiple R-squared: 0.5052. Adjusted R-squared: 0.4907. F-statistic: 34.72 on 1 and 34 DF, p-value: 1.189e-06

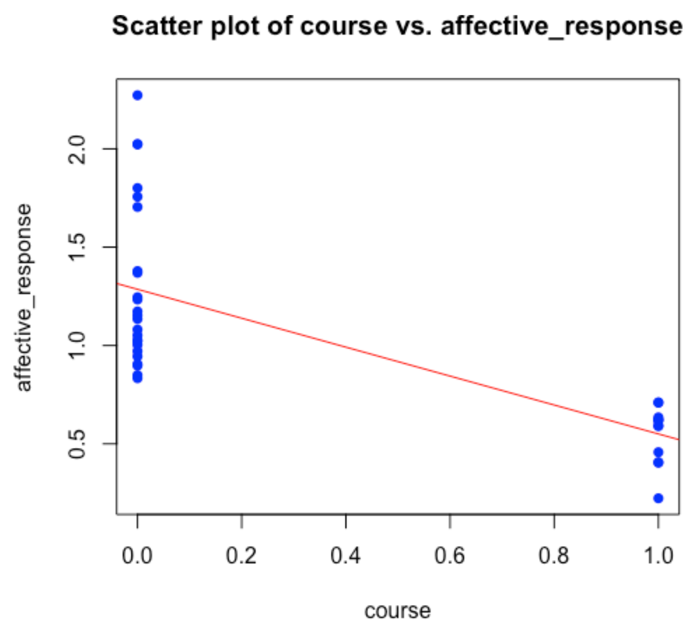
These results underscore the strong association between course disciplines, particularly STEM and non-STEM courses, and the "affective response" social presence indicators, suggesting the need for further in-depth investigations to comprehend the underlying mechanisms governing these observed differences.

According to the observations depicted in the scatter plot (Figure 2), the majority of "affective response" social presence indicators exhibited a higher level in non-STEM classes compared to STEM classes. The standardized mean of non-STEM classes ranged from 0.8 to 2.5 while the standardized mean of STEM classes ranged from 0.2 to 0.7. The scatter plot vividly illustrates individual data points, with each dot representing a specific observation. Notably, most dots associated with 0 (representing the non-STEM course) appeared larger standardized mean score compared to those associated with 1 (representing the STEM course).

The regression fitted line displayed a discernible trend, indicating that a higher score of the independent variable corresponded to a lower level of "affective response" social presence indicators.

The use of 0 for the non-STEM course and 1 for the STEM course in the regression analysis suggests that the non-STEM courses exhibit a notably higher level of "affective response" social presence compared to the STEM courses.

Figure 2 *Scatter Plot Representation of "Affective Response" Social Presence Indicators for STEM and Non-STEM Courses*



Note. The red line is the regression fitted line.

Analysis of the Influence of STEM and Non-STEM Courses on "Interactive Response" Indicators

The examination of the influence of STEM and non-STEM courses on "interactive response" social presence indicators indicated significant variations across diverse course disciplines ($p < 0.0001$). Residual analysis showed potential deviations from actual values in the range of -0.52461 to 0.50504.

The "Adjusted R-squared" suggests that 38.9% of the dependent variable's variability could be attributed to the independent variable, underlining its substantial explanatory role. Additionally, the F-statistic's extremely low value ($p < 0.0001$) reinforced the model's statistical significance.

Table 13 *Results of Linear Regression for "Interactive Response" Social Presence Indicators Across Various Course Disciplines*

Coefficients:				
	Estimate Std.	**Error**	**T value**	**Pr(>|t|)**
(Intercept)	0.92442	0.04854	19.04400	< 2e-16 ***
Course	-0.40565	0.08407	-4.82500	2.89e-05 ***

Note. '***' indicates p<0.001, '**' indicates p<0.01, '*' indicates p<0.05. Residual standard error: 0.2378 on 34 degrees of freedom Multiple R-squared: 0.4064, Adjusted R-squared: 0.389 F-statistic: 23.28 on 1 and 34 DF, p-value: 2.894e-05.

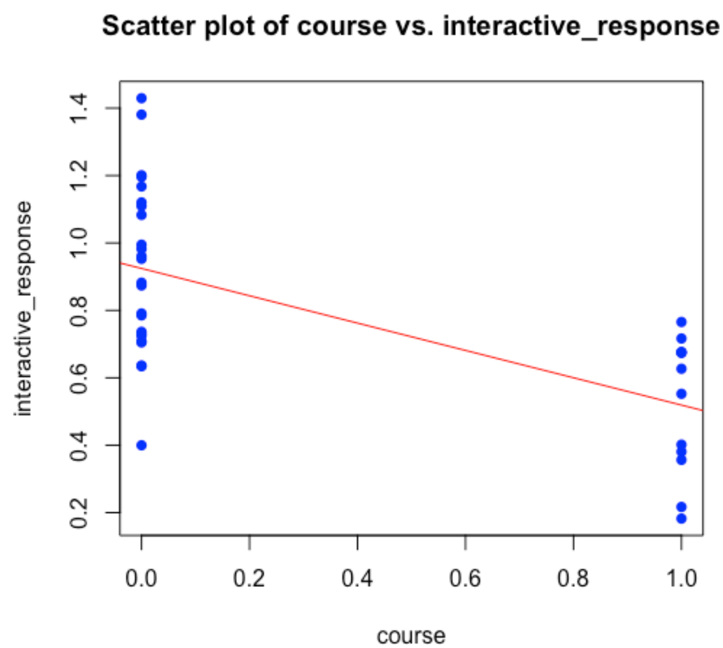
These results underscore the noteworthy association between course disciplines, STEM and non-STEM courses, and the "interactive response" social presence indicators, emphasizing the importance of further investigations to comprehend the intricate dynamics underlying these findings.

