JRIHE
JOURNAL OF RESEARCH AND INNOVATION IN HIGHER EDUCATION

Vol. 4, No. 1 (Spring 2023)
ISSN: 2960-4419 (Online)
https://doi.org/10.48341/fca5-d394

University-based incubators, makerspaces and co-learning spaces as Creative Knowledge Environments: The case of a university-based CKE in Karachi, Pakistan

Hareem Salman[1]

[1]Graduate of MARIHE – Master in Research and Innovation in Higher Education, s.hareem.salman@gmail.com, **ORCID**: 0009-0006-3390-4016

Suggested citation: Salman, H. (2023). University-based incubators, makerspaces and co-learning spaces as Creative Knowledge Environments: The case of a university-based CKE in Karachi, Pakistan. *Journal of Research and Innovation in Higher Education*, *4*(1), 73-97.

The article is available online at: www.rihe-journal.com

Acknowledgement

This article contribution is based on course work the author submitted in the Master in Research and Innovation in Higher Education (MARIHE), supported by the Erasmus Mundus programme of the European Commission.

Abstract

This paper seeks to understand three types of knowledge production spaces, namely co-learning spaces, incubators, and makerspaces through the framework of the Creative Knowledge Environment (CKE), a theoretical term coined by Hemlin, Allwood, & Martin (2004). The physical, social and cognitive environments of these three types of spaces is described, followed by a discussion on the growing importance of CKEs in the higher education sector and their role in enhancing graduate employability. A preliminary case study of a university-based CKE named Playground located in Habib University, Pakistan is introduced. Based on the analysis of this case study, the trans-sectoral, trans-disciplinary and trans-level nature of university-based CKEs is discussed. This study has three main outcomes. Firstly, it provides an umbrella term for various types of creative, collaborative spaces that exist in the higher education arena, by adopting the conceptual terminology of Creative Knowledge Environment. Secondly, through a preliminary case study, it sheds light on the presence of real CKEs in the higher education sector and shows how they are similar in nature to other types of CKEs. Thirdly, it concludes that university-based CKEs are truly transversal in nature; often not limited by discipline, sectors of society or levels of operation. This is eventually reflected in their development of transversal competencies (or soft skills) in university students, which enhances their graduate employability and entrepreneurialism in the long run.

Keywords: creative knowledge environment, creative knowledge production, creative learning spaces, co-learning spaces, makerspaces, incubators, graduate employability.

Introduction

This paper analyses three types of spaces for creative knowledge production in the higher education arena, and attempts to explain their nature and relevance through the theoretical framework of the Creative Knowledge Environment (CKE), as presented by Hemlin, Allwood and Martin (2004).

Firstly, this study sheds light on the operational characteristics of Creative Knowledge Environments (CKEs) and their identifying features. It examines the commonalities between makerspaces, incubators and co-learning spaces that allow them to be categorized as CKEs. While there is an abundance of literature available on various kinds of makerspaces, incubators and co-learning spaces as standalone categories, there is a dearth of literature that views these spaces as a collective category on the basis of their shared features and almost no literature that employs the term 'CKE' as a theoretical concept for studying knowledge production spaces. However, there is potential for concept of the CKE to serve as a useful framework for the classification of such spaces. A collective classification of co-learning spaces, incubators and makerspaces as CKEs allows for a deeper understanding of CKEs as a broad category as well as an exploration of the combined functionalities, potentialities and constraints of these individual categories of co-creative spaces.

Secondly, the paper discusses the growing presence of such co-creative spaces in the higher education sector and the benefits they potentially bring. Forbes and Thomas (2022) argue that while culturally the concept of 'play' is only associated with children and is more widely accepted as an effective pedagogical method for learning at the primary level, there is little difference between what constitutes effective teaching at the primary and tertiary levels. Therefore, the presence of CKEs in institutions of higher education play a direct role in improving curriculum and pedagogy. Engaging in the acts of playing, making and experimenting opens up avenues for creativity, innovation and the development of transferrable competencies in students. To depict this, the paper specifically explores the case study of the Playground, a university-based CKE at Habib University in Pakistan, which incorporates elements from the three aforementioned types of spaces, in order to build a unique Creative Knowledge Environment.

Thirdly, the paper analyses the Playground case study in light of the literature review on Creative Knowledge Environments. This analysis seeks to identify the distinct characteristics of CKEs that make them transversal, as they transcend traditional boundaries between sectors, disciplines and levels of operation. The study projects that the transversal nature of these spaces is reflected in the development of transversal competencies in university students, which eventually enhances their entrepreneurialism

and employability. Finally, the paper discusses the opportunities and limitations of developing the study further.

Creative Knowledge Environment

This section elaborates on the author's (re-)definition of the term Creative Knowledge Environment (CKE), provides an overview of three types of CKEs (i.e., makerspaces, incubators and co-learning spaces), and discusses the cognitive, physical and social environments of these three types of CKEs.

The concept of the Creative Knowledge Environment (CKE) has been used by Hemlin et al. (2004) to describe various settings where knowledge is being produced and disseminated in a creative manner. Based on this definition, the author of this paper will employ the term CKE as an umbrella term to encapsulate the nature of some spaces in the higher education arena that have the potential to produce creative knowledge through the means of a creative environment, namely makerspaces, business incubators and co-learning spaces. The category of co-learning spaces also includes creative learning spaces, referred to as C-spaces by Jankowska and Atlay (2008).

