

A study exploring learners' informal learning space behaviors, attitudes, and preferences

HARROP, Deborah <<http://orcid.org/0000-0002-6528-4310>> and TURPIN, Beatrice <<http://orcid.org/0000-0003-3816-8493>>

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A study exploring learners' informal learning space behaviours, attitudes and preferences

What makes a successful informal learning space is a topic in need of further research. The body of discourse on informal space design is drawn from learning theory, placemaking and architecture, with a need for understanding of the synergy between the three. Findings from a longitudinal, quantitative and qualitative study at Sheffield Hallam University, explore learners' behaviours, attitudes and preferences towards informal learning spaces in higher education, within and outside of the context of the academic library. The learning spaces study contributes to the discourse on informal learning spaces design by producing a typology of nine learning space preference attributes which address aspects of learning theory, placemaking and architecture. The typology can be used to evaluate existing spaces and inform redevelopment of informal learning spaces in higher education institutions. Implementing the typology will be subject to localised conditions, but at Sheffield Hallam University the key conclusions have included developing a portfolio of discrete, interrelated learning environments, offering spaces with a clear identity and encouraging students to translate their learning preferences into space selection.

Keywords: learning spaces; informal learning; learning environments; space design; learning theory; placemaking; architecture; higher education; learners; students; learning preferences; behaviours; attitudes; libraries

Introduction

Across the higher education sector worldwide, in particular the UK, Australia and the US, you do not have to look far for examples of new or redeveloped learning spaces, with particular growth taking place in what are termed 'informal learning spaces'. For the purposes of clarity, here, informal learning spaces are defined as non-discipline specific spaces frequented by both staff and students for self directed learning activities and can be within and outside library spaces.

The need for research on space and its relationship to learning has been identified by Jamieson (2007) who questions how many new spaces really challenge the status quo, and most recently by Boys (2010, p160) who concludes, ‘almost no data exists to help assess the effectiveness of the new and adapted buildings currently being constructed across universities and colleges’.

The need to understand why and how informal learning spaces, not just those within library environments, can remain relevant is pressing and achieving this can contribute a response to the question: what makes successful higher education informal learning spaces? With this aim in mind, Sheffield Hallam University was taken as a case study and the following objectives were defined:

- to determine learners' behaviours and preferences in relation to where, what, when and how they use informal learning spaces
- to determine learners' behaviours, attitudes and preferences in relation to why they select and use informal learning spaces
- to enable evidence based decision making in the redevelopment of informal learning spaces at Sheffield Hallam University
- to inform the design of informal learning spaces internally and at other higher education institutions

A commitment to meet and anticipate future learning needs is evident in the architectural footprint across Sheffield Hallam University and exemplifies understanding that 'space can either enable - or inhibit - different styles of teaching as well as learning' (Oblinger 2005, p14). The most notable example demonstrated by the inception of the Adsetts Learning Centre in 1996. The initial design brief for this building, which is arguably still relevant, stated an intention 'to provide an exciting series of interlinked spaces offering a wide choice of environments for study – from quiet individual places to group interactive areas' (Sheffield Hallam University 1998). Despite the continued popularity of Learning Centres and other informal learning spaces across campus; a key driver was recognition that spaces must continue to be refreshed and/or expanded to ensure ongoing relevancy to learners, and that decisions must be evidence based. The decision to use Sheffield Hallam University as a case study was also in part opportunistic as access to undertake research was readily granted.

Literature review

Literature searches were undertaken on multidisciplinary, education and library and information specific information databases. The search strategy contained three components: terms relating to preferences, behaviours and attitudes; terms relating to learning spaces and learning environments and terms relating to students. The literature searches yielded in excess of 7000 unique results. Review of the results may in part explain the rationale prompting Jamieson (2007) and Boys (2010) aforementioned critical assertions about the quality of both spaces and research. Analysis reveals the body of discourse pertinent to informal learning space design is primarily drawn from three distinct disciplines; namely, learning theory, placemaking and architecture, with few research articles exploring all three disciplines. Relevant literature addressing

informal learning and each of the disciplines is outlined below.

Learning theory

Learning theory refers to an understanding of how people learn and an appreciation of differences in learning preferences. Learning theory also recognises that learning can take place anywhere. Dugdale (2009) refers to this as the 'Learning Landscape' and emphasises that learning spaces can be formal or informal, as well as virtual or physical. Lippman (2010, p1) builds on Dugdale's position and explores the concept that 'the environment shapes the learners, and that learners influence their environment'.

