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Enhancing Students' Development through Human-Space Correlation: A Conceptual Review of Co-Working Spaces in Educational Institutions

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ABSTRACT

Education spaces are an important factor in maximising students' learning experience. Tertiary education institutions in Malaysia could benefit from co-working spaces as informal learning spaces to improve student interactions, well-being, productivity, and knowledge. This paper aims to establish a framework for developing co-working spaces in tertiary education institutions, particularly in Malaysian institutions. This research undertakes a review of journal articles, reports, and other documents gathered from the Google Scholar database concerning two main areas: firstly, co-working spaces, and secondly, education institutions. The data was analysed using VOSviewer software for specific keywords; 'education institution', 'university', 'student', and 'library'. The review brings forth important attributes when developing co-working spaces in tertiary education institutions. The findings can tremendously help education institutions apply the concept of co-working spaces to enhance learning environments for students' holistic development.

1. Introduction

Referring to the message from the Director General of Health Malaysia reported in the National Strategic Plan for Mental Health 2020-2025 by the Ministry of Health Malaysia, the 2015 National Health and Morbidity Survey (NHMS) revealed that nearly a third of Malaysians aged 16 and above were grappling with mental health issues. By 2017, these issues had escalated among adolescents, with one in ten reporting stress, one in five suffering from depression, and two in five experiencing anxieties. The situation further deteriorated, with the prevalence of suicidal behaviour among adolescents increasing from 7.9% in 2012 to 10% and a 2.3% prevalence of depression among Malaysians aged 18 and above in 2019 [1]. The role of natural environments and accessible green and blue spaces in promoting health and well-being is significant [2]. They not only mitigate the impacts of climate change and lower disaster risks but also provide recreational spaces for relaxation

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and stress relief. Co-working spaces, designed with an understanding of the influence of natural and built environments on mental health, can play a significant role in this context. They provide a workspace and a community that fosters social interactions, reducing feelings of isolation. Incorporating elements of the natural environment into these spaces, such as green and blue spaces, can further enhance their positive impact on mental health. These spaces can serve as a sanctuary from daily stressors, promoting relaxation and well-being.

The concept of co-working spaces is not exactly nascent. In fact, many have popped up in Malaysia's big cities. Employment Hero named co-working spaces such as We-Work, Colony, Co-Labs co-working, and Common Ground the best in Kuala Lumpur in 2022 [3]. By the end of this year, there is expected to be a whopping 41,975 co-working spaces worldwide [4]. A co-working space is where people can sit together and do individual work despite being from different organisations; sharing such space allows them to become a community by communicating and helping each other [5].

There are two main types of tertiary education institutions: public and private [6]. Public education institutions are government-funded, while private education institutions gain funding by charging relatively higher tuition fees as well as through donations. Usually, public universities have extensive facilities, while private universities have varying sizes of facilities, depending on how much funding they can secure. Education institutions comprise a myriad of spaces, such as classrooms, labs, libraries, cafeterias, student centres, and so forth. These spaces are indeed useful and beneficial for students. However, each space has its intended purpose and drawbacks, and rarely is there a single space that collectively enhances human interaction, productivity, well-being, and knowledge dissemination.

There has been quite a fascination among researchers in changing and improving spaces in education institutions, such as by creating co-working spaces with a sense of community and multifunctionality [7,8]. These studies highlight the need to update traditional layouts in education institutions to more modern layouts to accommodate the current needs of students, both in terms of learning as well as mental health. Optimistically, the shift towards more modern layouts such as co-working spaces can achieve two Sustainable Development Goals: SDG 3 (Good Health and Well-being) to "ensure healthy lives and promote well-being for all at all ages" and SDG 4 (Quality Education) to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" [9].

Studies have shown that the design of physical space affects the way a person interacts with their surroundings. Many theories discuss the relationship between different spaces and human interactions [10-15]. Literature has shown that co-working spaces improve not only human interactions [16], but other aspects as well, such as employees' well-being [17], productivity [5], and knowledge sharing [18].

