

Paper

Creating Physical Learning Environments that Enable Effective Learning and Teaching

James Rutherford

Centre for Learning and Academic Development and Learning Spaces, University of Birmingham

Abstract

This paper is a summary of a Master's thesis completed in 2013 and considers the types of physical environments that are required to enable effective learning and teaching in respect of a student centred, active and collaborative pedagogy. The paper examines the conclusions of a small-scale empirical research study that investigated the impact of new spatial designs at two universities in England. The methodology was mixed and resulted in a set of data from interviews of academic staff and student focus groups that regularly occupied the learning spaces, together with classroom observations and photography. A thematic data analysis resulted in conclusions that were intriguing, persuasive and thought provoking. It is clear that student's preferences for their working environment are evolving. They require a more informal atmosphere, closer connection with their tutors, more space within which to sit comfortably and sufficient writing surfaces to access. There are key social and psychological considerations to understand in order for an effective design and arrangement of learning spaces that encourage and enhance the learning experience.

Background and Context

It is evident from a review of the literature that the higher education sector is considering emerging pedagogies and is taking significant steps towards the design of new learning spaces intended to cater for active and collaborative learning (Blackmore *et al.* 2011; Neary *et al.* 2009; Van Note Chism, 2006). The literature was drawn from the UK, Australia and the United States and demonstrated how students may be engaged in activities such as discursive seminars, facilitated group study, experiential, enquiry and problem-based learning.

The overall aim of the study was to understand the impact of new student-centred learning spaces aligned with the principles of constructivist learning (Biggs, 1993; Montgomery, 2008; Prosser and Trigwell, 1999; Ramsden, 1992). Psychologists and contemporary educationalists use the theory of constructivism to understand how humans learn.

Biggs believes that knowledge is not '*out there*', an entity waiting to be discovered nor reproduced from others, rather learners should actively construct knowledge from their own experiences and these could be constructed through problem solving (Biggs, 1993). It is argued that problem-based learning as a paradigm is a key feature of group-based work and the social construction of knowledge. Problem-based learning involves challenging students with an issue linked to their curriculum, rather than the traditional didactic transmission of information (Ahlfeldt, Mehta & Sellnow, 2005). It is claimed that this improves student motivation and develops greater cognition, stimulating independence and ultimately interdependence. It is also seen as improving student's ability to work together, to analyse issues and in strengthening their communication skills (Beetham & Sharpe, 2007; Fry, Marshall & Ketteridge, 2008).

The Study

The intention was to visit two universities in the UK where their deliberate and considered efforts to design collaborative learning spaces would be examined with a view to understanding what the impact has been through the triangulated methodology of observation, photography and interviews. The focus of the investigation was on the consequences of new layouts and furniture arrangements that have been designed to enable group based and active learning. The aim being to establish how effective these spaces are and how academic staff and their students perceive them. This work is of value as few studies have been carried out to question and evaluate the physical aspects of the layout and furniture in this new generation of learning spaces.

The research methodology was mixed, adopting an interpretive approach and based on a phenomenological study (Dick, Stringer & Huxham, 2009) of learning spaces at two different higher education institutions, to be known here as University D and University L. Two days were spent at each campus gathering data from a number of observed seminar classes, together with hosting 10 academic staff interviews and 7 student focus groups. Each interview and focus group lasted between twenty and forty five minutes, held in collaborative teaching rooms and social learning spaces on campus.

In terms of the data analysis, codes were utilised to represent and highlight instances identified from the transcriptions of staff interviews and student focus group sessions. These were viewed along a theoretical range from the '*mundane to the remarkable*' (Silverman, 2007:16) and in phenomenological terms, according to their level of sophistication as determined relevant to the research question. Such an example would be when a student talked about the layout helping her overcome her shyness when presenting to the cohort. This instance was marked with the codes of 'Confidence', 'Presentation' and 'Layout'. Braun and Clarke (2006) note in their work on inductive thematic analysis, themes soon to appear in one's consciousness as the codifying process develops.

Over forty different codes were grouped so to arrive at an overarching topic and then the completion of the naming of themes. So in adopting this phenomenological approach, the data has been arranged into the themes shown within Table 1.