Creativity is a highly loaded term, which different readers will interpret differently. Simply put, 'creativity' can be considered as the "generation of a product not only novel and imaginative, but also useful and of good quality" (Hemlin et al., 2004, p. 4) while 'knowledge' can be understood as "the state in which a person is in cognitive contact with reality" (Zagzebski, 2017, p. 92). Hence, 'creative knowledge' can be defined as the creation of new knowledge that adds value to an existing pool of knowledge, produced through an active cognitive process. In most literature on creativity, a distinction is often made between creativity as a process versus creativity as a product (Gonçalves, Mueller, & Badke-Schaub, 2017; Hemlin, Allwood, & Martin, ,2008). When talking about Creative Knowledge Environments as enablers of 'creativity', this paper would primarily refer to creativity as a process.

Wallas (1926) was the first to describe creativity as a process consisting of four stages. The first stage involves investigating a problem, followed by a period of sub-conscious processing of related thoughts. The third stage involves a sudden inspiration or insight for a solution, and the final stage consists of experimentation and validation of the

solution. This creative process is also encapsulated by the notion of 'play' or 'playful learning', which is a recurring feature of most Creative Knowledge Environments (Forbes & Thomas, 2022).

Finally, the term 'environment' is described broadly by Hemlin et al. (2004) to include all factors, tangible and non-tangible, that contribute to creating a setting in which an activity (such as the production of creative knowledge) can take place. However, for the purposes of this research paper, I will use the term 'environment' more narrowly to refer only to physical spaces that are specifically designed and socially configured for creative knowledge production. Hence, putting together the three building blocks of a CKE as explained here, I will define CKEs as physical spaces that are purposefully created and configured to provide an environment conducive to creative processes in order to potentially facilitate creative knowledge production[1]. In accordance with this definition, I will explore how makerspaces, incubators and co-learning spaces constitute creative knowledge environments (CKEs).

Creative spaces

This section provides an introduction and a brief overview of makerspaces, incubators and co-learning spaces.

Co-learning spaces

Co-learning spaces include both university-based co-working and creative learning spaces. Co-working spaces are defined as places where different people can find a free and dynamic workspace to work alone or in teams on projects of their interest, in order to potentially engage in creative production (Fuzi, 2015; Schmidt, Brinks, & Brinkhoff, 2016). One form of co-working spaces in the context of universities are creative learning spaces, which serve as flexible spaces where students can engage in creative learning and knowledge application by working on course projects or other projects of their interest. Many universities are now designing separate Creative Learning Spaces (also referred to as C-Spaces), which are distinct from F-spaces (formal spaces for lecture-based teaching) and S-spaces (social spaces for learning in a relaxed environment) (Gonçalves et al., 2017; Jankowska & Atlay, 2008). Based on the significant overlaps between university-

[1] One limitation of defining CKE in this manner is that it may also include other places, such as various office environments, which are outside the scope of this paper.

based co-working spaces and creative learning spaces, these two types of spaces have been grouped together and collectively referred to as co-learning spaces for the sake of convenience.

Incubators

In present times, incubators are considered to be a vital, indispensable element of the entrepreneurship ecosystem. Since there are many forms of creative production spaces that are similar to incubators, distinguishing amongst them can be confusing. There is no consensus on a rigid definition that would clarify the exact delineations of these various types of spaces, but there is a general understanding of the varying features of such spaces (Hausberg & Korreck, 2018). Nearly all incubation facilities share the common features of providing a physical office space, access to sources of investment, peer-to-peer mentorship, business development support and opportunities for networking. They also offer other services suited to their aim and area of expertise. Most modern incubators are infrastructurally modelled after co-working spaces (Gertner & Mack, 2017; Štefko & Steffek, 2017). These business incubators and accelerators play a key role in open innovation and knowledge transfer between universities and the industry, helping enhance graduate employability (Leitão, Pereira, & Gonçalves, 2022). For the purpose of this paper, the term ‘incubator’ also includes 'pre-incubators' or 'university business idea incubators', spaces which are purposefully designed to help university students find a safe place to ideate, collaborate and experiment with potential entrepreneurial ideas (Mele, Sansone, Secundo, & Paolucci, 2022).

Makerspaces

Makerspaces can be defined as “community-run physical places where people can utilize local manufacturing technologies” (Niaros et al., 2017, p. 4). This definition encapsulates the various forms of makerspaces, while also differentiating them from the rest of the manufacturing and innovation sector. While the first recorded lookalike of a makerspace dates back to the 1800s, the modern form of makerspace was recreated by MIT in 2017 in the form of Fab Lab. These labs were designed to be “globally connected open workshops, where people can meet, interact and exchange ideas, machines, tools, materials and software with the common purpose of making (Walter-Herrmann & Büching, 2014, p. 12).

The three types of spaces described above can be considered as CKEs based on their environmental characteristics. There are three primary dimensions to the environment of a CKE: the physical environment, determined by the workplace, the equipment and resources; the social environment, dependent on the worker relationships, the organizational culture and the workers' collective attitude towards innovation; and the cognitive environment, comprising of the workers' mindsets, their skillsets, and their understanding and methods of work (Hemlin, Allwood, & Martin, 2004, pp. 2-11).

Environmental characteristics of CKEs

This section will elaborate on how the social, physical and cognitive environments of makerspaces, incubators and co-learning spaces determine their character as creative knowledge environments (CKEs).

