Connecting Physical University Spaces with Research-based Education Strategy

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This paper looks at the link between enhancing education and ensuring an innovative fit-for-purpose estate. It argues that a nuanced approach and joined-up dialogue is needed between university staff whose remit covers these areas. Drawing from fifteen semi-structured interviews with students and staff at a research-intensive university in London, UK, the project offers a window into the relationship between the institution's innovative education approach (which brings research and education closer together, so all students learn about research and have opportunities to conduct it) and the university's spaces. The paper outlines the institution's approach to research-based education and then moves on to unpack four key space principles to implement a research-based education strategy which is sensitive to a university's physical environment.

Introduction

The higher education sector in many countries, including the United Kingdom, is seeing unprecedented change. Substantially increased student fees, new government regulation, student satisfaction metrics, and global competition are all key factors that underscore the importance of offering the best possible student experience. Senior managers have responded by establishing relevant institutional priorities. While there are likely to be many sub-priorities that fall under the goal of improving the student experience, enhancing education and ensuring an innovative fit-for-purpose estate are likely key themes. In order to improve the student experience holistically, this paper argues that a nuanced approach and joined-up dialogue is particularly needed between university staff focusing on enhancing the physical environment and colleagues devoting their time to improving education. In order to limit its scope, the research and paper do not explicitly deal with the intersection of digital spaces and education enhancement (though see *inter alia* Nordquist and Laing, 2015; Carvalho, Goodyear and de Laat, 2016); however, it takes a holistic approach to educational space which recognises "the whole campus as a place where a continuous flow of formal and informal learning can take place" (UCISA, 2016, p. 9). It positions itself within work that takes a large-scale view of the learning landscape arguing that the nature of academic space must offer students an intimate experience to our pedagogic environment (Neary and Beetham, 2015, 84).

The focus of this paper follows on from dialogue with colleagues and students at University College London (UCL). In those original conversations, that germinated the small but formal research project, on the one hand people were inspired by and valued the institution's new prioritised approach to education, and on the other they felt the physical environment, including the university's learning spaces, may offer challenges for meaningful educational enhancement in the ways that the university has committed itself. There is a disconnect between spaces and strategy: university spaces must reflect key educational principles and contribute to overall strategic goals (UCISA, 2016, p. 6, p. 8). The methodology for the subsequent formal research project which informs this paper consisted of semi-structured qualitative interviews with twelve staff and three students (*n* = 15), exploring the links between strategy and space (see Appendix 1 for the research questions). Although by no means representative of the large and diverse institution, interviewees are based in seven distinct departments in the university. Along with a student from every level (undergraduate, masters and PhD), positions of staff include teaching fellow, lecturer, professor, head of department, and senior management. Interviewees range from aged early twenties to early seventies, with eight males and seven females. Institutional research ethics were cleared as an extension to project 4507/001. Although engaging a relatively small qualitative data set, the material offers a window into the themes of education strategy and space.

The paper begins by first outlining the main component of UCL's education enhancement strategy, branded as the UCL Connected Curriculum – a research-based education conceptual framework designed to enhance education by fostering closer connections between the institution's two main endeavours: research and education. Then, shifting to understand how the university's estate can enable or

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challenge this approach to education, the second section highlights four themes to come out of the interview data. This section uncovers what the physical environment might look like at a university that excels in research-based education. Beyond arguing that there are important connections between space and strategy, this section's four parts work as a series of key principles to implement a research-based education strategy that is sensitive to an institution's physical environment.

A Research-Based Education Strategy: The UCL Connected Curriculum

UCL and other institutions are beginning to adopt research-based education strategies in response to the shifting higher education climate and the need to offer the best possible student experience. Education theorist and writer, Ron Barnett, suggests the role of the university is changing: it must increasingly prepare students with new ways of knowing, in order to thrive in an unknown future. He notes: "In an age of supercomplexity, a new epistemology for the university awaits, one that is open, bold, engaging, accessible, and conscious of its own insecurity. It is an epistemology for living amid uncertainty" (Barnett 2000, p. 409; see also Brew, 1999). It is with this spirit in mind that a growing body of literature (Brew, 1999; Brew, 2012; Hattie and Marsh, 1996; Healey, 2005a, 2005b) argues that bringing students closer to research, employing education approaches that engage learning as shared discovery or enquiry, will go a long way to improving contemporary education. Learning through research can deepen understanding, especially when it enacts inquiry-based learning and that which closely parallels problems one may find in one's future career (Healey, 2005a, p. 67). The urge to bring teaching and research closer together is also driven by university managers who aim to remove a long-standing binary which sees both areas as separate and unproductively disparate. The challenge is for universities to reshape curricula so that staff and students can work together to treat learning as a journey – one where academics are further along the path. Such an approach aims to reconceptualise higher education as "communities of practice" (Brew, 2012, p. 111; Wenger, 1998) or a network of learners.

