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A HYBRID FRAMEWORK FOR A SOCIAL LEARNING HUB: INTEGRATING PEDAGOGY AND DIGITAL TECHNOLOGIES TO BRIDGE FORMAL AND INFORMAL LEARNING

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ABSTRACT

Aim/Purpose	This study aims to present and evaluate a hybrid framework that was designed to bridge formal and informal learning contexts in secondary education. It addresses the ongoing challenge of effectively integrating social technologies into pedagogical practice to promote digital competence, social interaction, and critical thinking.
Background	Despite the potential of social technologies to enhance learning, many systems lack cohesive pedagogical grounding. Thus, this study responds to that gap by proposing an integrated social learning hub grounded in social constructivism, connectivism, and communities of practice.
Methodology	Conducted with a cohort of 72 sixteen-year-old students, the research employed a mixed-methods design, combining quantitative data from social learning hub interactions and questionnaires alongside qualitative insights from the teacher interview.

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Contribution	The study contributes an empirically tested framework that unites technological, social, and pedagogical dimensions within a single environment, demonstrating how learning design, combined with the social functionality of technology, can enhance both engagement and digital skills development.
Findings	The findings indicate that the framework had a positive impact on student engagement, promoting social learning and digital socialization, yet reveal challenges, including limited incentives and adaptation difficulties.
Recommendations for Practitioners	Educators should integrate social learning hubs (structured yet flexible) into curricula that combine intentional learning goals with authentic peer interaction. Providing continuous guidance and clear incentives can strengthen the learning experience and, consequently, learning outcomes. For this purpose, teacher training is vital for bridging formal and informal contexts and promoting open, collaborative, and stimulating learning environments.
Recommendations for Researchers	Future studies should explore the longitudinal effects of social learning hubs on digital competencies, incorporating samples of diverse educational levels and advanced metrics to validate the framework across different contexts.
Impact on Society	By promoting independent, collaborative, and open learning behaviors through the combination of formal and informal learning contexts, the proposed framework supports the cultivation of digitally literate and socially responsible citizens, aligning with Area 2 of the European DigComp Framework.
Future Research	Longitudinal research tracking long-term digital competency gains, comparative analyses across cultures, and scalability tests of the hub in varied educational settings are recommended to refine the hub's adaptive components, with a focus on how it may foster a deeper pedagogical transformation in formal educational systems.

Keywords	formal and informal learning, social learning hub, hybrid learning framework, formal and informal learning, digital tools, learning theories

INTRODUCTION

The amount of time and energy most children spend in a wide range of online activities – often in passive scrolling, endless consumption of short-form content, or superficial interactions on platforms like TikTok and Instagram – renders the development of a responsible digital culture imperative, one that ensures the meaningful participation of the younger generation as active and responsible citizens in the digital world. This necessitates extending the classroom into everyday activities and vice versa, bridging the gap between students' school-based and out-of-school experiences (Sefton-Green, 2004; Sefton-Green et al., 2016). Thus, informal learning contexts, as unconventional spaces for (digital) literacy development, do not merely supplement institutionalized learning processes; they empower self-directed learning by breaking down traditional constraints of school learning and laying the foundation for lifelong learning (Greenhow & Robelia, 2009; Hague & Payton, 2011).

The need to extend the learning process beyond formal schooling aligns with Papert's (1980) predictions, who, as early as the late 20th century, foresaw the radical transformation new technologies would bring to the educational process. Today, this need is more pressing than ever, as ongoing social, political, and economic upheavals globally reshape school structures and educational practices. Recognizing the dynamic nature of societal developments and their impact on professional environments and public discourse, educational policymakers and researchers acknowledge the need to overcome the rigid learning constraints imposed by conventional, formal schooling since the previous century (Greenhow & Robelia, 2009; Greenhow et al., 2009).

Within this context, the discussion of formal and informal learning contexts becomes particularly significant. Connecting schools with the broader socio-cultural context is critical, as learning cannot be viewed as detached from students' daily experiences (Dewey, 1998; Williams, 2008). Bridging these two contexts thus becomes essential for developing a digital culture, allowing students to recognize the connection between the school and the digital world. Indeed, disregard for schools and disinterest in lessons stem not from young people doubting the value of the educational system, but from a failure to recognize its relevance due to a lack of connection to their own lived experience (Aldridge et al., 2016; Georgopoulou et al., 2024b; Hull & Schultz, 2002; Samdal et al., 1999; Wang & Holcombe, 2010). Education is therefore called to adopt a learning ecology approach (Barron, 2006), treating learning as a process intertwined with real-world contexts and incorporating technological and social advancements.

Consequently, the challenge lies in creating a learning ecosystem that transcends traditional school limitations and draws on the contemporary needs and demands of the digital world. This study addresses this challenge by developing and evaluating a hybrid framework for a social learning hub that integrates formal and informal learning, offering a novel approach to foster digital citizenship. Unlike prior fragmented systems that often treat social technologies as add-ons without deep pedagogical integration or structured guidance, this framework introduces a unified, pedagogically informed model that merges digital socialization with intentional learning objectives. Moreover, it shows how a cohesive social learning hub can boost participation, foster digital competencies, promote responsible digital socialization, and cultivate a culture of continuous learning, providing practical insights for innovative educational practices (Vuorikari et al., 2022). Conducted in a secondary education context, the study extends the literature by empirically validating this hybrid framework and offering educators actionable guidance to nurture students as active digital citizens.

RELATED WORK

The theoretical foundation of this research centers on understanding learning as a dynamic and multifaceted process that occurs across diverse environments, beyond the confines of the formal education system. In this section, we refer to key theories and studies that contribute to this approach, aiming to outline the assumptions underpinning the conception and implementation of this hybrid framework for a social learning hub.

Technological tools appear inextricably linked to the daily lives of young people, playing a crucial role in shaping their identities. Besides, just as lack of access to school excludes children from "critical opportunities to learn, interact with peers, and develop their own identity", so too does the failure of the school to meet contemporary socio-cultural demands exclude them from similar opportunities that would make them active citizens of their time (Gee, 2018). The way institutional education attempts to integrate technology into traditional classroom settings often conflicts with youth culture, which encompasses concepts such as self-expression, open communication, collaboration, creativity, and instant sharing (Boeskens & Meyer, 2025; Lankshear & Knobel, 2006; Sharples, 2006). This incompatibility between school and real-life experiences generates challenges, as students are faced with two distinct cultures: one is the culture of society outside the school, and the other is the culture of the school's micro-society. When there is no point of connection between these cultures, students reject the one that seems less relevant or has less practical utility (Aldridge et al., 2016; Posch, 1996; Wang & Holcombe, 2010). Therefore, the school, as a micro-society that prepares future citizens for the multifaceted roles they will undertake in the broader local and global communities (New London Group, 1996), must narrow the gap between in-school and out-of-school experiences (Hague & Payton, 2011).

Lifelong learning reframes learning holistically, extending beyond formal institutions to meet evolving demands and support continuous digital engagement (Erstad & Sefton-Green, 2012; European

Commission, 2006; Ito et al., 2013; Meyers et al., 2013; Nygren et al., 2019). Based on these circumstances, different forms of learning should not be seen as competing paradigms, but as complementary elements that together form a holistic approach to learning as a process of continuous empowerment. Such an approach recognizes the contribution of all environments to overall learning (Jackson, 2013), constituting a "learning ecology" (Barron, 2006), where various environments intersect and intertwine, allowing each action to relate to the broader framework within which it is situated and from which it derives meaning (Street, 1984).

In this context, the boundaries between various environments are permeable, facilitated today by the widespread use of digital media, particularly Web 2.0 technologies (Davidson, 2012; Troussas et al., 2021; Vogels et al., 2022; Wells, 2022). These social spaces expand learning opportunities across space and time (Hardof-Jaffe & Amzalag, 2024; Krouska et al., 2021; Kumpulainen & Mikkola, 2016; Song & Lee, 2014). However, despite the shift towards a more interconnected social reality, the persistence in maintaining a fixed space (school/classroom) and rigid time (curriculum schedule) impedes the transition towards viewing learning experience as a lifelong process of personal growth. A brief overview of the main challenges that exacerbate the divide between these two traditions (inside and outside school) would help identify the inhibiting factors for connecting academic and everyday learning practices.

Starting with pedagogical challenges, we can refer to the structural constraints imposed by school culture. Adherence to the institutional requirements, like the time constraints of each lesson defined by centralized curricula in some countries, alongside the need for quantitative assessment of educational progress, restricts the flexibility required to bridge academic learning spaces with everyday experience (Erstad & Sefton-Green, 2012; Georgopoulou et al., 2024a; Hsi, 2007; Ito et al., 2013). Furthermore, the integration of technology into the educational process often takes on an instrumental or assimilative form. In the first case, technology is utilized as an end in itself, aiming to imbue teaching with elements of postmodernity (e.g., evaluating the use of a specific device and presenting it as an innovation) while overlooking its impact on skill development through the application of contemporary pedagogical methods (Cochrane et al., 2013). In the second case, technology is assimilated into the existing standardized system, where technological tools and digital media support traditional teaching practices without fundamentally altering the learning process (Erstad & Sefton-Green, 2012; Salomon, 2016). Another barrier to reconciling in-school and out-of-school digital practices is student resistance. The mere incorporation of digital media in the classroom does not ensure automatic acceptance and engagement from young individuals; students may react negatively to blurring the lines between in-school and out-of-school digital activities if they feel that their personal space is being violated (Chromey et al., 2016; Kumpulainen & Mikkola, 2016; Lewin & Charania, 2018; Sharples, 2006).

Continuing with research challenges, it is noted that scholars who approach studies in this field from disciplines unrelated to pedagogical practice, or who focus solely on learning outcomes without considering the range of theoretical traditions that underpin learning, fail to yield transformative change (Hsi, 2007). Transforming the current educational system demands a holistic approach to the learning process (Arnesen et al., 2016; Torres, 2001). Another facet of research challenges is studying the full spectrum of informal learning (Livingstone, 2002), which is boundless and often invisible (Coffield, 2000; Rogers, 2014). Conducting ethnographic studies to examine the learning process in these contexts synchronically and diachronically, as well as in various settings, can illuminate its multifaceted dimensions and provide feedback to improve learning approaches (Erstad & Sefton-Green, 2012). Moreover, it is undeniable that the boundaries between them are blurred (Rogers, 2014; Schugurensky & Myers, 2003). There are literature reviews in this field that indicate the lack of consensus on the definitions of formal and informal learning, making it difficult to create a coherent perspective on pedagogical practices that would support a holistic learning approach in these contexts (Sefton-Green, 2004, 2013). Moreover, the fact that the outcomes of formal learning are directly observable

and can be evaluated increases its social value and broad social acceptance (Rogers, 2014). Yet, understanding all facets of informal learning and recognizing its impact on individuals could advance pedagogies that bridge discontinuities between formal and informal learning (Khaddage et al., 2016).

