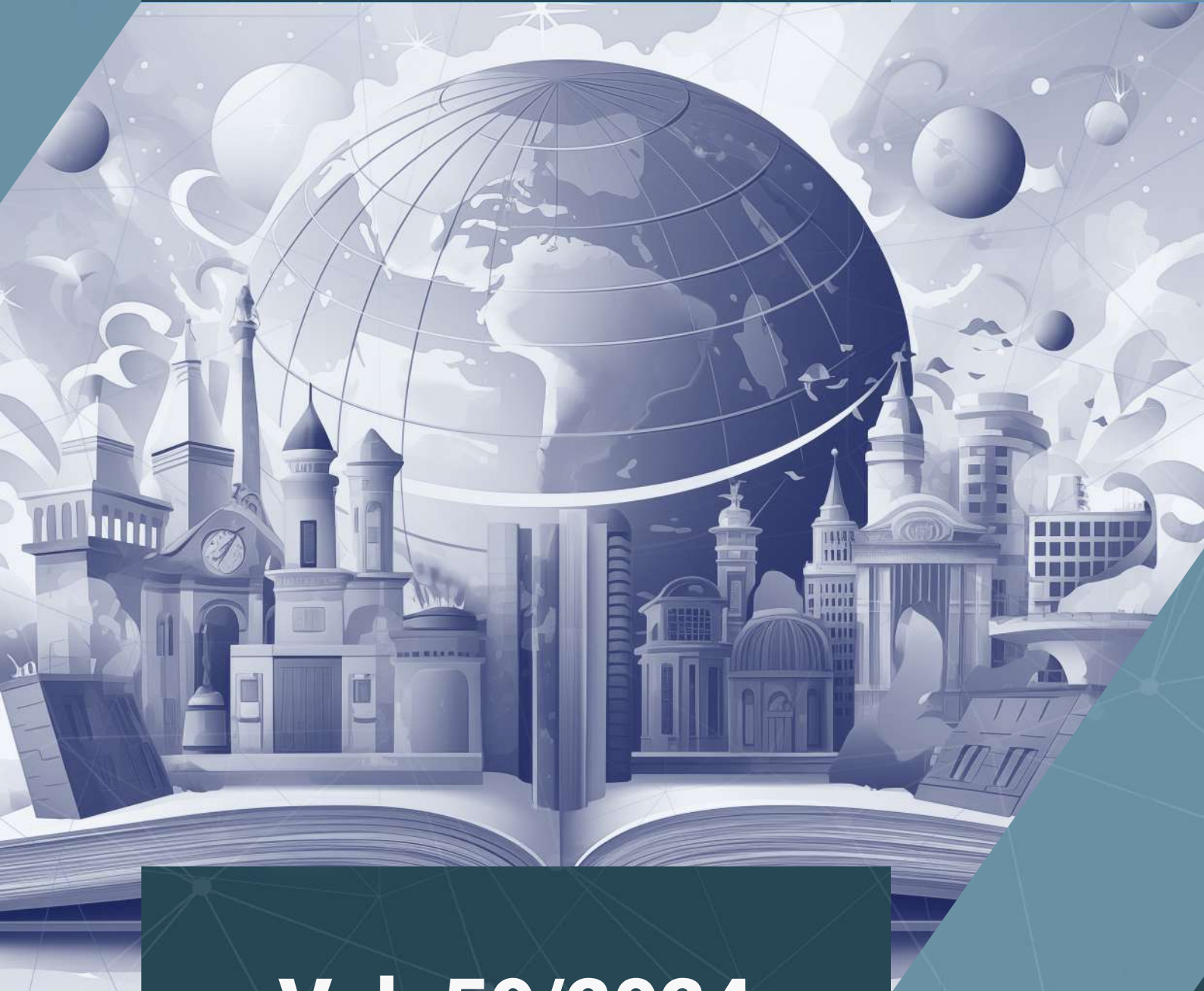




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The domino effect of teacher cognitive presence triggering events and resolution on student's grit

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Abstract. The aim of this current study is to assess the essential role of teacher cognitive presence within the context of the community of inquiry framework in relation to enhancing students' academic perseverance, more specifically this type of presence influences the most students' academic perseverance. In order to test this hypothesis, an online questionnaire was created, including the community of inquiry scale and the grit scale. A total of 529 valid and consented answers were collected. We have further analyzed the structure of the variables network with network analysis and then we have employed several sequential mediation analyses testing the impact of cognitive presence triggering events and resolution on the relationship between all the other presences and students' academic perseverance. A circular structure has emerged in network analysis and eight significant full complementary sequential mediation analysis. Results confirm the domino effect of teacher cognitive presence triggering events and resolution on student's grit under the community of inquiry framework.

Keywords. community of inquiry; triggering events; resolution; students' grit; domino effect; complementary sequential mediation analysis

1. Introduction

As a method of lifetime and continuous learning, blended education has grown in importance with the development of contemporary technology. Less research has been done on the impacts of teaching, social presence, and cognitive presence on student academic perseverance.

According to the community of inquiry model, the learning experience can occur when specific qualities of the learning environment are present, such as the teacher's involvement and practices, the level of social openness and engagement, and the student's cognitive presence and involvement (Shea et al., 2010). In other words, the community of inquiry may be defined based on levels of instructional, social, and cognitive presence, and all three dimensions must be present in the learning environment for the learning experience to be ideal (Garrison, Anderson,

& Archer, 2010; Gairín-Sallán & Rodríguez-Gómez, 2012; Harasim, 2006; Garrison, 2013; Kennedy & Kennedy, 2013).

High degrees of cognitive presence are found in blended learning sessions, as evidenced by higher order learning, such as metacognition, an executive process that monitors and coordinates other cognitive processes engaged during learning, such as recall, rehearsal, or problem-solving (Tobias & Everson, 2009; Akyol & Garrison, 2011). In a study conducted by Vaughan, Cleveland-Innes, and Garrison (2013), the examination of facilitation encompassed cognitive and social aspects, proposing strategies to enhance these presences through social engagement in both physical and online learning environments. Researchers (Szeto, 2015) utilized a qualitative case study methodology to investigate the influence of these presences on the experiences of both online and in-person students, as well as their instructor. The findings suggested that, concerning the attainment of desired learning outcomes, teaching presence held greater importance compared to cognitive and social presences within the framework. However, the combined influences of teaching, social, and cognitive presences, supporting the blended synchronous learning and teaching approach, continued to exert a significant impact on the learning process.

Online students were more adept in drawing and engineering knowledge, while face-to-face students found it difficult to solve drawing issues in the hybrid synchronous learning mode. In a recent study by Almasi, Zhu, and Machumu (2018), the authors looked at how students' cognitive, social, and teaching presences impacted their academic performance. According to age and gender categories, they did not find any statistically significant differences between the three presences, however students with more advanced ICT abilities reported stronger cognitive and social presences. They came to the conclusion that while cognitive and social presences are favorably connected with teaching presences and with student performance, they do not independently predict student success.

Based on the Community of Inquiry framework, Li (2022) conducted an empirical test to examine the dynamic relationships between various presences in blended learning during COVID-19. Results determined that both social presence and feelings of inclusion play a role in influencing and partially moderating the connection between instructional presence and cognitive presence. Social presence, which enhances cognitive presence, acts as an intermediary to some extent in the correlation between cognitive presence and teaching presence. Additionally, teaching presence significantly enhances social presence, the sense of community, and cognitive presence.

The cognitive presence is crucial to the learning process since it allows for the understanding and determination of student involvement and skill levels. The instructor is in charge of determining the students' ability level, setting the proper parameters, providing the appropriate materials, and providing the appropriate answers to the problems that have been presented. The students will be more interested and passion-ate about the subject and be able to apply the knowledge they have learned outside of the classroom if the instructor wakes their cognitive presence. In this context, the study's findings indicate that learners might become more enthusiastic and involved with the subject matter if the teacher's presence is at its best, which enhances the learning process.

Limited research exists on the impact of instructors' presence on students' academic perseverance, commonly referred to as grit. This study represents one of the initial cross-sectional investigations aimed at investigating the influence of various teaching presences on students' academic perseverance or grit. The study seeks to comprehend the immediate and delayed outcomes of a teacher's cognitive presence, recognized as a pivotal factor. Given the

established validity of cognitive presence as a mediator variable in related studies, this research focuses on the teacher's cognitive presence as a primary mediator.

