

RESEARCH ARTICLE

Unveiling the power of social interactions: A systematic review of student experiences in informal learning space

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ABSTRACT

The purpose of this study is to examine the role that social interaction plays in informal learning environments on the part of students, it provides implications for understanding student experiences in informal learning spaces and for policymakers to incorporate more opportunities for social interaction in informal learning spaces. The PRISMA statement was followed when conducting a systematic search of Scopus and China National Knowledge Infrastructure (CNKI) databases to identify relevant studies published within the past decade. Search strategies for informal learning spaces and social interactions included a combination of keywords and controlled vocabulary. On the basis of predefined inclusion criteria, twelve studies were selected for analysis, including articles published in English and Chinese, scientific articles published in peer-reviewed journals, and studies that examined student experiences in informal learning spaces and social interaction. Among the findings of this study are a description of informal learning spaces, a conceptualization of social interaction, as well as the positive impact of social interaction on student learning and engagement. Based on the results of the study, educators and policymakers need to create environments that foster social interactions that are inclusive and engaging. The study identifies gaps in the literature and suggests directions for future research, including the exploration of a broader range of informal learning spaces and the investigation of specific design elements that optimize student experiences.

Keywords: engagement; informal learning space; self-study; social interaction; students' experiences; systematic review

1. Introduction

Informal learning spaces refer to environments outside of formal educational settings where learning and knowledge acquisition take place in a more relaxed and self-directed manner. These spaces can vary widely in their physical or virtual nature and include places such as libraries, community centers, museums, parks, online platforms, and social learning communities. Unlike formal learning settings like classrooms, informal learning spaces provide opportunities for individuals to engage in learning activities that are driven by personal interests, curiosity, and self-directed exploration. They often foster a collaborative and interactive learning environment, encouraging social interactions, peer learning, and the sharing of knowledge and experiences. Informal learning spaces play a crucial role in facilitating student learning and engagement outside of formal educational

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settings^[1]. The objective of this comprehensive review is to examine how social interactions within these learning spaces differ in terms of characteristics, classifications, and effects, and to emphasize the importance of social interactions in the shaping of student experiences and outcomes by reviewing existing literature. The authors will also consider the implications of these findings for policy-makers and practitioners in the field of education, and identify the areas where further research is needed. Finally, we will suggest a set of recommendations for improving educational practice. This study is significant as it is aimed at examining how social interactions in informal learning spaces affect student experiences and outcomes. In order to provide a deeper understanding of these interactions, it reviews existing literature to identify their characteristics, classifications, and effects. As a result of the findings, policymakers and practitioners in education will be provided with insights about creating supportive environments and improving educational practices. Additionally, the study will identify research gaps and recommend further investigation areas, contributing to the ongoing development of knowledge in this area. As a result, it emphasizes the significance of social interactions in informal learning spaces and their potential to enhance student engagement and learning.

1.1. Related work

A significant part of the literature is dedicated to examining the characteristics and classifications of informal learning spaces. Ramsay et al.^[2] demonstrated the practical implementation of an educational research team collaborating with an instructional design and development team to support the research-to-practice cycle, demonstrating how recursive and generalizable frameworks can be applied to education. The implementation of Play-and-Learn Spaces in libraries led to significant increases in children's programming attendance, emphasizing the importance of social interaction and informal learning spaces in fostering community engagement and educational opportunities^[3]. In contrast, Berman^[4] emphasized the need for a nuanced understanding of these spaces, cautioning against romanticized and overdetermined portrayals. Quinnell^[5] provided valuable insights into the design aspects of informal learning spaces by focusing on the utilization of affordances to create improved study places.

There is also evidence in the literature that social interaction can be defined and conceptualized within the context of learning spaces. Using a quantitative approach, Vanichvatana^[6] aimed to assess students' perceptions of social interaction in informal learning spaces, which contributed to the understanding of how learners perceive social interactions. The lack of evaluation methods for the influence of spatial design characteristics on student preferences and activities within these spaces was addressed by Wu et al.^[7], who investigated the impact of spatial design characteristics on students' preferences and utilization of informal learning spaces.