The literature review shows the necessity of a broader view of the learning process, one that extends the confines of formal learning and encompasses aspects of informal learning. Numerous scholars have advocated bridging diverse learning spaces and practices used in them (Eshach, 2007; Greenhow & Robelia, 2009; Hull & Schultz, 2002; Hung et al., 2012; Lewin & Charania, 2018; Lund, 2016). However, previous research often featured fragmented social systems, lacking integrated approaches to support both digital and pedagogical development. Based on these identified needs, this study presents and evaluates a hybrid framework for a social learning hub that incorporates three core pillars – intentional/conscious learning, technology as a means of learning, and learning theories – to integrate social functions, offering dual benefits: enhancing digital competencies and supporting pedagogical growth.

Central to this integration is the role of digital tools, which not only facilitate seamless learning across diverse contexts but also align with Area 2 (Communication and Collaboration) of the Digital Competence Framework for Citizens (DigComp) (Vuorikari et al., 2022). This area emphasizes competencies such as interacting and collaborating through digital technologies, sharing information, and fostering digital citizenship – critical skills for students who navigate online environments. These competencies resonate with the theoretical foundations of this study: social constructivism, which views learning as a social process (Vygotsky, 1978); connectivism, which underscores networked learning (Siemens, 2005); and communities of practice, which highlight collective knowledge-building (Lave & Wenger, 1991). By integrating these principles, our hybrid learning framework leverages digital platforms, like the social learning hub, to extend classroom interactions into informal contexts, supporting students' development as active participants in a digital society (Greenhow & Robelia, 2009; Kumpulainen & Mikkola, 2016). Unlike earlier approaches that treat technology as an add-on, our framework embeds digital tools within a pedagogically grounded hub. Its originality stems from operationalizing social constructivist, connectivist, and community-of-practice principles into a practical model applicable in classroom settings. By empirically testing the framework with secondary students, the study contributes novel evidence of how digital environments can simultaneously enhance social participation and digital competence in a networked world. This contribution advances the field by offering an empirically tested model that aligns with DigComp's goals and provides a scalable solution for bridging in-school and out-of-school experiences.

A HYBRID FRAMEWORK FOR A SOCIAL LEARNING HUB

The Hybrid Framework for a Social Learning Hub proposed in this study introduces an innovative approach to secondary education by leveraging digital platforms to bridge formal and informal learning contexts. Unlike traditional models that often separate these domains, this framework uses a social learning hub to foster intentional informal learning, promote digital socialization, and develop skills for an active digital citizenship; key competencies in the digital age (Vuorikari et al., 2022). By integrating social constructivism, connectivism, and communities of practice, the framework not only extends classroom interactions into students' daily digital lives but also reimagines the learning process as a dynamic, networked ecosystem (Kumpulainen & Mikkola, 2016; Siemens, 2005). This innovative approach sets the stage for achieving the study's primary objective: creating a learning experience that transcends traditional boundaries.

The primary objective of this study is to bridge learning environments so that learning can be understood as a continuous, natural, and seamless process (Lemke, 2013) that draws from life experiences and serves life's purposes (Erstad & Sefton-Green, 2012; Siemens et al., 2020). This is a holistic view of learning, which acknowledges that these spaces are inherently interconnected in one's life, enhancing their presence, whether physical or virtual, in any given context. Formal and informal learning are

seen as complementary elements that can create a dynamic, engaging, and appealing learning environment that leverages the strengths of each context (Lai et al., 2013). These principles formed the assumptions and theoretical foundation for a hybrid framework for a social learning hub, introduced at the theoretical level in another study (Georgopoulou et al., 2023).

Pillars of the Hybrid Framework for a Social Learning Hub

This pedagogical framework (Figure 1) focuses on three core pillars:

1. *Intentional/Conscious Learning:* The first pillar focuses on the concept of deliberate and active learning, where students take a proactive role in their educational journey. In this approach, learners deliberately choose the activities they engage in and are accountable for their learning progress (Rogers, 2014; Vavoula et al., 2005). These activities span both formal settings within the regular school schedule and informal contexts that link classroom learning to students' everyday digital experiences. This pillar thus positions learning as a dynamic, student-driven process, bridging school-based education with the broader sociocultural and digital landscape.
2. *Technology as a Means of Learning:* The second pillar positions technology as a catalyst in education, leveraging digital platforms as supplementary learning environments, making education more directly relevant to students' daily (online) interactions. Additionally, technology serves as a cognitive tool that reshapes the way knowledge is explored and understood in a scientific field (Fletcher, 2019; Salomon, 2016). Through a social learning hub, such as the one developed for this study, students connect formal school knowledge to expansive digital networks, fostering a networked learning experience that mirrors the principles of connectivism (Siemens, 2005). So, it offers opportunities to co-create knowledge and engage with diverse perspectives (Troussas et al., 2021).
3. *Learning Theories:* Our framework is informed by various learning theories that promote independence, collaboration, and openness. Of particular importance is Vygotsky's social learning theory, which supports the idea that learning is a process of social interaction (Vygotsky, 1978). Additionally, Lave and Wenger's Situated Learning Theory recognizes that learning happens through participation in social communities, where collective knowledge is constructed (Lave & Wenger, 1991). The framework also draws from connectivism, which emphasizes the importance of connecting to broader digital networks beyond the classroom (Siemens, 2005). Therefore, these theories align with the fundamental principles of this research, which focuses on supporting students through participation in online learning environments that promote continuous interaction and self-directed learning.

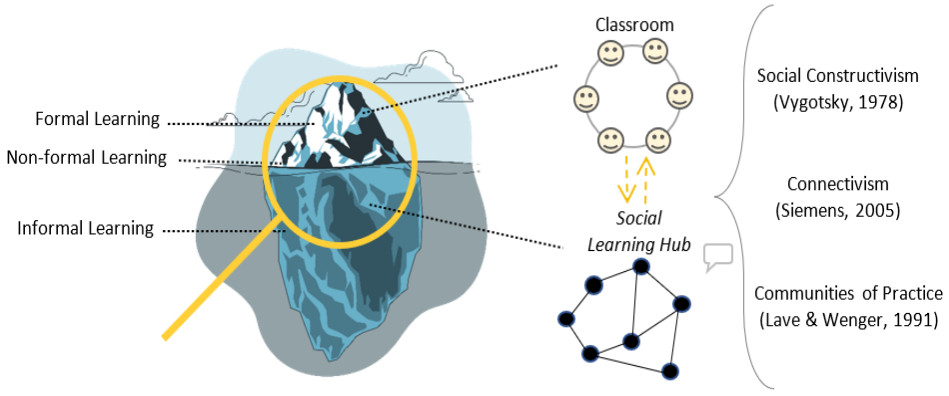

Figure 1. The hybrid framework for a social learning hub

Development of a Social Learning Hub for Intentional Informal Learning

To facilitate intentional informal learning, a social learning hub was developed. This hub served as a space where students could engage in discussions, exchange ideas, and collaborate with both their classmates and the teacher outside of the physical classroom setting.

The social learning hub aimed to serve as a channel for communication and collaboration within the context of intentional/conscious informal learning. Its added pedagogical value lies in its dynamic nature as a Web 2.0 platform, which strengthens the sense of community, encourages peer interaction, boosts participation, and allows for the development of free expression within a secure online environment (O'Rourke, 2005; Schugurensky, 2006). The hub gives students the opportunity to discuss controversial topics, react to each other's posts, share experiences, analyze their reasoning, reflect on diverse perspectives, collaboratively explore a specific area of interest, and develop evaluation criteria for digital content. As such, it provides an ideal setting for shaping an online community and bridging the gap between formal and informal learning practices.

The social learning hub was developed as an online platform to facilitate collaborative and interactive learning, connecting formal and informal contexts. It was designed with a user-friendly interface to ensure easy navigation and accessibility for students. A simplified layout was adopted as the default setting to enhance usability, while a Q&A format was incorporated for specific topics to spark students' interest and encourage active engagement with controversial issues, allowing them to evaluate their peers' contributions through interactive features, such as up/down voting, thus fostering a dynamic and socially connected learning space (see Figures 2 and 3).

Figure 2. Simplified layout

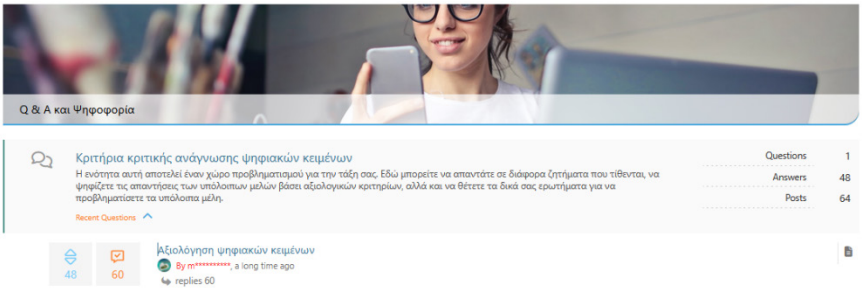

Figure 3. Q&A layout

Additionally, the social learning hub provided an advanced reward system based on points, which increases as participation in it grows. As users accumulate points, they level up and earn new titles and corresponding badges. Users can progress through 10 ranking levels, starting at Level 0 with 0 points and reaching Level 10 with 20 points (see Figure 4).

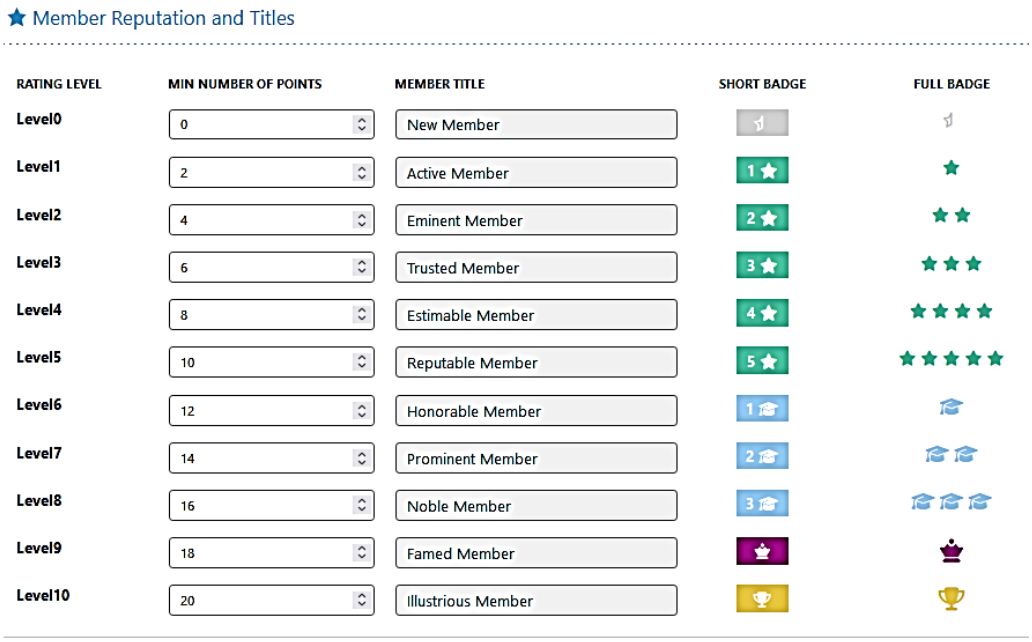

Figure 4. Reward system

Points are collected in various ways. For this project, the following methods for collecting points were defined, in order to simplify the process (see Figure 5):