The UCL Connected Curriculum is one institution-wide strategic approach that aspires to reinvigorate learning in this way. Its framework (Fung, 2015, 2016, 2017; Fung and Carnell, 2016) is designed to operate as a flexible tool for course or programme leaders and others with a stake in education planning to think through the development of their offering (Figure 1). It also invites staff and students to question critically the nature of evidence and knowledge production in their own subject field, and in others' (Fung

and Carnell, 2016, p. 10). The core (centre) principle is that students learn through research and enquiry. Six dimensions of activity each branch out from this core, which invite teams to think about approaches to learning and opportunities for connecting learning beyond the classroom.
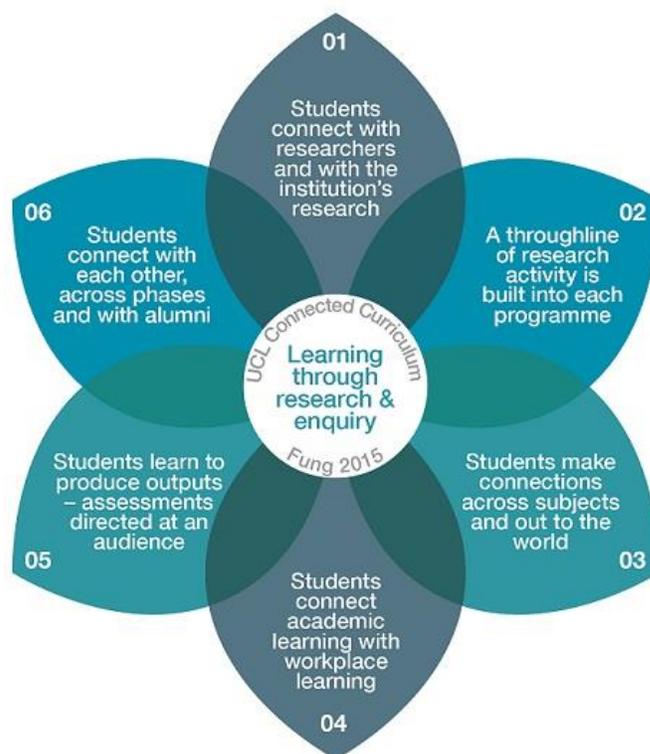
Figure 1 - *The UCL Connected Curriculum Framework*

Dimension 1 encourages students to connect with staff and to learn about ongoing research. It aspires to both breakdown unproductive hierarchies between staff and students, with students able to ask questions, and to bring students closer to a part of university life that they may traditionally never experience. This is also about introducing students to many members of the research community of practice that they belong to. Dimension 2 encourages a connected sequence of research activities throughout students' programmes. While the final dissertation project is encouraged as a minimum, there should be structured opportunities to develop expertise in research throughout earlier years, both within the curriculum and through extra-curricular activities. Dimension 3 recognises that research is inherently social, and in order to strengthen the community of practice opportunities need to be structured which encourage students to connect their learning across the subjects they are taking and with the wider world beyond, with external organisations and communities. Similarly, students need opportunities to make connections between

the research and learning they undertake on a course with what they will be doing in their future careers – the focus of dimension 4. Dimension 5 focuses on course work / assessments and invites programme teams to reconceptualise them as relevant and appropriate for students' future careers. It could ask: is the traditional essay or final exam actually the best form of assessment? Ideally they will engage an audience beyond the marker, giving students a voice beyond the immediate activity, including with the community, industry partners, or employers. Finally, dimension 6 encourages connections with students across one's programme, across disciplines, and with people beyond the university, including alumni. The UCL Connected Curriculum's core principle and six dimensions aim to inspire staff, in partnership with students and alumni, to design discipline-specific responses to research-based education. While this been received positively both within the university as well as beyond, in wide-reaching international contexts, there are some challenges and voices of worry, particularly around space implications.

Key Space Principles Enabling Research-Based Education Strategy

The research themes from the interview material that the remainder of the paper unpacks is in response to hesitation from staff and students around how the physical university at UCL – an historic institution based in a dense and expensive urban area – may present both real and perceived challenges to implementation of the above outlined research-based education approach. While the physical university may offer constraints, in many cases space has the power to facilitate rich connections as well. What follows focuses on the ways in which the UCL Connected Curriculum – or a similar institutional educational strategic enhancement project – can be enabled by the physical university environment. The link is strong between research-based education strategy and the built environment.

