Author/s:
Mahat, M

Title:
Purpose, process, place, pedagogical affordance and product (5Ps) of student learning in higher education: beyond Beckers

Date:
2022-01-01

Citation:
Mahat, M. (2022). Purpose, process, place, pedagogical affordance and product (5Ps) of student learning in higher education: beyond Beckers. Facilities, 41 (1-2), pp.140-156. https://doi.org/10.1108/F-06-2022-0086.

Persistent Link:
https://hdl.handle.net/11343/324507

Purpose, process, place, pedagogical affordance and product (5Ps) of student learning in higher education: Beyond Beckers

Journal:	*Facilities*
Manuscript ID	f-06-2022-0086.R1
Manuscript Type:	Original Article
Keywords:	physical space, pedagogy, affordances, student learning, Higher education, learning theories

Purpose, process, place, pedagogical affordance and product (5Ps) of student learning in higher education: Beyond Beckers

Abstract

Purpose. Universities are investing billions of dollars in building infrastructure, with the design of learning spaces driven by technological developments and long-standing changes in pedagogical theory and practice. The aim of the study is to investigate the alignment between pedagogy and space by responding to a single research question: What is the relationship between the purpose, process, place, and product of student learning in higher education?

Design/methodology/approach. Drawing on Beckers et al. (2015) purpose-process-place framework, the study employs an online survey and photo elicitation method to gather perspectives from educators and students in one Australian university about their learning spaces. A hybrid approach consisting of inductive and deductive coding to thematic analysis was employed to find repeated patterns of meaning.

Findings. 24 images of learning spaces were received from eight educators and 16 students. Thematic analysis of the images and responses by participants highlights the importance of the pedagogical affordances of the learning environment and the product of learning, which are aligned to the purpose-process-place of learning.

Originality. The study's findings extend the purpose-process-place framework (Beckers et al., 2015) to include pedagogical affordances and the product of learning. The 5Ps of Aligning Pedagogy and Space Framework posits that *pedagogical affordances* within a *place* must be deployed in such a way so that teaching and learning *processes* can contribute to enhancing educational goals or *purpose* to improve student learning outcomes, i.e. *product*. This framework provides a context for understanding the relationships between pedagogy and space in higher education.

Research limitations/implications. This study provided a robust approach grounded in data to understand the alignment between space and pedagogy. Articulating students learning as an output of the alignment between space and pedagogy has important implications for the design of learning

spaces and pedagogical practices in higher education. One limitation to the study however is noteworthy. The surveys had limited responses. Whilst the small response rates may not necessarily lead to biased results, it is acknowledged that a larger sample is likely to give more reliable results to enable the theory to be generalised.

Keywords

Physical space, Pedagogy, Affordances, Learning theories, Higher education, and Student learning

Introduction

Universities globally are investing billions of dollars in building infrastructure. This investment reflects the universal access to higher education (Trow, 2007) that has resulted in increased enrolments, and have taken place as part of campus master planning and architecture (Temple, 2008), with principal concerns around space utilisation and financial effectiveness (Avery, 1994; Higher Education Funding Council for England 2000). Despite this great investment, there is little evidence that the design of learning spaces is aligned with pedagogical implementation (Marmot, 2012; Temple, 2007, 2008) or an understanding of the teaching and learning that occurs within it (Barnett & Temple, 2006).

The university, space, and learning are intimately connected, and understanding the university space is crucial in understanding how universities work, specifically in terms of teaching and learning (Temple, 2008). This is a methodologically difficult area, with many moving variables to take into account but one that needs more attention. In particular, there is a need to develop "better conceptual frameworks and more appropriate methods and tools that reveal, assist and inform" (Boddington and Boys, 2011, p. xviii) greater alignment between pedagogy and space. This study responds to this critical need to create and design learning environments through an understanding of how the physical space reflects and promotes different pedagogical processes.

Drawing on Beckers et al. (2015) 'purpose-process-place' framework, this paper discusses a study undertaken of higher education spaces in one Australian university. The aim of the study is to investigate the alignment between pedagogy and space by responding to a single research question:

What is the relationship between the purpose, process, place, and product of student learning in higher education? Employing an online survey and photo-elicitation method, the paper investigates the relationships between student learning and educational learning spaces that can positively impact higher educational outcomes and design practices. In doing so, it advances a new theoretical framework that links physical space to pedagogy and student learning in higher education. It concludes with important implications for design practice, pedagogical planning, and student learning.

Aligning pedagogy and space in higher education

Higher education has been experiencing a more diverse student body, which requires new ways of teaching, putting pressure on traditional teacher-centred spaces (Boddington & Boys, 2011; Boys, 2015; Ellis & Goodyear, 2010, 2016). As physical learning spaces in higher education gained widespread acknowledgment and increasing importance (Vercellotti, 2018), the role of pedagogy in these spaces has gained equal importance (Valtonen et al., 2021). These student-centred pedagogical approaches in more innovative learning spaces are said to support the acquisition of the necessary 21st century skills (Voogt & Pareja Roblin, 2012), strong content expertise along with more general abilities, such as problem-solving and collaboration skills (Valtonen et al, 2021).

However, as the pandemic has shown, it is possible to imagine higher education being supported through and within a far greater variety of settings and pedagogies than is usual. Hybridity and flexibility is key as higher education moves out of the pandemic. A learning environment where technology permeates physical spaces, augmenting and enhancing learning experiences (Bennett et al., 2020), creating interfaces between virtual spaces and real-world phenomena to overcome disciplinary and organizational boundaries (Ninnemann et al., 2020) can help accommodate and promote pedagogical approaches that can go beyond online and in-person activities (Jens & Gregg, 2021).

Several frameworks attempt to articulate the alignment between the design of physical spaces and pedagogical practices. The Pedagogy-Space-Technology framework, for instance, identifies key requirements for a new learning space in terms of pedagogy, technology, and physical space (Radcliffe et al;., 2008). Another framework, the Spaces for Knowledge Generation, provides

guidelines for designing student-centred learning environments including a set of practical rules, steps for the production of future-proofed spaces, and a series of design principles for maximising learner agency (Souter et al., 2011). This current study uses the purpose-process-place framework by Beckers et al. (2015) which provides a theoretical lens for the research.