2. Theoretical framework

The community of inquiry model implies that the learning experience can occur when certain characteristics are present within the learning environment, i.e. the teacher's involvement and practices, the level of social openness and engagement, and the student's cognitive presence and involvement (Shea et al., 2010). In other words, the community of inquiry can be classified through the levels of teaching, social, and cognitive presence, and in order for the learning experience to occur at an optimal level, all three dimensions must be present in the learning environment (Garrison, Anderson, & Archer, 2010).

In a study by Kilis and Yildirim (2019), an analysis was performed on the patterns of students' contributions in online environments pertaining to their cognitive, social, and teaching aspects. The findings revealed that these presences were perceived as high, with discussions revolving around real-life cases, scenarios, and reflective coursework emerging as the foremost factors driving these presences. Causing event and resolution shared average levels (55% and 49%, respectively) across the cognitive present categories, whereas exploration and integration were top and last (72% and 35%, respectively). In their study of qualified online teachers' establishment of cognitive, social, and teacher presences during emergency remote instruction, Meda and El Sayary (2021) found that social presence, enabling students to have practical contact with human aspects within an online community, was core, although all three presences are equally important and inseparable. The Learning Modality Change Community of Inquiry and Self-Efficacy measures were created and validated by Jia et al. (2022) to measure students' self-efficacy with online learning. Additionally, they investigated the perceptions of students transitioning abruptly from in-person to online learning, discovering overlap between cognitive, social, and teaching presences. Their exploratory structural equation modeling confirmed three factors for the final scale. Only social presence scores and emotional engagement scores varied according to the number of online courses taken, as indicated by Duha et al. (2022), who examined how earlier online learning experiences affected students' perceptions of cognition, social interaction, teacher presence, satisfaction, and engagement. Utilizing multivariate statistical techniques, Nasir and Ngah (2022) conducted a cross-sectional survey, revealing a significant impact of cognitive, social, and teaching presences on students' contentment with their courses. Moreover, increased engagement in the forms of cognitive, social, and teaching presence was found to have a constructive effect on students' overall satisfaction with the course.

In literature, grit is viewed as a personality characteristic attributed to a person's level of perseverance mixed with the passion for a specific deep-rooted objective or goal (Duckworth, Peterson, Matthews, & Kelly, 2007) or as a personality trait characterized by perseverance and passion for achieving long-term goals (APA Dictionary of Psychology). Moreover, grit entails working strenuously to overcome challenges and maintaining effort and interest over time despite failures, adversities, and plateaus in progress. Recent studies suggest this trait may be more relevant than intelligence in determining a person's high achievement. For example, grit may be particularly important to accomplishing an especially complex task when there is a strong temptation to give up altogether (APA Dictionary of Psychology). Grit is commonly associated in literature with concepts such as ambition, dedication, resilience, aspiration, hardiness, perseverance, conscientiousness, determination, and need for achievement (Duckworth & Quinn, 2009; Credé, Tynan, & Harms, 2017; Credé, 2018), competence (Kurt

Taşpınar & Külekçi, 2018), firmness of passion, perseverance of effort, and powerful motivation (Lohi, Hanif, & Fatima, 2019). These concepts can be summarized as individual variations in how people complete their task instead of inherited abilities or talents (Duckworth, Peterson, Matthews, & Kelly, 2007). Numerous studies have addressed the significance of grit in academic attainment (Christopoulou et al., 2018; Reed & Jeremiah, 2017; Kannangara et al., 2018). Beyond inherent abilities, such as intelligence or artistic talent, the level of grit present in individuals emerges as a crucial determinant distinguishing successful individual from others, notwithstanding their possession of certain talents and abilities (Duckworth et al., 2007). Grit propels individuals towards their desired objectives regardless of encountered obstacles, facilitating the discovery of effective solutions conducive to success. Consequently, a substantial body of literature has established associations between grit and various educational facets, including engagement, motivation, achievement, perseverance in tackling challenging tasks, and time allocation to educational pursuits (Kannangara et al., 2018).

Researchers (Kannangara et al., 2018; Hodge, Wright, & Bennett, 2017; Eskreis-Winkler et al., 2014; Pate et al., 2017; Lucas et al., 2015) conducted investigative work to explore the significance of grit within the university student population, utilizing a hybrid research methodology. The initial phase of the study encompassed a survey administered to 440 students, assessing grit, stress, mental well-being, and self-control. Grit exhibited notable variances across gender, age groups, and academic levels, demonstrating the strongest correlation with self-control. Subsequently, the study expanded its scope to include 340 students, examining grit alongside self-control, well-being, resilience, and mindsets. Higher grit scores corresponded to heightened levels of self-control, well-being, resilience, and growth-oriented mindsets.

To address conflicting conclusions regarding the significance of grit and its associations, and to explore how engagement mediates the relationship between grit and academic outcomes, a cross-sectional survey investigation was conducted (Hodge, Wright, & Bennett, 2017). This investigation involved 395 university students and included measurements of grit, engagement, and academic productivity. The study's findings revealed no gender-based disparity in grit, although this assertion was constrained by an unequal distribution of male and female participants. Notably, it was discovered that being the first in one's family to attend university correlated with heightened levels of the 'effort' facet of grit. Furthermore, a positive correlation emerged among grit, engagement, and academic effectiveness. Further analysis revealed that engagement functioned as a mediator between grit and productivity. This suggests that individuals with higher levels of grit tend to exhibit increased engagement, thereby contributing to enhanced academic productivity.

In a comprehensive exploration (Eskreis-Winkler et al., 2014), the study examined the association between grit, characterized by perseverance and commitment towards long-term goals, and retention across various contexts such as military service, sales positions, high school education, and marriage. Grit emerged as a robust predictor of retention outcomes, surpassing the influence of established predictors specific to each context, including intelligence, physical capabilities, personality traits, job tenure, and demographic factors. Moreover, in a separate investigation (Pate et al., 2017), it was found that the level of grit exhibited by student pharmacists might correlate with their academic success. Furthermore, the potential integration of the Grit-S Scale into pharmacy education programs was identified as having significant implications.

Another study (Lucas et al., 2015) examined the potential drawbacks associated with higher levels of grit, particularly in situations where individuals persisted despite the option to disengage. The research revealed that individuals with greater grit demonstrated a decreased

willingness to abandon tasks, even when continued persistence might lead to unfavorable outcomes. Two key findings emerged: firstly, individuals with higher grit were more inclined to risk failure by persisting with individual elements of a task; secondly, in competitive scenarios, these individuals exhibited a stronger determination to persist and invest more effort, rather than opting to quit, despite facing potential losses. Overall, the study demonstrated that individuals with high levels of grit were more willing to endure potential losses to pursue their objectives, a pattern consistent across all examined settings, emphasizing the consistent role of grit in determining retention outcomes beyond context-specific factors (Kelly, Matthews, & Bartone, 2014).

Grit, defined as a combination of passion and unwavering persistence in pursuit of long-term goals, has been recognized as a crucial factor in achieving objectives effectively over time (Cross, 2014). In a recent investigation, the primary aim was to present a systematic framework and tool for enhancing educational interactions through computer-mediated communication (CMC) and computer conferencing. This research centers on a community inquiry model, comprising three essential elements vital for productive educational engagement: cognitive presence, social presence, and teaching presence.

Social presence pertains to an individual's ability to engage socially and emotionally with others within the learning environment (Garrison, Anderson, & Archer, 1999). It involves comprehensive communication and interaction among the teacher and all students, serving as a fundamental prerequisite for a successful learning experience, preceding the development of teaching and cognitive presence (Garrison, Anderson, & Archer, 2010).

Teaching presence encompasses the techniques and strategies employed by instructors to facilitate learning. It involves managing various teaching methods to deliver accurate information, organizing class activities, adapting to diverse learning contexts, providing necessary learning materials, and offering support and guidance to students facing challenges (Garrison, Anderson, & Archer, 2010). Effective teaching presence requires teachers to be open to communication, and it is recognized as a significant determinant of student motivation and satisfaction (Garrison, Anderson, & Archer, 2010).