- ✓ Posting (1 point per post)
- ✓ Receiving positive/negative votes on their posts (0.5 points per like, -0.5 points per dislike)

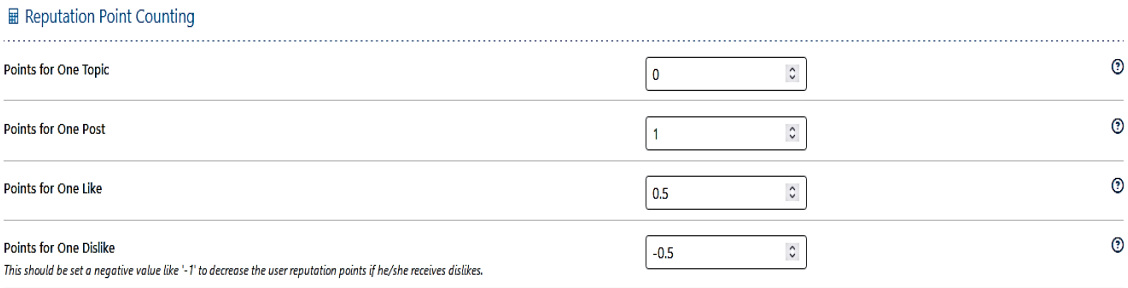

Figure 5. Point counting system

The incorporation of gamification, such as the reward system, added an engaging and interactive dimension to the social learning hub, encouraging users to participate actively and contribute high-quality content (Alsawaier, 2018; Ansar & George, 2023; Buckley & Doyle, 2016). However, the reward system was not intended as an end in itself, so as to avoid relegating participation to mere behavioral practices.

Consequently, this study seeks to assess the applicability and functionality of this pedagogical framework in real classroom settings in secondary education and, through its findings, contribute to the transformation of learning processes and the optimization of learning quality. This, in turn, aims to enable the development of skills necessary for responsible participation in online communities – an objective that simultaneously represents a benefit expected to arise from the research.

Steps for operationalizing a Social Learning Hub for Intentional Informal Learning

To operationalize this hybrid framework in secondary education settings, the following steps provide a structured approach for educators to bridge formal and informal learning using digital platforms. These steps draw from the ADDIE model (Analysis, Design, Development, Implementation, Evaluation), a well-established process for creating effective learning experiences (Branch, 2009) (see Figure 6):

1. *Analysis:* Assess students' needs by analyzing how their everyday social activities (like social media sharing and group chats) differ from their school tasks (such as structured classroom discussions). This step helps pinpoint areas where the framework can merge these aspects, based on the idea of a learning ecology (Barron, 2006), to better address real-world demands for effective online social practices.

2. *Design:* Ground the learning environment in social constructivism, connectivism, and communities of practice. Design an environment with activities that encourage social interaction (e.g., peer discussions), networked learning (e.g., connecting lesson topics to online resources), and community-building (e.g., collaborative projects). Learning interventions planned for the classroom to combine face-to-face discussions with asynchronous hub tasks included structured small-group debates on controversial issues (e.g., ethical use of social media or impact of digital misinformation) to promote dialogic exchange and perspective-taking (social constructivism); guided resource-sharing sessions where students locate, evaluate, and present external digital materials (e.g., articles, videos, or infographics) relevant to lesson themes, fostering networked connections beyond the textbook (connectivism); and collaborative tasks in class, such as co-creating criteria for assessing digital content or preparing joint reflections on real-world applications, to build a sense of shared practice and mutual accountability (communities of practice). This ensures that the framework's theoretical pillars guide implementation, with the social learning hub designed to integrate these elements seamlessly.

3. *Development:* Create a user-friendly social learning hub to facilitate intentional informal learning. Configure the platform to support interaction (e.g., Q&A formats), gamification (e.g., reward systems), and safe communication (e.g., moderated spaces). Develop content and features based on the analysis phase, ensuring alignment with students' preferences for mobile-friendly, interactive tools. As part of this, create learning tasks that tie curriculum-based content to students' everyday online experiences; for instance, initiate a topic discussion in class (formal setting) and then encourage students to keep the chat going on after school hours (informal setting), share resources, reflect on peers' posts, and engage in self-directed exploration, fostering a learning ecosystem.

4. *Implementation:* Introduce the social learning hub to students with clear objectives, emphasizing its role in extending classroom learning into informal contexts. Leverage the hub to promote Area 2 competencies of the DigComp Framework (Vuorikari et al., 2022), such as digital collaboration and citizenship. Assign tasks that require students to co-create knowledge (e.g., group analysis of controversial topics), practice netiquette (e.g., respectful commenting), and build a sense of community (e.g., through peer feedback and "likes"). Continuously monitor student participation using social learning hub analytics (e.g., post frequency, reward system progress) and provide scaffolding to address challenges, such as unfamiliarity with the platform or limited peer engagement. Offer incentives (e.g., badges, teacher feedback) and adjust activities to align with students' digital habits (e.g., mobile-friendly interfaces) to ensure sustained interaction.

5. *Evaluation:* Assess the framework's impact through mixed-methods evaluation, combining quantitative data (e.g., online participation metrics) and qualitative insights (e.g., teacher interviews). Use findings to refine the approach. Additionally, collaborate with stakeholders, including students and educators, to co-design future iterations, ensuring the framework remains responsive to evolving educational needs.

Figure 6. Steps for creating a social learning hub

These steps provide a clear roadmap for educators, making the framework actionable and demonstrating how innovative practices, like the social learning hub, can transform traditional education into a dynamic, socially connected process. By embedding theoretical principles into practical application, the framework fosters digital socialization and lifelong learning, aligning with contemporary educational needs (Greenhow & Robelia, 2009; Kumpulainen & Mikkola, 2016).

RESEARCH METHODOLOGY

PURPOSE AND RESEARCH QUESTIONS

The primary objective of this study is to present the hybrid framework for a social learning hub designed to bridge formal and informal learning contexts and evaluate its applicability and impact in real classroom settings. The research methodology was designed to assess its effectiveness through the following research questions:

1. How did the different organization of the learning space and time affect the learning process?
2. Which factors facilitated or hindered the connection between formal and informal learning?
3. How did students respond to the social learning hub in terms of participation, interest, and emotions?
4. How can we evaluate the applicability and pedagogical effectiveness of the proposed framework?

PARTICIPANTS

The study was carried out in Greek secondary education over six weeks, combining remote interactions through a digital platform with weekly face-to-face classroom sessions devoted to discussion and reflection. A sample of 72 16-year-old students, along with their language teacher, participated. The participants were selected using convenience sampling, a common method in educational research for accessing available groups in natural settings (Etikan et al., 2016). This approach was chosen because the school was readily accessible to the researchers.

The focus on 16-year-old students was justified by their developmental stage in secondary education, where digital socialization and informal learning preferences are particularly relevant, as adolescents in this age group exhibit high engagement with online platforms, while facing challenges in bridging academic and social digital use (Vogels et al., 2022). Younger teenagers were excluded due to potential limitations in maturity for self-directed online interactions and reflective discussions. Older students in the final two high school grades were also excluded, as their focus on university entrance exam preparation was likely to reduce their participation and commitment to the project's demands.

A homogeneous age group was therefore selected, allowing more conclusive insights into the framework's impact, consistent with prior studies on age-specific educational interventions (e.g., Turan et al., 2022). All participants received full information about the study's objectives and procedures and volunteered with the understanding that they could withdraw at any time without penalty. Data was collected anonymously using pseudonyms, stored securely on password-protected devices, and used solely for research purposes.

Data Collection and Analysis

Data were rigorously collected from three sources – students' online activity in the social learning hub, a student questionnaire, and a teacher interview – employing a mixed-methods approach to cross-check multiple perspectives, thus strengthening the study's reliability. Figure 7 schematically illustrates the multi-source approach, showing how quantitative (social learning hub data and questionnaires) and qualitative (teacher interviews) sources were triangulated for validity (Creswell & Plano Clark, 2018).

Social learning hub data

The analysis focused on the frequency and nature of students' online interactions. Data was collected during the six-week implementation. The social learning hub provided students with a digital space to interact, exchange opinions, and collectively build knowledge, while simultaneously strengthening their digital skills. The aim of the analysis was to examine students' engagement in the discussions and to evaluate the degree of utilization of the online environment, along with their response to the informal learning opportunities. Participation and engagement were operationally defined as any student-generated content in the hub outside school hours, primarily measured by: (a) post frequency (number of original posts or replies); (b) engagement indicators (involvement in threaded exchanges, including reacting via positive/negative votes received); and (c) reward system progress (points accumulated: 1 per post, ± 0.5 per vote, though no negative votes occurred). Overall engagement was summarized descriptively by categorizing students into low (0–1 posts or Levels 0–2), intermediate (2–7 posts or Levels 3–4), and high (8+ posts or Levels 5+) activity groups, supplemented by qualitative review of post content for depth. Key indicators examined thus included these metrics along with other factors that capture the dynamics of the social learning hub. So, data was analyzed both qualitatively and quantitatively, using descriptive statistics to summarize patterns, to enable a clear mapping of students' online activity, primarily answering RQ1 and RQ3.

Student questionnaires

After the completion of the learning interventions, students were asked to fill out an anonymous questionnaire, which examined their preferences for discussion settings (physical or remote) and their experiences using the social learning hub. The questionnaire was developed by the authors based on prior literature on student engagement in digital learning (e.g., Hew & Cheung, 2012; Sailer & Homner, 2020). It was modified from existing instruments on online participation preferences and validated through expert review (two educational technology professors) and a pilot test (included 10 similar-aged students not in the main sample). Reliability was assessed using Cronbach's alpha (overall $\alpha = 0.82$, indicating good internal consistency) (Tavakol & Dennick, 2011), while validity was ensured through content alignment with research questions and triangulation with other data sources. The instrument comprised six questions that addressed the following areas: preferred discussion setting (single choice); aspects liked in in-class and online discussions (multiple-select options); reasons for infrequent participation in online discussions (multiple-select); preferred platforms for online learning communities (multiple-select); and device usage frequency for accessing the hub (3-point Likert scale). The data were analyzed quantitatively using the statistical software package SPSS 29.0.2.0, applying mainly descriptive statistical methods to record data related to RQ3.

Teacher interview

Following the completion of the teaching interventions, a semi-structured interview (lasting approximately one hour) was conducted with the teacher, who served as the primary instructor for language subjects for the entire cohort of 72 students. The purpose of the interview was to explore her views on the experience of bridging formal and informal learning environments. The data were analyzed using thematic analysis, following the six-phase framework developed by Braun and Clarke (2006). This process involved transcribing the interview, coding the data, and identifying key themes emerging from the teacher's responses. The analysis sheds light on themes related to the connection between formal and informal learning contexts and the effectiveness of the social learning hub, addressing RQ2, RQ3, and RQ4.