Cognitive environment

The cognitive environment is perhaps the most essential aspect of the CKE in fuelling creative knowledge production. If the mind is stimulated, there is a much higher chance for makers and learners to engage in creative processes. Listed below are certain factors that allow co-learning spaces, incubators and makerspaces to provide an optimal cognitive environment for promoting creativity.

In traditional learning systems, the learning timeframe and assessment criteria is often quite limited and inflexible, which does not provide a suitable environment for free and self-guided modes of learning. On the other hand, places like makerspaces have much more loose structures, which allow for open thought, experimentation and learning through trial and error (Burke, 2015). While the idea of making is often associated with a creative outcome, making can also be seen as a creative process. Ratto (2011) puts forth the concept of "critical making", which he defines as a way to "connect two modes of engagement with the world that are often held separate—critical thinking, typically understood as conceptually and linguistically based, and physical "making," goal-based material work" (Ratto, 2011, p. 253). This concept challenges the idea of creative and critical thinking as a purely mental and/or verbal process while lending legitimacy to the idea of thinking by doing.

Spaces like incubators are also rich in educational and human resources that can aid the stimulation of creative thinking processes. The availability of useful resources and relevant software at hand, engagement in critical and collaborative exercises, the possibility to connect with mentors, and the opportunities available for networking all serve as mental and cognitive stimuli. While peers and colleagues can bring ideas from their areas of expertise, mentors may bring experiences of having worked on similar projects in the past. While most creations at the university level stay in their early, embryonic stages, universities with good support structures such as university-based incubators or research centres are more likely to create new ventures and produce innovation (Leitão, Pereira, & Gonçalves, 2022).

In the same way, creative learning spaces promote the role of the teacher as a facilitator instead of an instructor (Jankowska & Atlay, 2008). These spaces allow for active, self-directed and collaborative learning. When a group is more active and engaged in collaborative work, it increases the possibility of idea generation and resultantly, idea implementation. Co-working and co-learning spaces are often designed to have an aura of vigour and inspiration, so as to provide a proactive, stimulating, dynamic and co-creative environment for budding entrepreneurs (within or without their teams), freelancers and other professionals to work on their projects of interest individually or in groups (Fuzi, 2015).

All of these spaces contain tools, processes and mechanisms that fire up creative thinking capacities and have the potential to lead to idea generation.

Physical environment

The entrepreneurial orientation of a space (defined by its degree of innovativeness, risk-taking and proactiveness) varies amongst different incubation facilities and creative spaces, depending on the management structure, the design elements, the spatial configuration, the geographical location and the organizational context of the space (Gertner & Mack, 2017; Gonçalves et al., 2017).

Most CKEs are constructed using design elements that can potentially facilitate the creative process. Creative learning spaces, for example, attempt to fire up creativity by providing an environment conducive to creativity – whiteboard walls, movable furniture,

collaborative working tools, a distinctive architectural layout, anonymous brainstorming software, and other similar features are often the defining characteristics of these spaces (Jankowska & Atlay, 2008). From their surveys at the University of Bedfordshire, Jankowska and Atlay (2008) found that students and lecturers both reported the university's in-house creative learning space to have a positive impact on their creativity, their ability to discuss and share ideas, and their capacity to think from a fresh perspective.

CKEs are also often equipped with the tools required for prototyping and experimentation. A defining characteristic of makerspaces is the availability of tools, that have traditionally been available only to people working in the relevant fields (such as 3D printers). While traditional workshop spaces also provide access to tools and workspaces, makerspaces go a step further by providing a "technology-rich learning environment that facilitates innovative design experiences (Andrews, Borrego & Boklage, 2021, p. 2)." By providing access to tools and trainers that are not commonly available to people, makerspaces act as sources for creative production, knowledge application, and interest-based networking for common citizens. This can potentially lead to business generation, as people who would not otherwise be able to engage in entrepreneurial activities are able to do so (Holm, 2015, 2017). Incubators also facilitate creative and cooperative work, but with an added focus on nurturing and incubating potential businesses from it. Fuzi (2015) discusses how an entrepreneurial culture can be spurred in regions where there is a scarcity of entrepreneurialism through the development of 'hard infrastructure', such as physical co-working spaces along with the presence of facilitators and trainers.

This is how the physical infrastructure, the location, the design elements and the available toolkit of various CKEs assists them in carrying out the kind of activities required to achieve their intended creative outcomes.

Social environment

Creativity is often influenced by new environments, knowledge and ideas. As each individual has a unique and singular perspective, an individual's thought process is usually unidirectional. Group work allows these perspectives to mingle and merge, making these thought processes more multivarious, and more likely to inspire inventiveness and innovation (Hemlin et al., 2004). For this reason, collaborative work,

skill-sharing and internal and external networking are common features across most CKEs.