Cognitive presence involves fostering motivation and engagement among students within a specific discipline (Garrison, Anderson, & Archer, 2010). It can be conceptualized through four phases: triggering a challenge, analyzing through reflection and communication, creating meaning through debate, and applying acquired knowledge in both classroom and real-world contexts.

Education plays a pivotal role in societal development, and concerns regarding academic disengagement and dropout rates are significant for the future of education (Christopoulou et al., 2018; Keegan, 2017). Various factors, such as skills, organizational abilities, and motivation, influence the learning process, with teachers playing a crucial role in guiding students towards achievement (Hodge, Wright, & Bennett, 2017; Sedlacek, 2017). Academic success is thus influenced not only by inherent abilities but also by non-cognitive factors such as grit (Sedlacek, 2017; Steinmayr et al., 2019; Wolters & Hussain, 2015). Achieving academic success depends on the synergy between cognitive abilities and personal characteristics, including a high level of grit or a strong drive for achievement (Bazelais, Lemay, & Doleck, 2016).

In order for the learning experience to be successful, the teacher's presence is crucial. The teacher plays a significant role by providing relevant information and necessary tools and instruments that facilitate the learning experience. It is the responsibility of the teacher to ensure effective communication channels and assist learners in achieving success and accomplishment

(Barber, van Oostveen, & Childs, 2019). The manner in which teachers engage with learners and the methods they employ to maintain student interest and involvement can significantly impact the success of the learning experience (Reed & Jeremiah, 2017; Barber, van Oostveen, & Childs, 2019).

In a study by Reed and Jeremiah (2017), the role of grit in promoting student success across diverse age groups was examined, initially focusing on its significance in workforce development. The study highlighted grit's predictive capacity concerning achievement and its relevance to teacher effectiveness and student learning across multiple dimensions. Students' self-perception of their capabilities was found to exert a notably greater influence than intelligence. Moreover, while several motivational factors were considered, most accounted for less than 5% of the variance in students' academic performance within a comprehensive model incorporating measures of intelligence (Steinmayr et al., 2019).

Another study by Wolters and Hussain (2015) revealed that a specific facet of grit, particularly the perseverance of effort, consistently and positively predicted various dimensions of self-regulated learning (SRL). These dimensions included value, self-efficacy, cognitive and metacognitive strategies, motivation, time management, study environment management, and procrastination. Although perseverance of effort significantly predicted academic achievement, this relationship attenuated after considering SRL, suggesting that students' engagement in SRL may mediate the association between this aspect of grit and enhanced academic performance.

Furthermore, a study by Bazalais, Lemay, and Doleck (2016) highlighted the predictive role of prior academic performance in college success, including performance in introductory physics courses. However, grit did not exhibit a significant association with student academic achievement or performance in physics courses (Bazalais, Lemay, & Doleck, 2016).

Grit has gained recognition as a fundamental component in learning and education, fostering student engagement in classroom activities and promoting a willingness to tackle challenges, even under arduous circumstances (Wang, 2021). Furthermore, the concept of resilience, aligned with positive psychology, emerges as a comparable construct, emphasizing the importance of perseverance and an individual's ability to navigate unexpected challenges with self-control and determination (Barber, van Oostveen, & Childs, 2019).

To enhance the learning experience and foster educational achievement and success among learners, educators are increasingly emphasizing the cultivation of grit and resilience (Wang, 2021). By instilling these qualities in students, instructors aim to equip them with the determination and perseverance needed to overcome challenges and pursue their educational goals effectively (Cassidy, 2015). When learners encounter obstacles or setbacks, possessing grit, resilience, and intellectual drive can serve as motivational factors, encouraging them to persist in their educational endeavors despite difficulties. This focus on nurturing these attributes underscores the recognition of their importance in not only academic pursuits but also in preparing individuals for lifelong learning and success in various domains.

3. Materials and Methods

3.1. Methodology and design

This study aims to investigate the significance of teacher cognitive presence within the community of inquiry framework concerning its influence on students' academic perseverance or grit. Specifically, the study examines whether cognitive presence has the most substantial impact on students' academic perseverance. To test this hypothesis, an online questionnaire was developed, incorporating the community of inquiry scale and the grit scale, both translated into Romanian. A total of 529 valid and consented responses were collected.

Further analysis involved examining the structure of the variables network using network analysis techniques. Subsequently, several sequential mediation analyses were conducted to assess the impact of complementary sequential mediation of cognitive presence triggering events and resolution on the relationship between all other presences and students' grit.

The network analysis was performed in JASP and the variables included in the analysis are presented in Figure 1.

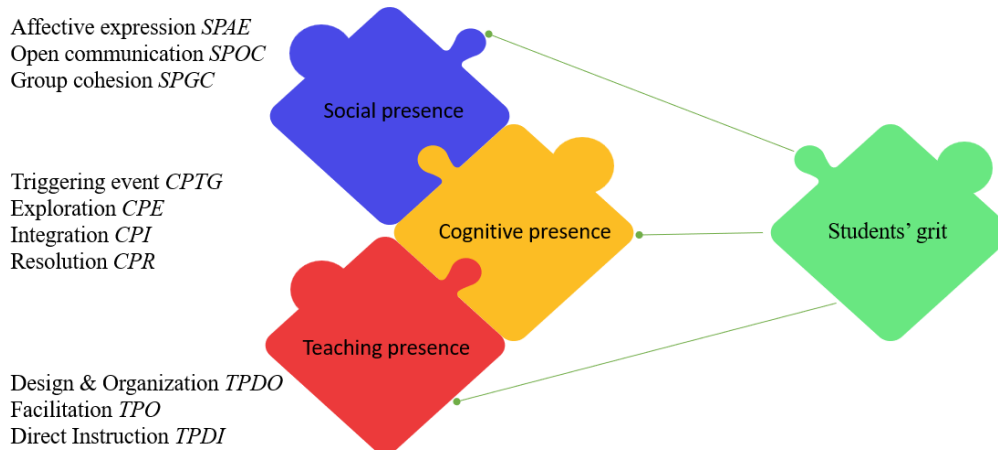


Figure 1. Research variables

The sequential mediation analyses were performed in SPSS V26 Process Macro 6, using the dependent variable students' grit, as sequential mediators triggering event and resolution and independent variables the three types of social presences, the three types of teaching presences and the remaining cognitive presences: exploration and integration.

With Process Macro number 6, implying sequential mediation analysis with up to 4 mediators, we have tested whether social, teaching and two cognitive presences could increase teachers' cognitive presence triggering events, which in turn increases teachers' cognitive presence resolution which could in turn increase student's grit and therefore their academic perseverance towards successfully graduating the higher degree program in which they are involved.

3.2. Participants

This cross-sectional study examined the perspectives of students and alumni at Aurel Vlaicu University of Arad, Romania, during October and November of 2022. Participants were recruited using a convenience sampling method, whereby respondents were selected based on their accessibility to the researcher. This method was chosen due to its non-biased nature and was ethically approved by Center of Research Development and Innovation in Psychology of Aurel Vlaicu University of Arad. The convenience sampling approach involved disseminating a call for respondents among Bachelor, Master, and alumni student groups across all nine faculties of the university.

Upon consideration of the research objectives, students willingly provided consent to participate in the study. Consequently, a comprehensive dataset comprising 529 valid responses was amassed for analysis. The surveyed participants exhibited a diverse age distribution, with an average mean age of 28 years and a range spanning from 20 to 62 years. Among these

respondents, 165 (32%) were male students, while the majority, comprising 364 (68%), were female students. In terms of their educational pursuits, the respondents demonstrated a varied spectrum. A total of 353 (66%) were currently enrolled in bachelor's degree programs, with an additional 117 (22%) engaged in master's degree programs, indicative of their commitment to advanced studies. Moreover, the study included 59 (12%) individuals who had already achieved their academic goals and were part of the alumni community, representing a diverse range of educational trajectories.

3.3. Instruments

This study employs two key instruments for data collection: the Community of Inquiry Survey Instrument and the Short Grit Scale. The Community of Inquiry Survey Instrument, developed collaboratively by Arbaugh et al. (2008) and Swan et al. (2008), is recognized as the primary reliable and validated measure for assessing the constructs within the community of inquiry framework. Specifically designed to capture elements related to cognitive presence, social presence, and teaching presence, this instrument provides a structured foundation for examining dynamics within educational settings.

