

Combining Worlds: A Mixed Method for Understanding Learning Spaces

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Abstract

Understanding student interaction in learning spaces is an ongoing challenge. The move away from didactic lecture delivery towards more active and hybrid learning renders this challenge ever more difficult. Researching pedagogic use of informal learning space, which is not formally timetabled or controlled, is always challenging because it is interacted with only transiently by both students and teachers. This paper introduces a mixed methods, phenomenological approach used in recent research to investigate campus learning spaces in face-to-face learning contexts. The full mixed methods approach combined space occupancy monitoring data with naturalistic ethnographic observation, field interviews and, where appropriate, more formal in-depth interviews to provide an effective way of understanding student and teacher engagement with learning spaces. Convergent use of these qualitative and quantitative methods yielded data which informed the application of subsequent methods, and the investment of researcher, pedagogic and infrastructural resource. In this paper we argue that as learning outside of formal teaching spaces increases, these mixed methods enable better, more efficient monitoring of pedagogic use of informal learning spaces. The mixed method can be adapted depending on the question being addressed and has the potential to inform resource allocation and investment into pedagogic and infrastructural change.

Keywords

mixed methods, space occupancy data, ethnography, learning spaces, transition

Introduction

Context

There is a growing awareness that traditional teaching in higher education, dominated by transactional didactic lecture delivery (Barnett et al., 2001), is not as inclusive and engaging as it could be, and does not benefit students as much as it should. Consequently, there has been an evidence-driven change in science education (Singer et al., 2012) with a shift to more authentic teaching through research (Wald & Harland, 2017) and from passive to more active learning (see Deslauriers et al., 2011; Freeman et al., 2014; Wieman & Gilbert, 2015; Talbot et al., 2016). Furthermore, the recent COVID-19 pandemic forced institutions globally to adjust their mix of remote and in-person delivery to support learning and teaching (Tsang et al., 2021). It seems likely that, post-pandemic, there will be ongoing pressures to retain elements of online and hybrid learning to increase flexibility, inclusivity and to accommodate a growing and diverse student population (Spire, 2022).

With increasingly reduced emphasis on campus spaces for solely transactional didactic instructional methods (Deed & Alterator, 2017), the spaces between these ‘formal’ educational engagements play a greater role in enhancing the student experience as part of the ‘Informal Learning Landscape’ (Harrison & Hutton, 2013). Informal learning spaces are defined as those used by staff and students for self-directed learning activities (Harrop & Turpin, 2013), whereas formal learning spaces are those provided for timetabled, planned teaching like lecture theatres and laboratories (Middleton, 2019). However, these conventional definitions are being

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contested as students physically situated in the formal classroom may at the same time be actively engaging in and beyond the university's online estate as part of a 'hybrid' learning experience (Raes, 2022). Similarly, students are remotely engaging with formal online lectures within informal physical spaces like campus common rooms and halls of residences.

The reduced reliance on timetabled transmission lectures together with the increase in online and in-person self-directed learning has led to students studying alone and in groups in many other formal (e.g., library and tutorial rooms) and informal (e.g., breakout rooms and cafes) learning spaces since the pandemic. While it is relatively easy to track the pedagogic use of formal, timetabled space, Wu et al. (2021) argue that a lack of methods for evaluating informal spaces exist. These more 'hidden' learning spaces (Eisner, 1985) are heavily controlled and contested by students (De Certeau, 1988) yet represent increasingly important resources for learning. There is then a related challenge within a changing hybrid context of how we quantify and justify physical university spaces which continue to draw intensely from capital budgets and resources (Lamb et al., 2022). These challenges require effective ways of understanding and evaluating campus learning spaces and their interactions, such that pedagogic and infrastructural resources can be better invested (Temple, 2019).

Recent work investigating student engagement with learning spaces has included focus group-based studies like Oliveras-Ortiz et al. (2021) who explored students' perceptions of the impact of learning spaces on their engagement in learning. Whilst focus groups, like interviews, are good for eliciting participants' opinions (Creswell, 2002), they report best on what people think they do, as opposed to what they actually do. Arguably, the best way to gain access to students' authentic use of learning spaces is via an ethnographic approach. Pantidi's (2013) doctoral study used participant ethnography to explore the actual versus anticipated use of innovative learning spaces. Other recent studies have adopted mixed method approaches to understanding learning spaces and their interactions, including Wu et al. (2021) who used observations, interviews, questionnaires, and focus groups to evaluate the influence of learning space design characteristics on student preferences and activities.

This paper introduces a mixed methods approach which combines qualitative methods with automated occupancy monitoring data for understanding student perception of, and engagement with learning spaces. The convenience and objectivity of remote 24/7 occupancy monitoring helped to identify possible patterns of engagement and target subsequent ethnographic observation, to add nuanced meaning to those occupancy patterns. Brief ethnographic field interviews were used to collect further detail and confirm interpretation of observations, whilst longer in-depth interviews were used to delve deeper when needed. To demonstrate the potential of this mixed method we introduce indicative data from a research study in which these mixed methods were used to

investigate student pedagogic engagement in transitions between formal, timetabled and informal, non-timetabled learning space in a departmental setting.

Settings and Participants

The research study was conducted in a highly devolved, mid-size urban research-intensive science, technology, engineering, maths and medicine (STEMM) focussed institution in the UK. In part prompted by the sector-wide increase in state-mandated quality assurance and competition for resources, British universities like the case institution have developed learning and teaching strategies (Goodyear & Ellis, 2019). The case institution's learning and teaching strategy sought to develop more authentic and active forms of learning and consequently funded the research underpinned by the methods reported in this paper. The primary author was a doctoral student and the secondary author the doctoral supervisor who as director of the research unit was closely linked to the institutional learning and teaching strategy. Both researchers had varied relevant and complementary experience of the institutional context. While the aim of the research, as guided by the strategic investment and intent, was to acquire a better understanding of interaction in learning spaces and the impact of learning spaces on that interaction, the researchers took a neutral stance as to the nature of possible interactions and their potential value to the strategy in conducting the research.