These features of CKEs are evident in makerspaces, which double as sites for socialization, community-building and networking, often having an "open door policy" to encourage interaction and engagement (Niaros et al., 2017, p. 16). They alsoand connect citizens locally and globally through local and international makerspace networks. They bring together innovators with diverse skillsets onto one platform, engage them in participatory ideation and prototyping, and encourage them to "benefit from synergies, diversity and cross-pollination of ideas (Capdevila, 2015)". Most makerspaces start out as citizen-driven initiatives, as they are founded and run by the local community. These spaces encourage "citizen-driven transformation" (Niaros et al., 2017, p. 6) by employing bottom-up, participatory and inclusive approaches to product creation, encouraging tool- and idea-sharing, and promoting community-based practices (Niaros et al., 2017). Moreover, creative learning in a community-driven context allows the inclusion of groups that have traditionally been socially marginalized and economically disadvantaged. While makerspaces initially emerged through business organizations, they have since spread to various spaces such as museums, libraries, and the higher education sector. In general, creative spaces and innovation labs are becoming increasingly common as they are thought to promote higher-order thinking skills, by encouraging group work, idea-sharing and problem-solving approaches (Halverson & Sheridan, 2014; Jankowska & Atlay, 2008).

Similar to makerspaces, incubators and co-learning spaces also have a strong system of internal networking. These spaces do not just provide financial and professional support but also social, moral and emotional support through the means of mentors and peers (Fuzi, 2015). The environment in which a potential entrepreneur is based affects their capacity to innovate and the quality of their ideas. Hence, incubators generally exist in the form of clusters, which either develop organically or as part of planned institutional policy (Piterou & Birch, 2014). This means that they often have associations with other similar organizations and are part of larger networks.

Therefore, it can be inferred that a supportive management style, strong internal collaboration, a spirit of collegiality, and robust external networks of a CKE often become

the measure for its potential creative capacity (Aernoudt, 2004; Gertner & Mack, 2017; Hausberg & Korreck, 2018; Jansen, van de Zande, Brinkkemper, Stam, & Varma, 2015).

Summary

Table 1 (on the next page) presents a summary of the above discussion, summing up how various environmental features of makerspaces, incubators and co-learning spaces play a role in rendering it a CKE. There are significant overlaps and crossovers between the characteristics of the physical, social and cognitive environments of each type of space. There can also be many similarities between the features of three types of spaces (for example, 'movable furniture' can be a feature across makerspaces, incubators and co-learning spaces). However, most features have only been mentioned once in the table for the sake of avoiding repetition.

Table 1: Summary of the environmental features of CKE

Type of Environment / **Type of Space**	***Cognitive Environment***	***Physical Environment***	***Social Environment***
Makerspaces	'Doing as thinking' Shared expertise Experiential learning Participatory prototyping Skill-sharing Tinkering Experimentation Trial and error	Availability of tools Access to high-tech machines (e.g., 3D printers)	Cross-pollination of ideas Networking with larger maker/hacker network Shared identity as makers Open door policy

Incubators	Collective brainstorming Co-creation Experiential learning Collaborative problem-solving Presenting ideas & receiving feedback Debating/discussing	Office space Software for collaborative work Architecturally accommodative of group and individual work	External networking Mentoring Motivated and driven peers Idea-sharing across platforms Moral and emotional support
Co-learning Spaces	Individual thinking Group thinking Facilitated thinking/reasoning Idea-sharing Problem-based approach	Movable furniture Whiteboards Post-it notes Distinctive architectural layout Anonymous brainstorming software	Internal networking Diverse backgrounds of learners/workers Socialization with other groups Stakeholder collaboration

Importance of CKEs in higher education

As entrepreneurialism gains recognition as a tool for economic growth and development, the focus on developing an entrepreneurial mindset and skillset through a university education is also gaining importance across the higher education sector. Higher education institutes are increasingly placing emphasis on developing entrepreneurship ecosystems that support innovation and encourage entrepreneurial development (Hausberg & Korreck, 2018). Universities play a key role in determining the regional climate for innovation and entrepreneurship. As teaching and research have been the first and second missions of universities for a long time, entrepreneurialism is increasingly being framed as the third mission for many modern universities and has quickly become a priority for academics, recruiters, and policymakers.(Schnurbus, & Edvardsson, 2022). Most universities are now aiming to develop an entrepreneurial profile, as more evidence gathers on how programs encouraging entrepreneurialism in students play a role in

increasing the likelihood of students pursuing more entrepreneurial paths and eventually promoting regional development (Jansen et al., 2015; Schnurbus, & Edvardsson, 2022). Entrepreneurialism is no longer seen as a niche quality only possessed by students from business programs, but a soft skill (or transversal competency) that should be developed in all students regardless of their disciplinary background.

University-based incubators and co-learning spaces are becoming increasingly common as they allow universities to form links with enterprises, which provides them access to funding, improves their relevance in the job market, makes their graduates more employable, connects them to the community, and leads to knowledge transfer between business organizations and institutions of higher education. By bringing together university research expertise and business funding, these incubators (or pre-incubators) often work on solutions to real-world problems, and become sites for the production of new, creative knowledge (Piterou & Birch, 2014). Similarly, makerspaces are also fast gaining relevance in higher education institutions, especially in STEM programs, as new spaces are being opened up that offer advanced tools for making and an area for students to work collaboratively with peers and faculty (Andrews, Borrego & Boklage, 2021). Co-learning spaces are also being used as sites for ideation and experimentation of alternative ideas and innovative practices. An example of such spaces is innovation labs, where knowledge is brought by experts from various fields, allowing for interdisciplinarity research and innovation..

With increasing democratization, commercialization, and decentralization of work, the demand for such creative knowledge environments has grown globally (Schmidt et al., 2016), which is influencing the higher education arena in Pakistan as well (Usman, 2014). The next section presents the case of a university-based CKE in Karachi, Pakistan, which has features in common with makerspaces, incubators and co-learning spaces.