### Principle 1: Informal spaces for making social connections

Through outlining UCL's strategic approach to research-based education the first section of this paper highlighted the importance of fostering a community of practice – or network of learners. Connecting with the community – with students, staff, and the world beyond – is an explicit part of five out of the six dimensions, and an important part of learning in higher education (Temple, 2007, p. 72). While undoubtedly it is important for students to make connections in formal learning settings, this principle pays particular attention to non-formal social settings which are valuable in aiding authentic community interaction;

investment in both informal and formal spaces are essential (UCISA, 2016, p. 5). Conceptualising holistic learning spaces where a learning community develops, the National Learning Infrastructure Initiative White Paper (2004, p. 2) argues that university spaces should allow students to get to know each other and engage in dialogue, work together on group projects and interact in a variety of social ways. And the JISC report "Designing spaces for effective learning" (2006, p. 28) suggests that "well-designed social spaces are likely to increase students' motivation" to learn. Many interviewees noted the importance of informal social-study spaces.

The importance of learning in social settings is not a new point to make, indeed social constructivist theory (see for example, Vygotsky, 1978) articulates that humans learn best through social interaction. While in universities students must be able to think independently, "the range of skill that can be developed" in a social setting "exceeds what can be attained alone" (Falchicov, 2007, p. 129). Research-based education, as one interviewee articulates, is "less on [sic] learning as an individual thing… and more learning in a collaborative sense." Further, "a lot of research is based around kind of exchange and collaborating, so I think the space has to be adaptable to that". And the recently published Learning Spaces Toolkit agrees with this notion by suggesting a university's physical environment "should create a sense of being part of a learning community" (UCISA, 2016, p. 10). One student interviewee comments on the way learning is extended through social interaction: "I think having connections to people beyond [the classroom] would be a good way to start thinking more abstractly about what you're learning." Indeed, it was in those "in-between spaces", between classes and lectures, where students felt learning really happens. Another interviewee feels it is so valuable to have "space that enables people to connect", in well designed environments. It is in these social spaces that, as another person notes, students "grow in the connections that they make and the opportunities they have". Serendipitous connections are also quite valuable for developing through education; places, as an interviewee notes, where "different types of people will turn up". In terms of space, that may mean simply providing opportunities for interaction at multiple junctures throughout the campus; a few chairs, a bench, or even a window seat can facilitate these opportunities. These impromptu connection spaces are noted as "incredibly popular" in one department. "spaces where students can sit down [in] some little physical booths that we've built out of plywood, which has simply a chair and some tables in there". Others believe that more of these "break out spaces, where students can come, sit, be, and study and work together" are needed (Figure 2, Figure 3, and Figure 4).

Figures 2, 3, and 4 – *Breakout spaces should be designed to allow serendipitous discussion between students and between students and staff. Author's own image.*

Common rooms were raised on several occasions as valuable informal social spaces for connecting with others. A few common rooms accessible to everyone, managed by the Students' Union, were noted as incredibly popular. Talking about her programme's common room (Figure 5), one student put it like this:

> Everybody loved it, it was absolutely amazing to have that space, I know we were really lucky to have it… because having a common room as students we all, we could all go back there and have conversations with people who were doing our degree on different levels…

The challenge in a densely urban campus where space is under pressure means that common rooms are a luxury. And students even noted that the few common rooms that did exists are now turning into quiet study spaces. Despite the challenges of space, common rooms must continue to be prioritized for their valuable role in fostering connections. While this is true on one hand, on the other the loss of common rooms is perhaps offset by the availability of social spaces in the nearby urban area: "because of where we are in the metropolis, there's so much out there, such a huge market and wealth of stuff". This means urban universities need to think creatively to draw students back – or to keep them on campus – and to get them engaging with each other. Simple interventions that could foster connections in less-formal spaces include coffee machines or "board games or a chess set… pool tables and foosball tables".

Figure 5 – *Common rooms are important spaces to help students connect with each other in an informal and social environment. Author's own image.*

Coffee shops are an important social-study space, and indeed the few on campus are very popular. An abundance of public commercial coffee shops proximate to the urban campus means that they may not need to be replicated, and

it was suggested that they are certainly well used by students. However, some interviewees felt the commercial coffee shop's design and atmosphere could shape informal study spaces within the campus boundary. For instance, "the general ambience" of a coffee shop is familiar, "there'll be some comfortable seating, there's generally a nice feel about the way that furniture is set out in the spaces". Similarly, markers of homeliness are noted as important design spaces in informal connection spaces.