Figure 3 represents the scatter plot depicting the relationship between course disciplines and "interactive response" social presence indicators. The visualization highlights that a majority of courses categorized as non-STEM exhibited a higher level of "interactive response" social presence compared to STEM courses.

The standardized mean of non-STEM classes ranged from 0.4 to 1.5 while the standardized mean of STEM classes ranged from 0.1 to 0.7. The regression fitted line further confirmed the pattern, illustrating that as the independent variable score increased, the level of "interactive response" social presence indicators decreased.

Given that this study designated 0 for the non-STEM course and 1 for the STEM course, the regression fitted line indicated that the non-STEM course manifested a notably higher level of "cohesive response" social presence compared to the STEM course.

Figure 3 *Scatter Plot Representation of "Interactive Response" Social Presence Indicators for STEM and Non-STEM Courses*



Note. The red line is the regression fitted line.

Analysis of the Influence of STEM and Non-STEM Courses on "Cohesive Response" Indicators

The influence of course discipline on "cohesive response" indicators was statistically significant ($p = 0.00214$), suggesting notable differences in the "cohesive response" social presence indicator levels between STEM and non-STEM courses. Residual analysis indicated possible deviations from actual values within the range of -0.3648 to 0.4816.

The “Multiple R-squared” value suggested that approximately 22.23% of the dependent variable’s variability could be explained by the independent variable. Furthermore, the F-statistic yielded a p-value of 0.002136, affirming the model’s overall statistical significance.

Table 14 *Results of Linear Regression for “Cohesive Response” Social Presence Indicators Across Various Course Disciplines*

Coefficients:				
	Estimate Std.	**Error**	**T value**	**Pr(>|t|)**
(Intercept)	0.75621	0.04125	18.33200	< 2e-16 ***
Course	-0.23745	0.07145	-3.32400	0.00214 **

Note. ‘***’ indicates p<0.001, ‘**’ indicates p<0.01, ‘*’ indicates p<0.05. Residual standard error: 0.2021 on 34 degrees of freedom. Multiple R-squared: 0.2452. Adjusted R-squared: 0.223. F-statistic: 11.05 on 1 and 34 DF, p-value: 0.002136

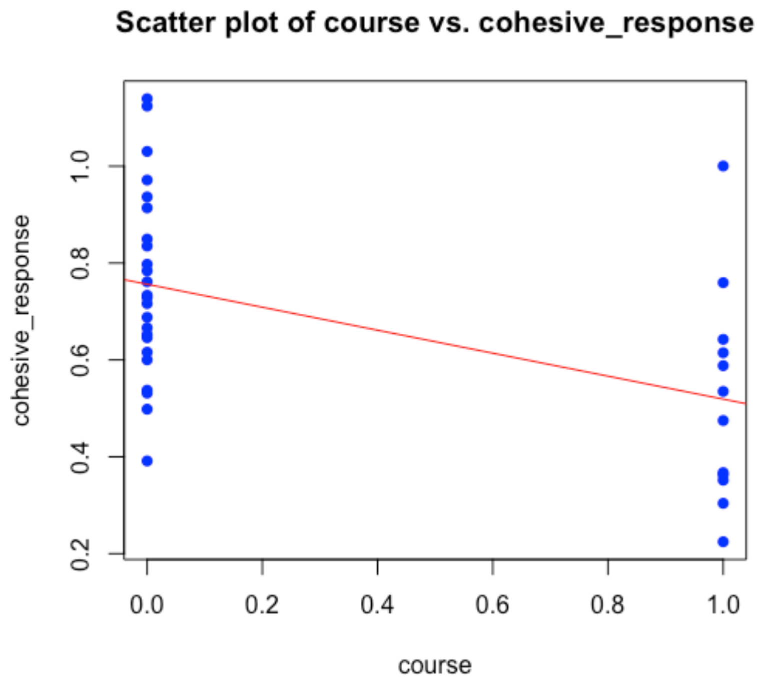
These findings highlight the significant role of course disciplines, emphasizing the differences between STEM and non-STEM courses in shaping the dynamics of “cohesive response” social presence indicators. Further exploration is warranted to gain deeper insights into the nuanced factors contributing to these observed differences.

Figure 4 presents a scatter plot illustrating the relationship between course disciplines and “cohesive response” social presence indicators. The visualization indicates that the majority of courses categorized as non-STEM exhibited a higher level of “cohesive response” social presence indicators compared to STEM courses. The standardized mean of non-STEM classes ranged from 0.4 to 1.5 while the standardized mean of STEM classes ranged from 0.1 to 1.0. Additionally, the regression fitted line revealed a discernible trend, indicating that as the independent variable score increased, the level of “cohesive response” social presence indicators decreased.

Given that this study designated 0 for the non-STEM course and 1 for the STEM course, the regression fitted line emphasized that the non-STEM course demonstrated a notably higher level of “cohesive response” social presence compared to the STEM course.

These findings underscore the crucial role of course disciplines, particularly the distinction between STEM and non-STEM courses, in influencing the dynamics of “cohesive response” social presence indicators, emphasizing the need for further investigation to unravel the underlying mechanisms driving these trends.