Preliminary case study: Playground, Habib University (Karachi Pakistan)

This study will analyse the case of ‘Playground’ in Habib University, which the author considers to be an example of a Creative Knowledge Environment (CKE) based in a higher education institution in Karachi, Pakistan. Using the case study method, the author attempts to explore the nature of this space, analyse which features it shares in common with other types of CKEs (like makerspaces, incubators and co-learning spaces), and look

at its function as a producer of creative knowledge. A complete case study of the Playground will be based on analysing the centre's website, documents and databases, interviewing its staff and students, and observing community interactions and dynamics within the space. However, for the purposes of this working paper, the author has only conducted a preliminary case study using two main sources: the centre's website and information obtained from an introductory interview with the centre's director and two staff members.

Based on a website and documentary review as well as an interview with the Playground Director, Dr. Anzar Khaliq, the author has developed some insight into the mission and functions of the Playground, which is the basis of the subsequent analysis. According to its website, the Playground is "a space, and an ecosystem, designed exclusively to enable learning, experimentation, ideation and prototyping across all disciplines at Habib University (Playground: Centre for Trans disciplinarity, Design & Innovation, 2023)". The name Playground itself centres on the word play – an act of interacting, experimenting and creating in an enjoyable manner (Forbes & Thomas, 2022). As gathered from interviewing Dr. Khaliq, the Playground is a creative, collaborative, transdisciplinary and human-centered space of learning and knowledge production, where creative forms of knowledge are produced, applied and disseminated (Khaliq, personal communication, Nov 28, 2019). Therefore, it is deducible that the Playground can be viewed as a Creative Knowledge Environment (CKE), which has commonalities with makerspaces, incubators and co-learning spaces. It does not, however, fit entirely into the description of a single such space category, and is therefore more broadly definable as a CKE.

Case study analysis

Background

The idea for the Playground was first conceived when a few Habib University faculty members were introduced to a visiting team from the Hasso Plattner Institute of Design at Stanford University (commonly known as Stanford d.school). Drawing upon the idea of the d.school as a space for creative exploration, they decided that Habib University could benefit from a similar initiative. Therefore, employing a bottom-up approach, interested faculty and students of Habib University were gathered to conceptualize a

human-centred space for creative production, which eventually led to the creation of Playground. The centre is now considered to be a user-centred ideation space which adopts an empathy-based, design thinking approach, where all problems are looked at from the human-centred perspective of the impacted users (Khaliq, personal communication, Nov 28, 2019).

CKEs as trans-sectoral

The academia in Pakistan has traditionally been removed from other sectors of society. However, there has been a growing interest in strengthening the relationship of academia with other sectors, especially with the industry (Usman, 2014). While an increasing number of Pakistani universities are becoming more entrepreneurially inclined and a few have even started to develop business and technological incubators, hardly any have established a multi-purpose space like the Playground. According to Khaliq (personal communication, Nov 28, 2019), this is the only space of its kind to exist in an academic institute in Pakistan. It is more generic in nature than a lot of the other spaces in the same category, as it is neither limited in terms of discipline nor with regard to the sector from which problems and projects can be adopted.

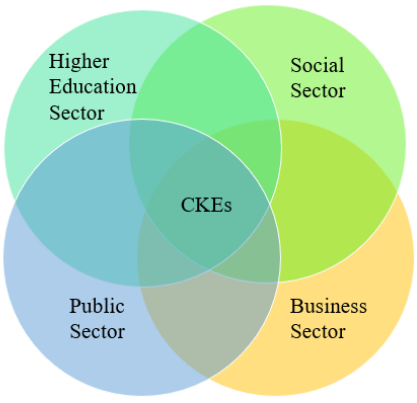
Because of its activities, the Playground has become a means to bridge the gap between the higher education sector and the industrial, social and public sector. Since its initiation, several companies and non-profit organizations have contacted the Playground to seek student involvement in ongoing projects, as a result of which students have worked with businesses on different projects, such as conducting market research, creating product prototypes and designing marketing campaigns. One example of such a project involved a market analysis of electricity consumption patterns in various areas of Karachi, which resulted in the creation of a user database – a potentially useful tool for market analysis.

Besides working with the industry, social innovation is also at the core of Playground's agenda. Through the Playground forum, undergraduate students have conducted projects to address the state of public health, education and mobility in the city, by working with organizations such as the Karachi Neighborhood Improvement Project, Shehri Citizens for a Better Environment, and others. Similar projects have also been conducted in partnership with public sector organizations. For instance, a project was completed in cooperation with the local Ministry of Education which approached the Playground to

seek support in improving some aspects of the public-school curriculum in the province of Sindh. Research has shown that working on such projects enables students to become more self-reliant and develop an increased confidence for engaging in professional practice. Project-based learning involves collaboration with peers and engagement with real-world stakeholders, which can help students to develop important interpersonal and communication skills, and to learn how to work effectively in teams. These are highly valued skills in many professions, and can help students to succeed in their future careers (Andrews, Borrego & Boklage, 2021).

Through projects like these, the Playground provides a platform for the interaction of academia, industry, government and society, the four elements of the “quadruple helix" of innovation (Carayannis & Campbell, 2009). Like the Playground, most university-based CKEs (including co-learning spaces, makerspaces and incubators) help in bridging the gap between these four distinct sectors of society. Figure 1 shows how CKEs are located at the intersection of the social, public, business and higher education sector, which allows them to bring these sectors closer together to work in tandem with each other.