Theme 1	Behavioural
Theme 2	Environmental
Theme 3	Pedagogical
Theme 4	Practical
Theme 5	Social/psychological

Table 1: Themes emerging from thematic analysis.

Findings and Summary of Data Analysis

With the Behavioural theme (1) one element was codified as 'time-consuming' and is related to classroom management. If students are set group tasks within the space, there is an obvious point to make about setting temporal parameters to the cohort. At University D staff development programmes have been introduced to support those academics new to the collaborative approach that these rooms enable. Another coded aspect of the Behavioural theme was 'talking in class'; this is intriguing as it is something of a dichotomy. The shape and layout of tables are designed to allow for group collaboration, which naturally is mainly about discussion. Where one academic found talking in class to be a problem, others recognised it as part of the nature of the space and recognised that students were more likely to be commenting on the content of the lesson.

Academics at both universities have witnessed supportive peer learning amongst their students, stating that this is more prevalent in the collaborative learning spaces than observed in traditional teaching spaces. In the rooms that were observed, there was a noted tendency for students to stay on after class. The academics believe this is due to students feeling more comfortable with the space, suggesting a greater sense of ownership. Students talked about 'our' rooms, which is arguably an essential requirement for student engagement and the possibility of an enhanced experience of learning.

The Environmental theme (2) drew on issues that are important in terms of basic human comfort. According to the students interviewed, issues were discussed that are perhaps so obvious that they are often ignored or compromised. Clearly all rooms need good ventilation, controllable lighting and heating, with access to daylight. This featured regularly in comments by students, as apart from the natural aspect of needing daylight, it clearly impacted on their concentration and energy levels (Graetz & Goliber, 2002). Daylight is their connection with the outside world and for some, the view outside can be important for reflection and a reference to their day.

Then there is the issue of acoustics, an environmental aspect frequently neglected or demoted in the priorities for creating learning spaces. Again it seems to be an obviously apparent requirement, but inadequate loudspeakers, poor room reverberation or noisy ventilation can have a negative impact on learning (Dockrell & Shield, 2006).

Another significant factor is that of colour, which not only provides an aesthetic statement, but there is also the psychological element to consider. Respondents recalled how colour gave the rooms a modern look and significantly, left a lasting impression on them. There was a general dislike of rooms that appear bland and clinical, a factor that was uncovered in a research study at the author's previous institution (Rutherford, 2010). This demonstrates the significance of the environmental factors working in harmony with the layout, furniture and technology of the room, which is a major element of a holistic approach to learning space design.

With the Pedagogical theme (3) it was discovered that the majority of academic participants were very positive in their responses when discussing the pedagogical impact of the learning spaces under investigation. Staff considered that their students engaged more actively in exploratory learning than in other rooms. As the dynamics have changed, they talk more and engage in responses to their tutor more as they have worked together in their groups. Staff found greater engagement amongst students; they experienced more spontaneous questions, whereas teaching the same module in a traditional room had nothing like same level of interaction.

Two academics at University D responded positively about their own emerging practice, stating that they would change their delivery to suit the room and adopt more group-based work. Respondents found it easier to support higher order intellectual skills in the new spaces, as it appears to suit emergent styles of teaching and learning. One academic discovered that since she has adopted the role of facilitator, she has witnessed more risk taking by her students. Another tutor was quite emphatic in describing his role as a conductor, not as a teacher. Most academic staff saw the need for a change in the dynamics, where the relationship is less didactic, so that students gain an important and different perspective of their learning experience.

At University L, two tutors from different courses concurred on the impact of the new spaces on their students' learning outcomes. The new rooms provided the opportunity to combine the application of practice with discussion groups then considering theory. One respondent felt that this embodiment of pedagogy leads to a more confident learner who is then capable of acquiring transferable skills. With the feedback from her students, another academic was aware that they preferred group work as it significantly helped in developing their analytical skills.

Students were in agreement about the open nature of the rooms that encouraged an informal teaching approach. '*Being relaxed helps with creative work*', and '*it is easier and quicker to learn*', were common responses, unlike the small spaces where they are '*crammed in*' and where they are '*just talked at*'. Students at both universities preferred to be active and working in groups where they feel that they are learning more through discussion and participation.