However, their works focused on the context of the working population. To date, co-working spaces in educational institutions have not been extensively studied. Hence, this paper aims to examine the vital attributes of co-working spaces required in educational institutions and the importance of introducing co-working spaces in educational institutions via a metadata analysis. The achievement of these two objectives translates into a theoretical framework for future researchers to apply the concept of co-working spaces to enhance learning environments in educational institutions for students' holistic development. This pioneering study is the first globally to distinctly highlight and compare the attributes of co-working spaces with those of existing shared spaces within tertiary educational institutions. This paper also includes a bibliometric analysis of co-working space research; this can contribute towards future research in determining related topics to focus on.

2. Methodology

Journal articles containing the keyword 'co-working space' were searched using Publish or Perish software to obtain journals published between 2019 and 2024 from the Google Scholar database and saved as an Endnote file (.enl). Publication data produced by Publish or Perish was summarised into a table. The Endnote file was further analysed using VOSviewer software to generate a bibliometric network. Then, the network was investigated for its correlation to the keyword' education institution' and relevant keywords, namely 'university', 'student', and 'library'.

Out of the 970 papers found using the keyword 'co-working space', only 40 relevant papers were selected for a metadata analysis by cross-examining keywords of 'co-working space attributes' and 'spaces in education institution'. The analysis was based on two hypotheses:

i. (H1), existing spaces in education institutions share some similarities towards co-working spaces.
ii. (H2), co-working spaces are important in educational institutions to enhance students' well-being, productivity, and knowledge through improved interactions with teachers, students, staff, and visitors. Then, a potential theoretical framework is suggested.

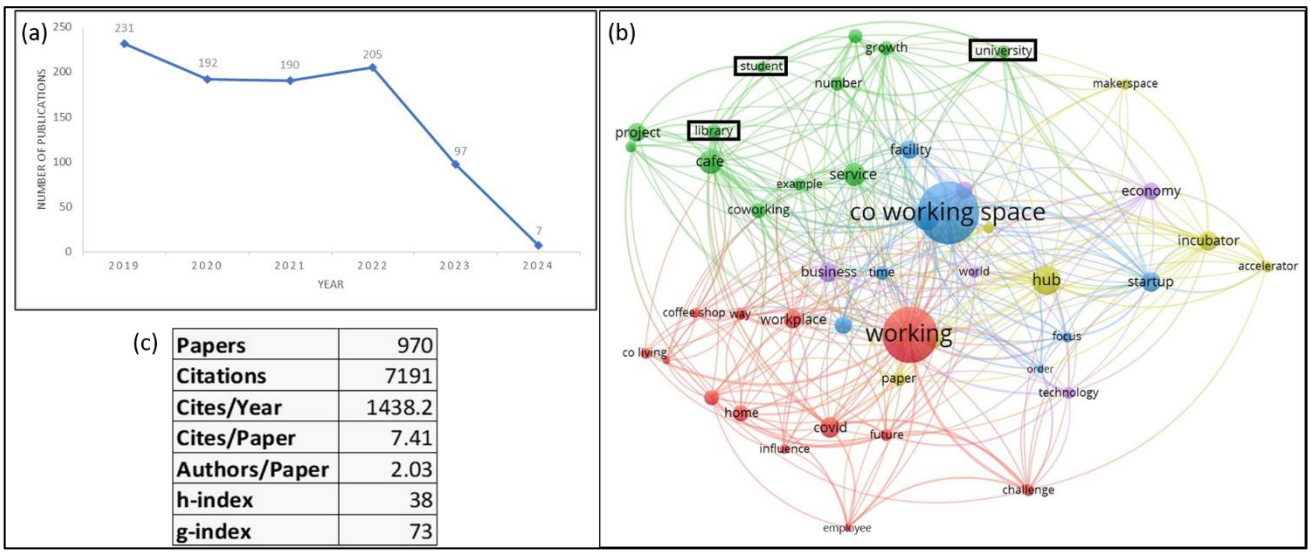
The methodology is navigated by three research questions, as follows:

i. Q1: What is the current state of research on keywords related to co-working spaces and their relation to educational institutions?
ii. Q2: What are the similarities between co-working spaces and existing spaces in educational institutions?
iii. Q3: Why is the concept of co-working space significant in educational institutions?