Having a departmental home base with spatial provisions for students is very important. Feeling at home with a sense of belonging and attachment to a social group – key factors of successful learning landscapes (Temple, 2007, p. 5) – is mentioned by several interviewees, as crucial to a successful research-based education and community of practice. For instance, one member of staff believes, "students like space that they feel they have some kind of ownership over". It is in departmental space that this happens, "a kind of space that they can attach to and form an identity with". While moving to more centrally bookable space may be a necessary way to maximise the use of space in a tight urban campus, students should also have access to their own departmental informal spaces. A lecturer interviewed as part of the research felt that students need consistent familiarity with space in order to form a sense of attachment, so that students begin to feel comfortable in the space. One of the challenges of encouraging students to form an attachment and to feel part of a community of practice, for an urban campus in particular, is that many students will commute from areas where housing is more affordable. These students are likely to limit their hours on campus, and their ability to socialise, connect, and stick around beyond five in the evening. Informal social spaces that allow for the development of identity, which foster connections in a community of practice, should be high on the list of priorities in the dialogues university planners and education specialists should be having. As Peter Jamieson asserts, "the future campus will be determined by the university's response to informal learning" (Jamieson, 2009, p. 19). Equally important is the availability and access to more formal, structured collaborative learning spaces.

Principle 2: More formal spaces for collaborating and connecting

Connections will happen in almost any well-designed space, and like the informal social spaces discussed above, more formal group collaboration and study zones are important spaces in a thriving research-based education setting. As one interviewee suggests, "collaboration is a part of research... and I think the space has to be adaptable to that". Students will thrive in purpose-built study spaces where groups can collaborate and work on projects, spaces

which foster peer-to-peer learning. To quote one interviewee: "I think the more of those sorts of spaces that we can make available to students to connect together, …perhaps purposefully in things like peer study groups and things like that, …I think the better".

Figures 6 and 7– *Students need access to well-designed group study spaces, often found in libraries and learning hubs. Author's own image.*

Planned formal spaces that could facilitate group collaboration and similarly allow for teacher instruction could include computer rooms, research laboratories, learning labs and learning hubs, and workshops/research building spaces (known as maker spaces). These spaces may be centrally bookable or openly accessible to all. Interviewees at UCL recall the newly finished library hub as an excellent example with plenty of options for students to collaborate in group settings with each other (for example around tables or in semi-private booths) and with (or without) a teacher in seminar-style rooms (Figure 6 and Figure 7). Students also value enormously formal spaces like

these for their ability to connect with others, beyond those one would normally study with: "I used those libraries a lot, you would just start recognising faces and start saying hi to people and making friends that way. So I do think you do need to be in a space where you have other people doing similar things to you". In a large campus with a substantial student cohort, and considerable distance between university buildings, the provision for students to book group study space is important. Extending this even further, it would be ideal if students could book learning spaces out of hours. Some universities have built large-scale buildings with many study spaces; two student interviewees note that they prefer more diverse and small scale study space options. The more ideal solution, to avoid long travel times, would be to invest in "localised study space".

In creative disciplines, where students work on built projects, artwork or design concepts, the studio is a unique and indispensable more formalised collaborative departmental space. In these spaces one interviewee suggests, "you get to know people who are in the studio and next door to you, and that becomes your social scene, as much as where you do your studies, your research, and your work." The divide between group work, socialising, and learning is tenuous. Students feed "off each other as well", in an open-planned space a rich and potentially serendipitous dialogue can take place where "people just wander past". The studio culture, where students can see each other in an open plan, it was noted, has been "hugely beneficial", especially for collaboration and connection across the years (Figure 8). Along with facilitating group work and collaboration, studio is also a valuable departmental space where students can make connections with staff and their research, which is an important part of a research-based education. In the studio "you see staff and tutors mixing with students so there's a real kind of vibe or buzz."

While space plays an important role in fostering connections, it also has the power to reduce staff-student connection. As one interviewee notes: "the environment has a lot of influence over the culture of that partnership, and I suppose some of the bits where it is segregated very clearly, doesn't lend itself" to cross-connection. In a university building recently renovated, space has been designed with student-staff connections in mind. Around three sides of the perimeter of the building, on almost all storeys, floor to ceiling glazing and seating areas create "a kind of active zone where," according to one interviewee, "students will be sitting down with staff or they'll be doing" collaborative work. Moving away from the ways in which space – whether formal or informal – enables connections, social learning, and collaborations, the next section shifts to look at two additional key design approaches that research-based

education institutions should incorporate into their built environments, specifically flexibility and variety.