Figure 4 *Scatter Plot Representation of "Cohesive Response" Social Presence Indicators for STEM and Non-STEM Courses*



Note. The red line is the regression fitted line.

In summary, the research findings underscore a notable disparity in all three types of social presence, namely "affective response," "interactive response," and "cohesive response," based on the distinction between course disciplines. Specifically, the statistical analysis highlighted that non-STEM courses consistently exhibited a higher level of all three types of social presence compared to their STEM counterparts.

Implications and Recommendations

While different course disciplines exhibit a significant disparity in social presence levels, the findings suggest that this discrepancy is not directly associated with specific course content or the volume of interactive posts.

The linear regression analysis examining the relationship between course disciplines and “interactive behavior” (number of replies and likes) revealed a p-value of 0.25, which does not meet the criterion of 0.05. Consequently, the data suggest that the classification of a course as STEM or non-STEM does not significantly impact the variability in the “interactive behavior” levels within the courses.

The primary driver behind the significant differences in social presence levels among different course disciplines is primarily attributed to the quantity and quality of posts incorporating personal information. The qualitative content analysis findings from Research Question 2b indicated that posts demonstrating a high level of social presence often encompassed personal information, emotions, experiences, connections with specific groups, or personal interests. Such posts tend to humanize the interaction, fostering a stronger sense of connection among participants, thus contributing to heightened social presence levels.

The discrepancy in social presence levels between non-STEM and STEM courses can be attributed to the prevalence of human-like information in posts from non-STEM courses compared to their STEM counterparts.

Research Question 3: Does The Duration of a Course Significantly Affect the Course’s Social Presence Level and Nature?

Research Question 3 concerns the influence of the time duration, represented by the number of weeks, on a course’s social presence level. Within the context of this study, the course duration is divided into specific time points, ranging from the initial weeks to the seventh week.

These temporal junctures potentially impact the social presence level within each course of the sampled dataset. Following the exclusion of courses that lacked sufficient data for each week, a total of 25 courses were retained for analysis. I conducted individual linear regression analyses for each course within the sample to examine the potential influence of time points on the corresponding course's social presence level. This approach aimed to ascertain the relationship between specific time intervals and the observed variations in the level of social engagement within the respective online educational context.

The findings indicated a significant correlation between the course duration and the "affective response," "interactive response," and "cohesive response" social presence indicators across most sample courses. Particularly, the "cohesive response" indicator showed pronounced sensitivity to the time frame in 80% of the sample courses (20 courses). Similarly, the "interactive response" and "interactive behavior" indicators exhibited notable sensitivity in 68% (17 courses) and 72% (18 courses) of the sample, respectively.

Likewise, the "affective response" indicator displayed notable reactivity to the course duration, in 60% (15 courses) of the sample. The analysis demonstrated that the social presence level was higher in the initial weeks, such as week one, compared to later stages, like week 7, indicating a diminishing trend over time.

Analysis of the Influence of Course Duration on "Affective Response" Social Presence Indicators

In Table 15.1 and Table 15.2, the linear regression analysis results for all courses in the sample were presented, each course labeled as course 1, 2, 3... up to 25. These tables include the correlation coefficient estimate and p-value for each course, with 15 courses (60% of the sample) displaying a notably low p-value (<0.05), indicating a statistically significant relationship between the course duration on the "affective response" social presence indicator.

Each course is structured in ascending time point order, following a weekly sequence, from week 1 to week 7. All courses with a significant p-value exhibited a negative estimate value, suggesting a negative relationship between the course's social presence level and its duration. In essence, the "affective response" social presence level of the course demonstrated a downward trend with an increase in the course's duration.

Table 15.1 *Results of Linear Regression for "Affective Response" Social Presence Indicators Across Various Course Time Duration*

Affective response	**Estimate**	**p-value**
Course 1	-0.028	0.027 *
Course 2	-0.022	0.419
Course 3	-0.184	0.050*
Course 4	-0.020	0.297
Course 5	0.048	0.841
Course 6	-0.235	0.180
Course 7	-0.023	0.038 *
Course 8	0.019	0.511
Course 9	-0.151	0.031*
Course 10	-0.045	0.042*
Course 11	-0.072	0.049*
Course 12	-0.100	0.047*
Course 13	-0.044	0.003 **
Course 14	0.090	0.361
Course 15	0.009	0.385
Course 16	-0.084	0.042 *
Course 17	-0.117	0.045 *

Note. '***' indicates $p<0.001$, '**' indicates $p<0.01$, '*' indicates $p<0.05$.

Table 15.2 *Results of Linear Regression for "Affective Response" Social Presence Indicators Across Various Course Time Duration*

Affective response	**Estimate**	**p-value**
Course 18	-0.007	0.031*
Course 19	-0.023	0.043*
Course 20	-0.092	0.022 *
Course 21	-0.136	0.040*
Course 22	-0.153	0.388
Course 23	-0.049	0.206
Course 24	-0.037	0.001**
Course 25	-0.174	0.285

Note. '***' indicates $p<0.001$, '**' indicates $p<0.01$, '*' indicates $p<0.05$.

Analysis of the Influence of Course Duration on "Interactive Response" Social Presence Indicators

As depicted in Table 16.1 and Table 16.2, 17 courses (68% of the sample) exhibited a p-value smaller than 0.05, indicating a significant influence of the course duration on the "interactive response" social presence level. Furthermore, the consistently negative estimate value for these courses implied a negative relationship between the course duration and the "interactive response" social presence level. Consequently, an increase in the course duration correlated with a decrease in the course's "interactive response" level.