Within the Practical theme (4) the research findings demonstrated that space is a crucial factor in the success of a room for collaborative learning. Students discussed needing sufficient space to work and move comfortably within the room. In simple terms, students need adequate table space, to work on a mobile device, to write or draw or carry out practical tasks. The findings show that students require space to work comfortably within each group without overcrowding, including adequate legroom. The argument appears to be simple and persuasive, discomfort leads to distraction, which results in disengagement.

Students do not like being '*crammed*' into lecture theatres, feeling '*penned in*' by the restrictions of folding writing tablets, nor sat in rows in small and uncomfortable chairs. There is a lesson here for those who timetable too many students into a room, which has been shown in this study to have a negative impact on the ability of staff to facilitate group working. Interestingly, the focus groups demonstrated that students need a balance; they want sufficient space in the room to avoid distractions from other groups who might otherwise '*invade*' their space. But they also prefer a space that allows for movement within the room, so that they can engage with other groups at their choosing, surely a factor that leads to wider group collaboration.

Quality of furniture is an important and challenging issue, as furniture can be under specified due to budget restraints or a lack of understanding of its significance. As one student at University D commented, 'weary' furniture can inadvertently send out the wrong psychological message, he implied that the university does not consider student comfort to be important. Students can be in class for a considerable time and as is known from research (McClelland, Dahlberg & Pilhal, 2002) discomfort can lead to distraction and therefore disengagement.



Figure 1: 'Plectrum table'.

The findings from this study were clear about the value of chairs on castors, a simple but practical feature that enables effective group-based learning. A number of respondents commented that square or rectangular tables are not so practical and far less effective for group work. Staff at University D commented on their preference for rounded triangular group tables that allow adequate space for the activities assigned to students (See Figure 1). These 'plectrum' shaped tables have equal sides and cater for six students, allowing space for students to easily move around the table on a wheeled chair to observe a presentation and returning to a position to work in a collaborative fashion. These tables have become widely adopted at a number of universities, recorded in visits to institutions both in the UK and in Australia (Rutherford, 2011). What was noticeable at University L was that the type of triangular tables did not give equal space to students due to their shape not being equilateral (Figure 2). This can cause problems for students and perhaps lead estates and timetabling staff to misjudge the real capacity of a room.

Another important factor to emerge from the study is that students need time to develop their confidence and expertise in working collaboratively in these types of spaces. Some students were observed as quite reticent and naïve in their use of shared spaces. For example, it was unclear if they were permitted to swivel or move their wheeled chairs. A number of students sat almost rigid in a chair with castors, rather than moving to face their tutor.

Through the introduction of adequate writing surfaces, rooms can afford opportunities for conceptual and creative work, liberating students to express themselves with greater confidence and to experiment on a larger scale, so complementing the layout with an additional dynamic and active element. Confidence is key issue here. At University D one student gave her appraisal of the impact of the new space on her whole learning experience. She described how her confidence in presenting to others had improved and that has impacted on her approach to other classes.

The Psychological theme (5) drew out significant outcomes, the consensus amongst academic respondents showed that these collaborative spaces do engender greater participation. Students reported that they are more willing to collaborate if they feel relaxed in the classroom and by their tutors' complementary style of teaching. The research data underlined the strength of opinion from students about the importance of working in an informal environment. So the imperative must surely be to create spaces that allow students to feel comfortable and less inhibited, a more relaxed environment that is conducive to a greater sense of egalitarianism, so that students are able to learn without an overbearing sense of pressure or undue formality.

Describing their classes in group study rooms, students talked about the positive change in their relationships with others;

'People say to me that it's really nice you make friends with people on your course, where they just go to a lecture and then walk out afterwards without speaking to anyone, sitting on a group table you're bound to talk to other people.'

Product Design student, University L

Another student talked about the effect of collaborative working on her whole learning experience:

'You need to engage more with people's opinions, whereas at school it was more intimidating to say something when you got a whole load of people in rows. It's weird how that works I'm not sure why.'

English student, University L

Participants from both universities spoke emphatically about the collaborative spaces, recalling them as their favourite rooms on campus, using superlatives such as *'fantastic'*, *'fabulous'*, *'innovative'* and *'exciting'*. This is of course an emotive aspect of the research, but it was a key feature of the thematic data analysis. The data showed that the academics recollection of these rooms clearly impacted on their own levels of motivation.