3. Results & Discussion

3.1 Bibliometric Analysis of Co-Working Space and Education Institutions-related Keywords

The development of research on co-working spaces from 2019 to 2024 (the last five years) turned up 970 articles, summarised in Figure 1. Figure 1(a) shows the research trend over the past five years. There has been a lot of research about co-working spaces, with the most prevalent keywords highlighted in Figure 1(b) and Figure 1(c) summarising the publication data. It is apparent that this is an increasingly important topic to be studied.



(c)

Papers	970
Citations	7191
Cites/Year	1438.2
Cites/Paper	7.41
Authors/Paper	2.03
h-index	38
g-index	73

Fig. 1. Bibliometric summary of co-working space studies; where (a): Number of publications from 2019 to 2024, (b): Bibliometric network of related keywords, and (c): Publication data of co-working space

To elucidate: The size of each circle reflects the extent of the occurrence of the keywords with co-working research. As highlighted in Figure 1(b), it can be seen that very minimal research is done relating co-working with educational keywords, such as 'university', 'student', and 'library' (reflected using tiny green circles). These keywords were then further focused on in Figure 2.

Figure 2 summarises the number of papers studying co-working spaces and education institutions, with the bibliometric networks for each keyword. Since only one paper contained both keywords, 'co-working space' and 'education institution', the keywords were expanded and analysed to match the concept of educational institution, namely 'university', 'student' and 'library'.