Figure 1: CKEs at the intersection of Quadruple Helix (self-conceptualization)



The Bring Your Own Challenge (BYOC)[2] program is one of the initiatives of Playground that allows people from any field and section of society to bring a project of relevance to

[2] “Bring Your Own Challenge (BYOC) is our program for industry and community partners to benefit from Habib’s intellectual and material resources” (Playground: Centre For Transdisciplinarity, Design & Innovation, 2023).

the forum. The university's students benefit from working on problems of real life significance, and the persons bringing the project benefit from the university's vast pool of knowledge, and the fresh and creative perspective of its students. Many of these events, projects and workshops are also open to the public, so there is often participation of interested people from outside the university as well. This interaction between the higher education sector and other sectors of society is essential for knowledge application, innovation and regional development (Schnurbus, & Edvardsson, 2022).

CKEs as transdisciplinary

According to its website, the Playground is a "transdisciplinary, design-led, innovative, collaborative, playful and experiential" centre of learning (Playground: Centre for Trans disciplinarity, Design & Innovation, 2023). This broad set of characteristics does not restrict the kind of projects that can be carried out at the Playground, but does define the perspective and procedure through which all projects are approached. Through the forum of the Playground, all students of the university (regardless of their disciplinary background) have access to the tools, gadgets, facilities and resources present in the university, such as its design lab, computer labs, library makerspace, and so on. They can also contact faculty, staff, students and external stakeholders from any department, sector or area of expertise to collaborate with them on a joint project.

In addition, the Playground also serves as a hybrid teaching-learning-working space, as several course modules being taught in the Playground follow a more learner-centred pedagogy, such as using problem-based learning and applied research methods. In this way, it also serves as a site for curriculum development and academic reform (Khaliq, personal communication, Nov 28, 2019).

CKEs as trans-level

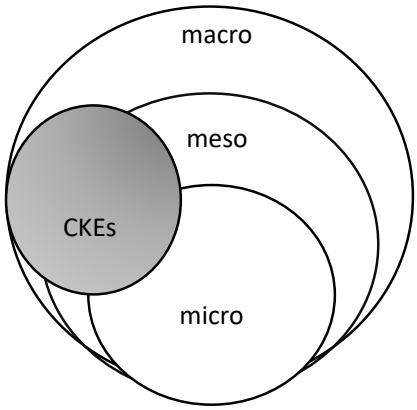
Creative organizations can usually be divided into three levels: macro-level, which comprises of national-level and interorganizational environments; meso-level, which refers to the level of research institutes and business companies; and micro-level, which is used for individuals and small research groups (Hemlin et al., 2008). In terms of definition, spaces such as the makerspaces, incubators,co-learning spaces, and their hybrids (such as the Playground) should be categorized as meso-level CKEs. However, in reality, these spaces often tend to cut across the three levels due to their trans-

disciplinary and trans-sectoral nature. For instance, as a university-based centre, the Playground is a meso-level CKE by definition. However, it has the potential to have far-reaching impacts at the macro-level, such as through some of its previous projects in partnership with public sector actors and large corporate sector organizations, such as the Ministry of Education in Sindh[3], the House of Habib[4] and The Citizen's Foundation[5]. One staff member at the Playground mentioned that when students assisted a public organization like a public utility company in helping it improve its services, they were automatically creating a massive impact because if the organization "implements it throughout the country later, then you're impacting millions and millions of people because of the sheer population of Pakistan (staff member, personal communication, October 2021)." Similarly, the Playground is also open to small-scale projects proposed by individuals. For example, students can use it as a launching pad for their own small startup ideas, social projects or research projects. This is how the Playground operates at the micro-, meso- and macro-levels.

Like the Playground, most CKEs are meso-level, as they are either independent organizations developed through communal initiatives or spaces systematically designed by a university, business or the government. However, they are usually well-connected with other spaces of a similar nature, and thus form wide and dense networks (such as makerspace and incubator networks), which enables them to create ripples at the macro-level. In these spaces, many people work individually and in small groups on their personal projects which are not governed by the organization itself, so there is also ongoing creative production at a micro level. This is how most CKEsallow for significant interactions and overlaps between the macro-, meso- and micro-levels. Hence, as shown in Figure 2, CKEs often serve as cross- and trans-level entities by transcending the boundaries of strictly defined levels of operation.

[3] Sindh is one the four provinces in Pakistan.
[4] The House of Habib is one of Pakistan's largest conglomerate companies which has multiple businesses in different industries.
[5] The Citizens Foundation (TCF) is a non-profit organization that operates the country's largest network of free or low-cost schools.