Table 16.1 *Results of Linear Regression for "Interactive Response" Social Presence Indicators Across Various Course Time Duration*

Interactive response	**Estimate**	**p-value**
Course 1	-0.042	0.010 *
Course 2	-0.043	0.027*
Course 3	-0.255	0.00**
Course 4	-0.040	0.025*
Course 5	0.034	0.836
Course 6	-0.126	0.020*
Course 7	-0.037	0.046*
Course 8	0.031	0.439
Course 9	-0.139	0.008**
Course 10	-0.025	0.006**
Course 11	-0.079	0.103
Course 12	-0.148	0.213
Course 13	-0.050	0.002 **
Course 14	0.058	0.348
Course 15	0.012	0.453
Course 16	-0.125	0.043*
Course 17	-0.139	0.023 *
Course 18	-0.011	0.007**

Note. '***' indicates $p<0.001$, '**' indicates $p<0.01$, '*' indicates $p<0.05$.

Table 16.2 *Results of Linear Regression for "Interactive Response" Social Presence Indicators Across Various Course Time Duration*

Interactive response	**Estimate**	**p-value**
Course 19	-0.037	0.022*
Course 20	-0.088	0.021 *
Course 21	-0.126	0.039 *
Course 22	-0.153	0.388
Course 23	-0.049	0.021*
Course 24	-0.059	0.006 **
Course 25	-0.203	0.137

Note. '***' indicates p<0.001, '**' indicates p<0.01, '*' indicates p<0.05.

The results from the linear regression analysis in Table 17.1 and Table 17.2 demonstrated that 18 courses (72% of the sample) displayed a significantly low p-value (<0.05), indicating the notable influence of the course duration on the "interactive behavior" level. The negative estimate value supported the inverse association between the course duration and the "interactive behavior" level. "Interactive behavior" is a subtype of "interactive response" within the social presence framework, and the congruent linear regression results further confirmed the significant variability of the "interactive response" social presence type based on the course duration. Consequently, an increase in the course duration corresponded to a decrease in the course's "interactive response" and "interactive behavior" social presence levels.

Table 17.1 *Results of Linear Regression for "Interactive Behavior" Social Presence Indicators Across Various Course Time Duration*

Interactive behavior	**Estimate**	**p-value**
Course 1	-0.120	0.010*
Course 2	-0.990	0.020*
Course 3	-0.666	0.036*
Course 4	-7.388	0.032*
Course 5	3.359	0.865
Course 6	-23.060	0.317
Course 7	-0.225	0.006*
Course 8	0.494	0.237
Course 9	-20.260	0.019*
Course 10	-2.625	0.030*
Course 11	-20.77	0.0344 *
Course 12	-10.682	0.023*
Course 13	-1.418	0.010**
Course 14	3.861	0.362
Course 15	0.100	0.238
Course 16	-0.410	0.013*
Course 17	-1.681	0.010**

Note. '***' indicates $p<0.001$, '**' indicates $p<0.01$, '*' indicates $p<0.05$.

Table 17.2 *Results of Linear Regression for "Interactive Behavior" Social Presence Indicators Across Various Course Time Duration*

Interactive behavior	**Estimate**	**p-value**
Course 18	-0.024	0.008**
Course 19	-1.438	0.012*
Course 20	-2.098	0.021 *
Course 21	-0.137	0.006 **
Course 22	-8.359	0.307
Course 23	-1.680	0.213
Course 24	-0.120	0.013 *
Course 25	-1.009	0.037 *

Note. '***' indicates p<0.001, '**' indicates p<0.01, '*' indicates p<0.05.

Analysis of the Influence of Course Duration on "Cohesive Response" Social Presence Indicators

Table 18.1 and Table 18.2 demonstrates that 20 courses (80% of the sample) exhibited a significantly low p-value in the linear regression results, highlighting a considerable influence of the course duration on the "cohesive response" social presence level. Additionally, the negative estimate value associated with these courses further reinforced the understanding that the "cohesive response" social presence level is inversely related to the course duration. Specifically, an increase in the course duration was found to correspond with a decrease in the course's "cohesive response" social presence level.

Table 18.1 *Results of Linear Regression for "Cohesive Response" Social Presence Indicators Across Various Course Time Duration*

Cohesive response	**Estimate**	**p-value**
Course 1	-0.030	0.006**
Course 2	-0.603	0.021*
Course 3	-0.128	0.006**
Course 4	-0.023	0.036 *
Course 5	0.019	0.825
Course 6	-0.109	0.011*
Course 7	-0.021	0.041 *
Course 8	0.012	0.547
Course 9	-0.069	0.020*
Course 10	-0.015	0.044*
Course 11	-0.042	0.018*
Course 12	-0.091	0.022*
Course 13	-0.027	0.001 ***
Course 14	0.032	0.376
Course 15	0.018	0.281
Course 16	-0.132	0.008**
Course 17	-0.095	0.0471 *
Course 18	-0.007	0.010*

Note. '***' indicates p<0.001, '**' indicates p<0.01, '*' indicates p<0.05.