Figure 8 – *Studio spaces are ideal collaboration and connection environments, where research is continuously in production. Author's own image.*

Principle 3: Spaces that are both flexible and varied

The UCL model of research-based education encourages flexible adaptations. This flexibility should be equally apparent in the education each student receives. And in order to facilitate a research community of practice students will need access to a variety of well-designed spaces that are each individually flexible. These spaces will need to be able to facilitate multiple ways of engaging, collaborating and connecting – between students, year groups, with staff, and with people beyond the university.

In his literature review, education theorist Paul Temple (2007, p. 73) makes a strong case for flexibility in modern learning spaces. And similarly, one interviewee notes: the built environment must be "most importantly, flexible so that people can move around in it and talk to each other in different ways". Put simply by another interviewee, a research-based education demands "just flexible teaching space, which could be used for lecturing and [that] could be used for other purposes like practical classes or other activities". When asked what a research-based education learning environment might look like, another interviewee found it difficult to pin down, but it has something to do with flexibility: "I don't think I've ever seen a purpose-designed [research-based education] space for students... it's a bit more ethereal than that. I think it comes down to flexibility".

Flat floor spaces are essential environments in a thriving research-based education university, which can offer maximum flexibility. These spaces are noted for their flexible

potential, however they are also the spaces needed most in a densely urban campus. Where large flat-floor spaces do exist, they could be better designed through both zoning and furniture, in order to foster a flexible approach to learning. More care needs to be put into the movability and stackability of furniture. In other words: "we need to get much more agile, so that we can reconfigure furniture much more easily," and so that students and staff can do it easily without further assistance. And, like furniture, future technology will need to be flexible enough and willing to allow students to take control.

When it comes to flexibility the lecture theatre can be a challenge for facilitating the kinds of dialogues a research-based education demands in a thriving community of practice. Traditional lecture theatres can, quite simply, limit active learning by encouraging forward-facing passive engagement: "you know there are some rooms that can prevent" the type of dialogue needed in a research-based education setting, "so the very old school lecture theatre settings just make it really difficult". And "these tiered lecture theatres, are not terribly useful if you've got people working together in groups and they're doing enquiry based learning".

For some interviews in research-based education the lecture theatre would see its emphasis shift so there will be less impetus to use it, while for others it is almost anathema: "there is a sense that if you build a university you have to build lecture theatres first and I don't think the lecture theatre is the ideal place for enquiry-based or research-based education". Although it has its challenges, ideally students will have access to modern and innovative lecture theatres. Keeping in mind the importance of flexibility, "the lecture theatre [should] allow students to turn around and have small group conversations", or similar break-out opportunities. Many interviewees cited innovative spaces that would encourage dialogue, problem-solving and working together; for instance, the "Loughbourgh Lecture Theatre" (Figure 9) – a design where seating is grouped in clusters like a cabaret environment. These options offer the chance to break out into group discussion with close neighbours. While it is hard to dispute the benefits of these innovative types of lecture theatres, unfortunately they reduce the overall student capacity. For a university in a dense urban environment with no green spaces on which to expand, and sky-high real estate prices, this is a worrying fact. Unfortunately, the strategic approach to space often aims to "maximise space utilisation [which] may have the unintended effect of reducing student opportunities for informal learning" and connection opportunities (Temple, 2007, p. 31). Despite this, a research-based education demands that students access some of these types of flexible spaces and a variety of spaces throughout their schedule.

Flexibility across the student timetable is important to ensure students access a variety of spaces, or as one interviewee suggests, a "mixed economy":

> I mean to be honest I don't honestly think that if you had a range of different activities during the day including every day a lecture, I don't think there'd be anything wrong with that… I think the difficulty is if that's all you do and you never get a chance to talk to anybody else. So what I would want ideally for myself you know running programmes or whatever, would be that kind of mixed economy.