Figure 2: CKEs cutting across the macro, meso and micro levels (self-conceptualization)



Conclusion

According to its research aims, this study has been conducted in three parts. The first part attempts to introduce and explain the concept of the Creative Knowledge Environment (CKE), in order to use it as a defining category for a multitude of creative spaces. While many different variations and hybrids of such spaces exist in the higher education arena, this research specifically focuses on three major spaces -makerspaces, incubators and co-learning spaces - in order to elucidate the kind of features that constitute CKEs. The purpose of studying these places using CKE as a framework is to find a common term to describe spaces that share the mutual feature of being physically designed for the purpose of creative production, and yet do not have a singular term that could collectively describe their nature. Drawing on the diverse kinds of CKEs described in the first part, the second part of the study attempts to explain the growing importance of CKEs in the higher education sector. The third part includes a short, preliminary case study of the Playground at Habib University (Pakistan), which is a university-based, transdisciplinary centre that employs a human-centred, design thinking approach to solving problems. The study takes note of the elements that the Playground has in common with makerspaces (as it gives access to tools and labs across the university), with incubators (as it provides access to mentors and experts, allows product prototyping, and provides students the opportunity to work on their own projects, including developing their own start-ups), and with co-learning spaces (as it is architecturally designed for creative, collaborative work and hosts project-based classes and other such learning experiences).

Corresponding to its three research aims, this study also has three main outcomes. First, it provides an umbrella term for various types of transdisciplinary, collaborative and creative spaces that exist in the higher education arena, by adopting the concept of the Creative Knowledge Environment and applying it to the context of higher education. Second, through conducting a preliminary case study of one such space in Pakistan, it sheds light on the presence of real CKEs in the higher education sector and shows how they share features with other CKEs. Third, by placing the case study in context of the literature review, it concludes that university-based CKEs are often not limited with regards to disciplines, sectors of society or levels of operation. To sum up, the term Creative Knowledge Environment by Hemlin, Allwood, & Martin (2004) was explored in this study, its usage was validated by its application to three distinct types of spaces (namely makerspaces, incubators and co-learning spaces), and a case study of a university-based CKE, which was a hybrid of these types of spaces, was introduced to broadly explore the nature of the CKE. It was inferred that CKEs are characteristically transversal: meaning trans-sectoral, trans-disciplinary and trans-level in nature.

As this paper only provides a preliminary case study, there is potential to develop this study further. A more detailed case study can provide deeper insight into the operations of CKEs in Karachi, Pakistan. The theory of the Creative Knowledge Environment already provides a solid theoretical grounding for exploring spaces like the Playground within and outside the higher education arena. If there is a better understanding of the physical, social and cognitive variables that influence creativity in these spaces, there is likely to be a greater effort towards designing environments, spaces and policies that encourage creativity (Hemlin et al., 2004). Thus, there is an identifiable need for a deeper analysis of the extent to which designing creative environments impact learning and creative production. There is also significant criticism on the concept of associating learning and creativity with a physical space. In order to see whether these spaces actually serve as enablers of creativity, the utility of such spaces needs to be explored through comparisons with other spaces that are not designed solely for the purpose of creative production. Furthermore, it is also important to analyse the impact of incorporating CKEs into higher education institutes, for example, by noting the extent to which Playground and similar CKEs aid their host universities in improving their stakeholder cooperation and achieving their third mission.

Overall, while creative learning spaces are emerging areas of interest in the field of higher education, there is a lot of room for research about the presence, need, effectiveness, and true role of Creative Knowledge Environments (CKEs) in creative production and their value in connecting the higher education sector to other sectors of society.

Hareem Salman is a graduate of the Erasmus Mundus programme, Master in Research and Innovation in Higher Education (MARIHE). She holds a Master of Administrative Sciences from Tampere University, Finland and a Master in Educational Science from ELTE, Hungary. She is currently working as a Deputy Manager at the Graduate School Curation Program at Habib University, Pakistan. She has previously worked in the Educational Help, Support and Academic Services Centre at Habib University and as a research intern at the Centre for Research in Higher Education Policies at the University of Porto, Portugal.

References

Aernoudt, R. (2004). Incubators: Tool for entrepreneurship? *Small Business Economics*, *23*, 127–135. https://doi.org/10.1023/B:SBEJ.0000027665.54173.23

Andrews, M.E., Borrego, M. & Boklage, A. Self-efficacy and belonging: the impact of a university makerspace. *IJ STEM Ed* 8, 24 (2021). https://doi.org/10.1186/s40594-021-00285-0

Burke, J. (2015). Making Sense: Can Makerspaces Work in Academic Libraries? *Journal of Library Administration*, 55(1), 31-43. https://doi.org/10.1080/01930826.2014.989271

Capdevila, I. (2015). How Can City Labs Enhance the Citizens' Motivation in Different Types of Innovation Activities? In T. Denison, M. Sarrico, & C. B. Tornquist (Eds.), *Social Informatics* (pp. 64–71). Springer International Publishing. https://doi.org/10.1007/978-3-319-15168-7_9

Carayannis, E. G., & Campbell, D. F. J. (2009). Knowledge Creation, Diffusion, and Use in Innovation Networks and Knowledge Clusters (Praeger, 2006), E-Development Toward the Knowledge Economy. In *International Journal of Technology Management*, *46*, 356 - 261. https://doi.org/10.1504/IJTM.2009.023374

Forbes, L. & Thomas, D. (2022). *Professors at Play Playbook*. Carnegie Mellon University: ETC Press. Pittsburgh, PA.