Beckers et al. (2015) proposed a framework where physical learning spaces are linked to learning theories and educational processes. The framework builds on the 'purpose-process-place' framework of Duffy et al. (2011) which was developed to analyse the interaction between organisations and the use of the physical environment. Purpose-process-place, as illustrated in Figure 1, refers to 'why, how, and where' in the specific context of 'what'. This is described in turn.

[Insert Figure 1]

Figure 1. Purpose-process-place framework (Source: Beckers et al., 2015)

The transformation of higher education learning spaces over many decades is shaped by the learning paradigms of the institutions (Boys, 2011; Lippmann, 2010; Monahan, 2002) and follows the trajectory of four key learning theories: behaviourism, cognitivism, constructivism, and connectivism or what Beckers et al. (2015) refer to as the purpose of education.

Firstly, behaviourism fits with Dewey's perception of the purpose of school as a place for the transfer of knowledge and preparing students to participate in society (Rodgers, 2002). Secondly, cognitivism focuses on how learners learn, how information is received, organized, and retrieved by the mind (Niesser, 1967). Thirdly, social constructivism stresses the need for collaboration and social interaction between learners (Vygotsky, 1962). Finally, connectivism involves understanding learning in a digital age (Siemens, 2005). Many authors, for the sake of simplicity, have delineated these theoretical orientations as teacher-centred or student-centred. Teacher-centred refers to pedagogies shaped by behaviourism and cognitivism where the teacher imparts knowledge to the learner. Student-centred refers to pedagogies shaped by constructivism, social constructivism, and connectivism where the student plays an active part in the construction of knowledge.

Beckers et al. (2015) classified the main education processes based on these four learning theories: programmed instructions, autonomous study, interactive learning in small groups, and

network learning through digital platforms, with different power distribution between learners and teachers. Programmed instruction or teacher-learner amplifies the traditional teacher-centred way of teaching based on behaviourism. Autonomous study or learner-content sees the shift away from teacher-centred methods of course delivery and more freedom for students to choose the type of learning that suits them best (Ashworth et al., 2004). Interactive learning in small groups or learner-to-learner stresses the need for collaboration among learners and the shift in a teacher's role from "the sage on the stage" to "the guide on the side" (Martin et al., 2007, p. 13). Finally, network learning or learner-interface interaction is a key component of a technology-based interactive learning environment.

By categorising the educational processes in this way, Beckers et al. (2015) identified the corresponding physical settings that are aligned with these educational processes: a setting for large groups, an individual learning setting for concentration, a setting for small group work, and informal settings. The didactic setting optimises teacher's transmission, presented with a one size fits all approach, regardless of the learners' unique needs or styles. The individual setting is focused on building students' capacity to build knowledge by individual reflection about external stimuli and sources. The informal setting is focused on new ways of learning characterised by synchronous and asynchronous interactions. And finally influenced by social constructivism, a collaborative setting helps students connect and exchange ideas.

Each component can be placed on a two-by-two matrix with social interaction in learning on the vertical axis and self-regulation in learning on the horizontal axis. According to Beckers et al. (2015), the development from behaviourism to cognitivism implies an increase of self-regulation in learning (Zimmerman, 1989; Chen, 2002), and the development from social constructivism to connectivism emphasises increase in social interaction (Siemens, 2005; Van der Zanden, 2010). This matrix can be transposed to the process and place quadrant.

The framework provides a theoretical lens for investigating learning spaces in higher education. However, the framework advanced by Beckers et al. (2015) could be extended to describe the alignment of purpose-process-place to student learning. Research suggests that physical learning environments correlate positively to student learning outcomes (Beichner et al, 2007; Brooks, 2011;

Dori et al, 2003). While the framework implicitly suggests that the alignment of pedagogy and space will result in improved outcomes, student learning is not explicitly discussed in the framework (Author, forthcoming).

Studies have shown that new and innovative spaces in higher education support the acquisition of 21st century skills of students (Beckers et al., 2015; Harrison & Hutton, 2014; Fisher & Newton, 2014; Park & Choi, 2014, Matthews et al., 2011; Boys, 2011). A simple characterisation of 21st century skills can be described as the 4Cs, i.e. Creativity, Critical thinking, Collaboration and Communication (P21, 2016). These skills are foundational elements for students' success in a highly connected, knowledge-based and complex world (National Education Association, n.d.). Consistent to behaviourism and the transfer of knowledge from teacher to learner, an additional outcome could be included: concept building. This refers to the learners' acquisition and mastery of the body of knowledge that is being studied—facts, theories, principles, ideas, and vocabulary. An extension of the purpose-process-place framework to include the alignment of the five skills required for students' success (i.e. product) would provide the much-needed lens to support the design of learning spaces.

In summary, the extended framework suggests that learning outcomes of students could be achieved vis-à-vis spatial developments in higher education that support changes in education by its considered alignment of purpose-process-place-product. As an example, students gain collaboration skills in a collaborative spatial setting, that is aligned to the learner-learner process, consistent with social constructivism theory. If one is to build critical understanding of the alignment between pedagogy and physical space, a well-considered framework that describes and evaluates this relationship is imperative (Author, forthcoming).

Methods

This study employs a mechanistic emergent constructionist grounded theory approach (Levers, 2013) which focuses on conceptual thinking to generate a theory on space and pedagogy (Glaser & Strauss, 1967; Strauss & Corbin, 1997). Using this approach, a theory, grounded in the data, must be produced (Birks et al., 2019). The grounded theory approach encourages researchers to go back and forth between data and the developing analysis as well as tolerate some ambiguity while gaining familiarity

with the empirical world (Charmaz & Thornberg, 2021). An online survey and photo-elicitation data collection method were used to collect data from both educators and students. Photo elicitation refers to the use of photographs as stimuli in fieldwork to "elicit implicit knowledge…in a way that other methods cannot" (Edgar, 1999, p.198). Previous studies have adopted photo-elicitation as one of the means to gain student-centric perspectives on their life or learning experience within a higher education context (see examples of Bates et al., 2017; Gomez, 2020; Kahu & Picton, 2020). While predominantly used in interviews, this study used an online photo-elicitation method to gather the perspectives of educators and students by seeking images of learning spaces from them.