Flexible spaces like innovative lecture theatres or flat-floored spaces need to be planned carefully so that the flexibility fosters meaningful student connections and dialogue.
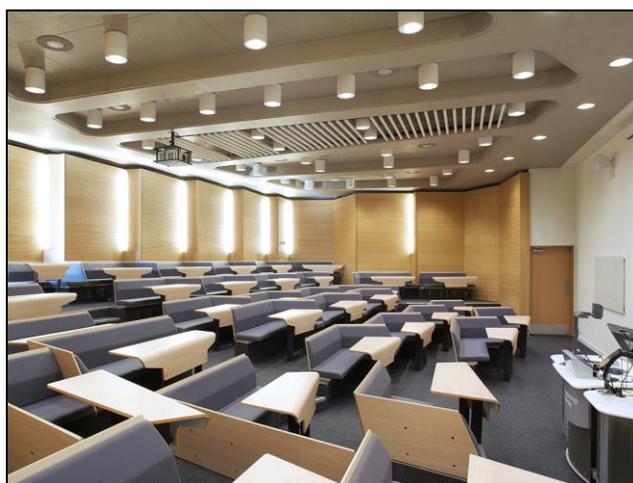
Figure 9 – *Well-designed lecture theatres can encourage collaboration and active learning. Loughborough Lecture Theatre, Loughborough University, reproduced with permission from Race Furniture – www.racefurniture.com.*

Approaching research-based education through a spatial lens demands foregrounding creative approaches to flexibility, so that the university's built environment can be used in unique and diverse ways. In addition to the examples above, this could mean ensuring rooms are not restricted to one purpose, or one-time occupation. A research-based education would also demand educators challenge their reliance on purpose-built space. In other words, this model of education also demands students move out off the campus into the surrounding environment. This fits with Nordquist and Laing's (2015, p. 337) notion of a multi-scaled learning spaces, ranging from the classroom, to the city (as well as digital spaces) – in the latter, Temple (2007, p. 33) suggests the city can become a learning space for higher education, "an idealopolis". An interviewee puts

it well, and offers a suitable quote to close this section on flexibility and variety:

> [I] hope [UCL's approach to research-based education] would expand people's ideas of the spaces that they might need. So maybe they will think, well, they could just walk out into London and do various things, or they could be doing this through Skyping with people from the US or Africa or whatever, and that thinking about research-based education would enable them to expand the landscape of possible spaces that they can imagine that research might work in.

Principle 4: Assessment and Exhibition Spaces

The fourth and final key principle to emerge in the research investigating the correlation between a university's physical environment and research-based education strategy relates to spaces in which course work or assessments can be displayed. Talking about the future of university spaces, Jamieson also argues that there must be more opportunities to engage others in assessment, celebrating "individual and collective achievement" (Jamieson, 2009, p. 23). There are a number of student benefits in displaying work, including developing essential presentation and engagement skills. Equally important is the benefit of informal feedback opportunities and informing others of creative work in production. As one interviewee suggests, it opens up programmes, allowing them to become engaging: "I can only see it as beneficial to have more interim presentations, to open up the whole debate". And clearly this has physical space implications. At UCL interviewees struggled to identify many spaces where students can engage others in their assessment. While purpose-built spaces are no doubt needed, there are also other easier answers. Responses to this challenge must offer room for making connections and truly engaging others. While some disciplines make use of lecture theatre spaces, for example student research presentations, this can be limiting for engaged and meaningful dialogue. Suitable spaces could include dedicated conference suites, exhibition zones (Figure 10), on or off-campus, and even rethinking the university's facilities policy on wall display.

In many cases building finishes and policy can be restrictive and prohibitive, with students and staff discouraged from mounting or displaying work on walls; curiously an approach of control and surveillance is opposite to the idea of academic freedom students and staff should enjoy (Brew and Popenici, 2003, p. 7). Rather, the walls within universities are the ideal place for extending the place of education. And while we may not have an overabundance of teaching spaces, as one interviewee suggests, "what we do have is a lot of wall space… so I think making more use of