Additionally, the research questions focus on the specific effects of social interactions on student learning and engagement within informal learning environments. Schweer and DeFrain^[8] compared the use and design features of informal learning spaces within different institutional settings, shedding light on the variation in usage patterns and design preferences. Meanwhile, Orr et al.^[9] explored the potential of extended reality technology to enhance learning experiences in informal environments such as museums and cultural heritage sites. They suggest that extended reality technology can be used to create immersive learning experiences that foster collaboration and knowledge sharing. These learning experiences can be tailored to the individual needs of learners and can be adapted to multiple different contexts. Students in effective learning groups (ELG) are better at coordinating team members' understandings leading to mutually shared cognition^[10], but there are also some students who may not work well with others in a group setting. Some students may feel like they don't have a say in the group, and they may be overwhelmed by having to listen to all the other people in the group. For these students, working alone may be the better option.

Degner et al.^[11] reported the findings of a systematic literature review in the field of informal learning with digital media in institutional informal learning places, and found that determined that portable and stationary digital media tools are investigated equally often, and that many of them are already equipped with augmented reality (AR). Also, it indicates that digital media have not fully tapped into their potential functions, as they primarily provide information retrieval, and only a limited amount of collaboration functions has been exploited. Therefore, a comprehensive systematic review of student experiences in informal learning space is also needed to provide insights into how social interaction can be used to improve informal learning. This review should assess the effectiveness of different types of social interaction, its potential for improving learning outcomes, and best practices for implementation. Additionally, the review should provide recommendations for the use of social interaction in informal learning spaces. By deepening our understanding of informal learning spaces, we can create environments that optimize social interactions and foster meaningful educational experiences. The complexity and potential of social interactions within these spaces require further study, which will ultimately benefit students' educational journeys.

1.2. Research purpose and research questions

Several studies have been conducted over the years examining the dynamics involved in generating productive social interactions within informal learning spaces, but not enough data exists at this time, as this theme remains under a relatively limited scope of study. Earlier discourse focused more on the technical aspects such as spatial design and affordances thereof, completely overlooking any potential impacts resulting from the nuanced interactions between participants as they interact socially, ultimately ignoring its significance and leaving key untapped aspects that require further exploration. Thus, the research gap remains significant while exploring comprehensively how robustly rooted casual meetings bring about positive changes that leave significant implications within these unique environments. To fill this apparent void, this research will contribute new insight into how students interact with each other, thus shaping their overall experience while participating in informal learning environments. Based on previously published literature, the aim of this study is to provide an enhanced understanding of how social interactions affect student learning outcomes.

To achieve this purpose, the following research questions will guide the inquiry:

RQ 1: According to the existing literature, what are the key characteristics and classifications of informal learning spaces?

RQ 2: In the selected literature, how is social interaction defined and conceptualized within the context of learning spaces?

RQ 3: What are the specific effects of social interaction on student learning and engagement in informal learning environments?

2. Methodology

A systematic review was conducted following the established guidelines for systematic reviews and meta-analyses outlined in the PRISMA statement^[12,13]. This systematic review was conducted in order to gather all evidence that meets the eligibility criteria. To collect and analyze the relevant studies, we utilized two primary databases, Scopus and China National Knowledge Infrastructure (CNKI).

The search in Scopus and CNKI was conducted between April 2023 to June 2023, encompassing the literature published within the last 10 years. This time frame was selected to ensure the inclusion of recent research relevant to the topic of the review. The search strategy incorporated a combination of keywords and controlled vocabulary specific to the field of informal learning spaces and social interactions.

The search terms used in Scopus and CNKI included variations of keywords such as “informal learning

spaces”, “shared learning spaces”, “social interactions” and other related terms. These keywords were combined effectively through boolean operators (AND, OR). In Scopus and CNKI, the search string was (TITLE-ABS-KEY (“informal learning spaces”) OR (TITLE-ABS-KEY (“shared learning spaces”) AND TITLE-ABS-KEY (“social*”))). As a result of the initial search, the retrieved articles were subjected to a multi-step screening process based on predefined inclusion and exclusion criteria. The inclusion criteria for this review were:

- 1) Language: Only articles published in English and Chinese languages were considered for inclusion. Articles not available in these languages were excluded.
- 2) Publication Type: Only scientific articles published in peer-reviewed journals were included in this review. Other types of documents, such as book chapters, theses, conference papers, and non-peer-reviewed sources, were excluded.
- 3) Relevance to the Main Objective: Articles that specifically addressed student experiences in informal learning spaces and the role of social interactions were included.