Instrument

The online survey consisted of 31 items in total, including four items to collect demographic information, one photo upload request, and one open-ended question. Respondents were asked to upload an image they have taken of a learning space that they have taught or studied on campus. For this study, a learning space is any space on the university campus that they have taught or studied in, either individually or in small or large groups. They were then asked to respond to 17 items that asked their views about the space using a 4-point Likert scale (strongly agree, agree, disagree, strongly disagree). These items relate to the purpose, process, place, and product of the learning space they have chosen. Finally, they were asked to respond to eight items (with images) that best matched their learning space using a 3-point Likert scale (most like, somewhat like, least like). These eight items functioned as a validation method to verify the images of learning spaces that were uploaded. The questionnaire was administered via Qualtrics and took approximately 15 minutes to complete.

Sample

This study was conducted at one Australian university using open sampling (Lewis-Beck et al., 2003) and snowball sampling (Biernacki & Waldorf, 1981) methods to seek as much variation as possible within the limits and scope of the topic. An invitation was sent to all staff and students at the institution using avenues available such as Staff news, the Student portal and the Community forum within the institution's learning management system. Midway through the data collection period, snowball sampling (Biernacki & Waldorf, 1981), was used to yield a study sample through referrals

made among staff and students through the researcher's networks. Creswell (2002) suggests a sample size between 15 and 20 for research design employing a grounded theory approach. In this study, 29 participants responded to the survey. 24 complete responses were included in the final analysis. This involved responses from eight educators and 16 students. It is important to note that response rates were affected by the closures of the university campus as a result of the COVID pandemic. Table 1 summarises the respondents' characteristics.

Table 1. Respondents' characteristics

[Insert Table 1 here]

Data Analysis

Quantitative analyses of participants' responses were conducted using Excel and SPSS. Responses of strongly agree or agree with the relevant items were considered to be aligned. The opposite, i.e. responses of strongly disagree or disagree, were also considered to be aligned. For instance, if a participant responded strongly agree or agree to the behaviourism item, then they will need to respond strongly agree or agree to items relating to teacher-learner, to didactic setting, and to concept building, and vice versa. Similarly, if a participant responded strongly agree or agree to the item on social constructivism, then they will need to respond strongly agree or agree to items relating to learner-learner, collaborative settings, and collaboration skills.

Thematic analysis of the images was employed. This involves "identifying, analysing and reporting patterns (themes) within data" (Braun & Clarke, 2006, p.79), which can be used across a range of epistemologies and research questions (Nowell et al., 2012). As well, thematic analysis can be used to identify themes that emerge from the photos and the data (Harding & Whitehead, 2013). In this study, a deductive approach to thematic analysis, also known as theoretically-driven coding, was employed to find repeated patterns of meaning. It is differentiated from other approaches as it starts with the theoretical ideas derived from a review of the literature and applies these to the analysis of data (Boyatzis 1998; Fereday & Muir-Cochrane 2006). The steps of deductive thematic analysis described and illustrated by Boyatzis (1998) and Fereday and Muir-Cochrane (2006) include: (1) Examine sampling and design concerns; (2) Creating the code manual; (3) Validating or assessing the

code's reliability; (4) Summarizing data and identifying early trends; (5) Applying the coding template and adding additional coding; (6) Connecting the codes and recognizing themes; and (7) Confirming and legitimizing coded themes. The epistemological roots of thematic analysis dictate that a priori codes need to be flexible, and can be modified as the analysis progresses (King, 2004). Within the thematic analysis, a meaningful 'codebook' is typically derived, but the frequency of occurrence of specific codes or themes is usually not the main goal of the analysis (Neuendorf, 2018).

Two researchers underwent the process, reducing research bias and increasing reliability (Noble & Smith, 2015). Additionally, validity was achieved through the use of visuals provided by the researchers (Torre & Murphy, 2015). The rigour of the research was maintained by within-methods triangulation of data sources (Jonsen & Jehn, 2009). Survey data and images were used to inform each other, however, triangulation was not intended to seek a singular truth but rather to capture and report multiple perspectives (Patton, 2002). Consistent with the grounded theory approach, complexities and ambiguities are considered to be important. Through the richness and complexity of the data, patterns and meanings can be created.

Finding

Table 1 summarised participants' responses against items relating to purpose, process, and place. Analysis of the survey responses found those participants who matched their images to the four learning purposes of behaviourism, cognitivism, social constructivism, and connectivism were highly aligned to the four learning processes (teacher-learner, learner-content, learner-learner and learner-interface). For instance 100% of responses showed alignment between behaviourism, and teacher-learner process, 92% of responses demonstrated alignments between cognitivism and learner-content process and between connectivism and learner-interface process. Of all responses, 83% showed alignment between social constructivism and learner-learner process.

Table 2. Participants' responses against purpose, process, and place (n=24)

[Insert Table 2 here]

Survey responses also showed great alignment to spatial settings. For instance, 83% of responses showed alignment between behaviourism and teacher-learner process and didactic setting.

The lowest response of 63% was for the cognitivism to learner-content to individual setting. This is not surprising as cognitivism focuses on the conceptualisation of students' learning processes and addresses the issues of how information is received, organized, stored, and retrieved by the mind. This involves thinking, problem-solving, language, concept formation, and information processing (Snelbecker, 1983) that could typically occur in many different settings, and not limited to individual settings.

The learning product included in the survey consisted of items relating to the 5Cs: Concept building, Creativity, Critical thinking, Collaboration, and Communication, with the hypothesis that each learning setting may predominantly contribute to one of those skills. The analysis of the survey showed that all five learning products tended to align predominantly to social constructivism to learner-learner to collaborative setting. It should be noted also that all five learning product rated second highest to the alignment to Connectivism to learner-interface to informal setting. From the data, an argument could be made that each purpose-process-place also contributes to the development of the five Cs. **Table 3** summarises the results.

Table 3. Participants' responses against purpose-process-place and product (n=24)

[Insert Table 3 here]

Using a deductive approach and driven by the theoretical ideas of Beckers et al. (2015), the analysis of the images made clear that spatial settings could not be easily delineated solely based on the educational purpose and processes occurring in these spaces. Through finding repeated patterns of meaning in the photos and data, findings suggested that learning spaces needed to be characterised by the affordances of the learning environment. Affordances can be defined as the perceived and actual functional properties of an object that determine how it could be used (Pea, 1993). In this study, the taxonomy of affordances developed by Villafranca (2019) and Young et al. (2020) was used in developing a code manual for the study. Each photo was analysed by identifying the pedagogical affordances in the space.