Placemaking

The term placemaking may not be so well known, but is about people and their experiences whilst occupying a given space. Fleming (2007, p14) captures the essence of placemaking when he states that it is 'the recollection of patterns of life lived in a particular building or space that creates the cornerstones of mental association and gives such places the patina of affection'. Pine and Gilmore (1999, p20) also echo this philosophy and place the emphasis firmly back on the individual reminding us that 'the best things in life are not things'.

Architecture

Architecture refers to the tangible inside and outside of a physical space. It includes the bricks and mortar, design, furnishings, lighting, ventilation and acoustics, and many of the resources and facilities; for example PCs and refreshments offered in a space (Jamieson, 2006; Kennedy, 2003; George, Erwin and Barnes, 2009). It has long been established and widely agreed that the architecture of space can enable or hinder

learning and teaching (Oblinger, 2005; Jinnings Burruss 2001).

Combining physical object and abstract subject

Further analysis of the relationship between the three disciplines reveals that space is treated primarily as either a physical object or abstract subject. For example, whilst without doubt underpinning space design, Lewin's (1963) work on 'life space' is a salient illustration of learning theory treating space as an abstract conceptualisation. If we are looking for emphasis on the 'how to' of constructing built environment and place, we need to look towards architectural spatial guidance (Littlefield 2008) which sits entirely in the sphere of space as physical object, or the afore mentioned body of discourse on placemaking which predominantly treats space as abstract subject. Yet, it is the physical object, or architectural discipline that may find itself the weakest partner in the relationship as the longevity of a building is far greater than, and potentially in opposition to, the evolution of theories of learning and the types of environments our learners wish to frequent and use.

Arguably, to construct understanding and successful physical iterations of informal learning spaces, consideration must be paid to all three and their relationship to one another. Notable examples of research supporting this stance and already explicitly addressing all three disciplines is less voluminous, but examples include; Bennett (2007a and 2007b) who goes as far as to suggest six preliminary questions we ought be asking before redeveloping an informal learning space and Lefebvre (1991, p144) whose work is underpinned by the belief that 'form must express function'. Bryant, Matthews and Walton (2009) also report on an observational case study where both analysis and verbatim comments from observer field notes appear to recognise the

importance of learning theory, placemaking and architecture, although not using these terms explicitly. Their conclusions also emphasise requirement to consider theories behind the concept of higher education space. A study undertaken at the University of Rochester seeks to build on the concept of higher education space by asking: ‘what do students really do when they write research papers?’ (Fried Foster and Gibbons 2007, pV). It is an extensive research programme, and although the research question does not explicitly refer to informal learning spaces; the results drive at a set of responses on a par to those elicited at Sheffield Hallam University and conclude in an author recommendation for ‘user-centred design’ (Gibbons and Fried Foster 2007a, p81) .

It is intended that outputs from the learning spaces study undertaken at Sheffield Hallam University take a step towards bridging gaps between learning theory, placemaking and architecture by adding to the body of knowledge and offering understanding of the synergy between the three disciplines.

Methodology

Sheffield Hallam University is taken as a case study. The findings from this longitudinal mixed mode study which used a series of quantitative and qualitative research events are reported. To maximise data reliability, data collection was divided into two distinct phases which took place over a 16 month period. Both phases used an opportunistic random sample of Sheffield Hallam University students. No demographic data was collected and the survey instruments were piloted.

In the first instance (phase I), Learning Centre spaces from across Sheffield Hallam University define the parameters of the study and are explored accordingly.

However, the need to understand learning preferences both within and outside of the context of the Learning Centres led to a second phase of research exploring a portfolio of physical spaces which can and do support informal learning and includes on and off campus spaces.

Both quantitative and qualitative data collection methods were used to enable data triangulation, improve research rigour and reduce what Robson (2002, p370) terms 'inappropriate certainty'. In phase I and phase II, quantitative data collection was undertaken first with the objective of identifying 'how, what, where and when' in relation to learner informal learning space preferences. Qualitative data sought to build on this information by focusing on 'why' learners held or demonstrated particular informal learning space preferences.