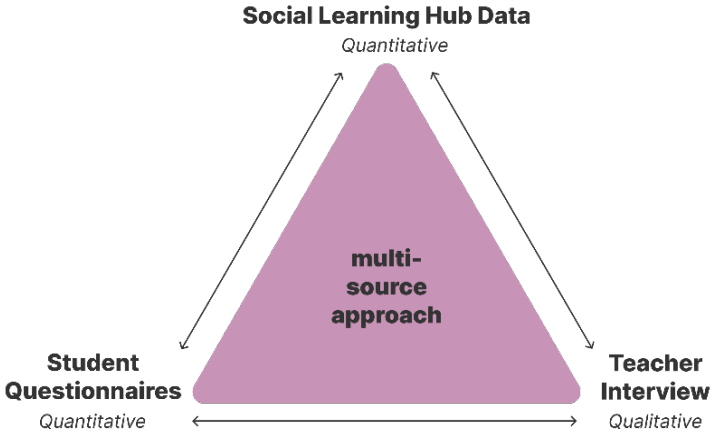

Figure 7. The multi-source approach

RESULTS

SOCIAL LEARNING HUB

Data collected through the social learning hub provides key observations about students' activity patterns. The analysis of these data enables a quantitative assessment of student participation levels and provides insights into their interaction patterns within the online learning platform.

Posts frequency

According to the data in Table 1, nearly all students, except four, participated in posting outside traditional classroom settings. At first glance, this high percentage suggests that students developed a positive stance in getting to know this platform and in further engaging with the course subjects.

Table 1. Participation rates on the social learning hub during non-school hours

		Frequency	Percent	Valid percent	Cumulative percent
Valid	Yes	68	94.4	94.4	94.4
	No	4	5.6	5.6	100.0
	Total	72	100.0	100.0	

Table 2 outlines the frequency of students' postings in the online platform outside regular school hours. The data reveal a variety of engagement levels among students. A small portion of students demonstrated limited online activity, posting 0-1 times. Conversely, an equally small group of students actively participated in discussions, contributing 8-11 posts, thereby fostering a strong sense of

community within the learning environment. More than half of the students (66.7%) were classified as having an intermediate level of participation, posting between 2 and 7 times.

Table 2. Distribution of students' posts in the social learning hub

		Frequency	Percent	Valid percent	Cumulative percent
Valid	0-1	12	16.7	16.7	16.7
	2-3	20	27.8	27.8	44.4
	4-5	16	22.2	22.2	66.7
	6-7	12	16.7	16.7	83.3
	8-9	8	11.1	11.1	94.4
	10 and more	4	5.6	5.6	100.0
	Total	72	100.0	100.0	

Figure 8 illustrates the frequency distribution of students' posts in the social learning hub during non-school hours. The different colors represent the varying number of posts made by students, making it simple to visualize the distribution.

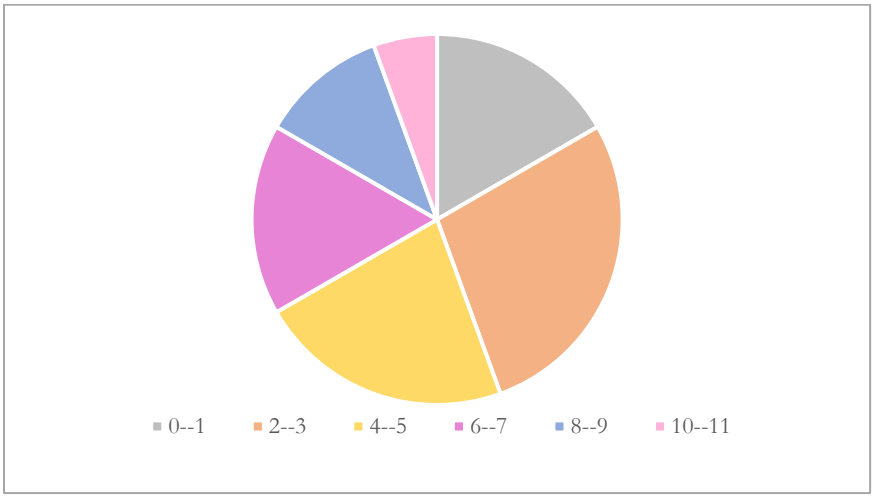

Figure 8. Distribution of students' posts in the social learning hub during non-school hours

Ranking in reward system

As outlined previously, the social learning hub employed a points-based reward system to motivate participation. The ranking system consists of 10 levels, with a minimum of 0 points at Level 0 and a maximum of 20 points at Level 10. Users earn points for posting (1 point per post) and receiving positive votes (0.5 points per like), while negative votes deduct points (-0.5 points per dislike). It is important to acknowledge that no one gave any negative feedback on the content shared by others.

Although the reward system was clearly explained to students at the outset of the intervention (including how points were earned via posting and voting), Table 3 reveals that the majority of students fall within Levels 0, 1, or 2 (low-activity group), indicating limited engagement and interaction with other users' posts. Level 5 represents the highest achievement level, reached by only a small percentage of students (the high-activity group), and showcases high activity and commitment to using this network. These results underscore the significant disparity in students' active involvement in the social learning hub.

Table 3. Student ranking levels in the reward system

		Frequency	Percent	Valid percent	Cumulative percent
Valid	Level 0	12	16.7	16.7	16.7
	Level 1	20	27.8	27.8	44.4
	Level 2	16	22.2	22.2	66.7
	Level 3	12	16.7	16.7	83.3
	Level 4	4	5.6	5.6	88.9
	Level 5	8	11.1	11.1	100.0
	Total	72	100.0	100.0	

Figure 9 more clearly illustrates the distribution of student ranking levels in the social learning hub, highlighting a concentration at low levels.

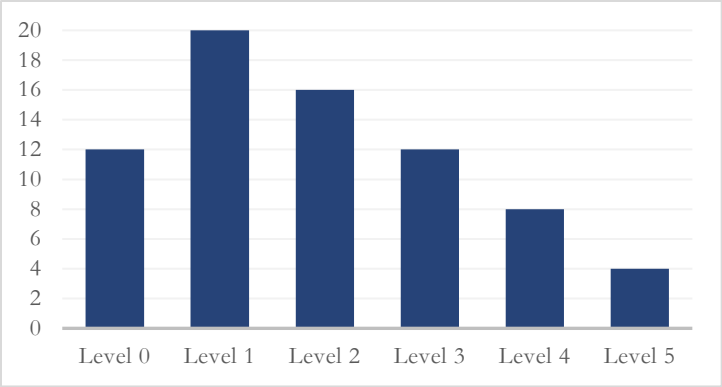

Figure 9. Distribution of ranking levels according to the reward system

Qualitative data of the posts

In addition to the quantitative analysis of the posts, qualitative aspects of participation were also investigated in order to examine the nature of the participation of students in the social learning hub. We meticulously examined the discussion threads, specifically recording the students who were involved in every discussion, those who responded to their peers' posts, and those who engaged by reacting to their classmates' replies.

The length and substance of responses varied depending on the topic at hand. For questions that demanded quick, spontaneous answers or involved visual content, students provided short and surface-level responses (refer to Figures 10 and 11). Conversely, questions that required deeper reflection or analysis prompted students to provide more detailed and elaborate responses (refer to Figures 12 and 13).

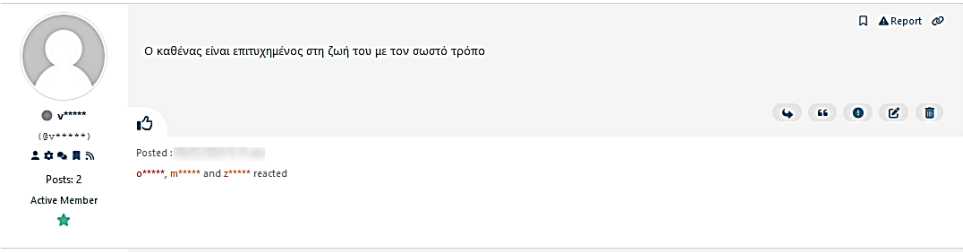

Figure 10. Response of Student 44

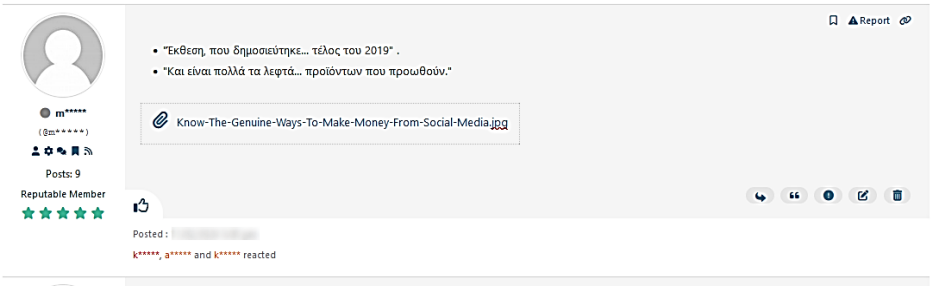

Figure 11. Response of Student 4

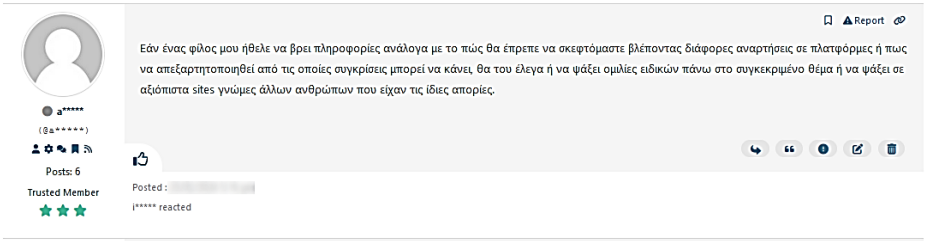

Figure 12. Response of Student 20

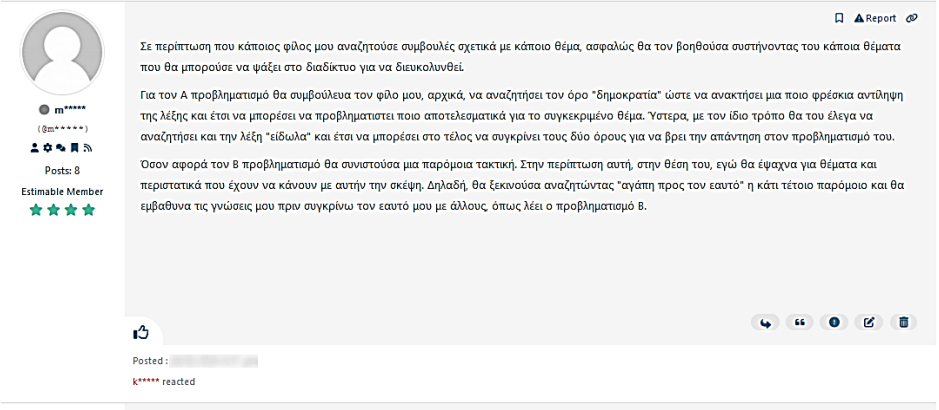

Figure 13. Response of Student 12

STUDENT QUESTIONNAIRE

The data gathered from these questionnaires provides valuable insights into the research questions regarding learning space and time. All students participated, ensuring complete data collection (Table 4).