Images that represent didactic settings seemed to have the following pedagogical affordances present: immovable furniture, furniture that are the same/similar, a front of room/space in the form of a lectern, stage, etc., and predominantly a single installed technology. This is illustrated in Figure 2.

Pedagogical affordances that relate to individual settings seem to include: acoustic, privacy, carried objects, and mobile technology. Figure 3 provides an example of the affordances of an individual setting. Figure 4 illustrates an example of the pedagogical affordances in a collaborative setting. Pedagogical affordances in a collaborative setting include circular tables and booths, mobile furniture, open space for students to gather and work, and multiple installed technology. Finally pedagogical affordances that relate to informal settings include zones, breakout areas, booths, natural environment, mobile furniture, and diverse types of furniture. Ubiquitous technology is assumed to be present in informal settings. Figure 5 provides an example of an informal setting.

[Insert Figure 2 here]

Figure 2. Pedagogical affordances of a didactic setting

[Insert Figure 3 here]

Figure 3. Pedagogical affordances of an individual setting

[Insert Figure 4 here]

Figure 4. Pedagogical affordances of a collaborative setting

[Insert Figure 5 here]

Figure 5. Pedagogical affordances of an informal setting

To summarise, pedagogical affordances can be grouped into the following categories of Didactic affordances, Informal affordances, Collaborative affordances, and Individual affordances, as illustrated in Table 4. These affordances have been categorised based on what was typically evident in the images that participants have provided. It should be noted that some of the affordances could be present in all types of settings, for instance, ubiquitous technology and acoustic. Similarly, it should also be noted that in some cases, an image that characterised a type of setting may not have a specific affordance listed in Table 4, for instance, booths in informal settings and a single installed technology in didactic settings.

Table 4. Pedagogical affordances by spatial settings

[Insert Table 4 here]

Discussion

Space and learning are intimately intertwined, and understanding the university space is an essential element in understanding how teaching and learning work in a higher education context. The findings of the study extend the purpose-process-place framework (Beckers et al., 2015), to include pedagogical affordances as well as the product of learning. The 5Ps of Aligning Pedagogy and Space Framework (see **Figure 6**) proposes purpose, process, place, pedagogical affordance, and product. It posits that *pedagogical affordances* within a *place* must be deployed in such a way that teaching and learning *processes* can contribute to enhancing educational goals or *purpose* to improve student learning outcomes, i.e. *product*. This framework provides a context for understanding the relationships between pedagogy and space.

[Insert Figure 6 here]

Figure 6. The 5Ps of Aligning Pedagogy and Space Framework

In the same way that purpose-process-place is located in a quadrant, pedagogical affordance and product can also be devised in the same way. Understanding how purpose, process, place, and pedagogical affordance come together provides opportunities to achieve the intended learning outcome for students. The two concepts pedagogical affordance and product of learning will be discussed in turn.

The concept of affordances originated from Gibson's (1979) seminal work where he describes the features of natural environments which are perceptible by animals, to actualise specific behaviour. In this study, pedagogical affordances can be defined as the possible uses of an element of the learning environment to facilitate the learning of an individual (Villafranca, 2019). The analysis of the images provides evidence of an assemblage (Carvalho et al., 2020; Dovey & Fisher, 2014) of pedagogical affordances. Dovey and Fisher (2014) considered the learning environments as complex adaptive assemblages because of the interconnectedness of the learning environments' different elements.

It can be argued that some of these affordances could be present in all types of settings. The concept of spatial flexibility comes to mind, which refers to “the manipulation of elements to create

different spatial arrangements and could be described as a transformational type of change" (Woodman, 2016, p. 56). By categorising the affordances in this way, it does not represent the entirety of types of affordances nor does it mean that all these affordances must exist for the space to work as intended. The characterisation typifies, rather than specifically describe or prescribes the spatial settings. It provides a framework for discussion of what would otherwise be a complex phenomenon (Mahat & Imms, 2021).

Affordances, in and on themselves, do not determine specific behaviour, or in this context outcomes of learning, but instead they shape the possibilities of directing specific behaviour towards the intended learning outcomes (Faraj & Azad, 2012; Willermark et al., 2020). Reified as product, the intended learning outcomes can be conceptualised as Concept building, Critical thinking, Creativity, Collaboration, and Communication.

Whilst each product did not align predominantly to a specific process or setting, an argument could be made that each purpose-process-place also contributes to the development of the five Cs. Aligned to the behaviorist's approach, students achieve concept building by concentrating on building knowledge, accepting information and ideas specifically, and learning facts and procedures routinely. In the same way, aligned to connectivism and the idea of increased self-regulation, students achieve critical thinking by endeavouring to understand material for themselves, interacting vigorously and critically with content, and relating ideas to previous knowledge and experience. Integrating ideas in connectivism and learning in informal settings, students achieve creativity by finding ways to spark curiosity, stimulate creativity, and encourage problem-solving through the use of technology, art, music, and culture. In tandem with social constructivism, students achieve or develop collaboration skills by working with others towards a common goal and learning to better understand and anticipate difference, recognize it in themselves and others and use it to their advantage. Finally, communication is achieved in varying degrees in all learning theories, processes, and places. Students achieve these by engaging in reflective learning opportunities, participating in active learning, and taking part in group presentations and assignments that encourage forms of communication between teacher-learner, learner-learner, learner-content, and learner interface.

The findings demonstrated that students' acquisition of knowledge at universities is a result of social interaction and language use, and is therefore a shared, rather than an individual experience (Vygotsky, 1962). Additionally, the findings reiterated the importance of digital technology in enabling learning (Siemens, 2005). University educators must move from being 'people who teach' to 'facilitators of learning' with increasing use of technology-enabled learning to cater to digital natives—focusing as much on the process of learning as they do on the acquisition of knowledge. Additionally, the analysis has shown that it is possible to link pedagogical affordances to these products of learning (Villafranca, 2019). However, furniture that is mobile, is just it—mobile, if its mobility is not used to engender the intended learning outcome of our students. Universities need to raise awareness amongst their educators for the importance of and use of these affordances.

This completes the conceptual purpose, process, place, pedagogical affordances, and product framework for education. Similar to the framework advanced by Beckers et al. (2015), each component can be placed on a two-by-two matrix with social interaction in learning on the vertical axis and self-regulation in learning on the horizontal axis. In the same way that the vertical quadrants in the Beckers et al. (2015) framework imply an increase in social interaction in learning, and the horizontal quadrants imply an increase self-regulation in learning, the impact of the four learning theories on educational processes, places, pedagogical affordances and product of learning can also be mapped in a matrix with the same axes.