In addition, the research methodology utilizes the Short Grit Scale, developed through collaborative efforts by Duckworth et al. (2007) and Duckworth & Quinn (2009). This scale serves as a robust tool for measuring academic perseverance. The Short Grit Scale offers insights into students' persistent efforts in their academic endeavors, providing a reliable means to explore and quantify the essential aspect of grit. The community of inquiry survey instrument can be freely downloaded from <https://coi.athabasca.ca/coi-model/coi-survey/> and the short grit scale can be downloaded from: <https://sjdm.org/dmidi/files/Grit-8-item.pdf>

The Community of Inquiry Survey Instrument, consisting of 34 items, is designed to capture teaching presence, social presence, and cognitive presence within the educational context. These dimensions collectively facilitate a thorough exploration of the dynamics involved in meaningful online learning experiences. Teaching presence, focusing on the instructor's role in facilitating learning, is assessed by three specific subscales: Design and Organization, Facilitation, and Direct Instruction. These subscales analyze distinct facets of instructor involvement, including structuring the learning experience, facilitating interaction, and delivering direct instruction. Similarly, social presence, essential for fostering connection and engagement among participants, is further assessed with three subscales: Affective Expression, Open Communication, and Group Cohesiveness. These subscales provide insight into how social interaction and communication contribute to a vibrant learning environment. Cognitive presence, vital for promoting critical thinking and active learning, is assessed with four subscales: Triggering Event, Exploration, Integration, and Resolution. These subscales offer a comprehensive framework to evaluate how learners engage in critical inquiry, exploration, integration of ideas, and resolution of complex challenges.

Participant responses to each item in the survey were collected using a 5-point Likert scale. The scale ranged from 1 ("strongly disagree") to 5 ("strongly agree"). The survey demonstrated good reliability, with a Cronbach's Alpha coefficient of 0.95, indicating high internal consistency and reliability. This coefficient underscores the instrument's suitability for assessing the dimensions of the community of inquiry framework.

The Short Grit Scale comprises eight items with Likert-scale responses ranging from 5 ("Very much like me") to 1 ("Not like me at all"), with questions 2, 4, 7, and 8 reversed. To interpret scores, the total points must be divided by eight. Scores can range from 1 (indicating low academic perseverance or grit) to 5 (indicating high academic perseverance or grit). The

items primarily assess ambitions and professional concentration. The reliability of the scale was assessed using Cronbach's Alpha coefficient, yielding a value of 0.95, indicating high reliability.

4. Results

4.1. Preliminary results

The analysis of the ten distinct subscales within the Community of Inquiry Survey provided valuable insights, summarized through descriptive statistics. These statistics offer a comprehensive understanding of participants' perceptions across various survey dimensions.

In terms of Teaching Presence, the "Design & Organization" subscale demonstrated a high average score of 4.59, with a small standard deviation of 0.61, indicating that participants generally perceived the learning experience as well-structured and effective. The "Facilitation" subscale garnered an average score of 4.49, accompanied by a standard deviation of 0.73, suggesting robust and engaging facilitation efforts. Similarly, the "Direct Instruction" subscale received an average score of 4.41, with a standard deviation of 0.84, indicating positive perceptions of direct instructional components' effectiveness.

Regarding Social Presence, participants reported an average score of 4.27 for "Affective Expression," with a standard deviation of 0.76, denoting well-presented and engaging emotional communication. The "Open Communication" subscale also received an average score of 4.27, coupled with a standard deviation of 0.77, indicating perceived transparency and conducive communication for open dialogue. The "Group Cohesion" subscale had an average score of 4.14 and a standard deviation of 0.84, suggesting participants' sense of togetherness within the learning community.

Within Cognitive Presence, participants indicated an average score of 4.42 for the "Triggering Event" subscale, accompanied by a standard deviation of 0.76, highlighting recognition of thought-provoking elements stimulating critical thinking. The "Exploration" subscale yielded an average score of 4.27, with a standard deviation of 0.85, implying perceived opportunities for in-depth exploration. The "Integration" subscale received an average score of 4.43 and a standard deviation of 0.74, indicating comprehensive integration of ideas. Lastly, the "Resolution" subscale received an average score of 4.36, with a standard deviation of 0.79, suggesting perceived meaningful resolution of complex issues.

Consequently, the concept assessing learner engagement and the organization of learning activities, Teaching Presence Design & Organization (Bolliger & Martin, 2018), had the highest mean. The flexibility, student accountability, and consideration of macro design components like setting clear goals and scheduling activities are all part of the design and organization factor (Garrison, 2017). Critical elements within this dimension include establishing a secure learning environment conducive to exploration and information gathering, devising activities that promote purposeful investigation, and structuring assessment procedures thoughtfully. Organizational efforts, such as announcements and external email communications, are crucial components, extending beyond the confines of the discussion board (Shea et al., 2010). Effective design and communication strategies can motivate students to engage actively in cognitive presence. While social presence ranks last, it still maintains a high mean. Affective expression encompasses socio-emotional aspects of communication that foster relationship-building.

The lowest mean (4.14) was obtained by Social presence Group cohesion, even if reported to the maximum score of five, this mean represents an overall upper limit value. The degree to which group members are drawn to the group and its aims is referred to as group cohesiveness.

Feelings of interpersonal friendliness, task dedication, and collective pride can all contribute to cohesion, and not surprisingly, these variables have been linked to improved group and team performance. We found a mean of 3.72 on the Grit scale, with a standard deviation of 0.62, which indicates that students are generally persistent and enthusiastic about long-term goals (Credé, 2018).

These summarized results are presented in Table 1.

Table 1 - Descriptive statistics

Descriptive Statistics		Valid	Missing	Mean	Std. Error	Std. Deviation	Coefficient of variation	Minimum	Maximum
TPDO	529	0		4.594	0.027	0.631	0.137	1.000	5.000
TPF	529	0		4.499	0.032	0.735	0.163	1.167	5.000
TPDI	529	0		4.415	0.037	0.846	0.192	1.000	5.000
SPAE	529	0		4.275	0.033	0.768	0.180	1.000	5.000
SPOC	529	0		4.279	0.034	0.774	0.181	1.000	5.000
SPGC	529	0		4.147	0.037	0.844	0.204	1.000	5.000
CPTG	529	0		4.423	0.033	0.768	0.174	1.000	5.000
CPE	529	0		4.271	0.037	0.850	0.199	1.000	5.000
CPI	529	0		4.435	0.032	0.744	0.168	1.000	5.000
CPR	529	0		4.368	0.034	0.792	0.181	1.000	5.000
Grit	529	0		3.720	0.027	0.627	0.169	1.000	5.000

In Table 2 there are presented the Pearson correlation coefficients among all variables in this research. There are positive and significant associations between all variables, as expected, thus between the social, cognitive, and teaching presence subscales and students' academic perseverance or grit there are positive and significant associations, which further methodologically allow us to test the mediation analysis.

Table 2 – Pearson Correlation coefficients

Pearson's Correlations		TPDO	TPF	TPDI	SPAE	SPOC	SPGC	CPTG	CPE	CPI	CPR	Grit
1. TPDO	Pearson's r	—										
2. TPF	Pearson's r	0.864	—									
3. TPDI	Pearson's r	0.760	0.887	—								
4. SPAE	Pearson's r	0.531	0.590	0.613	—							
5. SPOC	Pearson's r	0.546	0.566	0.564	0.750	—						

Pearson's Correlations

Variable		TPDO	TPF	TPDI	SPAE	SPOC	SPGC	CPTG	CPE	CPI	CPR	Grit
6. SPGC	Pearson's r	0.536*	0.570**	0.583*	0.742**	0.805**	—					
7. CPTG	Pearson's r	0.659*	0.738**	0.742**	0.627*	0.692**	0.689**	—				
8. CPE	Pearson's r	0.669*	0.633*	0.637*	0.710*	0.747**	0.780**	0.766**	—			
9. CPI	Pearson's r	0.681*	0.759**	0.737**	0.668*	0.679*	0.690**	0.833**	0.794**	—		
10. CPR	Pearson's r	0.663*	0.723**	0.714**	0.627*	0.613*	0.669**	0.754**	0.713**	0.827**	—	
11. Grit	Pearson's r	0.209*	0.232**	0.213**	0.197**	0.238**	0.232**	0.250**	0.237**	0.256**	0.264**	—

* p < .05, ** p < .01, *** p < .001

4.2. Network analysis results

In this study, the 11 variables were subjected to network analysis using the JASP program to comprehend their interrelationships and validate the network's structure. Network analysis was chosen due to its ability to consider the simultaneous relationships among all variables, unlike Pearson correlation coefficients, which only reveal associations between pairs of variables.