those spaces would be good". A shift in culture, to one of wall display is needed, which helps develop students' sense of belonging and identity (Jamieson et al., 2000, p. 229; Brew and Popenici, 2013, p. 1). This may demand more suitable surface materials, among other interventions. In some disciplines, like architecture and art, that make use of informal critiques where interim work is regularly pinned up, wall display is already the norm. Yet clearly this is not so in other parts of the institution: "I mean the thing that gets me about so much of the estate is how little people make use of walls to display things. And I understand there's some sort of… prevention of people from using them". For another interviewee this sends a message that we are not very proud of the work our students have done. Indeed, displaying student work on walls, can have added benefit of making "the environment more personable because then you think about the people rather than just the buildings". One respondent felt the more formal areas in the university, including a large central space with high visibility, known as the Cloisters, could even have the more formal and long-displayed art replaced by student work. The benefit of displaying work here, an interviewee felt, is that it is well-located, with people continuously walking past, who may stop for a brief moment. Similarly, other successfully designed spaces, it was felt, would echo the spatial qualities, allowing students to stand back and view work, while also allowing for people to "mill around and to talk to other people… and for that you do need space for people to walk around".
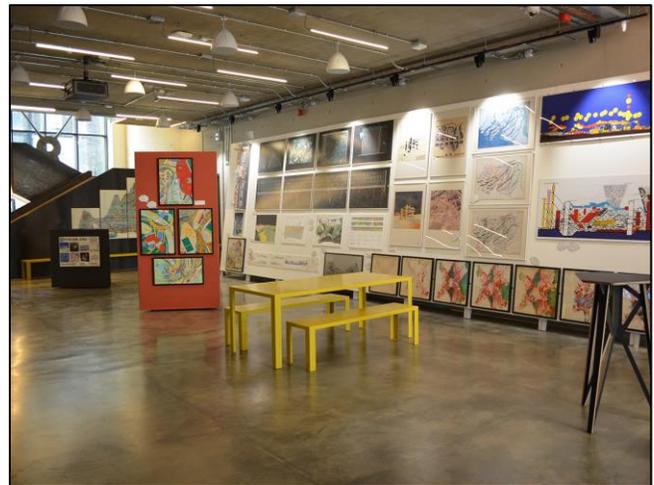
Figure 10 – *Exhibition spaces are needed to engage a wide audience in students' assessments. Author's own image.*

In that assessment drives learning (Biggs and Tang, 1999) – i.e. students will focus on what they have to do to succeed – and students are motivated (or demotivated) by assessment, it makes sense to encourage opportunities for

students' work to engage and connect with other people at multiple levels. Connecting with others across a department, beyond disciplines across the university, and even beyond the university including with the community and, importantly, employers, works towards establishing a community of practice. As such, one student feels, ideally, work will be accessible for a wide audience who may have a potentially brief time for engagement. If research across the institution took this approach she feels it would encourage students to have a more open outlook, making connections across disciplines, a divide which at times can be difficult to traverse. It is through engagement with assessments from diverse parts of the institution that students will "be exposed to new intellectual challenges outside of their formal disciplinary boundaries" (Jamieson, 2009, p. 23).

Making connections in a metropolis like London can be a challenge. While one is continuously in close proximity to others, and many people pass through the campus every day, intervention is needed to facilitate verbal and genuine connections. Relevant to assessments, one creative example of engaging passersby at UCL – albeit perhaps not on a very deep level – has been through student research displayed on temporary construction hoarding (Figure 11). This was remarked as particularly positive: "they've thought about what kind of hoarding to put up… and it's really good that members of the public are passing by [and get] to see the student work; that is very impressive". Engaging a public that otherwise may miss the world-class research and impressive student work is something two ongoing renovation projects at UCL are addressing, through the use of ground-floor publicly-accessible exhibition and event spaces, that will be both outward facing and inviting. The design idea is that "you can literally walk up and put your nose on the glass and say "oh, that looks interesting, what's going on in there?". This is key, to a research-based education approach, one interviewee suggests: "I think that's a very important part of the connected curriculum research-based education that people from outside of the university world are invited into our spaces and those should therefore be welcoming spaces". Making connections with employers is particularly important in these spaces. Engaging employers in a meaningful way can be challenging, but one often-cited successful example is an end-of-academic-year exhibition in the school of architecture, which all student work at all levels works towards – this also includes a large exhibition launched with a big party, open to the public: "the whole point is that employers are coming in looking at the work, and if they see something they like they can make job offers".

Space which facilitates connection through the display of student assessment will inevitably play an important role in the development of a strong sense of identity in a community of practice. Therefore, space will need to foster these opportunities, and the strategies facilities teams set will need to play a role in this. One interviewee admitted "there's probably a mish-mash" when it comes to prioritising this in such strategies at the level of space planning. Equally important is a revised approach which allows students to book spaces for student-run exhibitions of work, whether for peer review or otherwise. While there are a range of interventions that can be taken to encourage the display of student assessment, the strong link to the physical university environment demands dialogic conversation and engagement between everyone committed to enhancing the student experience through research-based education.