Observational sweeps

Quantitative, non-participant observational sweeps of all Learning Centre spaces took place in December 2008 and January and March 2009 on the 11th of each month, or the nearest weekday and in each instance at 10 a.m., 1 p.m., 4 p.m. and 7 p.m. For the purposes of data collection and analysis, all spaces on each floor were divided into discreet areas. This sampling strategy maximised opportunity to obtain information about study patterns and covered peak assignment hand-in dates and examination periods. However, it is important to emphasise the data collected only offers insight into informal learning space preferences between the time frames stated. Observations recorded usage and behaviours; specifically, number of spaces in a pre-defined area, number of spaces in use, type of furniture in use, whether learners were working individually or in groups (and respective group size), resources used by learners; for

example, PCs, laptops, books, learners' own handwritten notes, whether refreshments were visible and decibel readings. Results were recorded using a list of predefined criteria on a five bar gate. Observers also recorded any other pertinent factors on a discretionary basis. Phase II used the same time and date sampling strategy and took place in March 2010, but with the amendment of a stratified random sampling technique to select two-thirds of all non-Learning Centre, informal University spaces. Spaces covered were as follows: catering spaces, atrium spaces, PC laboratories when not in use for teaching, open access spaces, learning hubs and the Students Union.

Coordinate and photographic mapping

Qualitative data collection exercises also took place in phase I and phase II and sought to understand why learners had specific learning space preferences. Participants were randomly selected and asked to complete either a coordinate or photographic mapping data collection exercise. For the former, learners were asked to draw on a map where they had visited, or were planning to visit, on the day of research and explain why they had selected particular spaces for informal learning. The photographic mapping exercise asked learners to take photographs of their favourite spaces or something they would like to change and explain the rationale for this. Data were collected in March 2009 and January and February 2010 with 20 responses per exercise, campus and iteration. In phase I, data was collected in the Learning Centres; and in phase II, a central location on each campus. Phase II data collection activities were adapted to encompass wider University and external spaces and included the added advantage of capturing preferences of non-Learning Centre users. In both phases, audio recordings were made and interviews took 5-10 minutes per respondent. In total 240 interviews were undertaken. The coordinate and photographic mapping exercises were both adapted

from studies at the University of Rochester in the United States which used a ‘photo survey’ methodology (Briden 2007), but with different questions, and a near identical ‘mapping diary’ (Clark 2007).

Reliability

To maximise ‘inter-observer reliability’ (Robson 2002, p340), a pre-test was undertaken with researchers. This was followed up by application of a practical discussion based on Ahern’s (1999) technique of ‘reflexive bracketing’ where researchers were asked to identify personal values which may inhibit an objective research process.

Respondent bias, in particular the ‘Hawthorne effect’ (Payne and Payne 2004), was minimised through research design as quantitative data collection excluded opportunities for researcher/participant interaction, and participants undertaking qualitative exercises were not made aware of the context of the study until the exercise had been completed.

Ethics

Learners were made aware of the observational sweeps through user of posters and digital signage. All participants in the coordinate and photographic mapping completed written consent forms in accordance with Sheffield Hallam University regulations. Participants in all data collection exercises were given the opportunity to withdraw from the research at any time. All employees acted in accordance with Sheffield Hallam University’s code of conduct.

Findings

All quantitative, observational data have been transposed into Microsoft Excel

workbooks. The data have been used to calculate the maximum and mean usage of spaces and included aspects such as: percentage occupancy, percentage of learners working individually, in pairs, in a group, size of groups, presence of refreshments, percentage of learners using a PC, laptop or neither and preference for type of space. Results from the Learning Centres have also been transposed onto a series of colour coded maps and tables showing informal learning space preferences at area, floor and whole building level. To ensure the individual learner voice was retained; qualitative data from phase I and phase II were written up into case studies and have also been transcribed into NVivo 9 and then coded. An emergent coding scheme was used to categorise responses into core and sub-categories. A second level of coding was applied to finalise categories, removing and merging themes and to achieve appropriate data reduction. Sub-categories also contained polarities in responses.

Using data from the observational sweeps, alongside the categories generated from the coordinate and photographic mapping exercises; a typology of learning space preference attributes was constructed. The typology is not hierarchical and is designed to inform evaluation and decision making activities relating to informal learning space design. The nine attributes are as follows:

- destination
- identity
- conversations
- community
- retreat
- timely

- human factors
- resources
- refreshment

Destination

The destination attribute focuses on where learners go to study. On campus spaces designed for informal learning were a popular choice. Observations showed that Learning Centres were used throughout the observational sweep periods, with the heaviest usage being recorded during the 1 p.m. sweeps and some spaces being at full capacity during peak times. This was also observed in other spaces, particularly open access IT facilities.