Fuzi, A. (2015). Co-working spaces for promoting entrepreneurship in sparse regions: the case of South Wales. *Regional Studies, Regional Science*, *2*(1), 462–469. https://doi.org/10.1080/21681376.2015.1072053

Gertner, D., & Mack, E. A. (2017). The Entrepreneurial Orientation (EO) of Incubators, Accelerators, and Co-working Spaces. *International Journal of Regional Development*, *4*(2), 1 - 15. https://doi.org/10.5296/ijrd.v4i2.10210

Gonçalves, M., Mueller, R. M., & Badke-Schaub, P. (2017). Inspiration Space: Towards a theory of creativity-supporting learning environments. *Design, Technology, and Communication, 19*, 15-28. https://doi.org/10.21606/dma.2017.19

Halverson, E. R., & Sheridan, K. M. (2014). The maker movement in education. *Harvard Educational Review*, *84*(4), 495–504. https://doi.org/10.17763/haer.84.4.34j1g68140382063

Hausberg, J. P., & Korreck, S. (2018). Business incubators and accelerators: a co-citation analysis-based, systematic literature review. *Journal of Technology Transfer*, 43(3), 606-632. https://doi.org/10.1007/s10961-018-9651-y

Hemlin, S., Allwood, C. M., & Martin, B. R. (Eds.). (2004). *Creative knowledge environments: The influences on creativity in research and innovation*. Northampton, MA: Edward Elgar.

Hemlin, S., Allwood, C. M., & Martin, B. R. (2008). Creative knowledge environments. *Creativity Research Journal*, 20, 196–210. https://doi.org/10.1080/10400410802060018

Holm, E. J. Van. (2015). Makerspaces and Contributions to Entrepreneurship. *Procedia - Social and Behavioral Sciences*, *195*, 24–31. https://doi.org/10.1016/j.sbspro.2015.06.167

Jankowska, M., & Atlay, M. (2008). Use of creative space in enhancing students' engagement. *Innovations in Education and Teaching International*, *45*(3), 271–279. https://doi.org/10.1080/14703290802176162

Jansen, S., van de Zande, T., Brinkkemper, S., Stam, E., & Varma, V. (2015). How education, stimulation, and incubation encourage student entrepreneurship: Observations from MIT, IIIT, and Utrecht University. *International Journal of Management Education*, *13*(2), 170–181. https://doi.org/10.1016/j.ijme.2015.03.001

Leitão, J., Pereira, D., & Gonçalves, Â. (2022). Business Incubators, Accelerators, and Performance of Technology-Based Ventures: A Systematic Literature Review.

Journal of Open Innovation: Technology, Market, and Complexity, *8*(1), 46. https://doi.org/10.3390/joitmc8010046

Mele, G., Sansone, G., Secundo, G., & Paolucci, E. (2022). Speeding up Student Entrepreneurship: The Role of University Business Idea Incubators. *IEEE Transactions on Engineering Management*. https://doi.org/10.1109/TEM.2022.3175655

Niaros, V., Kostakis, V., & Drechsler, W. (2017). Making (in) the smart city: The emergence of makerspaces. *Telematics and Informatics*, *34*(7), 1143–1152. https://doi.org/10.1016/j.tele.2017.05.004 Playground: Centre For Transdisciplinarity, Design & Innovation. Accessed on 20-01-23. Retrieved from https://habib.edu.pk/playground/

Ratto, M. (2011). Critical making: Conceptual and material studies in technology and social life. *Information Society*, *27*(4), 252–260. https://doi.org/10.1080/01972243.2011.583819

Schmidt, S., Brinks, V., & Brinkhoff, S. (2016). Innovation and creativity labs in Berlin. *Zeitschrift Für Wirtschaftsgeographie*, *58*(1), 49–64. https://doi.org/10.1515/zfw.2014.0016

Schnurbus, V., & Edvardsson, I. R. (2022). The third mission among Nordic universities: A systematic literature review. Scan*dinavian Journal of Educational Research*, 66(2), 238-260. https://doi.org/10.1080/00313831.2020.1816577

Štefko, R., & Steffek, V. (2017). A study of creative industry entrepreneurial incubation. *Polish Journal of Management Studies*, *15*(2), 250–261. https://doi.org/10.17512/pjms.2017.15.2.23

Usman, S. (2014). Governance and Higher Education in Pakistan: What Roles do Boards of Governors Play in Ensuring the Academic Quality Maintenance in Public Universities versus Private Universities in Pakistan? *International Journal of Higher Education*, *3*(2). https://doi.org/10.5430/ijhe.v3n2p38

van Holm, E. J. (2017). Makerspaces and Local Economic Development. *Economic Development Quarterly*, *31*(2), 164–173. https://doi.org/10.1177/0891242417690604

Walter-Herrmann, J., & Büching, C. (Eds.). (2014). FabLab: Of machines, makers and inventors. Transcript Verlag.

Wallas, G. (1926). The art of thought. J. Cape: London.

Zagzebski, L. (2017). What is Knowledge? In *The Blackwell Guide to Epistemology*, 92–116. https://doi.org/10.1002/9781405164863.ch3

Appendix

Interview questions with playground staff

1. What is the nature and specific features of your space?
2. How will you define creative knowledge? Do you believe your space has the potential to generate creative knowledge? If yes, how?
3. How would you categorize your space? Do you think it can be described as a makerspace, a co-working space, a creative learning space or an incubator of sorts?
4. What are the key features and core functions of this space?
5. Do you believe this space is helping you achieve some part of the third mission of the university?
6. How does this space help the university build relationships with external stakeholders?
7. What is the contribution of this space to the broader society or to the student's personal development?
8. Do you know of any other similar spaces in Karachi, Pakistan or elsewhere?
9. Where did you draw inspiration for this space?
10. What resources would you refer me to, so I can do a case study of this space or other such spaces in Pakistan?