Conclusion and implications

This study provided a robust approach grounded in data to understand the alignment between space and pedagogy. It extends the purpose-process-place framework of Beckers et al. (2015) to include pedagogical affordance and student learning. Articulating students learning as an output of the alignment between space and pedagogy has important implications for the design of learning spaces and pedagogical practices in higher education. One limitation to the study however is noteworthy. The surveys had limited responses. Whilst the small response rates may not necessarily lead to biased results, it is acknowledged that a larger sample is likely to give more reliable results to enable the theory to be generalised.

Developments in learning and teaching typically do not occur at the same pace as developments in learning space design (Imms, 2018). In contemporary higher education, all four types of learning settings are still needed to support learning processes. They are complementary and not mutually exclusive, as are the pedagogical affordance and product of learning. Much of the literature that predicted the demise of the lecture theatre (Grainger, 2017, Morton, 2008) will not be a reality in the near future particularly as student enrolments in higher education continue to grow.

However, the findings suggest that collaborative and informal learning spaces are gaining importance in higher education as they support cognitive functioning and improvement of metacognitive skills and behaviours (Zheng et al, 2019) In designing more collaborative and informal learning environments, flexibility is key in allowing for more diverse uses of shared spaces within buildings (Jens & Gregg, 2021). How the learning outcomes of students are achieved will depend on how the affordances of the learning environment are used and actualised by educators. It becomes critical more than ever, as learning environments evolve, that educators are provided with the skills and knowledge to use university spaces effectively.

References

Avery, J. 1994. Strategic planning. In D. Warner and G. Kelly (Eds.). *Managing Educational Property: A Handbook for Schools, Colleges, and Universities*. Open University Press

Ashworth, F., Brennan, G., Egan, K., Hamilton, R., & Sáenz, O. (2004). "Learning theories and higher education", *Level3, 2*, 1-16. https://doi.org/10.21427/wgcf-zp04

Barnett, R., & Temple, P. (2006). *Impact on Space of Future Changes in Higher Education* (UK Higher Education Space Management Project, 2006/10). Higher Education Funding Council for England.

Bates, E. A., McCann, J. J., Kaye, L. K., & Taylor, J. C. (2017). ""Beyond words": a researcher's guide to using photo elicitation in psychology". *Qualitative Research in Psychology*, *14*(4), 459-481.

Beckers, R., Van der Voordt, T., & Dewulf, G. (2015). "A conceptual framework to identify spatial implications of new ways of learning in higher education". *Facilities*, *33*(1/2), 2-19. https://doi.10.108/F-02-2013-0013

Beichner, R., Saul, J., Abbott, D., Morse, J., Deardorff, D., Allain, R. et al (2007). Student-centered activities for large enrollment undergraduate programs (SCALE-UP) project. In E. Redish & P. Cooney (Eds). "Research-based reform of university physics" (pp. 1–42). American Association of Physics Teachers.

Bennett, D., Knight, E., & Rowley, J. (2020). "The role of hybrid learning spaces in enhancing higher education students' employability". *British Journal of Educational Technology*, *51*(4), 1188-1202.

Biernacki, P. & Waldorf, D. (1981). "Snowball sampling: Problems and techniques of chain referral sampling". *Sociological methods and research, 10*(2), 141-163.

Birks, M., Hoare, K., & Mills, J. (2019). Grounded theory: the FAQs. *International Journal of Qualitative Methods*, *18*, 1609406919882535.

Boddington, A. and Boys, J. (2011). Reshaping learning – an introduction. In A. Boddington and J. Boys. (Eds). "Re-Shaping Learning: a Critical Reader" (pp. 9-22). Sense Publishers.

Boyatzis, R. E. (1998). *Transforming qualitative information: Thematic analysis and code development*. Sage.

Boddington, A. and Boys, J. (2011). Reshaping learning – an introduction. In A. Boddington and J. Boys. (Eds). "Re-Shaping Learning: a Critical Reader" (pp. 9-22). Sense Publishers.

Boys, J. (2011). *Towards creative learning spaces: Re-thinking the architecture of post-compulsory education.* Routledge.

Braun, V., & Clarke, V. (2006). "Using thematic analysis in psychology". *Qualitative research in psychology*, *3*(2), 77-101.

Brooks, D. C. (2011). "Space matters: The impact of formal learning environments on student learning". *British Journal of Educational Technology, 42*(5), 719-726.

Carvalho, L., Nicholson, T., Yeoman, P., & Thibaut, P. (2020). "Space matters: Framing the New Zealand learning landscape". *Learning Environments Research, 23*, 307–329 https://doi.org/10.1007/s10984-020-09311-4

Chen, C. S. (2002). "Self-regulated learning strategies and achievement in an introduction to information systems course". *Information technology, learning, and performance journal*, *20*(1), 11-25.

Creswell, J. W. (2002). *Educational research: Planning, conducting, and evaluating quantitative* (Vol. 7). Prentice Hall.

Dori, Y., Belcher, J., Besette, M., Danziger, M., McKinney, A. & Hult, E. (2003). "Technology for active learning". *Materials Today, 6*, 44–49.

Dovey, K., & Fisher, K. (2014). "Designing for adaptation: The school as socio-spatial assemblage". *The Journal of Architecture, 19*(1), 43–63. https://doi.org/10.1080/13602365.2014.882376

Duffy, F., Craig, D. & Gillen, N. (2011). "Purpose, process, place: design as a research tool". *Facilities, 29*(3/4), 97-113.

Edgar, I. (1999). "The image work method in health and social science research". *Qualitative Health Research, 9*(2), 198-211.

Ellis, R. A. & Goodyear, P. (2010) Students' experiences of e-learning in higher education: The ecology of sustainable innovation. Routledge Falmer.

Ellis, R. A., & Goodyear, P. (2016). Models of learning space: Integrating research on space, place and learning in higher education. *Review of Education*, *4*(2), 149-191.

Faraj, S., & Azad, B. (2012). The materiality of technology: An affordance perspective. In P. M. Leonardi, B. A. Nardi, & J. Kallinikos, J. (Eds.). "Materiality and organizing: Social interaction in a technological world" (pp. 237 – 258). Oxford University Press.