Based on these inclusion criteria, a total of 12 relevant studies were selected from the initial pool of 157 articles identified through the search in Scopus and CNKI. These 12 studies were deemed appropriate for further analysis as they aligned with the main objectives of this review.

To ensure accuracy and eliminate duplication, the results obtained from the search in Scopus and CNKI were exported to reference management software Zotero for systematic organization and removal of any duplicate articles. The review process was facilitated by employing the PRISMA flowchart, as depicted in **Figure 1**, to outline the systematic selection of articles for inclusion in this review^[13]. Through this rigorous methodology, ensure a comprehensive and reliable review of the selected literature, providing insights into the power of social interactions in student experiences within informal learning spaces. Systematic reviews enable the gathering of all relevant evidence by employing specific search strategies and predefined inclusion criteria, thereby providing a comprehensive overview of the topic. The methodology helps minimize selection bias and facilitates data synthesis and analysis across multiple studies, uncovering patterns and trends. Additionally, systematic reviews identify research gaps and guide future directions, making them valuable for researchers, practitioners, and policymakers.

The flowchart (**Figure 1**) shows the method used for article selection.

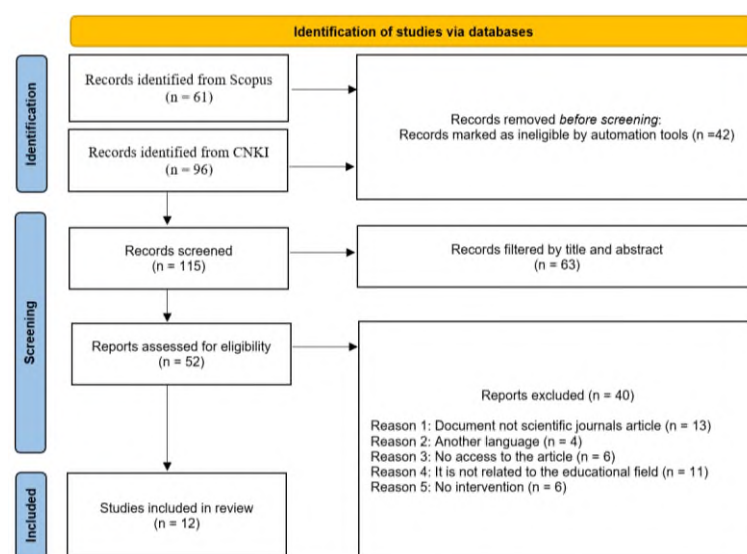


Figure 1. Flowchart of the systematic review.

3. Results

The literature identifies various types of informal learning spaces, including university libraries, home environments, social learning spaces, cafes, virtual spaces, and others. University libraries are recognized as informal learning spaces that provide both physical resources and social dimensions for learning. Home environments are preferred for individual study, while social learning spaces, such as coworking spaces, foster active learning and social interaction. Cafes and catering outlets are also utilized as informal learning spaces. Virtual spaces, facilitated by online communication platforms, have emerged as important extensions of formal learning. The literature emphasizes the need for diverse learning spaces that are well-planned, flexible, and supportive of different learning activities. The details of literature are shown in **Table 1**.

Table 1. Summary of results.