The analysis involved 11 nodes, each representing a distinct study variable. These variables were abbreviated as follows: "Social presence Group cohesion" (SPGC), "Social presence Affective expression" (SPAE), "Social presence Open communication" (SPOC), "Cognitive Presence Exploration" (CPE), "Cognitive Presence Resolution" (CPR), "Teaching Presence Direct instruction" (TPDI), "Cognitive Presence Triggering event" (CPTG), "Cognitive Presence Integration" (CPI), "Teaching Presence Facilitation" (TPF), and "Teaching Presence Design & Organization" (TPDO).

The network analysis revealed 36 non-zero edges out of a possible 55, indicating interconnectedness among the study variables. This intricate network highlighted the relationships and interactions among the variables. Additionally, the sparsity coefficient, calculated as 0.345, indicated the proportion of zero edges in the network, emphasizing the density of relationships among the variables.

These findings offer valuable insights into the complex connections among the study variables, providing a comprehensive understanding of their interplay within the research context.

The analysis integrated four central measures—betweenness, closeness, strength, and expected influence (Robinaugh, Millner, & McNally, 2016)—to identify nodes of utmost importance effectively. These centrality measures are systematically presented in both Table 3 and Figure 3, depicting critical nodes within the network. Closeness centrality, among these measures, offers insights into a node's proximity to all other nodes in the network. It is calculated based on the average of the shortest paths connecting each node. A node's centrality is inversely proportional to the sum of its distances from all other nodes, reflecting its pivotal role in disseminating information swiftly throughout the network. Conversely, betweenness centrality measures a node's reliance on others and its potential for exerting control within the

network. It quantifies the time a node spends navigating the shortest paths between other nodes. High betweenness centrality indicates a crucial role in facilitating communication and influence between nodes, conferring significant control. Strength evaluates a node's impact on immediate neighbors or directly connected nodes. It quantifies the absolute sum of all connections that a node shares with others in the network, demonstrating its ability to transmit or share information and influence. Through these centrality measures, the network analysis not only provides a comprehensive understanding of node roles but also quantitatively evaluates their significance within the larger network context. These measures collectively unveil the intricate dynamics and structures inherent in the research network.

Table 3 - Centrality measures

	Network			
Variable	Betweenness	Closeness	Strength	Expected influence
TPDO	-1.308	-0.605	-0.703	-0.703
TPF	1.090	-0.070	1.453	1.453
TPDI	0.291	-0.018	0.008	0.008
SPAE	-0.242	-0.416	-0.383	-0.383
SPOC	-0.775	-0.261	0.311	0.311
SPGC	0.291	-0.011	0.393	0.393
CPTG	-0.775	1.033	0.189	0.189
CPE	0.291	0.810	0.281	0.281
CPI	1.889	1.416	0.916	0.916
CPR	0.557	0.457	-0.008	-0.008
Grit	-1.308	-2.335	-2.458	-2.458

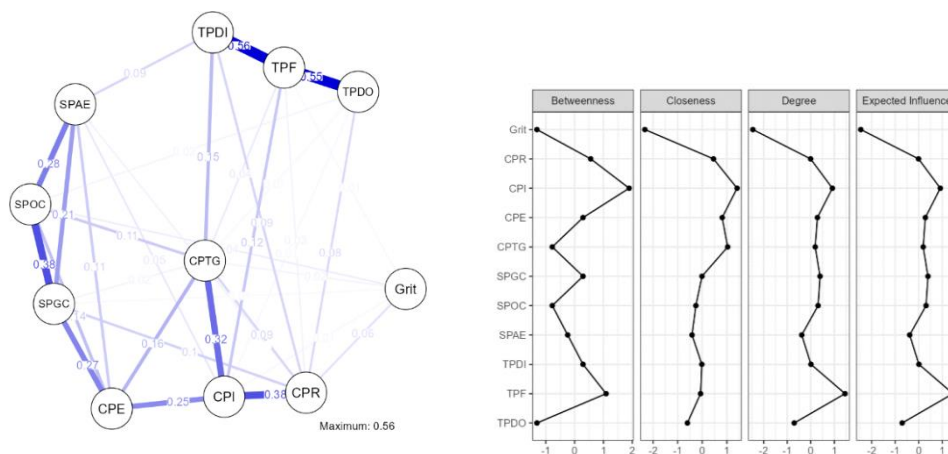


Figure 2– Network analysis and centrality measures

Upon examining the network analysis graph (Figure 2), it becomes evident that the variable "teachers' cognitive presence triggering event" (CPTG) occupies a central position, akin to the center of a circle, surrounded by other variables. This central positioning suggests potential sequential mediation processes, as the effect from all variables to the variable "student's grit" appears to flow through CPTG and the last variable placed on the circle before "student's grit," namely "teachers' cognitive presence resolution" (CPR). Consequently, we anticipate that grit will be indirectly influenced by all other variables, namely teachers' presences, through the sequential mediators: CPTG and CPR. We hypothesize full sequential mediation, thus establishing these two variables as crucial influencers over students' grit.

Cognitive presence, integral to the learning framework, encompasses the journey students undertake during their learning process. It involves the process through which students confront challenges, develop deeper insights, and actively engage with their learning community to exchange knowledge and understanding.

In the context of learning, cognitive presence refers to the complex routes that students follow when they interact with difficult material. Its main goals are to help students understand important ideas, locate pertinent materials, and incorporate fresh perspectives into their existing cognitive framework. This dynamic process entails combining disparate pieces of knowledge into a coherent understanding, creating mental frameworks, and synthesizing information. Students who embrace cognitive presence go on a transformative journey that goes beyond fundamental learning, leading to a thorough understanding of the material and the capacity to apply a variety of information in productive ways. Giving students the cognitive flexibility they need to get past foundational learning stages is the cornerstone of cognitive presence. It directs students toward a stage of learning that is meaningful and marked by the application of complex knowledge components with proficiency and the understanding of complex ideas. Students gain expertise in information analysis, problem solving, and contributing to the larger conversation within the learning community as they progress through this cognitive journey. Essentially, cognitive presence serves as a road map for students, guiding them from basic comprehension to thorough understanding and real-world application in their learning. It symbolizes the way in which learners develop from first discovery to proficient comprehension and application in the field of learning.

4.3. Results for complementary sequential mediation analysis

Based on literature review, and the circular pathway depicted in the network analysis, the following eight hypotheses have been proposed for testing. The general framework for the sequential mediation analyses is presented in Figure 5, where the independent variable (Y) is represented by students' grit, the first mediator (M1) is represented by teachers' Cognitive presence Triggering events (CPTG), the second sequential mediator (M2) is represented by teachers' Cognitive presence Resolution (CPR) and the dependent variable (X) is represented in the first sequential mediation model by teachers' Social presence Open communication (SPOC), in the second mediation model by teachers' Social presence Affective expression (SPAЕ), in the third sequential mediation model by teachers' Teaching Presence Design & Organization (TPDO), in the fourth sequential mediation model by teachers' Teaching Presence Direct instruction (TPDI), in the fifth sequential mediation model by teachers' Teaching Presence Facilitation (TPF), in the sixth sequential mediation model by teachers' Cognitive Presence Integration (CPI), in the seventh sequential mediation model by teachers' Social presence Group cohesion (SPGC) and in the eighth sequential mediation model by teachers' Cognitive Presence Exploration (CPE).

H1: Cognitive presence Triggering events (CPTG) and Cognitive presence Resolution (CPR) sequentially and complementary fully act as mediators in the relationship between Social presence Open communication (SPOC) and students' grit.