Many learners also expressed a preference for studying at home, especially when working individually; for example, 'individual study is always at home', and when fitting study around family life. It is impossible for spaces at Sheffield Hallam University to exactly replicate a home environment, but homely features such as soft seating and readily available refreshments can contribute to providing a space more appealing to learners with this preference. However, other learners reported finding home a difficult place to study because of the inherent distractions and it was also not frequently selected as a place suitable for group work.

The proximity of a space to other activities being undertaken was one of the factors influencing where learners chose to study. For example, a short break between scheduled formal learning sessions often only allowed time to find somewhere to study

in the same building or in a nearby location. However, students reported a willingness to move around and across campuses to their preferred learning spaces.

For some students the Learning Centres and other non-specialist facilities rarely, if ever, featured in their day to day schedule. For example, their choice of suitable destinations was limited by requirements for discipline specific resources and environments, such as arts studio spaces or subject specific technologies. On campus catering outlets were observed being used as informal learning spaces and a small number of students also reported using off campus catering establishments. Spaces in the Students Union were also being used for informal learning as were formal teaching environments such as PC labs, when they were not in use for classes.

It became evident that learners selected spaces to learn based on their own personal list of requirements and preferences. These changed according to the learning activity being undertaken, leading them to use different spaces at different times and for different purposes. For example, using the Learning Centre for a group activity, but returning home to undertake individual study. Habit also played a part in the selection of spaces with many learners commenting 'I'm a creature of habit'. Some learners had a favourite location and even a preference for a specific seat in a few instances. However, others were happy to study anywhere that fulfilled a few basic requirements and they selected a space to learn on a more ad-hoc basis. For example, they were content to use any space that had a PC.

Identity

The identity of a learning space is about the ethos of the space and how it feels it should

be used. Learners reported seeking a range of spaces, including those offering 'studious, relaxed and informal' ambience, as well as spaces typified by 'buzz and activity'. The significant numbers of students observed working in the Students Union and catering outlets, indicate that the identity of learning spaces is becoming increasingly blurred. At Sheffield Hallam University, in many cases, there has been a deliberate blurring of identity; for example, catering outlets provide access to a small number of PCs and can be used as a learning space without any requirement to purchase food.

How a space was laid out influenced usage and there were many positive examples observed of spaces enabling the activities expected. Equally, there were examples where a space had been designated for a particular purpose, but the layout and location gave mixed messages or suggested a function which was incongruous in that area. For example, in the Adsetts Learning Centre, a row of individual study desks, best suited to quiet study, were located in a high traffic area designated for collaborative work. These desks were observed to be significantly underused compared to other furniture in the area. In response to this, the desks were reconfigured by removing desk-top screens to make them more appropriate for collaborative work. An almost instant increase in their usage was seen. A study of learning space use by Hunley and Schaller (2009) found that the physical aspects of a space need to be reconfigured for the re-designation of the function of a space to be successful. This supports the findings at Sheffield Hallam University that the layout of a space, not the designation; for example using signage, is what most strongly influences usage.

It became evident when observing spaces that because learners select a space based on their own list of requirements and preferences, the space may not be used in

the way anticipated by the institution. For example, learners were observed using tables for individual study which were intended to be used for collaborative work. Spaces can therefore have multiple identities, with learners having differing and often contrasting views of a space and how it should be used. Multiple identities can be very positive for some areas, as this means they can be used flexibly for a range of learning activities. However, in other spaces this can lead to a negative experience if the identities are incompatible. Learners expressed the importance of spaces living up to expectations, most often in relation to silent and quiet study areas.

It was regularly observed that learners reconfigured their work areas, in particular by moving chairs, but also in limited incidence, tables and equipment. When there are collective or shared learning spaces, it is challenging to support a large student population each with a unique set of learning preferences, likely to shift depending upon any number of causal factors. An additional and complimentary approach to supporting a spectrum of learning preferences is to provide more opportunities for users to build their own space and thus also to facilitate a sense of ownership and responsibility for a space.