Fereday, J., & Muir-Cochrane, E. (2006). "Demonstrating rigor using thematic analysis: A hybrid approach of inductive and deductive coding and theme development". *International journal of qualitative methods*, *5*(1), 80-92.

Fisher, K., & Newton, C. (2014). "Transforming the twenty-first-century campus to enhance the net-generation student learning experience: Using evidence-based design to determine what works and why in virtual/physical teaching spaces". *Higher Education Research & Development, 33*(5), 903-920.

Gibson, J. J. (1979). *The ecological approach to visual perception*. Hilldale.

Glaser B G, Strauss A. L. (1967). *The discovery of grounded theory.* Aldine.

Gomez, R. (2020). "Photostories". *Qualitative and Quantitative Methods in Libraries*, *9*(1), 47-63.

Granger, R. C. (2017). The Elephant in the Lecture Theatre: Sharing ecologies, alternative economic spaces and the changing role of higher education in the creative economy.

Harding, T., & Whitehead, D. (2013). Analysing data in qualitative research. In Z. Schneider, D. Whitehead, G. LoBiondo-Wood & J. Haber (Eds.). "Nursing & midwifery research: Methods and appraisal for evidence-based practice" (pp.141-160). Elsevier.

Harrison, A., & Hutton, L. (2014). *Design for the changing educational landscape: space, place and the future of learning.* Routledge.

Higher Education Funding Council for England. (2000). *Strategic planning in higher education: A guide for heads of institutions, senior managers and members of governing bodies (00/24)*. Higher Education Funding Council for England.

Imms, W. (2018). Innovative learning spaces: Catalysts/agents for change, or 'just another fad'?. In S. Alterator & C. Deed (Eds.). "School space and its occupation" (pp. 107-118). Brill.

Jens, K., & Gregg, J. S. (2021). The impact on human behaviour in shared building spaces as a result of COVID-19 restrictions. *Building Research & Information*, *49*(8), 827-841.

Jonsen, K., & Jehn, K. A. (2009). Using triangulation to validate themes in qualitative studies. *Qualitative research in organizations and management: an international journal*, *4*(2), 123-150.

Kahu, E. R., & Picton, C. (2020). "Using photo elicitation to understand first-year student experiences: Student metaphors of life, university and learning". *Active Learning in Higher Education*, *23*(1), 35-47.

King, N. (2004). Using templates in the thematic analysis of text. In C. Cassell & G. Symon (Eds.), *Essential guide to qualitative methods in organizational research* (pp. 256–270). Sage.

Levers, M. J. D. (2013). "Philosophical paradigms, grounded theory, and perspectives on emergence". *Sage Open*, *3*(4), 1-6. https://doi.org/10.1177/2158244013517243

Lewis-Beck, M., Bryman, A. E., & Liao, T. F. (2003). *The Sage encyclopaedia of social science research methods.* Sage.

Lippmann, P. C. (2010). *Evidence-Based Design of Elementary and Secondary Schools.* John Wiley & Sons, Inc.

Author (Forthcoming)

Mahat, M., & Imms, W. (2021). "The Space Design and Use survey: Establishing a reliable measure of educators' perceptions of the use of learning environments". *The Australian Educational Researcher*, *48*(1), 145-164.

Marmot, A. (2012). *Matching Post-16 Estate Investment to Educational Outcomes*. Alexi Marmot Associates by order of Scottish Funding Council.

Martin, P., Katz, T., Morris, R. and Kilgallon, S. (2007). A learning space for creativity: early findings. In J. Barlow, G. Louw, & M. Price (Ed). "Connections: sharing the learning space. Articles from the Learning and Teaching Conference 2007" (pp. 13-17). University of Brighton Press.

Matthews, K. E., Andrews, V., & Adams, P. (2011). "Social learning spaces and student engagement". *Higher Education Research & Development, 30*(2), 105-120.

Monahan, T. (2002). "Flexible space & built pedagogy: Emerging IT embodiments". *Inventio, 4*(1), 1-19.

Morton, A. (2008). Lecturing to large groups. In H. Fry, S. Kettriddge & S. Marchall (Eds.). "A handbook for teaching and learning in higher education" (pp. 76-89). Routledge.

National Education Association (n.d.). Preparing 21st Century Students for a Global Society: An Educator's Guide to the "Four Cs". Retrieved from: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/viewer.html?pdfurl=https%3A%2F%2Fwww.aledoisd.org%2Fcms%2Flib%2FTX02205721%2FCentricity%2FDomain%2F2020%2FPreparing21C_Learners.pdf&clen=2082562&chunk=true

Niesser (1967). *Cognitive psychology.* Appleton.

Ninnemann, K., Liedtke, B., den Heijer, A., Gothe, K., Loidl-Reisch, C., Nenonen, S., ... & Wallenborg, C. (2020). *Hybrid environments for universities*. Waxmann Verlag.

Neuendorf, K. A. (2018). Content analysis and thematic analysis. In P. Brough (Ed.). *Advanced research methods for applied psychology* (pp. 211-223). Routledge.

Noble, H., & Smith, J. (2015). Issues of validity and reliability in qualitative research. *Evidence-based nursing*, *18*(2), 34-35.

P21. (2016). *Framework for 21st Century Learning. The Partnership for 21st Century Skills.* Retrieved from http://www.p21.org/about-us/p21-framework

Park, E. L., & Choi, B. K. (2014). "Transformation of classroom spaces: Traditional versus active learning classroom in colleges". *Higher Education, 68*(5), 749-771.

Patton, M. Q. (2002). Two decades of developments in qualitative inquiry: A personal, experiential perspective. *Qualitative social work*, *1*(3), 261-283.

Pea, R.D. (1993). Practices of distributed intelligence and designs for education. In G. Salomon (Ed.), "Distributed cognitions: psychological and educational considerations" (pp. 47-87). Cambridge University Press.

Siemens, G. (2005), *Connectivism: a learning theory for the digital age*. Retrieved from: http://Connectivism.ca

Strauss, A., & Corbin, J. M. (1997). *Grounded theory in practice*. Sage.

Radcliffe, D., Wilson, H., Powell, D., & Tibbetts, B. (2008). Designing next generation places of learning: Collaboration at the pedagogy-space-technology nexus. *The University of Queensland*, *1*, 6-20.