Table 18.2 *Results of Linear Regression for "Cohesive Response" Social Presence Indicators Across Various Course Time Duration*

Cohesive response	**Estimate**	**p-value**
Course 19	-0.020	0.024*
Course 20	-0.048	0.020 *
Course 21	-0.067	0.036 *
Course 22	-0.073	0.635
Course 23	-0.061	0.021*
Course 24	-0.029	0.007 **
Course 25	-0.104	0.015*

Note. '***' indicates $p<0.001$, '**' indicates $p<0.01$, '*' indicates $p<0.05$.

In summary, the linear regression analysis results for the entire sample revealed a prevailing negative relationship between the course's social presence level and its duration. Particularly, the "cohesive response" social presence indicator appeared to be the most sensitive, with 80% of the courses demonstrating a negative correlation between the "cohesive response" social indicator and the course duration.

Qualitative Content Analysis of Factors Influencing the Negative Relationship Between Course Duration and Social Presence Level

I conducted a qualitative content analysis on courses that demonstrated a significant negative relationship between their social presence level and course duration. Three main factors were identified as contributing to the decrease in the course's social presence level on the discussion board the course duration increase.

First, the reduction in the number of active students over the course duration impacted the level of social interaction. Analyzing the posts revealed a significant decrease in the number of participants contributing to the discussion board as the course progressed. For instance, Course 20 initially had 497 participants but only 36 in the final week. Similar trends were observed in all the sample courses. This decline in participation resulted in a decrease in social presence indicators.

Second, the shift in discussion topics towards more task-oriented content, such as homework, diminished the opportunities for personal interactions among students. The initial weeks prominently featured introduction and greeting topics fostering personal connections. However, as the course progressed, the focus shifted to academic discussions, leading to a decline in personal information sharing and emotional expression.

The changing topics within the course highlighted the influence of the "cohesive response" social presence indicator type, demonstrating its sensitivity to the course duration. Specifically, the analysis focused on key indicators within the "cohesive response" type, notably "greeting and salutation" and "group reference." Not surprisingly, posts related to initial greetings displayed the highest levels of the "greeting and salutation" social presence indicator. As the course progressed, the shift in topics led to a decline in this cohesive interaction, ultimately resulting in a decrease in the "cohesive response" social presence indicator.

The observed tendency for students to transition to alternative communication channels, such as personal messaging apps, to maintain social connections outside the course platform, contributed to decreased engagement on the discussion board.

Students established closer relationships and sought more direct and private communication channels, reducing their reliance on the course discussion board and leading to diminished social presence (at least in the formal platform for the course) over time.

CHAPTER 6

DISCUSSION

This chapter delves into the nuances of social presence within the context of virtual learning environments. It presents an overview of the research findings, emphasizing their implications for improving the social presence level of online education. Furthermore, it explores the practical implications of the research outcomes and provides actionable suggestions for amplifying social presence levels in online courses. Additionally, the chapter underscores the significance of the study, highlights its potential to inspire future research endeavors, and candidly addresses the limitations encountered during the research process. This analysis aims to provide valuable insights that can inform the development of a high-level social presence online learning experiences.

Summary of Research Findings

This study employed an exhaustive methodology to evaluate the social presence within online courses, combining both quantitative and qualitative content analyses. Leveraging Python web crawling, a random selection of online courses was conducted, and comprehensive data was gathered and analyzed. With an extensive dataset from 36 courses over a period of four months, this research provided a detailed examination of the various facets of social presence indicators within the discussion board of the among the different types of social presence sample courses.

The quantitative analysis revealed notable insights into the prevalence and disparities among different types of social presence indicators. While the "interactive response" type of social presence was found to be dominant within online course discussion boards, other indicators such as "use of humor" and "paralanguage" were less frequently observed. Additionally, the "affective response" and "cohesive response" type of social presence indicators exhibited significant differences, particularly in categories like "emoticon," "self-disclosure," "value," "greeting and salutation," and "group reference."

Potential Applications of Research Findings

This section presents specific recommendations for enhancing the social presence of online courses, based on the observed patterns in social interaction on the discussion board. It also includes suggestions for improving social presence levels depending on the course discipline and the stage within the course timeline.

Leveraging Discussion Board Dynamics for Enhanced Social Presence

Qualitative content analysis highlighted the significance of personal sharing, learning experience, and resource exchange in contributing to a higher level of social presence. Building on these findings, I proposed three strategies to enhance the social presence level in online courses, emphasizing the promotion of personal connections with course content, facilitating the exchange of learning resources, and encouraging proactive student engagement.

Deriving inspiration from my findings, online courses can augment their social presence by enacting the following strategic initiatives:

Promoting Personal Sharing: Course designers and instructors should consider instituting designated discussion topics tailored to elicit self-introductions and interpersonal greetings from students.

Encouraging students to share their learning experiences, thoughts, and emotional responses pertaining to the course material can similarly serve to stimulate personal connections. Active involvement from teachers and teaching associates in these discussions, with timely and meaningful responses, serves to further galvanize student engagement.

Facilitating the Exchange of Learning Resources: Instructors and mentors are poised to incentivize students to contribute additional learning resources by offering extra credits or acknowledgment. This approach serves as a catalyst for students to actively participate in discussions related to course materials, thereby enriching the exchange of valuable educational resources among their peers.

Students' Proactive Sharing: Furthermore, it is imperative to underscore the significance of students' proactive sharing of personal information when striving to establish a robust social presence within online course discussion board interactions. This proactive engagement not only enriches the overall discourse environment but also fosters authenticity and a sense of connectedness among peers. Encouraging students to actively contribute through personal sharing endeavors to create a vibrant and engaging learning community wherein students feel valued, understood, and intrinsically motivated to participate.