Conversations

Learners placed a great deal of importance on spaces for collaboration and interpersonal communication. Most learners reported experience of learning in groups which is to be expected with group assessments being a feature of undergraduate and postgraduate courses at Sheffield Hallam University. The observational sweeps recorded groups working across University spaces. A breakdown of the size of these groups observed during phase I of the learning spaces study is shown in Table 1. However, it is

important to emphasise that the balance of group sizes may have been influenced by the types of spaces on offer in 2008/2009.

Size of group (number of students)	Percentage of the groups observed
2	58.3%
3	23.2%
4	12.4%
5+	6.1%

Table 1. Groups sizes in the Learning Centres

A notable outcome from this data has been the planned introduction of spaces designed for those working in pairs and spaces accommodating a spectrum of group sizes.

The popularity of the Learning Centres for group work was clear from the study, with many learners citing them as their first choice of place to study in a group. This can be attributed in part to the Learning Centres, at the time of this study, being unique in the University in providing dedicated, bookable and open access spaces for students undertaking collaborative work. The Learning Centre group spaces were also viewed as neutral territory, familiar to all parties and therefore appropriate for group work especially when the group members did not live near each other or know one another well. Group study areas featured heavily in the designs students created as part of a project to involve them in developing a new library space at the University of Rochester (Gibbons and Fried Foster 2007b), corroborating that this is a facility learners' value.

Students described the importance to their learning of being able to talk, share ideas, discuss and debate. Conversations can be where 'significant learning can occur' (Kolb and Kolb 2005, p.208). It is therefore valid for learning spaces to support

interpersonal communication from a learning perspective as well as a social one.

Hunley and Schaller (2009) also observed the importance of interpersonal communication in their study of characteristics which encouraged engagement with library spaces, asserting that it should be facilitated in all spaces, both group and individual.

Community

Community is about social interactions, support and sense of common purpose which can be found in shared learning spaces. Both the qualitative and quantitative data demonstrated the importance of social interactions to learners, both in terms of study and for relaxation. Working in close proximity to friends or peers to create a sense of community, for co-support and for someone to take a break with was a key learning preference expressed by learners; for example, 'I came in to revise, my friends were already here so I joined them'. Observers also noticed that there were many learners working alongside colleagues and/or friends. Working alongside refers to learners undertaking an independent piece of work, but working near to or next to peers who are known to them (usually 2-3 people). This behaviour has also been reported by O'Connor (2005) who termed it "studying along". It was not possible to quantify the frequency of this with the observation method used, but it did appear to be prevalent.

Observations also uncovered incidences of serendipitous meetings and of individuals and groups meeting, splitting and re-joining. It appeared that shared learning spaces support the need for social and learning related conversations, both planned and unplanned. Some learners reported choosing spaces where they knew their friends were

also likely to come. Although sometimes the same students also worked elsewhere when they considered that the social element was likely to be a distraction.

Another aspect of community is the feeling of a common purpose. Many learners reported that working in a shared learning environment is motivational. It seems that students are aware of what makes a space feel like a place. Place is about environment, but also about people and what is going on inside.

Retreat

The idea of retreat was a central and recurring attribute encompassing preferences for privacy and quiet study. Learners with a preference for privacy expressed the importance of having 'my own little space, no distractions', or spaces where others could not see their work. Home was seen as a place offering private space and was associated with being relaxed, cosy, comfortable and with being able to sit how you like. Enclosed spaces, for example, meeting rooms, were mentioned by students as places providing privacy and others reported selecting seats in out of the way corners for this purpose. The majority of learners demonstrated clear self-awareness, expressing a preference for spaces where they were not being disturbed; nor were they disturbing others. Learners were also observed using personal sound systems. Privacy is also part of the comfort preference identified in the research by O'Connor (2005) into what makes a study place attractive.

Silent or quiet spaces were a preference for many learners when working individually. However, not all students choosing to work individually wish to be in a quiet environment. As has already been seen, there are learners who prefer to work

alongside colleagues and friends, or find it motivating to work in a more vibrant environment. In response to the requirement for silent study spaces, a new silent study area has been created in the Adsetts Learning Centre and the same is planned for Collegiate Learning Centre. A variety of preferences which may accompany silent study are catered for within this area. For example, the desk-top screens are of varying heights, offering different levels of privacy.

It is important to emphasise that retreat can, but does not necessarily refer to sound levels and individual study. For example, some students working in a group expressed a preference for using a meeting room in which to practice a joint presentation as it offered more privacy.