Rodgers, C. (2002). "Defining reflection: Another look at John Dewey and reflective thinking". *Teachers College Record*, *104*(4), 842-866.

Snelbecker, G. E. (1983). ls instructional Theory Alive and Well?. In C. M. Reigeluth (Ed.) "Instructional design theories and models: An overview of their current status". (pp. 437 – 476). Lawrence Erlbaum Associates.

Souter, K., Riddle, M., Sellers, W., & Keppell, M. (2011). *Spaces for Knowledge Generation.* Sydney: Australian Learning & Teaching Council.

Temple, P. (2007). *Learning spaces for the 21st century: A review of the literature.* Centre for Higher Education Studies. Institute of Education, University of London.

Temple, P. (2008). "Learning spaces in higher education: An under-researched topic". *London Review of Education, 6*(3), 229-241.

Torre, D., & Murphy, J. (2015). A Different Lens: Using Photo-Elicitation Interviews in Education Research. *Education Policy Analysis Archives*, *23*(111), n111.

Trow, M. (2007). Reflections on the transition from elite to mass to universal access: Forms and phases of higher education in modern societies since WWII. In P. Altbach (Ed.). "International handbook of higher education" (pp. 243-280). Springer.

Valtonen, T., Leppänen, U., Hyypiä, M., Kokko, A., Manninen, J., Vartiainen, H., ... & Hirsto, L. (2021). Learning environments preferred by university students: a shift toward informal and flexible learning environments. *Learning Environments Research*, *24*(3), 371-388.

Van der Zanden, A.H.W. (2010). *The facilitating university.* Eburon.

Vercellotti, M. L. (2018). Do interactive learning spaces increase student achievement? A comparison of classroom context. Active Learning in Higher Education, 19(3), 197–210

Villafranca, E. (2019). *Curated learning: a pedagogical approach to maximise learning environments for students' deep learning* [Unpublished doctoral dissertation]. The University of Melbourne.

Voogt, J., & Roblin, N. P. (2012). A comparative analysis of international frameworks for 21st century competences: Implications for national curriculum policies. *Journal of curriculum studies*, *44*(3), 299-321.

Vygotsky, L. S. (1962). Thought and word. In L. Vygotsky & E. Hanfmann, G. Vakar (Eds.). *Studies in communication. Thought and language* (pp. 119–153). MIT Press. https://doi.org/10.1037/11193-007

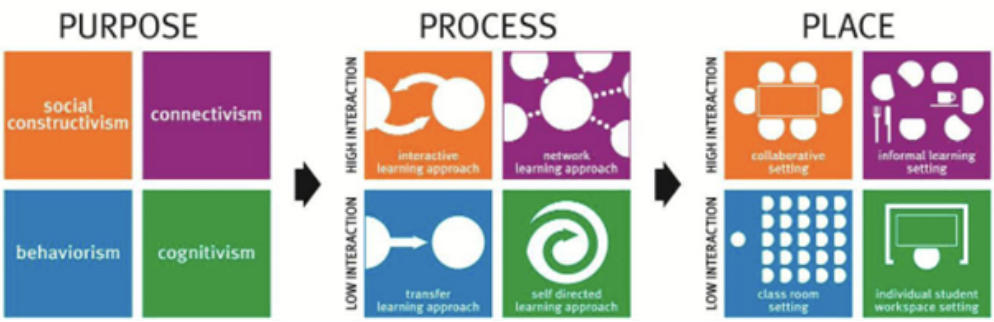
Willermark, S., & Sigríður Íslind, A. (2020, January). The polite pop-up: An experimental study of pop-up design characteristics and user experience. In *Proceedings of the 53rd Hawaii International Conference on System Sciences* (pp. 4204-4211). 10.24251/HICSS.2020.514

Woodman, K. (2016). Re-placing flexibility: Flexibility in learning spaces and learning. In K. Fisher (Ed.). "The translational design of schools" (pp. 51-79). Brill Sense.

Young, F., Cleveland, B., & Imms, W. (2020). "The affordances of innovative learning environments for deep learning: educators' and architects' perceptions". *The Australian Educational Researcher*, *47*(4), 693-720.

Zheng, L., Zhang, X., & Gyasi, J. F. (2019). A literature review of features and trends of technology-supported collaborative learning in informal learning settings from 2007 to 2018. *Journal of Computers in Education*, *6*(4), 529-561.

Zimmerman, B. J. (1989). "A social cognitive view of self-regulated academic learning. *Journal of Educational Psychology*, *81*(3), 329.



Purpose-process-place framework (Source: Beckers et al., 2015)

405x131mm (38 x 38 DPI)

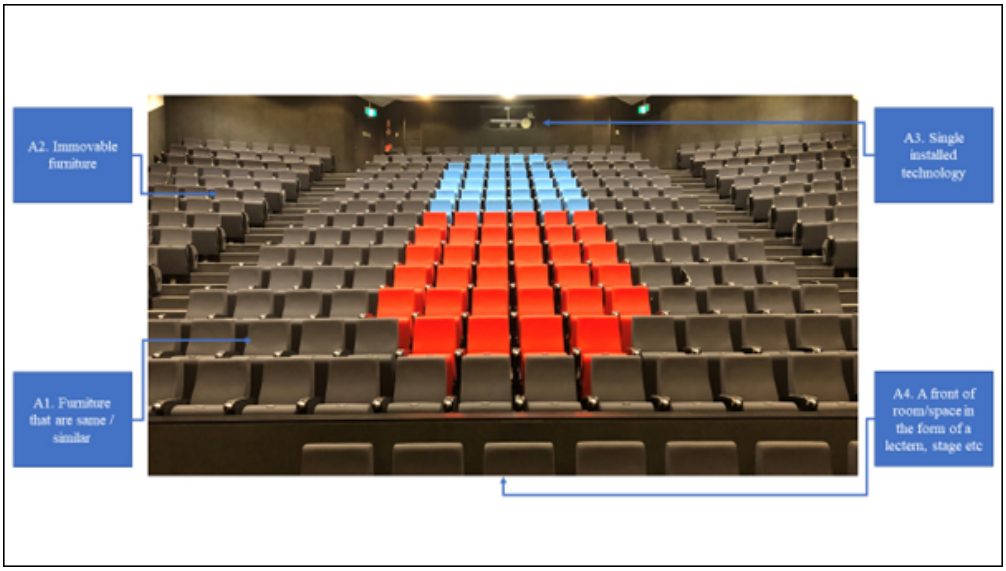


Figure 2. Pedagogical affordances of a didactic setting

403x227mm (38 x 38 DPI)