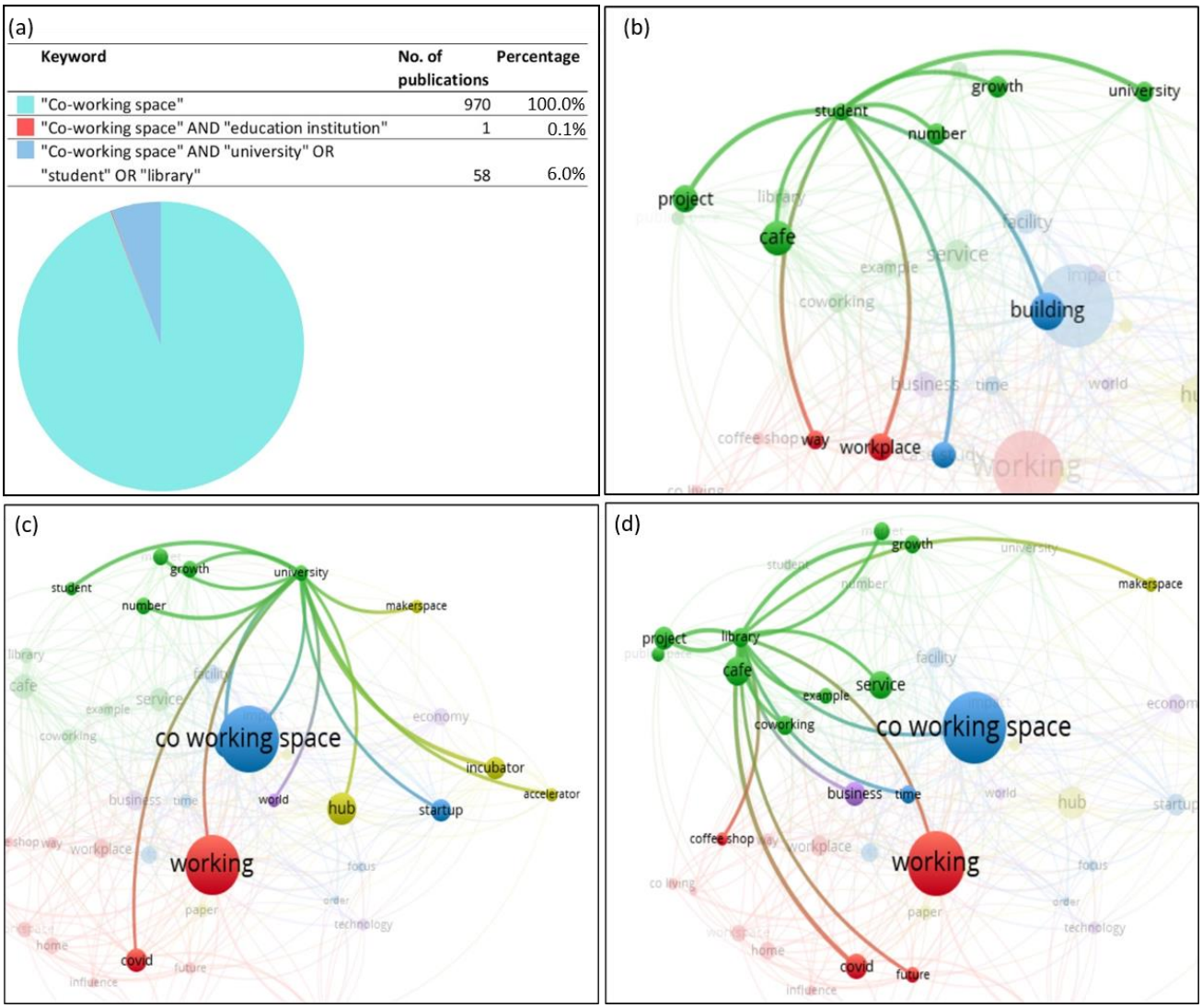


Fig. 2. (a): Number of articles containing the keywords' co-working space' and 'education institution' and other related keywords, (b): Bibliometric network branching from the keyword 'student', (c): Bibliometric network branching from the keyword 'university'; and (d): Bibliometric network branching from the keyword 'library'

3.2 Existing Space in Education Institutions and Attributes Versus Co-Working Space

3.2.1 Components of space in education institutions

An educational institution requires the necessary components to function and operate fully. There are five vital components of an educational institution:

i. academic staff
ii. other staff
iii. buildings
iv. equipment
v. materials
vi. time spent by students [19].

Table 1 categorises the components into tangible and intangible types and clustered into three main groups. The groups are human capital, facilities and student capacity.

Table 1
Vital components of an education institution

Type of component	Component group	Component [19]
Tangible	Human capital	• Academic staff • Other staff
	Facilities	• Buildings • Equipment • Materials
Intangible	Student Capacity	• Time spent by students

An educational institution is vital for the development of humans for many reasons besides knowledge production and dissemination. It teaches the concept of societal norms and values while equipping students with social skills [20]. Tertiary education institutions promote innovation among students, a skill employers prefer in the current economy [21]. Amina J. Mohammed, the Deputy Secretary-General of the United Nations, said, "Universities are places that nurture incubation, exchange, innovation and interdisciplinary analysis, setting the pathway to change" [22]. These statements highlight educational institutions' role in formal and informal learning. Formal learning takes place in the classroom and is assessed through generic assessments, where students are presented with grades and certificates.

On the other hand, informal learning happens in spaces outside the classroom and is less structured. Informal learning mainly occurs through human interactions such as observation, experiences and discussions [23]. The evolution of this notion can be seen through the introduction of the 'Plurality of Learning Places' concept in educational institutions [24]. The word 'plurality' in this concept demonstrates that learning takes place in many different settings; students learn in classrooms and laboratories. Yet, they also learn in libraries, cafés, bedrooms, and student lounges. These different settings affect the way students interact with their surroundings, which are supported by theories discussing human interactions in physical spaces, such as Proxemics, Affordance Theory, Biophilia, Space Syntax and Interaction Space [10-15]. However, it is essential to note a research gap here: These theories mainly discuss the interactions between humans and the things surrounding them, with very few discussions of interactions between humans and other humans.