Timely

Just in time and on demand access to spaces and their resources and services were particularly important to users. Overall, the responses reflected the demands on learner's time from university study, work, family and social life. The coordinate mapping exercise in particular, elucidated how learning spaces fit in with the schedule of a learner's day. It became clear that spaces are often used for quick tasks before and between other activities as well as for longer periods of study. It was common to use a PC to quickly check email or timetables before a lecture, or to print out an assignment just before a hand-in deadline, with many learners echoing the sentiment that they 'don't have time to walk all the way across campus'. To support this, quick access IT facilities have been developed just inside the entrances to Learning Centres. Gibbons and Fried Foster (2007b) report providing similar quick access facilities at the University of Rochester in response to feedback from students. At Sheffield Hallam University, the

quick access facilities in the Learning Centres are complemented by other quick access IT provision available around the campus; for example, PCs and printers in the reception (hand-in) areas of some faculty buildings. The proximity of quick access resources to where they may be required is logical. Some students reported working close to deadlines and therefore felt it was very important that resources and facilities likely to be required at the last minute were easily available and reliable.

Long opening hours are also important to provide on demand access to spaces. The extended opening hours of the Learning Centres; 24 hours Sunday through to Thursday, were considered essential to some learners. It was also clear that spaces needed to support learners wishing to study for long periods. Many learners studied for several hours and some reported staying in Learning Centres all day and night. Observations showed that the Learning Centres were used more heavily in the evenings than other campus spaces. Observational sweeps indicated open access PC rooms were heavily used during the day. In contrast PC rooms available only when not in use for teaching were not as popular.

Timely also relates to pre-planned events designated within a specific time slot. PC booking systems and bookable meeting rooms were popular resources. However ample provision of open access rooms and flexibility within booking systems are also essential to support last minute and impromptu activities as well as those planned in advance.

Human Factors

Human factors refer to the ergonomics of work spaces and, in this context, also cover a

wider range of physical attributes including lighting and sound levels.

Large personal work spaces were a common preference expressed by learners in the form of a desire for larger tables and space to spread out. Corroborating this, it was observed that students using individual desks, often 800mm wide in Learning Centres, struggled to find space for the all resources they were using and also for personal belongings and refreshments. In the Learning Centres there is now a policy that new individual desks be at least 1100mm wide. Some students expressed a preference for more relaxed comfortable seating, while others preferred formal chairs to help them stay motivated and awake. It is therefore appropriate to provide a range of furniture to support difference preferences.

Lighting and natural light were frequently described by learners as important. Outdoor spaces, spaces that replicate an outside environment, views of outdoor spaces and fresh air were also frequently referred to as a preference. Temperature was mentioned by a few students, particularly when spaces did not provide an optimal environment, but was not widely raised.

Learners indicated that sound levels could be a source of frustration in silent areas, whereas learners using other spaces reported sound levels offering a positive contribution to the social or motivational environment. Sound levels can therefore be a positive or negative attribute of a learning space depending on the requirements and expectations of the learner. As part of the observational sweeps, decibel readings were taken across the campus spaces.

Adsetts Learning Centre	Mean decibel readings (dBA)
All areas	53.1
Quiet study areas	51.6
Group study areas	55.0
Foyer	58.0
Stack	42.3

Table 2. Mean decibel readings in the Adsetts Learning Centre

According to the DEFRA (2012) descriptions, the sound levels recorded, were on the whole comparable to ordinary conversation or an office environment. As shown in Table 2, sound levels did not fluctuate greatly between different areas of the Adsetts Learning Centre which is an open plan building with a central open staircase and atrium.

Given the range of learning spaces within the building, this was a disappointing but not a wholly unexpected finding. In response to this, discrete spaces are being created in the Adsetts Learning Centre. For example, a ceiling height glass screen now divides the silent study area from the other areas of the building and a series of notional rooms have been created using 1600mm divides, typically with integrated white boards and large screen monitors.

Resources

Access to IT resources was important to the majority of learners. This usually meant PCs, but also printers, large screens, and access to the internet and software.

Observations of usage of spaces with and without PCs resulted in a complex picture

because spaces across the University are not necessarily comparable in respect to IT provision and power availability. For example in open access PC labs all of the students using the spaces were frequently observed using PCs, while in catering establishments with very few PCs, the numbers were correspondingly low. At the time phase I of the research was carried out, Learning Centres had a mix of desks, some with a fixed PC, some with no fixed PC but with access to a plug socket, and some with no PC or access to a plug socket. In these spaces, 80% of seated individuals or groups were observed using PCs, 7% were using laptops, 1% were using both and 12% were working with printed resources only. There were also other activities being undertaken such as borrowing books. When interpreting these figures, it is important to be mindful that they reflect availability as well as preferences and are indicative only.