H2: Cognitive presence Triggering events (CPTG) and Cognitive presence Resolution (CPR) sequentially and complementary fully act as mediators in the relationship between Social presence Affective expression (SPA) and students' grit.

H3: Cognitive presence Triggering events (CPTG) and Cognitive presence Resolution (CPR) sequentially and complementary fully act as mediators in the relationship between Teaching Presence Design & Organization (TPDO) and students' grit.

H4: Cognitive presence Triggering events (CPTG) and Cognitive presence Resolution (CPR) sequentially and complementary fully act as mediators in the relationship between Teaching Presence Direct instruction (TPDI) and students' grit.

H5: Cognitive presence Triggering events (CPTG) and Cognitive presence Resolution (CPR) sequentially and complementary fully act as mediators in the relationship between Teaching Presence Facilitation (TPF) and students' grit.

H6: Cognitive presence Triggering events (CPTG) and Cognitive presence Resolution (CPR) sequentially and complementary fully act as mediators in the relationship between Cognitive Presence Integration (CPI) and students' grit.

H7: Cognitive presence Triggering events (CPTG) and Cognitive presence Resolution (CPR) sequentially and complementary fully act as mediators in the relationship between Social presence Group cohesion (SPGC) and students' grit.

H8: Cognitive presence Triggering events (CPTG) and Cognitive presence Resolution (CPR) sequentially and complementary fully act as mediators in the relationship between Cognitive Presence Exploration (CPE) and students' grit.

In order to test our eight hypotheses, we have further computed our data with Process Macro model 6 (Hayes, 2012) under SPSS V.26. The summary of results is presented in Table 4.

Table 4 – Complementary sequential mediations summary

Model	Total effect	Direct effect	Relationship	Indirect effect	Confidence intervals		t= Indirect Effect /SE	R-sq	Conclusion
					Lower Bound	Upper Bound			
H1: (SPOC → grit)	0.1928 <i>p</i> < .0001	0.0789 <i>p</i> > .05	H1: SPOC → CPTG → CPR → Grit	0.0544	0.0150	0.0972	2.615	0.08 at F=15.293 <i>p</i> < .0001	Full complementary mediation
H2: (SPA → grit)	0.1608	0.0194 <i>p</i> > .05	H2: SPA → CPTG → CPR → Grit	0.0503	0.0160	0.0859	2.841	0.07 at F=14.378	Full complementary

	$p < .0001$							$p < .0001$	mediation
H3:(TPD O → grit)	0.2074 $p < .0001$	0.0297 $p > .05$	H2: TPDO→ CPTG→CP R→ Grit	0.0595	0.0179	0.1088	2.586	0.07 at F=14.406 $p < .0001$	Full complementary mediation
H4:(TPDI → grit)	0.1579 $p < .0001$	0.0007 $p > .05$	H2: TPDI→ CPTG→CP R→ Grit	0.0476	0.0144	0.0857	2.572	0.07 at F=14.314 $p < .0001$	Full complementary mediation
H5:(TPF → grit)	0.1978 $p < .0001$	0.0398 $p > .05$	H2: TPF→ CPTG→CP R→ Grit	0.0475	0.0111	0.0917	2.305	0.07 at F=14.488 $p < .0001$	Full complementary mediation
H6:(CPI → grit)	0.2156 $p < .0001$	0.0494 $p > .05$	H2: CPI→ CPTG→CP R→ Grit	0.0259	0.0010	0.0558	1.546	0.07 at F=14.465 $p < .0001$	Full complementary mediation
H7:(SPG C → grit)	0.1724 $p < .0001$	0.0529 $p > .05$	H2: SPGC→ CPTG→CP R→ Grit	0.0426	0.0098	0.0766	2.491	0.07 at F=14.807 $p < .0001$	Full complementary mediation
H8:(CPE → grit)	0.1747 $p < .0001$	0.0427 $p > .05$	H2: CPE→ CPTG→CP R→ Grit	0.0441	0.0094	0.0842	2.345	0.07 at F=14.569 $p < .0001$	Full complementary mediation

Hypothesis 1 (H1): Through the intermediaries of Cognitive presence Triggering events (CPTG) and Cognitive presence Resolution (CPR), the results revealed a notable indirect impact of teachers' social presence open communication (SPOC) on students' grit, a quality encompassing perseverance and determination ($b=0.0544$, $t=2.615$). This result provides credence to our hypothesis. However, in the presence of these mediators, the direct impact of SPOC on students' grit produced insignificant outcomes ($b=0.0789$, $p > .05$). Consequently, the results clarify a complementary sequential complete mediation pattern. Table 4 presents the overview of the mediation process. When considered collectively, the two mediators' tandem action fully complemented one another in mediating the relationship between teachers' social presence open communication (SPOC) and students' grit (IE = 0.0544, 95% CI: LL = 0.0150 to UL = 0.0972). This suggests that students' grit levels are positively correlated with

their perceptions of teachers' open communication, as well as their perceptions of their cognitive presence triggering events (CPTG) and cognitive presence resolution (CPR). Working in a complementary way, the sequential full mediation model provided insights into an 8% explanation of the variance in students' grit.

Hypothesis 2 (H2): The results revealed a significant indirect effect of teachers' social presence affective expression (SPAE) on students' grit, or their willpower and persistence, which was mediated by Cognitive presence Resolution (CPR) and Cognitive presence Triggering events (CPTG) ($b=0.0503$, $t=2.841$). The second hypothesis is supported by this result. Within the domain of these mediators, the direct effect of SPAE on students' grit was shown to be statistically non-significant ($b=0.0194$, $p > 0.05$). This suggests that instructors' CPTG and CPR have a unique complementary sequential full mediation function in influencing the association between students' grit and SPAE. A detailed description of this mediation results is included in Table 4. The whole mediation of the relationship between teachers' social presence affective expression (SPAE) and students' grit was completed by the two mediators working together (IE = 0.0503, 95% CI: LL = 0.0160 to UL = 0.0859). This suggests that high levels of students' grit are associated with a strong sense of instructors' affective expression as well as a strong sense of teachers' cognitive presence triggering events (CPTG) and teachers' cognitive presence resolution (CPR). The sequential complete mediation model provided a 7% explanation of the variance in students' grit, working in a complementary manner.

Hypothesis 3 (H3): The investigation revealed a significant indirect impact of instructors' TPDO (teaching presence design and organization) on students' grit, which is a trait characterized by tenacity and perseverance. Our third hypothesis is supported by the fact that Cognitive presence Resolution (CPR) and Cognitive presence Triggering events (CPTG) are successively involved in this impact ($b=0.0595$, $t=2.586$). But in the presence of these mediators, the direct effect of TPDO on students' grit showed non-significant findings ($b=0.0297$, $p > 0.05$). The results show a complimentary sequential complete mediation dynamic that is carried out by instructors' CPR and CPTG, which coordinates the relationship between students' grit and TPDO. Table 4 provides an overview of the mediation results. The two mediators worked together to facilitate the mediation of the relationship between teachers' teaching presence design and organization (TPDO) and students' grit (IE = 0.0595, 95% CI: LL = 0.0179 to UL = 0.1088). This relationship revealed that students' grit was positively correlated with their perception of teachers' organizational and design skills as well as their strong perception of their cognitive presence triggering events (CPTG) and cognitive presence resolution (CPR). An additional 7% of the variance in students' grit was explained by the sequential mediation model.

Hypothesis 4 (H4): The results supported our fourth hypothesis by revealing a significant indirect effect of teachers' teaching presence direct instruction (TPDI) on students' grit, or resilience and determination, which is mediated by Cognitive presence Resolution (CPR) and Cognitive presence Triggering events (CPTG) ($b=0.0476$, $t=2.572$). The examination of TPDI's direct effect on students' grit within the framework of these mediators produced insignificant outcomes ($b=0.0007$, $p > 0.05$). This result represents a complementary sequential complete mediation scenario in which instructors' CPR and CPTG work together to shape the association between students' grit and TPDI. Table 4 provides the results of this mediation procedure. Overall, the two mediators' collaborative efforts achieved the full mediation of the relationship between students' grit and teachers' teaching presence direct instruction (TPDI) (IE = 0.0476, 95% CI: LL = 0.0144 to UL = 0.0857). This suggests that high levels of students' grit are associated with strong perceptions of instructors' direct teaching abilities as well as strong

perceptions of teachers' cognitive presence triggering events (CPTG) and cognitive presence resolution (CPR). An additional 7% explanation of the variance in students' grit was revealed by the sequential complete mediation model.