Student's responses included a feeling of greater equality with their tutors, where the new rooms have created an opportunity for a more egalitarian and less formal type of relationship. They discussed their preference for rooms that allow their tutor to move freely.

The interpretation being that students do not like to feel isolated and want to have equal access to the academic, which is far more difficult in a traditional teaching room with serried rows of tables and fixed seating: *'Many undergraduates tend to be authority dependent, passive, irresponsible, overly competitive and suspicious of their peers'* (Bruffee, 1999:91). This situation is arguably fed by the lecture-based system. Bruffee suggests that collaborative learning can provide a *'re-acculturative process'* that assists students to become participants in learning communities and to learn the attributes of interdependence (Kelly, 2002). It is pertinent to this study as a number of academics at both the universities discussed the ease with which the new spaces allowed them to involve introverted students or those lacking in confidence.



Figure 2: Non-equilateral triangular table.

This was opposed to large lecture theatres where most students reported feeling too intimidated or physically restricted to actively engage in responses.

Finally there is the consideration of the implications for practice, policy and further research. In spatial terms, the ability to move freely also removes the traditional academic hierarchy. Collaborative spaces can facilitate greater equality in terms of dynamics and create mature relationships between staff and students. In pedagogical terms, the success of the studied rooms has encouraged staff to alter their teaching delivery. Some staff have begun to adopt techniques of blended-learning such as the 'Flipped' classroom approach (Bergmann & Sams, 2012) and one has experimented with the 'Jigsaw' technique of teaching with groups (Aronson, 1978; Perkins & Saris, 2001). This is surely a positive and important outcome from the new room designs and could be developed by creating new spaces within the universities. Certainly institutional approaches to learning and teaching may be addressed by wider and sustained research into learning space design alongside continuing professional development in the constructivist approach to pedagogy.

In practical terms, the success of a space is equally determined by something as simplistic as good housekeeping and intelligent timetabling. With a collaborative space, a more effective facilities regime is required, together with a considered and academically informed approach to timetabling. There is a real challenge here. If a room can be reconfigured with moveable furniture, then perhaps there should be a buffer zone between classes to allow for the room to returned to its designed state or rearranged according to the requirements of the next class. As the data has shown, this simplistic approach belies the importance of room configuration and cleanliness on the impact for effective collaborative learning and teaching.

Conclusions

The data uncovered material that is considered to be informative, invaluable and illuminating:

'I think the results are slightly higher, slightly better than results I have in previous years, I think it's because their critical skills have developed a little bit more but I haven't changed a lot in the way... I teach the theory, but I think they are having discussions about work, on developing presentation and critical skills, I think that was facilitated by the type of room that we were using.'

English academic, University L

There is compelling evidence in the study that should be a catalyst for further research. Clearly there is a requirement to determine the impact of collaborative learning spaces not only on students' learning outcomes, but also in respect of the constructivist principles of teaching and learning. So despite the small scale of this phenomenological study, it is argued that it has relevance for higher education and real value to those stakeholders who contribute to the design of new learning environments.

At the outset, students clearly demonstrated the significance of getting the environmental factors working in harmony with the spatial aspects of the room: heating, lighting, access to daylight, comfort and acoustic elements are fundamental, in fact this is considered to be representative of the desired holistic approach to learning space design.

Overall it seems that the engagement of students is easier to achieve within these new learning spaces. Along with a change in the dynamics, students appeared to be more relaxed, confident and focused on their learning. The spatial impact on group work was seen to be more

effective, with students able to function more efficiently whilst producing more experimental, collaborative and creative work than in traditional, more formal classrooms. There are important practical measures to consider too. Providing an equality of space, comfortable seating, new furniture, and bright and modern décor, together with appropriate and easy to use technology for all. But there are of warnings too, as students were clear what they did not like. If there are too many students in too small classrooms, it is far more difficult to adopt a collaborative approach and staff would be battling with unhappy, uncomfortable and ultimately, disengaged students. However, it is not all down to the physical space. New forms of teaching delivery are possible and seem to be evolving, indeed it was welcomed by participants, along with a parallel motivation for staff to engage with academic development to give them the confidence to change and embrace the opportunities offered by these new spaces. The impact of group-based learning was quite pronounced from the research, students were in the majority of cases very positive and encouraging about the impact on their experience of university.