3.2.2 Existing co-working concept in education institutions

A co-working space is described as "shared member-based spaces, which enable peer-to-peer interactions that engender camaraderie and a collective sense of achievement that enhances individual sociality and productivity as a form of socially and economically sustainable work" [5]. Co-working spaces are quite different from other types of office spaces in terms of visual styles and diversity of locations [25,26]. There is a growing importance of co-working spaces, or 'co-learning spaces', in educational institutions to act as a channel for the current generation to create relationships with other people in the same setting and promote innovation among different disciplines [27]. One particular research studied the characteristics of academic spaces and co-working spaces and how aspects of co-working spaces can meet the needs of the academic staff, researchers, and students who use academic spaces [8]. The research revealed that individuals within the academic sphere place significant importance on elements such as community, multifunctionality, convenience, and aesthetics in co-working spaces. As a result, these factors should be integral considerations in designing and constructing co-working spaces within educational institutions. Intriguingly, various members of the educational sector, including students, coaches,

trainers, and teachers, frequently utilise co-working spaces outside their respective educational institutions [28]. This pattern was also observed among individuals engaged in research activities. This trend underscores the fact that despite possessing dedicated workspaces or offices within their institutions, educational sector members strongly prefer frequent visits to non-traditional work environments, such as co-working spaces.

This inclination suggests a potential gap in the current provision of workspaces within educational institutions, indicating a need for a shift in spatial design strategies to better cater to the evolving preferences of its users. Moreover, the study's findings could have far-reaching implications for the future design of educational spaces. By integrating the valued aspects of co-working spaces into the design of institutional spaces, educational institutions could potentially enhance their members' productivity, collaboration, and overall well-being. This could also create a more dynamic, inclusive, and innovative learning and working environment. Innovative learning has also been shown to improve student learning [29]. Thus, the study underscores the importance of rethinking traditional educational spaces in light of the emerging trends and preferences in workspace design.

Table 2 compares the attributes of existing non-educational co-working spaces versus educational shared spaces.

Table 2
Attributes of different sharing spaces

Ref.	Type of sector	Type of Space	Purpose	Attributes						Users
				Open layout	Dynamic workspace	Private space	Collaborative space	Accessible and convenient location	Biophilia	
[28,36-39]	Non-education	Co-working office	• Independent work • Work discussions • Informal discussions	/	/	/	/	/	/	• Workers • Students • Freelancers
[40]	Education	Classroom	• Teaching / learning • Group discussions				/	/		• Teachers / lecturers • Students
[41,42]	Education	Library	• Reading • Use internet services • Independent study • Quiet discussions			/	/	/	/	• Students
[43]	Education	Cafeteria	• Consuming food • Informal discussions	/				/		• Teachers / lecturers • Students • Visitors
[44]	Education	Student Centres	• Studying • Socialising	/			/	/		• Students
[45,46]	Education	Prayer Rooms	• Praying • Religious discussions	/				/		• Teachers / lecturers • Students • Visitors
[47,48]	Education	Labs	• Experiments • Use computers / software	/			/			• Teachers / lecturers • Students

The space is illustrated in Figure 3. All similar attributes are grouped using a defined keyword; each keyword is explained as follows:

i. An 'open layout' refers to a large space the size of several rooms rather than individual offices or private rooms that are separated by walls [30]. Therefore, an expanse of desks in an office or library, where everyone can see each other, is considered an open layout.
ii. A 'dynamic workspace' means that work desks are not assigned to a particular person, and anyone can choose whichever desk or seating arrangement available [31]. This is the same as 'hot-desking' or flexible workspaces.
iii. A 'private space' is defined as either a private room or a quiet area a distance away from collaborative areas and can be used for phone calls, virtual meetings, etcetera [32].
iv. A 'collaborative space' refers to a space where discussions or brainstorming can take place and includes desks that can fit more than one person and may also include visual aids such as a whiteboard or a wall for visual projection [33].
v. An 'accessible and convenient location' means the space can be reached and entered easily and is a short distance from other locations, such as homes, dorms, and classes [34].
vi. 'Biophilia' refers to greeneries available either inside or outside the space [35]. For example, a space may have indoor plants or views of nature.