Figure 3. Pedagogical affordances of an individual setting

403x227mm (38 x 38 DPI)

Figure 4. Pedagogical affordances of a collaborative setting

403x227mm (38 x 38 DPI)

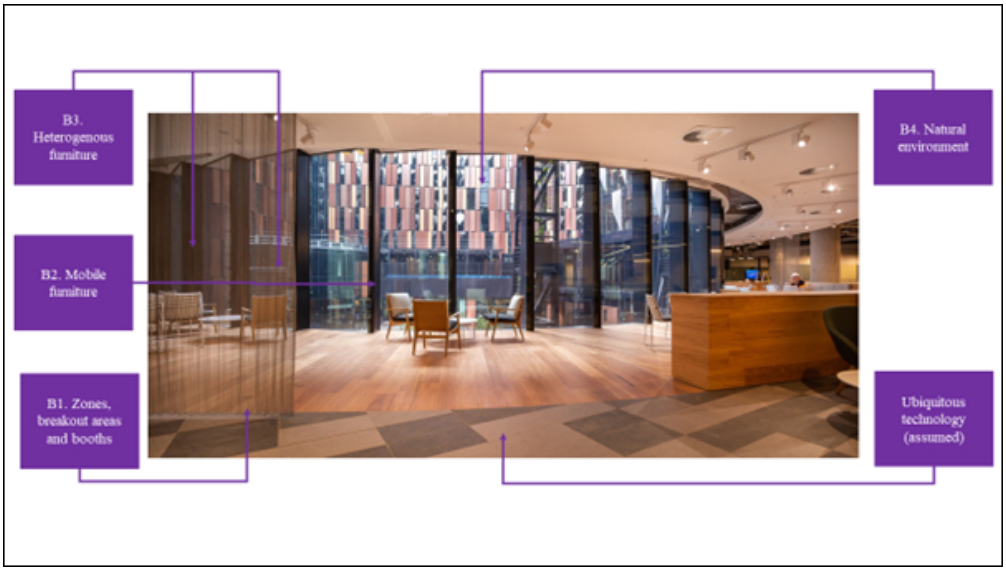


Figure 5. Pedagogical affordances of an informal setting

403x227mm (38 x 38 DPI)

Figure 6. The 5Ps of Aligning Pedagogy and Space Framework

402x121mm (87 x 87 DPI)

Table 1. Respondents' characteristics

Respondents characteristics	Staff (n = 8)		Students (n = 16)	
	n	%	n	%
Gender				
Female	5	62.5%	6	37.5%
Male	3	37.5%	10	62.5%
TOTAL	8	100.0%	16	100.0%
Type of course studying/teaching[1]				
Bachelor Degree	3	37.5%	-	-
Bachelor Honours	-	-	-	-
Graduate Certificate or Graduate Diploma	1	12.5%	1	6.25%
Masters by Coursework	5	62.5%	11	68.75%
Masters by Research			1	6.25%
Doctor of Philosophy or Doctor of Education or similar			3	18.75%
Others	3	37.5%	-	-
TOTAL	12	100.0%	16	100.0%
Faculty				
Architecture, Building and Planning	1	12.5%	-	-
Arts	-	-	2	12.5%
Business and Economics	1	12.5%	-	-
Education	2	25%	8	50%
Engineering	-	-	2	12.5%
Fine Arts and Music	-	-	-	-
Law	-	-	-	-
Medicine, Dentistry and Health Sciences	3	37.5%	2	12.5%
Science	1	12.5%	2	12.5%
Veterinary and Agricultural Sciences	-	-	-	-
TOTAL	8	100.0%	16	100.0%

[1] Staff can select more than one option

Table 1. Participants' responses against purpose, process, and place (n=24)

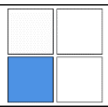
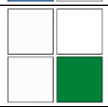
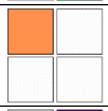
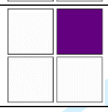
Purpose	Alignment between purpose-process (n=24)		Alignment between purpose-process-place (n=24)	
	n	%	n	%
Behaviourism 	24	100%	17	71%
Cognitivism 	22	92%	15	63%
Social constructivism 	20	83%	20	83%
Connectivism 	22	92%	20	83%

Table 1. Participants' responses against purpose-process-place and product (n=24)

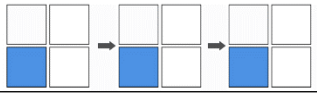
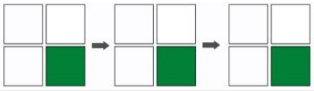
Alignment	**Product**				
	Concept building (n = 24)	**Critical thinking** (n = 24)	**Collaboration** (n = 24)	**Creativity** (n = 24)	**Communication** (n = 24)
Behaviourism to teacher-learner to didactic setting 	12 (50%)	10 (42%)	13 (54%)	9 (37.5%)	10 (42%)
Cognitivism to learner-content to individual setting 	14 (58%)	13 (54%)	12 (50%)	13 (54%)	11 (46%)
Social constructivism to learner-learner to collaborative setting 	**19 (79%)**	**18 (75%)**	**19 (79%)**	**20 (83%)**	**17 (71%)**
Connectivism to learner-interface to informal setting 	18 (75%)	17(71%)	16 (67%)	17 (71%)	16 (67%)

Table 1. Pedagogical affordances by spatial settings

Pedagogical affordance		**Characteristics**
Didactic affordances	A1	Furniture that are the same/similar
	A2	Immovable furniture
	A3	Single installed technology
	A4	A front of room/space in the form of a lectern, stage etc
Informal affordances	B1	Zones, booths and breakout areas
	B2	Mobile furniture: tables, chairs, ottomans, cushions, etc
	B3	Heterogeneous furniture
	B4	Natural environment
Collaborative affordances	C1	Mobile furniture: tables, chairs, ottomans, cushions, etc
	C2	Circular tables and booths
	C3	Multiple installed technology
	C4	Open space for students to gather and/or work
Individual affordances	D1	Privacy
	D2	Acoustic
	D3	Mobile technology
	D4	Carried object