To conclude, one of the most significant outcomes from this research study came from students who talked about being more motivated to attend classes. One student at University D remarked that he genuinely felt a real sense of enthusiasm on a Monday morning for his class; clearly a significant impression had been made. If students perceive a room as being memorable and the association with that space is one of a positive experience of learning, it can be argued that this is due to a heightened sense of engagement and motivation to participate in class.

References

- Ahlfedt, S., Mehta, S. & Sellnow, T. (2005) 'Higher Education Empirical Research Database – Measurement and analysis of student engagement in university classes where varying levels of PBL methods of instruction are in use', *Higher Education Research and Development*, 24, pp5–20.
- Aronson, E. (1978) *The jigsaw classroom*. SAGE.
- Beetham, H. & Sharpe, R. (2007) *Rethinking Pedagogy for a Digital Age: Designing and Delivering E-Learning*. Routledge.
- Bergmann, J. & Sams, A. (2012) *Flip Your Classroom: Reach Every Student in Every Class Every Day*. International Society for Technology in Education.
- Biggs, J.B. (1993) 'From Theory to Practice: A Cognitive Systems Approach', *Higher Education Research & Development*, 12, pp73–85.
- Blackmore, J., Bateman, D., Loughlin, J., O'Mara, J. & Aranda, G. (2011) *Research into the connection between built learning spaces and student outcomes*. Education Policy and Research Division, Department of Education and Early Childhood Development, Melbourne, Victoria.
- Braun, V. & Clarke, V. (2006) 'Using thematic analysis in psychology', *Qualitative Research in Psychology*, 3(2), pp77–101.
- Bruffee, K.A. (1999) *Collaborative Learning: Higher Education, Interdependence, and the Authority of Knowledge*. Johns Hopkins University Press.
- Dick, B., Stringer, E. & Huxham, C. (2009) 'Theory in action research', *Action Research*, 7, pp5–12.

Dockrell, J.E. & Shield, B.M. (2006) 'Acoustical barriers in classrooms: the impact of noise on performance in the classroom', *British Educational Research Journal*, 32, pp509–525.

Fry, H., Marshall, S. & Ketteridge, S. (2008) *A handbook for teaching and learning in higher education (3rd Edition)*. Routledge.

Graetz, K.A. & Goliber, M.J. (2002) 'Designing collaborative learning places: Psychological foundations and new frontiers', *New Directions for Teaching and Learning*, 92, pp13–22.

Kelly, J. (2002) 'Collaborative Learning; Higher Education, Interdependence and the Authority of Knowledge by Kenneth Bruffee: A Critical Study', *Journal of the National Collegiate Honors Council*, Spring/Summer 2002, pp91–100.

McClelland, J., Dahlberg, K. & Plihal, J. (2002) 'Learning in the Ivory Tower: Students' Embodied Experience', *College Teaching*, 50, pp4–8.

Montgomery, T. (2008) 'Space matters: Experiences of managing static formal learning spaces', *Active Learning in Higher Education*, 9, pp122–138.

Neary, M., Harrison, A., Crellin, G., Parekh, N., Saunders, G., Duggan, F., Williams, S. & Austin, S. (2009) *Learning Landscapes in Higher Education*. University of Lincoln.

Perkins, D.V. & Saris, R.N. (2001) 'A 'jigsaw classroom' technique for undergraduate statistics courses', *Teaching of Psychology*, 28, pp111–113.

Prosser, M. & Trigwell, K. (1999) *Understanding Learning and Teaching: The Experience of Higher Education*. Society for Research into Higher Education & Open University Press.

Ramsden, P. (1992) *Learning to teach in higher education*. Routledge.

Rutherford, J. (2011) *A Study of External Learning Environments at the University of Melbourne: Module Two*. Institute of Education, University of London.

Rutherford, J. (2010) *A study to assess the impact of newly designed learning environments on teaching and learning in a higher education university college: Module One*. Institute of Education, University of London.

Silverman, D. (2007) *A Very Short, Fairly Interesting and Reasonably Cheap Book about Qualitative Research (1st Edition)*. SAGE, London.

Van Note Chism, N. (2006) 'Challenging Traditional Assumptions and Rethinking Learning Spaces', in Oblinger, G. (Ed.) *Learning Spaces*. Educause.