Fig. 3. Various settings to accommodate self- and group-working, either through formal or informal set-up [produced by Canva Pro license from www.canva.com]

This study discerns both parallels and disparities between co-working spaces and the existing facilities within educational institutions. From Table 2, it can be deduced that shared spaces in educational institutions support a few co-working space attributes here and there, with a glaring absence of other attributes. Additionally, not all spaces are allowed to be utilised by non-students. It can, therefore, be deduced that, at present, shared spaces in educational institutions, such as

libraries, cafeterias, and student centres, lack the capacity to allow students to interact closely with other groups in the community. Libraries, for instance, align with approximately 66% of the attributes of a co-working space, albeit with a need for stringent noise control measures. Other prevalent spaces, such as cafeterias, student centres, and prayer rooms, only fulfil around 35% to 50% of the co-working space criteria. This underscores the importance of integrating co-working spaces within educational institutions.

For holistic improvement, it is proposed that student-to-student interactions, as well as student-to-teacher, student-to-other-staff, and student-to-visitor interactions, occur in an open and welcoming set-up. Therefore, co-working spaces in educational institutions require specific spaces that embrace co-working qualities to create an intended social space in the educational institution, particularly having the following attributes:

i. open layout
ii. collaborative area
iii. dynamic work set-up
iv. convenient and accessible location
v. biophilia [30-35].

Therefore, this paper proposes a framework for a co-working space in education institutions with the aforementioned attributes to meet students' needs, as depicted in Figure 4.

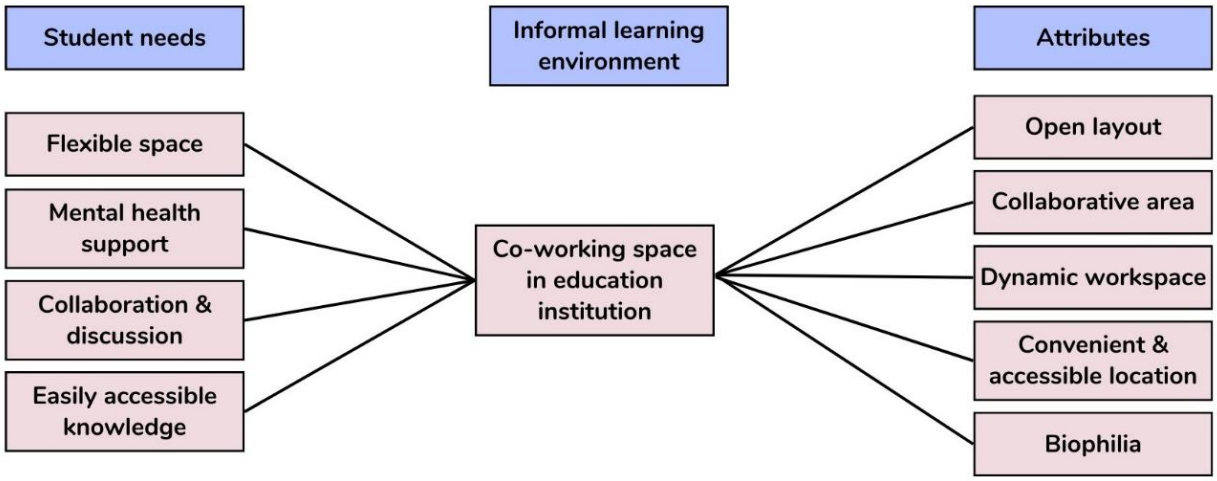


Fig. 4. Proposed framework for co-working spaces in education institutions

3.3 Significance of Co-Working Spaces in Education Institutions

3.3.1 The impact of co-working space

A co-working space generally has an open-plan layout [37], and open-plan layouts allow collaboration and discussions among people and urge people to be healthier by walking around more to discuss with each other. In fact, the change from traditional work layouts to open-plan layouts has been shown to improve physical and mental health [49]. Users of co-working spaces have been shown to appreciate open layouts – users in the Netherlands and Germany stated that they prefer a working space where they could collaborate to develop new ideas and transfer knowledge among themselves [28].