Hypothesis 5 (H5): Results from the investigation revealed a significant indirect effect on students' grit that stemmed from instructors' Teaching Presence Facilitation (TPF). Our fifth hypothesis is supported by the fact that this influence is mediated through Cognitive Presence Resolution (CPR) and Cognitive Presence Triggering events (CPTG) ($b=0.0475$, $t=2.305$). Within the context of these mediators, TPF's direct impact on students' grit produced non-significant findings ($b=0.0398$, $p >0.05$). This result highlights a complimentary sequential complete mediation process that shapes the relationship between TPF and students' grit. It is assisted by instructors' CPTG and CPR. Table 4 presents the mediation results. The overall relationship between instructors' teaching presence facilitation (TPF) and students' grit was effectively mediated by the two mediators working together (IE = 0.0475, 95% CI: LL = 0.0111 to UL = 0.0917). This suggests that high levels of students' grit are associated with a strong sense of instructors' facilitation abilities as well as their cognitive presence triggering events (CPTG) and cognitive presence resolution (CPR). The complementary sequential full mediation model provided insights into a 7% explanation of the variance in students' grit.

Hypothesis 6 (H6): The results demonstrated a significant indirect effect of teachers' cognitive presence integration (CPI) on students' grit, which was mediated by Cognitive Presence Resolution (CPR) and Cognitive Presence Triggering events (CPTG) ($b=0.0259$, $t=1.546$), in line with our sixth hypothesis. However, in the presence of these mediators, the direct impact of CPI on students' grit was shown to be statistically non-significant ($b=0.0494$, $p >0.05$). This result suggests that instructors' CPTG and CPR have a complimentary sequential full mediation process that shapes the link between CPI and students' grit. The results of the mediation are presented in Table 4. The full mediation of the relationship between instructors' cognitive presence integration (CPI) and students' grit was completed by the two mediators working together (IE = 0.0259, 95% CI: LL = 0.0010 to UL = 0.0558). This suggests that higher levels of students' grit are correlated with a strong sense of instructors' cognitive integration as well as a strong sense of teachers' cognitive presence triggering events (CPTG) and cognitive presence resolution (CPR). Working in tandem, the sequential full mediation model revealed a 7% explanation for the variation in students' grit.

Hypothesis 7 (H7): The results demonstrated a significant indirect impact of instructors' social presence group cohesiveness (SPGC) on student's grit. Our seventh hypothesis is strongly supported by the fact that this impact is mediated through the mediators of Cognitive presence Resolution (CPR) and Cognitive presence Triggering events (CPTG) ($b=0.0426$, $t=2.491$). Within the context of these mediators, SPGC's direct impact on students' grit, however, showed statistical non-significance ($b=0.0529$, $p >0.05$). This result highlights a complimentary sequential complete mediation process that shapes the relationship between students' grit and SPGC. The mechanism is aided by instructors' CPR and CPTG. Table 4 presents the mediation results. Overall, the coordinated efforts of the two mediators completed the mediation of the relationship between students' grit and teachers' social presence group cohesiveness (SPGC) (IE = 0.0426, 95% CI: LL = 0.0098 to UL = 0.0766). This suggests that higher levels of students' grit are correlated with better assessments of instructors' group cohesiveness abilities as well as their cognitive presence triggering events (CPTG) and cognitive presence resolution (CPR). A 7% explanation of the variance in students' grit was provided by the sequential complete mediation model.

Hypothesis 8 (H8): The findings revealed a significant indirect effect of instructors' cognitive presence exploration (CPE) on students' grit. Our eighth hypothesis is confirmed by the influence being funneled through the Cognitive Presence Resolution (CPR) and Cognitive Presence Triggering events (CPTG) ($b=0.0441$, $t=2.345$). Given the framework of these mediators, the direct impact of CPE on students' grit was shown to be statistically non-significant ($b=0.0427$, $p > 0.05$). This result emphasizes a complimentary sequential complete mediation dynamic demonstrating that CPR and CPTG shape the link between students' grit and CPE. Table 4 presents the results of this mediation procedure. The relationship between instructors' cognitive presence exploration (CPE) and students' grit was mediated by the two mediators (IE = 0.0441, 95% CI: LL = 0.0094 to UL = 0.0842). This suggests that higher levels of students' grit are associated with a strong perception of instructors' concept exploration as well as a strong perception of teachers' cognitive presence triggering events (CPTG) and cognitive presence resolution (CPR). The whole mediation model that is complimentary and sequential explained 7% of the variation in the students' grit.

Through the complex relationships between different aspects of presences and students' grit or academic perseverance, our findings have shed light on a compelling pattern of outcomes that demonstrate the significant impact of mediating factors, specifically Cognitive presence Triggering events (CPTG) and Cognitive presence Resolution (CPR). The phenomenon of complete sequential complementary mediation is shown by the appearance of statistically significant indirect effects ($p < .000$), which reinforces the major role performed by these mediators. The observation that initial direct effects become statistically non-significant when mediators are incorporated into the analysis underlines the role of mediators in facilitating a complementary sequential mediation process. This phenomenon emphasizes the dynamics between different presences and students' grit. Specifically, the inclusion of mediators such as Cognitive Presence Triggering Events (CPTG) and Cognitive Presence Resolution (CPR) reshapes and enhances the connections between these variables. This outcome provides valuable insight into the significance of considering the essential roles of CPTG and CPR in shaping students' academic perseverance.

5. Discussion

The confirmed eight hypothesis of this research depicting full complementary sequential mediation of cognitive presence triggering events and cognitive presence resolution over the relationship between all the other presences and students' grit or academic perseverance, clearly depicting a domino effect of the mediators. Our results show that in order to enhance students' academic perseverance through teaching presences, the two facets of the cognitive presence namely triggering events and resolution are acting like key process influencers. We have called this process a domino effect, due to the fact that if there two facets of cognitive presence are not clearly defined, then the rest of the presences are not able to reach and enhance student's' academic perseverance, which represents one of the main objectives of higher education.

The transformation of students from passive consumers in the classroom to active, engaged members of a learning community is a recurring subject in blended learning (Fiock, 2020). The Community of Inquiry framework can assist instructors in cultivating a blended classroom characterized by respect, discussion, inquiry, and discovery by integrating online and offline activities (Castellanos-Reyes, 2020).

Too frequently, classrooms are places where students do not have the flexibility or freedom to ask questions about subjects or situations that pique their interest, or to pursue investigation that may extend beyond the confines of a certain subject area. Rather than enabling

students to engage in the dynamic process of asking questions, seeking answers, and comprehending complicated issues, education concentrates on giving answers to questions and solutions to problems for students to absorb and remember. However, if the student does not actively participate in asking questions or researching issues, they are unlikely to be interested in or motivated to recall the solution. Cultivating an online and offline Community of Inquiry may assist students learn to think freely, creatively, and resourcefully (Maddrell, Morrison, & Watson, 2020; Martin et al., 2022).

Previous research exploring the interrelationships among components of the Community of Inquiry (CoI) framework consistently demonstrates a positive correlation between elevated levels of teacher presence and increased cognitive presence and social presence. Notably, prior studies have revealed a strong association between the prevalence of teaching presence and both social presence and cognitive presence in online educational contexts (Caskurlu et al., 2021). In line with these findings, recent study results further affirm that teaching presence significantly predicts social and cognitive presence. Thus, by developing activities that encourage autonomous study, foster community via in-depth material exploration, and provide a variety of formative assessments tailored to individual and group requirements, the teaching presence integrates cognitive and social components. The instructor performs three key tasks: (1) Establishes learning objectives, tactics, evaluation, and communication etiquette through planning, structuring, and planning, (2) Encourages involvement, responds to student remarks, refocuses the conversation, and maintains participants' attention, and (3) Uses resources for learning, guides the neighborhood, and gives comments in accordance with his area of competence (Hilliard & Stewart, 2019; Yu & Li, 2022; Dempsey & Zhang, 2019; Guo et al., 2021).