More usefully, the data made it possible to examine whether comparable spaces which offered different resources were in equal demand. For example, in the Adsetts Learning Centre, the usage of individual desks with a PC was significantly higher than desks with no PC. The proportion of learners using informal learning spaces without technology in the Learning Centres was significant; qualitative data collection exercises further supported this preference as learners expressed a preference for spaces without PCs and spaces for reading and writing. Spaces without technology in catering establishments were also being used regularly for study. This highlights the importance of ensuring perceived no-go zones for certain learners are not constructed by flooding spaces with too much of one facility.

Despite having a campus wide secure wireless network, the level of laptop usage observed was lower than expected, but was higher where students were readily able to

access plug points. Clark (2007) identifies issues relating to the weight of laptops and concerns over security as reasons students do not carry their laptops with them. It is important to emphasise the learning spaces study commenced in 2008 and it is anticipated use of mobile technologies will have changed. More plentiful and visible plug points encourage and validate student use of personal technologies which support learning. Therefore all desks and tables in new or refurbished spaces in the Learning Centres offer desk mounted plug sockets, even if they are intended to be used with a fixed PC.

The research highlighted the number of users integrating a range of resources; for example a group was observed using a meeting room which had a fixed PC in conjunction with laptops and with books and papers spread out across the tables. Having all the resources you may need within easy reach was often given as a reason for using the Learning Centres. Information resources; particularly books, but also journals and e-journals were all valued resources and were in evidence being used alone or alongside technology.

Refreshment

In the observational sweeps, it was found the majority of learners had food and/or drinks visible on their desks or tables. For obvious reasons this was seen most frequently in catering environments, but it was also common in Learning Centres and centrally provided PC labs. Policies in these areas allow drinks and cold food. Food and drink was also frequently mentioned in the qualitative research and learners preferring a home environment gave easy access to food and drink as one of the reasons. Outside of the context of this case study, external research by O'Connor (2005) found that being

able to eat and drink contributes to making a space attractive to learners. As well as a convenience and comfort element to the availability of refreshment, there is also a learning aspect. At Sawenee University 63% of learners reported that food and drink helped them to stay focused when studying (O'Connor 2005, p66).

Some learners in the Adsetts Learning Centre expressed that it was good not having to leave the building to get refreshments. This referred to the presence of the relatively newly opened café in the building when phase I of the research was conducted. Cafés and food outlets are now common in UK higher education libraries (West 2005) as a requirement for these becomes widely recognised. Refreshment related facilities were cited by several respondents as the best thing about the Adsetts Learning Centre and a similar facility is now also present in Collegiate Learning Centre.

Catering outlets were regularly observed being used for learning, although some learners reported the absence of resources as a reason why they didn't use them for learning more often. Students infrequently reported using city centre spaces for food and drink, although observations show that food and drink are brought in from home and from shops and catering outlets external to the University. However, reliance upon them, in the context of Sheffield Hallam University, is not a viable option.

Discussion

It is evident informal learning spaces at Sheffield Hallam University are starting from a position of strength. However, it is also clear, at present these informal learning spaces support some learning preferences better than others. The assertion here is that substantive focus should be placed on constructing and nurturing the appropriate ethos

alluded to by learners who participated in the learning spaces study, as well as considering the physical object. The former relates to the abstract subject discussed earlier in the article in the form of learning theory and placemaking; and the latter, architecture. Results from the data collected at Sheffield Hallam University also corroborate the requirement to consider these three disciplines as the typology illustrates elements from each of them. It is also evident that whilst particular attributes may be allied to a specific discipline, they are also cross cutting to a greater or lesser degree.

The learning spaces study at Sheffield Hallam University seeks to contribute to learning spaces dialogue by suggesting that when evaluating or planning an informal learning space there are nine attributes which must all be given due consideration. At macro level, i.e. building or campus level, all attributes should be incorporated and all spaces viewed as a portfolio offering. However, as part of an active decision making process, some attributes may be discarded at a micro level based on localised factors. For example, it would not be appropriate to introduce a silent study environment into a catering outlet.