Table 4. Total number of completed questionnaires

		Cases
N	Valid	72
	Missing	0

Question 1: Which discussion setting do you prefer?

Initially, we evaluated students' preferred settings for engaging in conversations, along with the reasons behind these preferences. The results of the first question, which explored students' preferred

settings for engaging in discussions, revealed a division between those who preferred in-class discussions and those who favored a combination of in-class and online discussions (Table 5). The fact that no one selected online discussion as their exclusive option can be attributed to several factors, such as a lack of familiarity with the platform or a preference for more direct forms of interaction, as will be explored in subsequent questions.

Table 5. Preferred discussion setting

		Frequency	Percent	Valid percent	Cumulative percent
Valid	In class	36	50.0	50.0	50.0
	Outside class	0	00.0	00.0	50.0
	Both	36	50.0	50.0	100.0
	Total	72	100.0	100.0	

Figure 14 shows that students equally prefer in-class discussions and a combination of in-class and outside-class discussions, while discussions exclusively outside of class are not preferred at all.

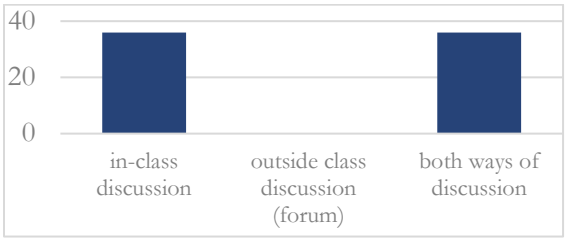

Figure 14. Preferred discussion setting

Question 2: What aspects of the in-class discussion do you like?

The second question aimed to identify the reasons why students prefer in-class discussion. Respondents could choose more than one option or provide their own response under the "Other" option. The results, displayed in Table 6, indicate that the majority of students value direct interaction with their teacher and peers. Close behind are preferences for the enjoyable atmosphere during class discussions, as well as the time saved by discussing the topic in class rather than at home. Additionally, some students expressed a preference for verbalizing their thoughts rather than writing them down.

Table 6. Distribution of reasons for preferred in-class discussion

		Responses		Percent of cases
		N	Percent	
What aspects of the in-class discussion do you like?[a]	Direct communication with the teacher and classmates	40	32.3%	55.6%
	Decreased out-of-class workload	32	25.8%	44.4%
	Preference for oral expression over written communication	20	16.1%	27.8%
	Enjoyable class atmosphere	32	25.8%	44.4%
	Other	0	00.0%	00.0%
	Total	124	100.0%	172.2%

a. Dichotomy group tabulated at value 1.

Table 7 reveals an interesting correlation between students' preference for in-class and mixed-mode discussions (Question 1) and their reasons for choosing in-class discussions as the only or one of the

preferred ways of discussion (Question 2). Students who prefer only in-class discussion place particular emphasis on direct communication with the teacher and their classmates, underlining the importance of social interaction and immediate feedback. On the other hand, those who express a preference for both ways of discussion seem to prioritize time-saving, choosing in-class discussions to avoid additional study outside school hours.

Table 7. Shared values for in-class discussion between both groups of students

			Preferred ways of discussion		Total
			In-class discussion	Combined discussion formats	
What aspects of the in-class discussion do you like?[a]	Direct communication with the teacher and classmates	Count	32	8	40
	Decreased out-of-class workload	Count	12	20	32
	Preference for oral expression over written communication	Count	8	12	20
	Enjoyable class atmosphere	Count	16	16	32
	Total cases	Count	36	36	72

Percentages and totals are based on respondents.
a. Dichotomy group tabulated at value 1.

Figure 15 provides a clearer visualization of the distribution of elements that students value most in classroom discussions. It presents the preferences of students who prefer in-person interactions versus those who appreciate a combination of formal and informal contexts.

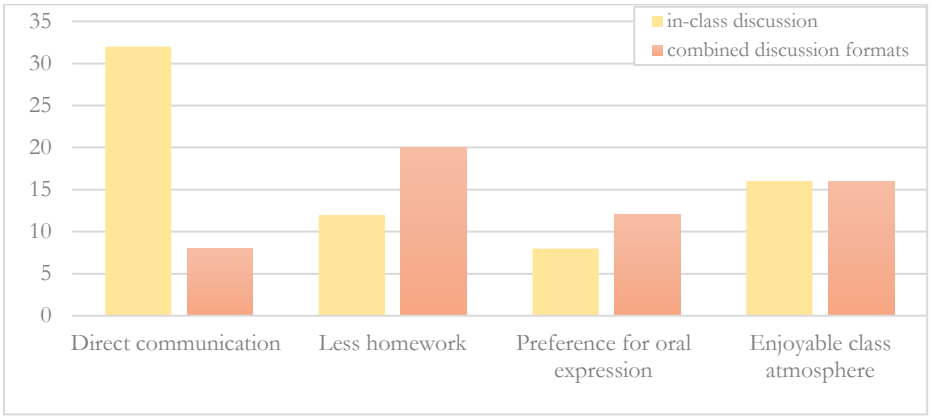

Figure 15. Distribution of reasons for preferred discussion ways

Question 3: What aspects of the discussion that takes place in a digital environment outside the classroom do you like?

The third question sought to explore what aspects students value in discussions held in a digital environment outside the traditional classroom setting. Respondents could select more than one answer and also provide their own answer if it was not listed. This question was answered by 36 out of 72 students, that is, those who had indicated a preference for both ways of discussion in Question 1. The results, detailed in Table 8, indicate that the majority of these students highly value the time they

have to reflect before responding. Following closely are preferences for written communication over oral exchanges and the comfort of freely expressing their opinions. Interestingly, only a small percentage of students cited increased ranking/badges in the social learning hub as a valued aspect in the reward system, indicating that gamification elements did not emerge as a significant extrinsic motivator for increased participation in this cohort.

Table 8. Distribution of reasons for preferred online discussion

		Responses		Percent of cases
		N	Percent	
What aspects of the discussion that takes place in a digital environment outside the classroom do you like?[a]	Having time to carefully consider my responses	32	42.1%	44.4%
	Feeling more comfortable expressing my opinions	16	21.1%	22.2%
	Earn points or recognition for active participation	8	10.5%	11.1%
	Preference to express my thoughts in writing rather than verbally	20	26.3%	27.8%
	Other	0	00.0%	00.0%
	Total	76	100.0%	105.6%

a. Dichotomy group tabulated at value 1.

The distribution of reasons for preferring discussion in an informal online environment becomes more visible in Figure 16.

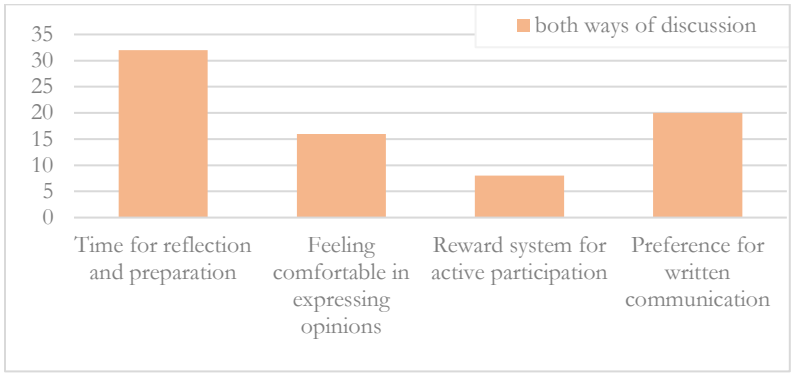

Figure 16. Distribution of reasons for preferred online discussion

Question 4: Why didn't you participate in the online discussions more often?

The fourth question on reasons for infrequent participation in the online discussions yielded interesting results. The survey allowed for multiple responses and students could also provide their own responses. One participant made this choice, whose answer has been added at the end of the list. Table 9 illustrates that the main reason why students did not participate in online discussions so often was the limited time available due to extracurricular activities. This suggests that students' workload significantly impacts their engagement with online educational platforms. In addition, the lack of involvement from peers seems to discourage some students from actively participating in online discussions. Other reasons cited relate to a lack of understanding of the platform's structure and functionality.

Table 9. Reasons for low online participation

		Responses		Percent of cases
		N	Percent	
Reasons for low online participation[a]	Time constraints (heavy workload, extracurriculars)	44	39.3%	61.1%
	Didn't see it as important element of the course	0	0.0%	0.0%
	Belief that participation in the social learning hub was not evaluated	4	3.6%	5.6%
	Confused about the structure of the online platform	12	10.7%	16.7%
	Difficulty in understanding how to use the social learning hub	16	14.3%	22.2%
	Didn't understand the benefit of using such a platform	0	0.0%	0.0%
	Preference to limit involvement in the course to school hours only	0	0.0%	0.0%
	Reluctance to participate when few classmates were actively engaged	32	28.6%	44.4%
	Simply forgot	4	3.6%	5.6%
	Total	112	100.0%	155.6%

a. Dichotomy group tabulated at value 1.

Table 10 presents a correlation between students' preferred ways of discussion (Question 1) and the reasons for low online participation (Question 4).

Table 10. Reasons for low online participation for both groups of students

			Preferred ways of discussion		Total
			In-class discussion	Combined discussion formats	
Reasons for low online participation[a]	Time constraints (heavy workload, extracurriculars)	Count	20	24	44
	Belief that participation in the social learning hub was not evaluated	Count	0	4	4
	Confused about the structure of the online platform	Count	8	4	12
	Difficulty in understanding how to use the social learning hub	Count	12	4	16
	Reluctance to participate when few classmates were actively engaged	Count	12	20	32
	Simply forgot	Count	4	0	4
	Total cases	Count	36	36	72

Percentages and totals are based on respondents.
a. Dichotomy group tabulated at value 1.

Regardless of students' discussion preferences, limited available time emerges as the main reason hindering active participation; 44 out of 72 students in both groups chose this answer as the main reason for their low participation in out-of-school interaction. Additionally, the lack of participation from

classmates seems to be a significant inhibiting factor, with 32 out of 72 students in both groups citing this as the reason for their lack of active involvement in the social learning hub.

Figure 17 depicts the main reasons that prevented students from both groups from actively participating in the social learning hub.

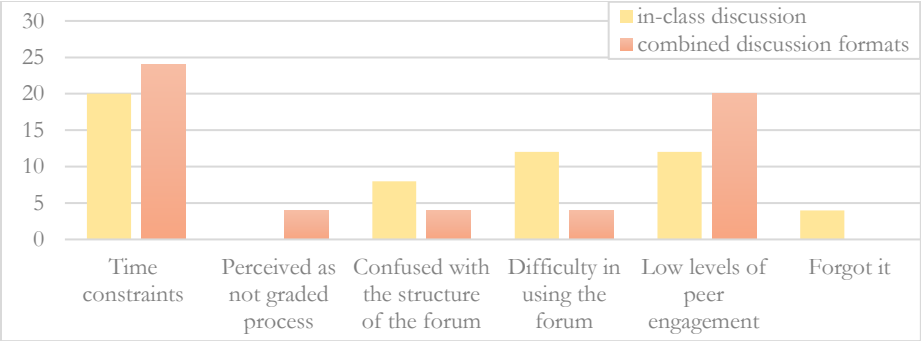

Figure 17. Distribution of reasons for limited participation for both groups of students

Question 5: Which are your preferred platforms for online interaction?