These strategies exhibit a universal applicability that transcends the confines of specific course content, rendering them pertinent to a diverse array of online courses. By fortifying social presence within discussion boards, instructors can elevate student engagement, thereby potentially enhancing overall learning outcomes.

Ultimately, these strategies underscore the human dimension of online learning, affirming that meaningful connections significantly bolster the efficacy of asynchronous online courses.

Tailored Approaches for Discipline-Specific Social Presence Enhancement

The study underscored the considerable impact of course disciplines on social presence levels. The analysis indicated that non-STEM courses consistently exhibited higher levels of all three types of social presence “affective response”, “interactive response” and “cohesive response” compared to STEM courses. Drawing on the distinctions between STEM and non-STEM courses, the research offered four actionable recommendations for STEM courses to elevate their social presence levels, emphasizing personal connections, information sharing opportunities, creating an enthusiastic environment, and enhancing instructor participation.

Upon thorough examination of the sample courses from both STEM and non-STEM disciplines, this study identified four key strategies that STEM courses can adopt, inspired by the practices of non-STEM courses, to improve their social presence levels.

Encouraging Personal Connection with Course Content. STEM courses could foster discussions linking course knowledge/content to students’ personal experiences. This approach not only enhances the social presence level on the discussion board but also contributes to improved learning outcomes.

Qualitative content analysis revealed that posts sharing personal and learning experiences with the course content often exhibited a high level of social presence. Non-STEM courses naturally facilitate connections with personal experiences.

For instance, while students in a mental health course might readily connect the course material to their personal experiences, those in a quantum mechanics course might find it more challenging. STEM courses could incorporate strategies like including such requirements in the syllabus, offering extra credits for relevant posts, and providing instructors with guidelines to encourage students to share personal experiences, thereby enhancing the social presence level.

Providing More Opportunities for Personal Information Sharing. After examining various STEM and non-STEM courses, it became evident that non-STEM courses provided more opportunities for students to share personal information. These opportunities offered students in-depth insights into their peers' lives, encouraging a strong sense of connection and fostering a high level of social presence. To bridge this gap, STEM courses can create additional discussion topics, encourage active participation, and guide students towards sharing more personal information, thereby enhancing the overall social presence within the course.

Creating an Enthusiastic Environment for Personal Information Sharing. Qualitative analysis of STEM and non-STEM courses highlighted that students in non-STEM courses exhibited a notable willingness to share detailed personal information. Unlike in STEM courses, where student pictures were seldom posted, non-STEM courses demonstrated a high level of personal engagement. 70% of non-STEM courses in the sample courses have posts where students share their own pictures, promoting a more personal and engaging atmosphere. Creating an enthusiastic environment that motivates students to share personal information can significantly improve the social presence level.

Implementing strategies such as encouraging active participation, recognizing students who contribute meaningfully, and guiding discussions can foster a more engaging and vibrant discussion environment.

Enhancing Instructor Participation in Personal Information Sharing. An examination of instructor participation across various courses revealed that non-STEM instructors engaged more frequently in personal information sharing posts compared to their STEM counterparts. In non-STEM courses, instructors actively interacted with students within these threads, fostering a more inclusive and engaging environment. Encouraging a more proactive approach among STEM course instructors in facilitating personal information sharing can effectively elevate the social presence level within the course.

In conclusion, the variation in social presence levels across course disciplines primarily hinges on the quality and quantity of posts containing personal information. Informed by the distinctions between STEM and non-STEM courses, this study suggests four strategies to enhance social presence in STEM courses, including encouraging personal connections with course content, providing more avenues for personal information sharing, fostering an engaging environment for student participation, and promoting increased instructor involvement in facilitating personal information exchange. Implementing these strategies can effectively bridge the social presence gap and cultivate a more dynamic and inclusive learning environment within STEM courses.

Optimizing Social Presence Level Across Different Phases of the Course Timeline

The investigation of the correlation between the social presence level and course time point underscored the inverse relationship between the two variables. Notably, the "cohesive response" social presence indicator demonstrated the highest sensitivity to course duration, influencing 80% of the sample courses. Similarly, the "interactive response" and "interactive behavior" indicators were significantly affected in 68% and 72% of the sample, respectively. I attributed the decrease in social presence to the reduction in participants, a shift in discussion topics toward task-oriented content, and the transition of personal interactions to alternative communication channels.

Based on the qualitative content analysis results, I recommended prioritizing increased student engagement and fostering social connections during the initial weeks to counteract the observed decline in social presence with the course's time points.

Drawing from the insights gathered through qualitative content analysis regarding duration, the result suggests two key recommendations for online courses to enhance their social presence levels and subsequently improve students' learning outcomes.

Enhancing Social Presence in Online Courses through Early Student Engagement Strategies. Given the observed decline in social presence with course duration, instructors should prioritize fostering increased student engagement and social connections during the initial weeks. Encouraging students to share personal information early on can help establish stronger social bonds and sustain engagement throughout the course, potentially mitigating dropout rates and leading to more favorable learning outcomes.

Promoting Secure and Collaborative Learning Environments through Official Online Study Groups. recognizing the desire for more immediate and private communication among students, course instructors or online institutions should consider creating official learning groups on alternate platforms, such as WhatsApp. Proactive facilitation of these groups can foster a supportive learning environment while minimizing the risks associated with unofficial groups, as identified in the analysis, including exposure to fraudulent information and potential cybersecurity threats. By organizing and guiding these official study groups, the course administrators can promote a secure and conducive learning experience, bolstering students' engagement and social presence within the online course environment.