No.	Title	Authors	Year	Objectives	Methods	Results
1	Comparative study of informal learning spaces in colleges based on the occurrence probability of informal learning.	Xu Y et al. ^[1]	2023	Examine the impact of layout designs of informal learning spaces on the probability of informal learning behaviors in college teaching buildings.	Visual, Topological analyses	Informal learning behaviors more likely in spaces with high accessibility and visibility, particularly corridor spaces with frequent use and high visibility attributes. Valuable insights for future renovations and construction of college teaching buildings.
2	Library café or elsewhere: Usage of study space by different majors under contemporary technological environment.	Zhou J et al. ^[14]	2022	Examine the usage of study space by different majors in a contemporary technological environment.	Survey	The use of learning and entertaining spaces, as students generally employed inquiry-based learning methods.
3	Indoor environment and student productivity for individual and collaborative work in learning commons: a case study.	Hong S et al. ^[15]	2022	Investigates the relationships between the built environments of learning commons and user productivity, such as collaborative and individual work productivity and overall environmental satisfaction.	Case study, Survey	Satisfaction with noise level is positively associated with individual productivity.
4	O'Donnell and Tuomey's university architecture: Informal learning spaces that enhance user engagement.	Molloy ^[16]	2021	Examine the prevalence of informal learning spaces that encourage social interaction within university buildings designed by O'Donnell and Tuomey, focusing on the Saw Swee Hock Student Center at LSE, CEU redevelopment in Budapest, and the Hub Project at UCC.	Analyzing the similarities in views, connections, permeability	The O'Donnell and Tuomey university buildings demonstrate the ability to encourage social interaction and connection to the public realm through their design features, thereby enhancing the learning experience for students.
5	Campus public space: from the flow corridor to the deep social practice field.	He and Tu ^[17]	2021	Explore the design and role of campus public spaces in facilitating social interaction and learning experiences beyond formal classroom settings.	Examining the concept of a "campus learning space continuum"	Emphasizes the significance of campus public spaces in promoting social interaction, facilitating learning experiences, and supporting the socialization and development of students.

Table 1. (Continued).

No.	Title	Authors	Year	Objectives	Methods	Results
6	Interiors, affect, and use: How does an academic library's learning commons support students' needs?	DeFrain and Hong ^[18]	2020	Sought to identify the learning needs, satisfaction levels, and preferences of students using an academic library's learning commons. A particular focus was understanding whether the socio-collaborative environment facilitated by the learning commons was aligned with the institutional objectives of supporting intensive study and scholarly work.	Mixed method	Behavior mapping and survey data showed that students were largely satisfied with the learning commons and that it was considered a supportive environment for them to complete their stated tasks.
7	Social learning spaces and student engagement.	Matthews et al. ^[19]	2011	Explore the role of social learning spaces in enhancing the student experience, particularly in terms of student engagement, using a qualitative research design and the student engagement framework.	Conducting informal interviews with 103 students within a social learning space.	Social learning spaces have the potential to enhance student engagement by facilitating active learning, social interaction, and a sense of belonging among tertiary students.
8	Privacy and interaction preferences of students in informal learning spaces on university campus.	Zhang et al. ^[20]	2022	Analyse privacy and interaction preferences in the social dimension of individual learning students and how the spatial configuration affects individual learners' choices of learning spaces.	Space syntax theories are applied to construct a four-quadrant theoretical framework.	Based on the differences between students in their individual characteristics, there are significant differences in their needs for privacy and interaction. This study reveals that spatial configuration affects individual learners' choices of learning spaces.
9	The future development trend of learning commons.	Cheng and Peng ^[21]	2020	Study Learning Commons as a new type of learning space within academic library reconstructions. It explores the relationship between knowledge creation and Learning Commons, and examines the reasons for the spatial transformation of academic libraries.	Use the four spatial models necessary for knowledge creation.	The Learning Centers in the academic libraries studied exhibit comprehensive spatial processing that meets the environmental requirements for knowledge creation.
10	Research on the design of shared study room space based on non-interactive relationship.	Liu and Li ^[22]	2021	Explore the emergence of shared study spaces, specifically shared self-study rooms, in response to the increasing demand for comprehensive learning environments, and to investigate their impact on improving work and learning efficiency.	Analyzing the concept of shared study spaces and their relationship with privacy, comfort, humanization, and diversity in spatial design	Shared self-study rooms, incorporating elements of privacy while promoting shared learning experiences, can create more comfortable, humanized, and diverse work and learning environments, leading to increased efficiency for the users.
11	Social analysis and enlightenment of learning space in foreign university libraries.	Sheng Q et al. ^[23]	2020	Explore the social nature of learning spaces in libraries, specifically focusing on the discussion around the dichotomy of quiet and collaborative spaces	Analyzing case studies that demonstrate characteristics	The importance of considering social aspects in learning spaces, and highlight characteristics such as consistency, balanced development, diversity, and attention to detail as valuable considerations for local universities
12	Informal learning spaces for undergraduate business school: A Bangkok private university case study.	Vanichvatana S ^[6]	2018	Investigate the behaviors and perspectives of students attending business programs at a Bangkok private university regarding their usage of Informal Learning Spaces (ILS) within and outside the campus for learning activities, considering the lack of formal learning spaces for business students.	Case study	Students primarily used their home or dorm for solo studies rather than group activities.