The fifth question was also a multiple-choice. This question aimed to determine students' preferred platforms for online interactions within a learning community. The results, as shown in Table 11, indicated a strong inclination towards platforms that students are already familiar with. Interestingly, Instagram was the top choice, while eClass, a widely used platform for educational purposes, also received considerable support. Other platforms, such as WhatsApp/Viber and TikTok, although popular in students' daily lives, were not widely chosen as suitable platforms for educational purposes. These findings underline the importance of choosing or creating a platform that is both user-friendly and attractive to students, in order to encourage their active participation in online learning communities. Of course, we consider it important that this platform draws on the real online activity of users, so that it is not just a platform to be used for "school" purposes.

Table 11. Preferred platforms for online interaction in a learning community

		Responses		Percent of cases
		N	Percent	
Preferred platforms for creating a learning community[a]	eClass	24	18.2%	33.3%
	Twitter	4	3.0%	5.6%
	Facebook	0	0.0%	0.0%
	WhatsApp / Viber	16	12.1%	22.2%
	Snapchat	8	6.1%	11.1%
	TikTok	16	12.1%	22.2%
	Instagram	64	48.5%	88.9%
	Total	132	100.0%	183.3%

a. Dichotomy group tabulated at value 1.

The visualization in Figure 18 provides a clearer insight into the distribution of preferences for online interaction in a community of learning.

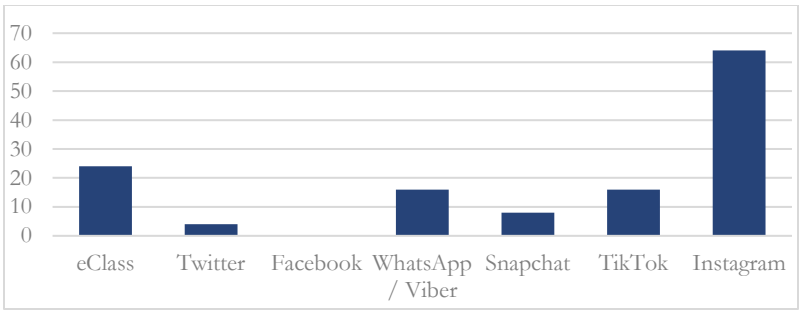

Figure 18. Distribution of preferences for other means of online interaction

Question 6: How frequently did you use the following devices to access online discussions?

The sixth question asked respondents to report how frequently they used various devices to access the social learning hub, using a three-point Likert scale. The results clearly show that students strongly prefer access through mobile phones, with 64 out of 72 students choosing it as their most frequently used device. In contrast, tablets and computers/laptops were used less often, mainly for occasional access (see Table 12). In fact, this trend is further reinforced by the fact that in the previous question, most students expressed their preference for a popular social media application, i.e. Instagram, that is primarily designed for mobile devices.

Table 12. Device usage frequency to access online discussions

		Count	Table N%
Mobile phone	frequently	64	88.8%
	sometimes	4	5.6%
	not at all	4	5.6%
Tablet	frequently	0	0.0%
	sometimes	40	55.6%
	not at all	32	44.4%
Computer/laptop	frequently	4	5.6%
	sometimes	32	44.4%
	not at all	36	50.0%

The data in Figure 19 reveals that the mobile phone was the most frequently utilized device for social learning hub access among students. The flexibility and ubiquitousness of mobile phones make them the perfect tool for engaging in lessons and discussions beyond regular school hours.

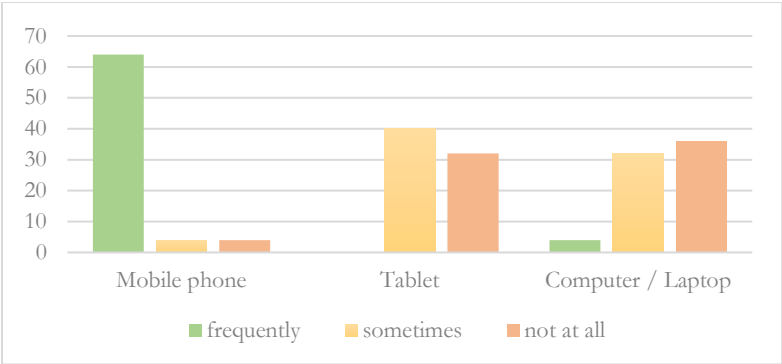

Figure 19. Device usage frequency for social learning hub access

TEACHER INTERVIEW

The interview sought to investigate the teacher's perspectives on the relationship between formal and informal learning, as well as the factors that facilitated or inhibited the connection between these two learning environments. Thematic analysis yielded key themes that offered valuable insights for addressing the study's research questions.

Impact of informal learning on the learning process

A different approach to language courses

The teacher emphasized the importance of deconstructing the formal structure of education, where the teacher held exclusive control of the classroom. The shift towards a more open, participatory learning environment was facilitated through the integration of the social learning hub into the educational process, which served as a bridge between the classroom and students' daily life. The hub provided a platform for students to collaborate, discuss, and learn together beyond the limits of the physical classroom.

This approach redefined the learning experience by making it more dynamic and inclusive. The teacher pointed out the value of this transformation, noting that the social learning hub allowed for more active student involvement and encouraged learning that was not confined to conventional academic settings. The teacher noted that:

> *"Through this experience, language class becomes a vehicle for digital socialization. Instead of being limited to a strictly academic or traditional way of approaching learning, students had the opportunity to interact outside the classroom in an interactive digital environment, which positively influenced the learning process."*

This shift also facilitated the development of students' digital literacy, as they navigated the online platform, and enhanced their social skills in a new context. By engaging with their peers in digital spaces, students were able to construct knowledge collaboratively, fostering critical thinking, creativity, and an awareness of the evolving digital world. As students interacted with each other in an informal, digital space, they also expanded their ability to think independently and engage with others' perspectives.

Interaction in a different digital environment

One of the primary advantages of combining formal and informal learning environments, as recognized by the teacher, was the introduction of students to a digital platform that was entirely new to them. The teacher reflected on this exposure, stating:

> "*They were introduced to a different platform that they had never used before. It provided them with a new arena in which to learn and grow.*"

This aspect was also emphasized in the school's internal evaluation report, where the teacher pointed out:

> "*Engaging in a social learning hub that differs from the typical social networking sites is a valuable practice that can enhance the learning experience.*"

This new environment not only offered a fresh dimension of engagement but also challenged students to adapt to a mode of interaction that was different from other forms of interaction that they might engage in on other social media networks. Despite their frequent use of social media, students were not used to engaging with educators and peers in a similar manner. The teacher reported:

> "*Although they are constantly exposed to social media, they are not accustomed to sharing their thoughts openly. I have noticed that the freedom of expression in the digital world does not necessarily translate to free thinking.*"

This observation suggests a gap in students' ability to engage thoughtfully and critically online. The social learning hub provided a structured yet informal space that allowed students to break away from this barrier, encouraging more meaningful and purposeful exchanges. Fostering an environment

that encouraged deeper reflection and open dialogue helped bridge the two types of learning environments, creating a more holistic and engaging educational experience.

Factors that facilitated or inhibited the connection between formal and informal learning

Factors that facilitated the connection between formal and informal learning

A key factor facilitating the connection between formal and informal learning was the use of the social learning hub itself. The social learning hub served as a dynamic network that "*fostered informal learning opportunities*", extending learning beyond the traditional classroom environment. By engaging with the hub, students were able to interact with each other and their instructor in a digital setting, expanding the learning experience beyond the confines of the classroom and timetable. As a result, the social learning hub served as a means of:

> "*… connecting the structured learning context of the classroom (formal learning) with an unstructured context of digital interaction (informal learning).*"

Furthermore, the detailed presentation of the online environment in the classroom proved to be crucial. By clearly outlining its objectives and functionalities in the classroom, the teacher helped students understand how the platform could serve as an interactive tool for learning and collaboration beyond the conventional educational space. Despite initial challenges in navigating the platform, this explanation was essential in clarifying the role of the social learning hub and helping students see its significance as a bridge between formal instruction and informal peer-to-peer interaction. Over time, as students became more familiar with it, they began to appreciate its value as a space for exchanging ideas and engaging in more self-directed learning. The teacher observed:

> "*Although adapting to the new platform required time and familiarization, students gradually realized its value as a means of exchanging ideas.*"

The social learning hub environment also offered a secure and structured space for students to communicate and collaborate using personal codes. This setup provided a safe space for students to freely express themselves. This balance between freedom and security was crucial in creating an atmosphere where students felt comfortable sharing their thoughts and participating in discussions. As a result, the social learning hub helped in "*creating the right conditions for students to trust this environment*".

Factors that inhibited the connection between formal and informal learning

An inhibiting factor for the connection of formal and informal learning appeared to be that informal learning has not been integrated into students' daily practices. This challenge stems from the traditional education model, which has long prioritized face-to-face, classroom-based teaching. The teacher expressed the difficulty of bridging the two learning environments by noting:

> "*It doesn't work because we don't have familiar students for it nor familiar teachers, to be fair.*"

Indeed, the resistance to combining the two learning contexts seems deeply embedded in the culture of the educational system. In Greece, for example, "*the prevailing educational practices do not support informal learning*", which makes it challenging for both teachers and students to embrace new pedagogical approaches. As a result, participants in the educational process –both teachers and students– are reluctant to move beyond their comfort zone and try new ways of learning.

To address this challenge, the teacher suggested that informal learning should be introduced at earlier educational stages to familiarize students with this approach before they reach high school. By building these learning habits from a younger age, students would be better equipped to adapt to informal learning environments. As the teacher put it:

> "*The truth is that this needs to be built from a young age, because, if someone shows them something different to high school, it is difficult for them to change. That is why some behaviors from much earlier should become everyday life, be expected.*"

However, since informal learning still holds a secondary role in the education system and is not integrated into daily practice as a core part of the learning process, its implementation remains largely dependent on the passion and initiatives of individual educators and the school community.

> "*Connecting formal and informal learning successfully requires a holistic approach that includes changing teaching practices, providing appropriate support to teachers and creating a learning environment that encourages active student participation.*"

Another challenge is that, while digital platforms offer new possibilities for interaction and self-expression, students' lack of familiarity with those environments initially created significant barriers. The teacher observed that students were often hesitant about using something they didn't fully understand, but "*If they fully understand how it works, then accepting the tool will be easier.*"

This hesitation also extended to the timeframe of implementing this approach. The teacher emphasized that longer exposure and consistent use would have led to more dynamic participation. She explained:

> "*If this practice was implemented consistently from the beginning of the school year, the response would clearly be different. Clearly, if we had implemented such a practice over a period of 5-6 months, from a certain point on, their familiarity would allow them to participate much more dynamically.*"

The systematic and continuous implementation of such practices over time is considered critical for their effectiveness. Consistency in practice is vital to help students become comfortable with new learning tools and methods, gradually shifting their behavior toward more participatory forms of learning.