In sum, this research has offered comprehensive insights into the dynamics of social presence within online courses, highlighting critical factors and proposing practical strategies to enhance social engagement and learning outcomes.

Significance of the Study

This study's multifaceted examination of social presence dynamics within online education not only enriches our theoretical understanding of virtual learning environments but also yields practical insights that can inform pedagogical practices and enhance the overall online learning experience.

First, this research significantly contributes to the advancement of theoretical and empirical understanding in the field of online education. By addressing the gap in the analysis of social presence indicators in asynchronous online education, this study deepens our comprehension of the intricacies inherent in fostering effective social interactions within virtual learning environments.

This understanding serves to inform and enrich existing theoretical frameworks concerning online pedagogy, shedding light on the intricate interplay between social presence and learning outcomes.

Second, the exploration of the influence of STEM and non-STEM courses on social presence levels not only provides valuable insights into the divergent dynamics shaping online learning experiences but also highlights the potential impact of disciplinary nuances on the effectiveness of online instructional strategies. The nuanced understanding of these dynamics serves as a catalyst for the development of tailored pedagogical interventions that can optimize social engagement and foster a collaborative learning environment conducive to improved student performance and satisfaction.

Third, the innovative utilization of advanced technological tools, such as Python web crawling and the Python algorithm, not only enhances the methodological rigor of social presence research but also sets a methodological precedent for future investigations in the domain of online educational research. By showcasing the efficacy of sophisticated data processing techniques, this study encourages researchers to adopt a more systematic and rigorous approach to the study of online social dynamics, fostering a more comprehensive understanding of the multifaceted nature of virtual learning environments.

Ultimately, the actionable recommendations derived from this study hold the potential to impact pedagogical practices in real-world educational settings, enabling instructors and educational institutions to proactively cultivate an enriched and engaging online learning environment that not only fosters social presence but also facilitates enhanced collaboration and knowledge construction among online learners.

Inspiration for Future Studies

This study's analysis of social presence dynamics in online education lays a solid foundation for future research endeavors. By elucidating the nuanced interplay between social presence indicators and learning outcomes, this study offers a springboard for future investigations to delve deeper into the mechanisms that underpin effective online social interactions.

Future studies could focus on exploring the longitudinal effects of tailored pedagogical interventions derived from this research, examining their sustained impact on fostering social engagement and enhancing student performance over extended periods.

There is a pressing need for research that investigates the cross-cultural implications of social presence dynamics in online education, acknowledging the potential variations in online social interaction patterns across diverse cultural contexts. Additionally, studies that delve into the intersectionality between social presence, technological affordances, and learning outcomes can provide valuable insights into the optimal integration of technology-mediated social interactions in online learning environments.

Furthermore, future research endeavors should aim to explore the potential role of emerging technologies, such as artificial intelligence and virtual reality, in fostering and enriching social presence within the context of online education, paving the way for innovative and immersive online learning experiences.

Limitations

Platform Limitation

In line with standard research practices, it is imperative to acknowledge certain limitations inherent in this study. Primarily, resource constraints, encompassing financial and temporal considerations, have necessitated the confinement of the investigation to a singular online education platform, namely Coursera. This constraint may potentially influence the generalizability of the study's findings due to the specificity of the chosen platform.

It is crucial to recognize that the participants in Coursera courses are self-selecting, engaging in courses voluntarily. This self-selection introduces a potential bias, as individuals opting for these courses may already possess a positive predisposition towards the concept of course presence, potentially skewing the results.

Consequently, the outcomes of this study may be more aptly representative of the nature and dynamics of social presence in the domain of online, self-directed, non-institutional public courses, rather than offering a comprehensive perspective encompassing all online courses.

To address these limitations and enhance the robustness of future research endeavors, it is recommended that subsequent studies broaden their scope by incorporating a diverse array of online education platforms.

Additionally, conducting comparative research between voluntary courses, such as those on Coursera, and institutional courses would contribute to a more nuanced and generalized comprehension of social presence dynamics across varied online learning contexts.

Manual Identification of Keywords

The manual identification of keywords to represent social presence indicators and the potential constraints of the Python algorithm in capturing the nuanced contextual aspects of social presence indicators present further avenues for future investigation. The integration of more sophisticated algorithmic designs and qualitative content analysis could contribute to refining the accuracy and precision of social presence measurement methods in the context of online course discussions, facilitating more reliable and robust research outcomes.

Despite these limitations, this study represents a significant and insightful contribution to the discourse on social presence within online education. It has yielded valuable and meaningful insights, established a robust research methodology for the quantitative analysis of text-based social presence, and laid the groundwork for future research to delve deeper into the intricacies of online social interactions and their impact on the learning experience.

Text-Based Study of Social Presence

The text-based examination of social presence presents a notable limitation. Given that social presence is inherently tied to the emotional experiences of media users, relying solely on a text-based study constitutes a theoretical and reasonable assumption rather than a direct measure of media users' self-reported feelings.

Consequently, there exists a potential discrepancy wherein a high frequency of social presence indicators may not necessarily correlate with a correspondingly high level of social presence among users.

It is important to recognize that while a heightened frequency of social presence indicators may suggest a more prevalent presence, it does not unequivocally guarantee a commensurate elevation in the users' actual social presence experiences.