Socializing effectively within interactive programs forms an integral part of effective learning strategies

where engaging groups with different mindsets foster collaboration in knowledge sharing activities along with developing relationships beyond them irrespective of where outreach takes place. As per recent studies Physical libraries offer immersive experiences where learners interact with peers creating a dynamic environment surpassing mere informational flow while facilitating cooperatives over coworking spaces; thus, helping garner better interactive experience leading to enhanced participation. Even digital libraries via web tools or online platforms help revolutionize the essence of education akin to its physical counterpart. Inclusive social interaction is essential for student motivation punctuated by confidence coupled with their educational engagement through fostering communication skills alongside growing teamwork and problem-solving skills leads to advanced performance academically here improved atmosphere serves as the key variable for immersive experiences. The research efforts focused on identifying critical elements that define successful social interaction in informal educational settings, through explore a plethora of characteristics and how they impact to provide useful insights. Through this research, collaborate on the design and improvement of informal learning spaces aiding both learners and academic institutions alike through enhanced student performance.

Social learning spaces such as coworking spaces, cafes, and catering outlets create immersive experiences that foster social interaction, collaboration, and knowledge sharing. Virtual spaces, facilitated by online communication platforms, have been incorporated into formal learning as well. Research has revealed that physical and digital libraries can improve the essence of education and social interaction is key to student motivation, confidence, and academic engagement. This research can help design and improve informal learning spaces to benefit both learners and academic institutions.

4. Discussion

4.1. Characteristics and classifications of informal learning spaces

The literature extensively covers a variety of informal learning spaces that students utilize for self-directed learning activities. These spaces include university libraries, social learning spaces, cafes, virtual environments, and more. Libraries at universities are highly significant informal learning spaces, offering resources as well as opportunities for social interaction. While online learning may not be ideal for group activities, students are attracted to its convenience and flexibility, particularly after having experienced online learning during the outbreak of COVID-19^[24,25]. The findings underscore the importance of well-designed and well-managed spaces that support diverse learning activities and cater to the preferences and needs of students. These spaces provide an attractive alternative to traditional learning environments, allowing students to customize their learning experience and pursue their academic and personal interests in a comfortable and relaxed setting. This is because such spaces allow students to learn in an environment that is tailored to their individual needs and preferences. Students have access to a variety of resources and activities that they can use to explore their interests and expand their knowledge. They also have the opportunity to collaborate with peers and receive personalized feedback on their work.

4.2. Conceptualization of social interaction in learning spaces

It has been widely recognized that social interaction within informal learning spaces is an integral part of the student experience, facilitating active learning, socializing, and knowledge sharing among peers. The studies emphasize the evolving role of physical libraries as social hubs where students collaborate, exchange ideas, and work collaboratively. Moreover, virtual spaces, such as online communication platforms, also contribute to social interaction and extend learning opportunities beyond physical borders^[26]. The findings underline the importance of designing learning spaces that promote social interactions, promote collaboration,

and encourage a sense of community among students. This is a shift away from traditional libraries, which are often more focused on providing access to resources rather than on fostering social connections. As such, it is important to create library spaces that are conducive to social interactions and collaboration.

The literature conceptualizes social interaction in learning spaces in several key ways. It is defined as facilitating active, collaborative and social learning among students through interactions, which can enhance engagement, motivation and performance. Specifically, social interaction is seen as promoting collaboration, knowledge sharing, relationship building and engaging diverse groups through interactive programs. It also fosters immersive experiences beyond information sharing by enabling peer interactions in physical and online spaces. Additionally, social interaction is important for motivation, confidence and learning through developing communication, teamwork and problem-solving skills. Students' space choices are influenced by their privacy and interaction preferences, shaped by environmental design. In summary, the research frames social interaction as central to students' experience by facilitating interactions that support active learning in both physical and digital contexts.