The combination of these presences creates complex dimensions in the educational setting. In particular, the combination of cognitive presence and instructional presence governs how learning objectives and instructional content line up. In a similar vein, the development of interpersonal connections and community cohesiveness is facilitated by the convergence of social and educational presence. This interaction highlights the complementary link between social and cognitive presences and promotes ongoing communication and critical discourse. This collaborative dynamic plays a major role in establishing a favorable and stimulating learning environment, as highlighted by (Garrison, Anderson, & Archer, 1999).

In a blended learning environment, establishing a Community of Inquiry can benefit teachers in a number of ways, including: leveraging students' natural curiosity to their advantage; promoting research and study; helping students understand how various courses are interconnected; enhancing their ability to communicate and work together both online and offline; enhancing students' agency and autonomy to increase intrinsic motivation; forging meaningful connections between students; and encouraging students to take an active rather than a passive role in their own education.

Universities serve as crucial environments where students acquire essential skills for effectively understanding and navigating their surroundings. An integral component of this educational process entails active student engagement with unfamiliar concepts and events, fostering the development of their analytical and problem-solving abilities. The utilization of the Community of Inquiry framework provides educators with a structured methodology for crafting learning experiences that seamlessly blend online and offline modalities, thereby empowering students to assume control over their educational trajectory.

At the core of the Community of Inquiry framework lies cognitive presence, a key determinant in the learning process. Cognitive presence enables educators to assess students'

proficiency levels and levels of engagement, facilitating a more targeted instructional approach. Educators shoulder the responsibility of gauging students' skill levels and establishing conducive learning environments, which encompass the provision of relevant content and tailored solutions to address identified challenges. This comprehensive approach ensures that students receive adequate support in their educational pursuits (Zou & Zhang, 2022; Yandra et al., 2021; Nasir & Ngah, 2022).

When educators foster cognitive presence among students, it has the potential to stimulate heightened engagement and enthusiasm for the subject matter, facilitating the transfer of acquired knowledge beyond the confines of the learning environment. The findings of this investigation underscore the significant correlation between an optimal level of teacher presence and increased learner engagement and passion for the subject matter, thereby enriching the overall learning experience (Englander & Russell, 2022; Tan, 2020; Cho et al., 2022; Ma et al., 2020).

This study represents one of the initial cross-sectional inquiries into the impact of various teaching presences on students' grit, aiming to elucidate the direct and indirect effects of specific teacher cognitive presence, considered a central element (Tingle et al., 2021; Dughi et al., 2023; Mardi, 2019; Zhang et al., 2022). Therefore, the research concentrates on teacher cognitive presence as a pivotal mediator, given its demonstrated reliability as a mediating variable in analogous studies.

Inadequate utilization of cognitive presence by educators poses a risk of students developing cyberloafing behaviors during learning, thereby compromising their academic perseverance or grit (Zhang et al., 2022). Cyberloafing, characterized by disengagement and distraction in online learning environments, presents a significant challenge to student learning and persistence (Rashid & Alyahya, 2022).

The Community of Inquiry framework, a well-established model in education, underscores the collaborative construction of knowledge through three interconnected dimensions: cognitive presence, social presence, and teaching presence. Through the application of this framework, educators can cultivate an environment conducive to effective learning, whether in traditional classroom settings or online platforms.

This research highlights the pivotal role of student engagement and motivation in the learning process. Active participation and engagement with course materials significantly enhance students' ability to comprehend and retain information. Moreover, sustained motivation is critical for maintaining students' interest and commitment to their academic endeavors.

Educators can leverage this understanding to design learning experiences that cultivate a sense of community, encourage interaction, and foster deep learning. Strategies such as facilitating meaningful discussions, delivering relevant and engaging content, and promoting collaborative activities are instrumental in enhancing student engagement and motivation throughout the learning process.

In summary, this study reaffirms the importance of actively involving and motivating students to create an enriching learning environment, whether in traditional or online settings. By adhering to the principles of the community of inquiry framework and prioritizing student engagement, educators can facilitate more impactful and effective learning experiences for their students.

6. Conclusions

The aim of this study was to examine the centrality of teacher cognitive presence within the community of inquiry framework and its association with students' grit or academic

perseverance. Specifically, the study sought to investigate the extent to which teacher cognitive presence influences students' grit. To achieve this objective, an online questionnaire was developed, comprising the community of inquiry scale and the grit scale. A total of 529 valid responses were obtained from participants who provided consent for their inclusion in the study. Subsequently, the structure of the variables network was analyzed using network analysis techniques. Additionally, sequential mediation analyses were conducted to explore the impact of cognitive presence triggering events and resolution on the relationship between all other presences and students' grit.

In network analysis and subsequent full complementary sequential mediation analyses, a circular structure has been identified, demonstrating the interconnectedness of variables. The findings of the study corroborate the hypothesized domino effect involving teacher cognitive presence, triggering events, and resolution on students' grit within the community of inquiry framework. The results of full mediation analyses elucidate that cognitive, social, and teaching presences exert a positive and potentiation effect on grit solely through sequential and complementary mediators, namely teacher cognitive presence triggering events and teacher cognitive presence resolution. Notably, teacher cognitive presence triggering events emerge as the more influential mediator, reflecting the teacher's ability to introduce challenging topics. However, the enhancement of students' grit necessitates the presence of the complementary mediator, teacher cognitive presence resolution, wherein students are prompted to resolve the challenges posed by the teacher. Failure to engage in this resolution process may hinder the cultivation of grit among students.

The Community of Inquiry (CoI) framework offers a valuable paradigm for designing educational experiences in higher education, grounded in its theoretical foundations. By leveraging this techno-pedagogical paradigm, educators can promote the development of social and cognitive presences through various strategies. These include designing effective instructional activities and resources, implementing refined online teaching methodologies, and fostering increased participant interaction, thereby enhancing the teaching presence. Research findings indicate that when participants engage in exchanging ideas that reflect diverse viewpoints, the cognitive presence facilitates learning within electronic discussions, thus underscoring the significance of social presence.

While our study sheds light on the impact of CoI on students' grit, certain limitations warrant consideration. Primarily, the research design, which was cross-sectional in nature, could benefit from transitioning to an experimental approach to assess whether specific types of presences can better bolster students' grit. Additionally, our model does not elucidate the potential consequences for students' grit when presences are inadequately addressed by educators. It is plausible to anticipate a decline in students' grit if presences are not perceived positively.

The instructor's ability to evoke curiosity and engender engagement among students towards the subjects and topics being presented holds significant importance in educational contexts. The manner in which the instructor orchestrates the delivery of content can profoundly impact students' academic achievements. The instructor bears the responsibility of not only piquing students' interest in the material but also of devising diverse challenges aimed at their improvement. However, it is not merely enough for the instructor to propose challenges; they must also provide solutions for these challenges. When presenting challenges or tasks, the instructor should offer assistance to learners in resolving them, ensuring that the challenges are aligned with the students' skill levels.

According to Csíkszentmihályi's model (Csíkszentmihályi, 1998) illustrating the interplay between skill and challenge levels, when both skill and challenge levels are minimal, apathy may ensue, leading to a loss of interest, lack of motivation, diminished enthusiasm, and disinterest in novel activities. Conversely, when the level of challenge matches the learners' skill level, a state of flow can emerge. In this state, learners are deeply engaged with the content and activities, facilitating progress and success.

It is imperative that educators go beyond the mere creation of challenges; they must also equip students with diverse methods and solutions to effectively address these challenges. Additionally, instructors play a pivotal role in guiding students through these challenges until they can independently surmount them. This concept aligns with Vygotsky's zone of proximal development theory (Miller, 2011), which posits a gap between a learner's current capabilities and their potential achievements with guidance or collaboration. Thus, educators serve to bridge this gap by providing the necessary support and assistance.

These pedagogical strategies significantly contribute to the cultivation of students' grit. By presenting content in an engaging manner that ignites students' interest and enthusiasm, and by assigning meaningful challenges aimed at improving their current skill levels, educators can foster increased motivation, engagement, and passion among students. Consequently, students are more likely to exhibit a drive for continuous improvement, thereby enhancing their prospects for academic success.

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