Finally, the lack of a collaborative culture posed a significant obstacle in connecting the two learning contexts. In the school's internal evaluation report, the teacher noted:

> "*Teamwork "stumbled" in the ability to distinguish roles and utilize each person's contribution to the overall result, so it needs to be strengthened as an educational practice.*"

Developing a collaborative spirit both inside and outside the classroom is crucial for connecting formal and informal learning. Without fostering a strong sense of teamwork and mutual responsibility, students may struggle to fully engage with both forms of learning. To truly integrate these learning modes, both students and teachers must actively participate in the learning process. The teacher emphasized the importance of viewing themselves as co-investigators in the learning journey, stating:

> "*Something that could definitely facilitate informal learning would be the common acceptance that we are partners in an exploration in the lesson process, both teachers and students. We search together, we have a common goal and we enter the search to reach our goal. This has not yet become realized.*"

Recognizing the co-creation of knowledge can help students understand the learning process as a dynamic collaborative process – one that evolves through inquiry and interaction, rather than a static transfer of information. When students see themselves as active participants in the learning process, they are more likely to take responsibility for their learning. This shift not only promotes greater participation but also fosters a culture of autonomous, lifelong learning.

Student engagement

Interest and participation

The level of interest and enthusiasm among students plays a crucial role in the success of any educational intervention. In this case, students demonstrated a genuine appreciation for the different approach to learning, especially when it connected classroom activities to real-world contexts. As the teacher pointed out,

> "*It appeared that they liked the different perspective of what they can see in a digital environment.*"

Moreover, the teacher emphasized that sustained student participation was a strong indicator of their interest. The consistent engagement demonstrated by students throughout the intervention suggests a positive reception to the new learning approach. She observed,

> "*To a certain extent, I want to believe that today's children are more pragmatic. If they do not see the value in something, they are more likely to lose interest quickly and give up easily.*"

This insight emphasizes the importance of making learning experiences feel directly relevant and valuable to students. When students perceive a clear connection between their learning activities and real-world applications, they are more likely to remain engaged and committed.

Adaptation to the learning space and time

While students generally expressed positive sentiments towards the new approach, challenges arose in students' ability to fully adapt to the informal learning environment. Specifically, student participation in the social learning hub did not reach the desired levels. Difficulties in interacting effectively within digital spaces and taking on diverse roles within group work were observed. This adaptation to a new learning paradigm is recorded as a challenge "*in the culture of the process*". As the teacher noted,

> "*Students have difficulty adapting to a different learning environment, but also to another form of coexistence and interaction of the group.*"

This brings about a key challenge. While students are generally familiar with digital spaces, the shift to using these spaces for academic purposes – especially in a collaborative setting – was not automatic. The transition from traditional, structured classroom settings to more flexible and interactive forms of learning was not seamless.

The internal evaluation report echoed these findings, emphasizing the need for time and targeted support for both teachers and students to fully embrace these new learning modalities, acknowledging that such a shift requires a gradual process. The process of integrating more modern, digital-based learning practices requires patience, as students and teachers alike need time to become accustomed to the new roles and interactions that come with these changes.

DISCUSSION

ANSWERS TO THE RESEARCH QUESTIONS

This study evaluated the applicability and effectiveness of a Hybrid Framework for a Social Learning Hub, designed to bridge formal and informal learning, by empirically testing its integration in secondary education through a triangulation approach. Employing a mixed-methods approach that included quantitative analysis of data from the social learning hub and student questionnaires, alongside qualitative analysis of teachers' interviews, yielded significant conclusions regarding the dynamics of the learning process, student engagement, and the factors that facilitate or hinder the connection between the two learning contexts. In the following sections, we present the conclusions drawn from the research data, organized by research question.

How did the different organization of the learning space and time affect the learning process? (RQ1)

The incorporation of additional learning experiences seemed to influence the learning process, offering flexibility beyond the traditional classroom boundaries. Findings show that introducing the social learning hub as an informal learning environment enabled learning to expand beyond the school timetable and the physical classroom setting. Based on data, 68 out of 72 students contributed entries outside school hours, with 66.6% posting 2-7 times, while a smaller group demonstrated higher activity with 8-11 posts, indicating that the digital platform provoked their engagement in informal environments. This is consistent with the learning ecology perspective (Barron, 2006), which argues that

learning is enriched when intertwined with diverse environments, though the variation in participation levels implies that this transition comes with challenges of adaptation. This finding also aligns with McGuinness and Fulton (2019), who found that blended learning initiatives enhance engagement but require reflective scaffolding to transform participation into deep learning. Similarly, Coelhoso and Kalogeras (2024) emphasized that the meaningful use of web-based and mobile learning tools depends on pedagogical clarity and perceived applicability, stressing the need for structured yet flexible digital spaces such as the present social learning hub. Besides, structured, guided activities are essential for learners to move from participation to critical engagement (Nasir et al., 2024). It seems, then, that adolescent learners may require more explicit scaffolding to convert spatial/temporal expansion into transformative critical engagement rather than mere extension of classroom patterns.

The teacher's observations support the growing body of research on the benefits of digital learning environments. In her interview, the teacher emphasized that the social learning hub represented an effort to deconstruct the traditional structure of the learning process, transforming language instruction into a "vehicle for digital socialization". She further noted that exposure to a new platform, distinct from renowned social media platforms, provided students with a new field for developing their digital skills through interaction with diverse perspectives. Participating in this digital community challenged students to rethink communication practices, find their own voice in a school-connected setting, bridge the gap between school learning and real-world applications, and take ownership of their educational journey. This echoes the conclusions of Giannetto et al. (2013), who demonstrated that digital spaces enhanced by social and gamification elements can stimulate engagement and identity-building within learning communities, reinforcing the socialization goals discussed here.

Which factors facilitated or hindered the connection between formal and informal learning? (RQ2)

The social learning hub served as a dynamic network that enabled the connection between formal and informal learning to encourage interaction among students beyond typical school settings. The clear description of its goals and functions from the outset helped students understand how the platform could serve as an interactive learning tool beyond conventional education. Thus, the social learning hub acted as a "bridge" linking the structured learning of the classroom with informal digital interaction, fostering active engagement within this micro-community (Khaddage et al., 2016; Lewin & Charania, 2018; Sefton-Green et al., 2016). Through this social learning hub, students had opportunities to communicate their thoughts and exchange "likes" in a safe environment, reinforcing a sense of community. This supports the argument of Lai et al. (2013) that digital tools can bridge learning contexts when designed with a clear pedagogical purpose.

On the other hand, several factors limited the framework's full utilization. Key inhibitors included the prevalence of traditional educational practices within students' entrenched learning culture, students' unfamiliarity with informal learning, and the absence of a collaborative culture for educational purposes (Georgopoulou, 2024). Despite their daily presence on social media, students are not used to interacting with their teachers and peers in that way. The teacher's observation that informal learning is not embedded in students' daily practices echoes existing literature that transitioning to hybrid learning models requires a holistic approach to the learning process (Arnesen et al., 2016; Greenhow & Robelia, 2009; Kumpulainen & Mikkola, 2016; Pimmer et al., 2016). Additionally, time constraints stemming from extracurricular activities, as evidenced by questionnaire data, posed another barrier to the broad acceptance and full exploitation of both learning contexts. Other reasons included a lack of familiarity with the platform's design and operation, as well as challenges in integrating participation in the social learning hub into their daily routines (Pechenkina & Aeschliman, 2017). Such adaptation barriers parallel those noted by Maesschalck (2024), who found that fostering critical thinking in digital learning contexts requires iteration and scaffolding –conditions that need to advance over time for hybrid learning to reach its full potential.

Furthermore, the data clearly show that student interaction primarily consists of responding to teachers' queries and exchanging "likes" on their peers' responses, rather than engaging in robust and

open discussions or fostering dialogic and creative exchanges. So, an intriguing revelation is that students tend to adhere to the traditional "question-answer" structure, as evident in the analysis of discussion threads, mirroring what they experience in traditional classrooms and, thus, impeding the transition to a more open and active learning culture underpinning the connection of informal with formal learning environments (Barron, 2006; Hardof-Jaffe & Amzalag, 2024; Rogers, 2014). This persistence of traditional interaction patterns, despite the hub's affordances for open dialogue, underscores a key tension in hybrid models: adolescents' entrenched school habits can override connectivist principles, unless explicitly challenged through iterative practice and role modeling. This is in line with the teacher's remarks that adaptation to new learning environments and practices requires time for gradual adjustment, a shift in learning habits, and strengthening of students' self-regulation –findings corroborated by the literature (Erstad & Sefton-Green, 2012; Hardof-Jaffe & Amzalag, 2024)– as well as teacher training in leveraging Technological Pedagogical Content Knowledge (TPACK) (Mishra, 2019; Mishra & Koehler, 2006).

How did students respond to the social learning hub in terms of participation, interest, and emotions? (RQ3)

There is a noticeable disparity in student engagement levels within the social learning hub. A small group of students demonstrated strong commitment to the platform, consistently posting and engaging with their peers. These students achieved higher points in the reward system, indicating a systematic, deliberate, and active involvement in the discussions. On the contrary, a significant number of students made only a few posts, while others did not participate at all. Overall, the extent of participation in online discussions is influenced by various factors, including personal motivation, social interactions, and the perceived value of collaborative learning, which is fully consistent with the literature (Alzahrani, 2017; Georgopoulou, 2024; Ozaydın Ozkara & Cakir, 2018; Xie et al., 2011). Moreover, the majority remained at low levels in the hub's reward system (Levels 0-2), with only a few reaching Level 5. This suggests that the gamification system was not a strong motivator, contrary to the expectations of the literature (Ansar & George, 2023; Buckley & Doyle, 2016; Giannetto et al., 2013), indicating that meaningful learning requires active and experiential participation rather than reliance on extrinsic incentives (Mitchell et al., 2017). Meanwhile, qualitative analysis of the posts revealed that students' interest depended on the nature of the content, with a preference for discussions that required shorter, surface-level responses.

The questionnaires reinforced this picture, revealing a positive attitude toward asynchronous nature and flexibility of online discussions, driven by factors like time for reflection and ease of expression, as noticed in other studies (Soffer et al., 2019; Turan et al., 2022). Yet, low engagement in the social learning hub indicates distinct participation patterns among students, which can be attributed to various factors (Hew & Cheung, 2012; Keskin, 2019), as identified in responses to Question 4 of the questionnaire. Factors such as limited time due to extracurricular activities and low levels of engagement from their classmates diminished motivation for interaction and did not draw attention to the importance of establishing learning networks that reinforce intrinsic motivation (Sailer & Homner, 2020; Siemens, 2005; Xie et al., 2011). Meanwhile, students' preference for in-class discussions remained strong, with 50% exclusively opting for this format, which means that students place high value on the social aspects of learning and the convenience of direct interaction with their teacher and peers, as other researchers confirm (Siemens, 2005; Vygotsky, 1978; Whiteside et al., 2023), so the digital participation did not fully meet the need for social connection. These findings suggest that students evaluate the advantages of each way of discussion differently and choose the one that best suits their personal needs and preferences (Paechter & Maier, 2010; Tapola & Niemivirta, 2008; Whiteside et al., 2023).