People working together in a shared space have the potential to stimulate innovation. Additionally, users of co-working spaces felt that camaraderie and prospective productivity in the co-

working space enhanced their work in such a way that when one person had an issue, another person would overhear and suggest a solution to the issue [5]. Working as a community allows better use of time and effort – in other words, it improves the productivity of users sharing the same space. This is supported by other research [16,18], which found that open layouts carry a sense of social proximity and community, impacting users' well-being, facilitating knowledge sharing and enabling potential business collaborations.

3.3.2 The potential impact of co-working space in education institutions

Literature has shown that co-working spaces improve human interactions, employees' well-being, productivity and knowledge sharing [5,16-18]. However, the research focused on the working population in workplaces rather than students in education institutions. Therefore, a conceptual framework is created, showing the relationship between co-working spaces and student interactions and, ultimately, its relationship with students' well-being, productivity, and knowledge, as shown in Figure 5.

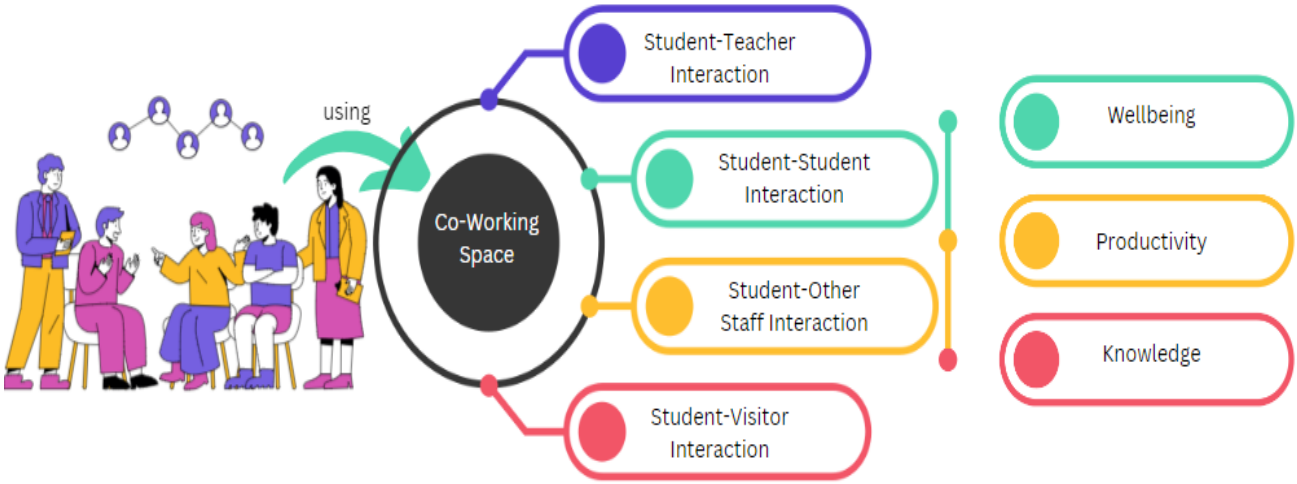


Fig. 5. Potential impact of co-working space on students in education institutions

4. Conclusions

This paper found that there is a lack of research regarding co-working spaces in educational institutions. Secondly, while there are some similarities between co-working spaces and existing spaces in educational institutions, only libraries are highly similar to co-working spaces. This paper proposes a framework for co-working spaces in education institutions with unique attributes to meet student's needs in an informal learning space. Theoretically, co-working spaces positively impact student interactions, well-being, productivity, and knowledge. Experimental data is needed to prove this theoretical assumption.

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