Figure 11 – *Students' work could be displayed on vertical surfaces, such as temporary construction hoarding, in order to celebrate a research community. The UCL Transformations Competition offered a winning doctoral student this opportunity. With permission from first-prize winner Bernadette Devilat.*

Conclusion

Through first outlining UCL's distinct approach to research-based education, and then working through four key principles of spatial design such an approach demands, this paper has begun to show the rich and dynamic relationship between space and an institution's education strategy (see Figure 12). While these have been essential points of focus, another article could highlight other themes that came up in the interviews with fifteen staff and students, including the related and powerful role of the educator/facilitator in research-based education – a role which cannot be underestimated in fostering the right kind of learning environment and connection opportunities – as well as the importance of communicating what the

institution is doing to join up approaches to education and space.
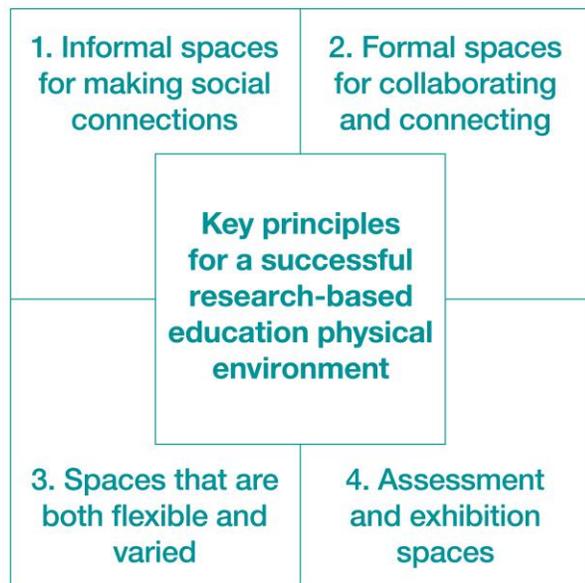
Figure 12 – *A thriving research-based education physical environment would contain these four key space principles. Author's own image.*

It is clear that good quality higher education cannot be supported without good quality environments (Edwards, 2000). And space clearly shapes learning (UCISA, 2016, p. 9; Nordquist and Laing, 2015, p. 338; Oblinger, 2005; Whiteside, Brooks and Walker, 2010; National Learning Infrastructure Initiative, 2004, p. 1; Johnson et al., 2016). Rather than separate approaches, there must be a dynamic dialogue between the two parts of an institution that have these areas within their remit. Others push this further by making the case for "built pedagogy", where a university's physical environment including its learning spaces must convey its educational philosophy and strategy (Monahans, 2002; JISC, 2006, p. 2; Temple, 2007, p. 12, p. 36; Whyte, 2006). In other words, this creates an opportunity to "express the mission of [the] university in built form" (Edwards, 2000, p. 3). If an institution's strategy is to improve the student experience through enhanced learning in a research-based environment, or through other educational enhancement strategies, space must be amenable to such an approach. The UCL Connected Curriculum, and similar university approaches to research-based education, demand moving away from a traditional teaching-centred model that favours content delivery towards a student-centred approach to learning and to space with opportunities for students to construct knowledge in collaborative and flexible environments (National Learning Infrastructure Initiative, 2004, p. 6; AMA, 2006, p. 1, p. 18). While access to good

quality spaces is fundamental in a research-based education strategy, and arguably to any education enhancement plan, this paper has also shown the nuanced approaches to space needed to develop learning environments. It is through connecting university spaces with innovative educational strategy that higher education will see real improvements to the student experience.

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Appendix 1: Qualitative research questions

1. Thinking about spaces you value in this university, can you tell me:

    a. What is your favourite teaching space (classroom, lecture theatre) and why?

    b. What is your, or might be your students', favourite study space and why?

    c. What is your, or might be your students', favourite social/hang out space and why?

2. Thinking about the same categories, what spaces do you think are really in need of renovation or does the university need more of? Why?

3. The institution is moving towards embedding enquiry and research into all programmes, what are the ways existing spaces would hinder or enable this?

4. What might be some of the differences between an urban university and a suburban campus – thinking about space both within and beyond the classroom?

5. How do you think the weather/climate at this university affects learning?

6. What might be some of the differences between an urban university and a suburban campus – thinking about space both within and beyond the classroom?

7. Can you think of any examples of spaces on campus where students present or showcase their assessments to a wide audience?

8. Can you think of spaces on campus that allow students to make connections with…

    a. Each other?

    b. Teaching staff and their research?

    c. People beyond the university?

9. How important do you think it is to make connections across these various groups? Why?

10. How much of your learning takes place outside of the traditional classroom/lecture theatre?

11. How important do you think learning from each other in a group setting is to an enhanced education? Can you think of any spaces on campus that facilitate group learning or group work?

12. Can you think of a space outside of this institution that creatively facilitates learning?

Additional questions for staff in the estates and facilities department:

13. Are there key space development strategies or building works planned?

14. Are there solutions to an ever-increasing student cohort, which places demand on physical spaces?

15. Is your team thinking about the impacts of research-based education on space? If so, can you elaborate? Are there challenges?