The teacher's interview further complemented this picture, adding an emotional layer to the data. She noted that students "liked the different perspective of what they can see in a digital environment," with their interest particularly evident when the online content connected to their daily practices. However, she addressed adaptation difficulties, noting that they struggle to coexist and interact in a

digital environment different from those they are accustomed to, ultimately limiting their ability to engage in meaningful, open dialogue within a learning community. These findings underscore the importance of building a networked community that leverages online environments to expand the learning process (Siemens, 2005; Siemens et al., 2020).

How can we evaluate the applicability and pedagogical effectiveness of the proposed framework? (RQ4)

Regarding the applicability of the hybrid framework for a social learning hub, the data collected suggest that the framework is indeed feasible, particularly when accompanied by clear guidance and support. The enhancement of digital expression and socialization underlines its pedagogical value, in line with social learning theories (Vygotsky, 1978) and Area 2 of the DigComp Framework (Vuorikari et al., 2022). Area 2 focuses on competencies such as interacting and collaborating through digital technologies, sharing information, and developing digital citizenship – skills directly evidenced in students' overall participation. For instance, students posted, responded to peers, and exchanged "likes." This also connects to connectivism (Siemens, 2005), as the social learning hub linked formal school knowledge to informal digital networks, and to communities of practice (Lave & Wenger, 1991), fostering a micro-community of learners. Thus, the hub encouraged responsible online practices and netiquette, directly supporting DigComp's goals for active and responsible participation in digital society (Vuorikari et al., 2022).

However, the difficulty students experienced in adapting to a non-traditional learning space that promotes open dialogue indicates a need to reassess the motivating forces that drive student interest and ensure consistent use of such tools throughout the school year. The teacher's recommendations to connect formal and informal learning spaces from younger ages reinforce the importance of gradually instilling new learning habits for a meaningful digital transformation (Rogers, 2014). Furthermore, familiarity with a platform often leads to more frequent use and greater effectiveness in learning activities, strengthening connections with their daily digital practices and, consequently, facilitating the learning process (Pechenkina & Aeschliman, 2017). In this study, students' preference for well-known forms of interaction across popular social media channels, such as Instagram, suggests that they associate successful social interaction with the platform's visual-centric features for meaning-sharing (Bataeva, 2024). Moreover, the fact that most students expressed their preference for an opinion-sharing platform similar to Instagram, primarily designed for mobile devices, suggests that students are looking for a user experience that is intimate, interactive, and aligns with their mobile usage habits that provide flexibility and ubiquitousness (Khaddage et al., 2016; Schaffhauser, 2018).

In terms of pedagogical effectiveness, it is important to acknowledge that a short timeframe may not provide a comprehensive understanding, as initial adaptation phases often mask longer-term competency gains. Longitudinal follow-up could reveal progressive deepening of self-regulation and dialogic capacity, suggesting the current findings represent a promising baseline rather than a ceiling. Repetition of procedures, familiarization with new parameters, and transformation of daily practices are necessary for reaching a comprehensive evaluation. Nevertheless, at a first level, as the teacher noted, the social learning hub transformed the language course into a "vehicle for digital socialization." This approach proved particularly valuable for enhancing critical thinking and creativity, as students learned to interact effectively with others, express their views clearly within a digital community, and gain a deeper understanding of the world around them through diverse stimuli (Georgopoulou, Troussas, Triperina, & Sgouropoulou, 2024). As Maesschalck (2024) stresses, critical and creative thinking in technology-rich education is not automatic but requires intentional instructional design; thus, the framework's emphasis on reflection and social interaction directly addresses this pedagogical demand. Consequently, within the context of the language course, students discovered their presence in a digital environment and honed their communication skills for effective meaning transmission (Turan et al., 2022). Indeed, even though the assimilation of information varied among students, this experience underlines the value of this new learning approach in building robust identities for digital citizenship, while offering opportunities for future reflection and further exploration.

General Conclusions of the Findings in Relation to Previous Studies

Comparing this study's findings with prior research reveals both convergences and divergences, highlighting how our hybrid framework for a social learning hub advances the field of digital education. For instance, while broader hybrid learning frameworks often prioritize content delivery (e.g., Siemens et al., 2020), our approach emphasizes digital socialization as a key pedagogical bridge. This is evident in the teacher's insights on the hub's transformative role, which provides a fresh perspective on building digital citizenship in secondary education by blending formal structures with informal interactions.

This focus aligns with several earlier studies that demonstrate the value of connecting school-based and everyday learning. Kumpulainen and Mikkola, for example, showed that hybrid models linking classroom activities to students' daily practices can boost engagement (Kumpulainen & Mikkola, 2016)–a pattern echoed here, as the social learning hub strengthened social learning when tied to participants' (digital) daily routines. However, our work in a secondary education context uncovers remarkable adaptation challenges, such as the need for greater scaffolding to overcome resistance, which mirrors concerns in broader educational technology literature (Kumpulainen & Sefton-Green, 2014; Selwyn, 2022). Similarly, Greenhow and Robelia noted that social media supports informal teen collaboration, resonating with the hub's role in promoting socialization (Greenhow & Robelia, 2009). Yet, our structured educational design differs from their emphasis on non-structured settings, allowing for more intentional knowledge-building. In a related vein, Hrastinski (2021) found that asynchronous platforms maintain participation in higher education, but our results indicate that secondary learners often favor brief, surface-level responses, underscoring the importance of targeted support to encourage deeper involvement, at least in secondary education.

The study's use of gamification elements further illustrates these dynamics. Drawing from research on rewards to increase engagement (Ansar & George, 2023; Buckley & Doyle, 2016), we incorporated a point-based system in the hub. However, the outcomes align more closely with Sailer and Homner, who argue that internal motivators like peer connections often surpass external incentives in digital environments (Sailer & Homner, 2020). Indeed, higher participation did not strongly correlate with gamification rewards, revealing that engagement factors are more complex than simple progression mechanics. As a result, while we expected these tools to increase involvement, the findings show that in secondary education, where extrinsic rewards may compete with established social hierarchies, intrinsic drivers tied to perceived relevance and peer dynamics prove more sustainable (Sailer & Homner, 2020; Zeybek & Saygı, 2024). Our results thus call for hybrid frameworks to foreground relational and meaning-making elements over behavioral incentives.

These comparisons affirm that the proposed hybrid framework for a social learning hub effectively weaves in theoretical foundations like social learning and connectivism. The recorded online activities demonstrate learning as a social exchange, where students developed skills in a dynamic environment of continuous and interconnected learning. Thus, active hub participation reinforced social constructivism (Vygotsky, 1978) by showing how social interaction in digital spaces supports knowledge growth (Luo & Clifton, 2017). It also supports connectivism (Siemens, 2005), as the hub connected classroom content to wider digital networks, encouraging self-regulation and highlighting the importance of connecting beyond the school setting. Still, the hurdles to full engagement and the limited depth in some exchanges suggest that these ideas require more time to take root. Overall, this framework highlights the roles of social learning, connectivism, and community involvement, while calling for policy changes such as adaptable schedules and curricula that integrate informal digital spaces. Such shifts would enhance communication and teamwork, key elements of the Digital Competence Framework for Citizens (Vuorikari et al., 2022).

CONCLUSION

While the sample of 72 students and the six-week duration constrained generalizability and a full view of long-term dynamics, respectively, they offered a focused lens on context-specific impacts within a controlled setting. As such, this study contributes to the continuous discourse on integrating digital technology into education by conducting a literature review to identify the need for bridging formal and informal learning, which led to the development and evaluation of a hybrid framework for a social learning hub. Unlike previous research with fragmented social systems, the framework integrates social functions within a social learning hub, offering dual benefits – enhancing digital competencies and supporting pedagogical growth – through three core pillars: intentional/conscious learning, technology as a means of learning, and learning theories grounded in social constructivism, connectivism, and communities of practice to bridge formal and informal learning contexts.

The findings confirm the framework's applicability in real school settings, with the social learning hub serving as a critical channel for informal learning – a digital space where students engaged, shared opinions, reevaluated their perspectives, and collaboratively constructed collective knowledge while enhancing their digital literacy (Hardof-Jaffe & Amzalag, 2024). The results highlight the importance of flexibility, collaboration, and familiarity with digital environments in enriching the learning experience, aligning with the lifelong and autonomous learning principles that support the five main areas of digital competence for confident and responsible engagement with digital technologies according to the EU's objectives (Vuorikari et al., 2022). Simultaneously, they reveal the need for strategic course planning to develop socialization and critical digital engagement, shifting mindsets of all the agencies involved in the educational process toward a model that promotes open dialogue and interconnected learning experiences (Georgopoulou, Troussas, Triperina, & Sgouropoulou,, 2024; Hrastinski, 2021; Turan et al., 2022). Therefore, while promising, the framework's complete success depends on gradual transitions and teacher support. Training educators in Technological Pedagogical Content Knowledge (TPACK) could bolster the integration of such learning models that bridge formal and informal learning, ensuring a holistic approach to learning and better support for students during this transition (Mishra, 2019; Mishra & Koehler, 2006).

Theoretically, these results reinforce DigComp's role in hybrid models, particularly Area 2 (Communication and Collaboration), by demonstrating how the social learning hub fosters networked interactions and digital citizenship in practice. Practically, the implications include scalable adoption of the hub in diverse educational settings, with recommendations for mobile-friendly designs and policy adjustments to accommodate informal digital spaces. Beyond Greece, these findings apply globally across diverse educational systems confronting digital adaptation challenges, as evidenced by studies highlighting teacher readiness gaps (Yulin & Danso, 2025), infrastructural inequities (Khalid et al., 2024), and policy implementation barriers (Boeskens & Meyer, 2025). Therefore, realizing these potentials demands pedagogical innovation and a transformative shift in schooling –a process with which educators are less familiar, as true change in the educational landscape requires comprehensively reimagining the learning process for a networked, global landscape (Arnesen et al., 2016; Siemens, 2005).

RESEARCH DATA

Research data will be available only upon request.

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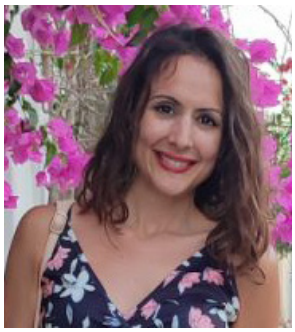

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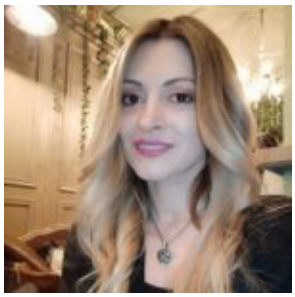

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