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APPENDIX A

EVOLUTION OF CATEGORIES AND INDICATORS OF SOCIAL PRESENCE

Rourke et al. (1999)	Swan (2003)	Hughes et al. (2007)
Affective responses		
Expression of emotions	Paralanguage	Expression of emotion
Use of humor	Emotion	Use of humor
Self-disclosure	Value	Self-disclosure
	Humor	
	Self-disclosure	
Interactive responses		
Continuing a thread	Acknowledgment	Referring to others' messages
Quoting from other messages	Disagreement	Asking questions
Referring explicitly to other messages	Approval	Complimenting, expressing appreciation
Asking questions	Invitation	
Complimenting, expressing appreciation	Personal advice	Expressing agreement
Expressing agreement		
Cohesive responses		
Vocatives	Greeting & salutations	Vocatives
Addresses or refers to the group using inclusive pronouns		Expresses group inclusivity
	Vocatives	Phatics or salutations
Phatics or salutations	Group reference	Embracing the group
	Social sharing	
	Self-reflection	

Note. From "Title of Work" by Lowenthal, A. A., & Dunlap B. B., 2020, *Title of Journal*, 2020, p.492).

APPENDIX B

THE LIST OF SAMPLE COURSE

An Introduction to American Law
Astronomy- Exploring Time and Space
Behavioral Finance
Brand Management- Aligning Business
Business Analytics with Excel
Connected Leadership
Corporate Strategy
Cryptography I
Cybersecurity for Everyone
Data Management for Clinical Research
Essentials in Clinical Simulations Across the Health Professions
Financial Markets
First Step Korean
Forensic Accounting and Fraud Examination
Game Theory
Indigenous Canada
Industrial Biotechnology
International Women's Health and Human Rights
Introduction to Calculus
Introduction to Mathematical Thinking
Introduction to Negotiation
Introduction to Psychology
Introduction to Statistics
Introduction to User Experience Design
Introductory Human Physiology
Learn to Program
Learning How to Learn
Management of Fashion and Luxury Companies
Medical Neuroscience
Organizational Analysis
Overcoming Dyslexia
Social Psychology
The Science of Well-Being for Teens
Understanding Clinical Research- Behind the Statistics
Understanding the Brain
Writing in the Sciences.

APPENDIX C

THE LIST OF SAMPLE COURSE DATA DURATION

List1.1

Course Name	**Oldest Post Time**
An Introduction to American Law	8 years ago
Astronomy	8 years ago
Behavioral Finance	7 years ago
Brand Management	5 years ago
Business Analytics with Excel	6 months ago
Connected Leadership	8 month ago
Corporate Strategy	5 years ago
Cryptography I	7 years ago
Cybersecurity For Everyone	N/A
Data Management for Clinical Research	N/A
Essentials In Clinical Simulations Across the Health Professions	4 years ago
Financial Markets	6 years ago
First Step Korean	N/A
Forensic Accounting and Fraud Examination	N/A
Game Theory	7 years ago
Indigenous Canada	6 years ago
Industrial Biotechnology	6 years ago
Introduction To Negotiation	8 years ago
Introduction To Psychology	5 years ago
Introduction To Statistics	2 years ago
Introduction To User Experience Design	7 years ago
Introductory Human Physiology	N/A
Learn To Program	N/A
Learning How to Learn	4 years ago
Management of Fashion and Luxury Companies	8 years ago
Medical Neuroscience	N/A

List1.2

Course Name	**Oldest Post Time**
Organizational Analysis	7 years ago
Overcoming Dyslexia	8 months ago
Social Psychology	5 years ago
The Science of Well-Being for Teens	8 months ago
Understand Clinical Research- Behind the Statistics	3 years ago
Understand the Brain	N/A
Writing In the Science	7 years ago

APPENDIX D

THE LIST OF SAMPLE COURSE STEM AND NON-STEM CLASSIFICATION

List 1.1

Course Name	**STEM or non-STEM**
An Introduction to American Law	non-STEM
Astronomy- Exploring Time and Space	non-STEM
Behavioral Finance	non-STEM
Brand Management- Aligning Business	non-STEM
Business Analytics with Excel	non-STEM
Connected Leadership	non-STEM
Corporate Strategy	non-STEM
Cryptography I	non-STEM
Cybersecurity for Everyone	STEM
Data Management for Clinical Research	STEM
Essentials in Clinical Simulations Across the Health Professions	STEM
Financial Markets	non-STEM
First Step Korean	non-STEM
Forensic Accounting and Fraud Examination	non-STEM
Game Theory	non-STEM
Indigenous Canada	non-STEM
Industrial Biotechnology	STEM
International Women's Health and Human Rights	non-STEM
Introduction to Calculus	STEM
Introduction to Mathematical Thinking	STEM
Introduction to Negotiation	non-STEM
Introduction to Psychology	non-STEM
Introduction to Statistics	STEM
Introduction to User Experience Design	STEM
Introductory Human Physiology	non-STEM

List 1.2

Course Name	**STEM or non-STEM**
Learn to Program	STEM
Learning How to Learn	non-STEM
Management of Fashion and Luxury Companies	non-STEM
Medical Neuroscience	STEM
Organizational Analysis	STEM
Overcoming Dyslexia	non-STEM
Social Psychology	non-STEM
The Science of Well-Being for Teens	non-STEM
Understanding Clinical Research-Behind the Statistics	STEM
Understanding the Brain	STEM
Writing in the Sciences.	non-STEM