4.3. Effects of social interactions on student learning and engagement

The literature reviewed identified several specific effects of social interaction on student learning and engagement in informal learning environments. Social learning spaces have the potential to enhance student engagement through facilitating active learning and social interaction, which fosters a sense of belonging. Social interaction also promotes collaboration, knowledge sharing, and relationship development beyond formal classroom settings by allowing engagement between groups with different perspectives. This interaction creates immersive learning experiences that surpass mere information flow. Social interaction can improve student motivation, confidence, and academic engagement by supporting the development of communication skills, teamwork abilities, and problem-solving skills. Additionally, individual students' choices of learning spaces can be influenced by their preferences for privacy and interaction, which are impacted by the spatial design and configuration of informal spaces. Finally, research indicates that social interaction supports students' needs and learning tasks, as indicated by higher satisfaction and feelings of facilitation among students using socio-collaborative learning commons environments. Overall, the literature suggests social interaction enhances learning outcomes, engagement, motivation, productivity and satisfaction for students within informal learning environments.

In informal learning spaces, social interactions positively influence student learning and engagement, according to consistent research findings. Students are motivated, and confident, and feel a sense of belonging when they participate in social interactions. It is important to engage in collaborative activities, discussions, and knowledge sharing to develop critical thinking, deeper understanding, and essential skills. Ultimately, the findings suggest that social interaction can promote active learning, enhance academic performance, and foster a supportive learning environment. When students interact with each other, they can gain a better understanding of the material by discussing and debating ideas. This engagement in social interaction can also help to build confidence and create a sense of belonging by allowing students to work together and support each other^[27]. Additionally, collective problem-solving can help to develop critical thinking skills, as well as a deeper understanding of the subject matter.

5. Conclusions

The main purpose of this systematic review was to provide an enhanced understanding of how social interactions affect student learning outcomes in informal learning environments. The literature reviewed identified several specific positive effects of social interaction on student learning and engagement. The main findings of the selected studies provide valuable insights into student experiences in informal learning spaces.

These spaces vary in their characteristics and classifications but generally emphasize the importance of well-planned and flexible environments that support diverse learning activities. Social interaction plays a crucial role in these spaces, promoting active learning, knowledge sharing, and skill development. The positive effects of social interactions on students' motivation, confidence, and sense of belonging are evident.

These findings have significant implications for understanding student experiences in informal learning spaces. They highlight the evolving role of physical libraries as collaborative hubs and the potential of virtual spaces to extend learning opportunities. Creating inclusive and engaging learning environments that foster social interactions can enhance students' social and cognitive development, leading to improved learning outcomes. A further investigation is, however, required to fill some of the gaps in the literature. To understand the long-term effects of informal learning spaces, longitudinal studies should be conducted, and design elements and interventions should be examined that optimize these spaces and enhance student experiences in the future. This will help to identify the most effective interventions and design elements that could be implemented to create better learning spaces for students^[28]. Additionally, longitudinal studies will enable researchers to measure the impact of these interventions and design elements on student engagement and learning outcomes over time.

These findings have implications for educators and policymakers as well. Educators can incorporate more opportunities for social interaction in informal learning spaces, promote collaboration, and provide support for virtual interactions. Policymakers can support the creation and design of flexible learning spaces that cater to different activities and ensure accessibility for all students. Furthermore, providing professional development and training for staff on facilitating social interactions can enhance the effectiveness of these spaces. In conclusion, understanding student experiences in informal learning spaces requires attention to their characteristics, the role of social interaction, and the effects on learning and engagement. By addressing the gaps in the literature and implementing practical implications, educators and policymakers can create conducive environments that optimize student experiences and foster effective informal learning.

One of the limitations of this study is that it is limited to the evaluation of existing literature. As such, it does not include any empirical evidence or data-driven analysis. Additionally, the study does not consider the potential differences in student experiences across different contexts and settings. Furthermore, there is a lack of research that examines the impact of informal learning spaces on student outcomes in the long term. Therefore, further research is needed to assess the long-term effects of informal learning spaces and understand the impact of design elements and interventions on student engagement and learning outcomes.

Author contributions

Conceptualization, ZL and WX; methodology, WX; software, ZL; validation, WX; formal analysis, WX; investigation, ZL; resources, ZL; data curation, WX; writing—original draft preparation, ZL; writing—review and editing, WX; visualization, ZL; supervision, WX. All authors have read and agreed to the published version of the manuscript.

Conflict of interest

The authors declare no conflict of interest.

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