In seeking to answer the question, what makes successful higher education informal learning spaces, based on the research undertaken at Sheffield Hallam University, the following points for discussion and resultant recommendations are drawn from the nine learning space preference attributes and in doing so, seek to add to the existing small body of discourse already exploring the synergy between learning theory, placemaking and architecture. However, it is also essential to stress the specifics of these conclusions and recommendations are localised and reflect thinking at Sheffield Hallam University. Whilst it is intended the typology of nine learning space preference

attributes can be used by other higher education institutions to inform the design of their own learning spaces, the specifics and therefore practical redevelopment outcomes may manifest themselves in a different ways to those described below.

Given the almost limitless combinations of learning preferences, a solution identified from the learning space study at Sheffield Hallam University has been to begin developing a portfolio of interrelated campus spaces which offer a coherent whole. The former is an overarching approach; however, delivering a coherent, but diverse range of spaces must also be achieved at building, floor and area level; for example, within the Learning Centres a series of discreet spaces are being introduced and offer new, but complementary types of learning opportunities. The identity of these discreet spaces has been constructed through development of a richer range of descriptors offering insight into the expected usage and ethos of the environment without predetermining it. The most notable example has been the planned introduction of spaces purposefully designed to support learner preferences for working alongside one another. Whilst these spaces will not be explicitly labelled as such, it is anticipated the calibration of the environment will suggest intended use. Informal learning spaces provision is also beginning to be extended through the use of catering outlets, thus presenting further opportunities for space utilisation.

Space design should encourage users to reflect on their learning preferences and translate these preferences into space selection. The Sheffield Hallam University has a responsibility to ensure users understand the ethos of the space they occupy. This can be particularly problematic when an interpretation of a space is ambiguous to the learner. Based on study outcomes, learning spaces at Sheffield Hallam University now seek to

either design in, or out, particular activities, with minimal signage used as a complementary measure to support wayfinding. For example, in spaces designed to support individual learning, only one chair per desk was purchased; in contrast, spaces with a collaborative function offer a purposefully higher chair to desk ratio derived from understanding of group sizes.

As part of recent redevelopment projects in the Learning Centres at Sheffield Hallam University, decisions underpinning space allowances have also been reviewed. Whilst more purposeful placing of study spaces increased overall seating capacity and desk sizes for all learners, this scheme also recognised that allocating space allowance on a per person basis is not effective and forms the basis for a recommendation for space allowance criteria to be reviewed across all on campus informal learning spaces. For example apportioning identical space quantity for a group as for an individual would generate an unworkable space for the former because the additional space would inhibit conversation.

In looking at the portfolio of on campus informal learning spaces, Sheffield Hallam University can more effectively consider which needs and preferences can be best met by specialist faculty based spaces and whether any of these can feasibly be provided in other spaces in order to offer more choice and increased access. It is self-evident that replicating particular types of space would be challenging, but there are elements that would be valuable to include outside faculty spaces. For example, aspects of the creative environment offered by studio spaces or more widespread provision of subject specific software. This process has also helped to identify the distinctive aspects of particular spaces and the unique environment created by each space as a whole. For

example Learning Centres are unique in offering silent study space and in offering this environment as part of a space which is open overnight and also offers access to printed materials. While this approach has been adopted at Learning Centre level it is hoped that this strategy will be applied elsewhere.

To deliver learning spaces which offer longevity, an institutional or 'mission based' approach (Bennett 2007b) has also been adopted. A 'mission based' approach looks at the things that bring students together and seeks to design spaces based on both the behaviours that the institution believes are important, as well as taking steps towards the type of educational development and learning they wish to embody (Bennett 2007b, p171).

Conclusions

Application of the chosen study methods and analysis and discussion of the study findings has enabled the creation of the typology of learning space preference attributes which can be used to inform informal learning space design. However, it has been less revealing in terms of offering understanding of student selection and use of space with regard to the types of assessment undertaken, nor has it revealed inter-relationships via patterns of responses; i.e. do certain behaviours, attitudes and preferences typically go hand-in hand? To identify further what makes a successful informal learning space it would be advantageous to feed these dimensions into the typology of learning space preference attributes and collaborate with external partners to test the applicability of findings outside of the context of the University

As both redevelopment projects and learning spaces research progress, the typology of learning space preference attributes must be viewed as an evolving entity which draws upon existing data sets to benchmark progress and ultimately afford practical progression in informal learning space design.

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