Understanding the role of learning spaces in crystallising or changing student and teacher mindset and learning behaviour is especially needed given the significant investment into campus space refurbishment, curriculum change and pedagogic transformation (Imms & Kvan, 2021). As part of a drive to optimise the utilisation of campus space, the case institution partnered with a commercial company to install occupancy monitoring technology. The technology uses the connection between mobile devices and Wi-Fi Internet to predict and track individual user presence in spaces. Whilst the monitoring does not capture individuals with no electronic devices, it is sufficiently 'smart' to distinguish between multiple devices carried by a single individual and single devices carried by a group of separate individuals. Occupancy monitoring technology was installed in institutionally determined spaces or groups of spaces (zones) in certain buildings on the main university campus. This mixed methods approach is therefore limited by the availability of such data, which may not presently be as available in other institutional, national, and international contexts. Nonetheless, the advance of other 'smart' tools which give insight into how campus spaces are utilised have potential to similarly complement a reliance on predicted use of spaces from timetables (Valks et al., 2018).

To illustrate the potential of this mixed methods approach we use indicative data and examples from a research study which investigated two learning spaces, a 'traditional' raked lecture theatre adjacent to an informal space in a chemical engineering department. These spaces were primarily used in

term-time for undergraduate chemical engineering teaching and by undergraduate students. The public nature of the informal space, due to its proximity to research offices and the building entrance, meant it also accommodated a diverse group of staff, postgraduate taught and postgraduate research student users from inside and outside of the department. This user diversity made for an interesting investigation of how different users groups transition into and negotiate ownership of such informal spaces.

Research participants included anyone being monitored or observed using the learning spaces. Timetable data allowed us to more accurately infer participant status as undergraduate students transitioned between the timetabled lecture sessions and adjacent informal space. However, the public nature of the informal space and confluence of usage from users within and outside of the department meant we could not always be sure of who we were observing when noting down learning behaviours. Field interviews allowed us to collect contextual information from individuals or small groups about their department and level of study. In addition to field interviews, we also carried out some in-depth interviews to further explore how the spaces empowered or inhibited certain learning behaviours and transitions.

Methods and Applications

Whilst each method has independent utility, a ‘convergent mixed methods’ design (Creswell, 2002, p. 570) was used during research data collection. The simultaneous use of qualitative and quantitative methods yielded data which informed the application of subsequent methods. Therefore, our continuous meaning-making of the data using our positioning and contextual knowledge, including when identifying patterns in the objective occupancy data or when using those results to target our subsequent observations, meant that the data analysis process was interpretive throughout. The mixed methods were underpinned by a hermeneutic phenomenological approach (Farrell, 2020), given our convergent use of methods and positioning granted us access to direct lived experience in the learning spaces.

Occupancy Monitoring Data

Occupancy monitoring technology records user occupancy in zoned campus areas (individual spaces like lecture theatres or groups of spaces like staff offices). By demarcating the edge of these zones along Wi-Fi wireless router infrastructure, an individual’s Wi-Fi connected device can be triangulated within a zone and recorded as an anonymous occupancy count using a Position Intelligence Engine (Wonnink, 2021). The single requirement for an individual to be anonymously detectable is for their device to be connected to the institution’s Wi-Fi; the technology still detects a single count even if a single individual has multiple devices connected. The resolution of the data is restricted to the level of the space such that

anonymised individuals cannot be identified or tracked between spaces, only the occupancy count of the space can be retrieved.

These quantitative occupancy data are displayed in a Building Intelligence Dashboard (BID) from which numerical data can be exported for any space on any day or time. The primary perceived function of these data was for optimising room bookings, timetabling workflows, and space utilisation. Later, the institution’s space data insights group recognised the additional scholarly potential of such data for better understanding student use of learning spaces and transitions between learning spaces. By providing an objective account of actual space utilisation, occupancy data informed data-driven decisions about campus space allocation from timetabling analytics (including amid the COVID-19 pandemic).

Research Use Case. Whilst timetable data provided information on planned use of the formal lecture theatre, occupancy data confirmed actual use of this formal learning space in terms of attendance and arrival times at the session. In addition to understanding lecture theatre utilisation in the context of the timetable, a broader capture of occupancy in the adjacent informal space (through which students physically entered and exited the lecture theatre) enabled transitions into and out of the lecture theatre to be analysed. The occupancy trends of these adjacent learning spaces could be easily compared by plotting the occupancy of the formal and informal learning spaces as single graphs in BID (see Figure 1 for example). This made interpretation of occupancy trends, including at timetable transition points, considerably easier.

Generation of occupancy plots (like in Figure 1) enabled cohort-level dwelling patterns and transitions just before and just after the timetabled session to be visualised and analysed. Whilst this method had independent value for comparing occupancy of adjacent learning spaces, it was also powerfully used in conjunction with ethnography. The following summarise the different ways in which occupancy data were utilised during data collection:

1. *Retrospective* analysis of occupancy trends for non-observed periods in the lecture theatre and adjacent informal space during:
 - i. Non-observed, timetabled periods – comparison of occupancy patterns and transitions in non-observed timetabled teaching sessions
 - ii. Non-observed, non-timetabled periods – studying occupancy trends in spaces when there was no timetabled teaching, including on weekends or during holiday periods, granted broader insight into student engagement with each physical learning space outside of the timetabled context.

Examining occupancy data retrospectively helped us to establish patterns of actual occupancy and engagement and how this related to ‘expected’ timetabled activity over

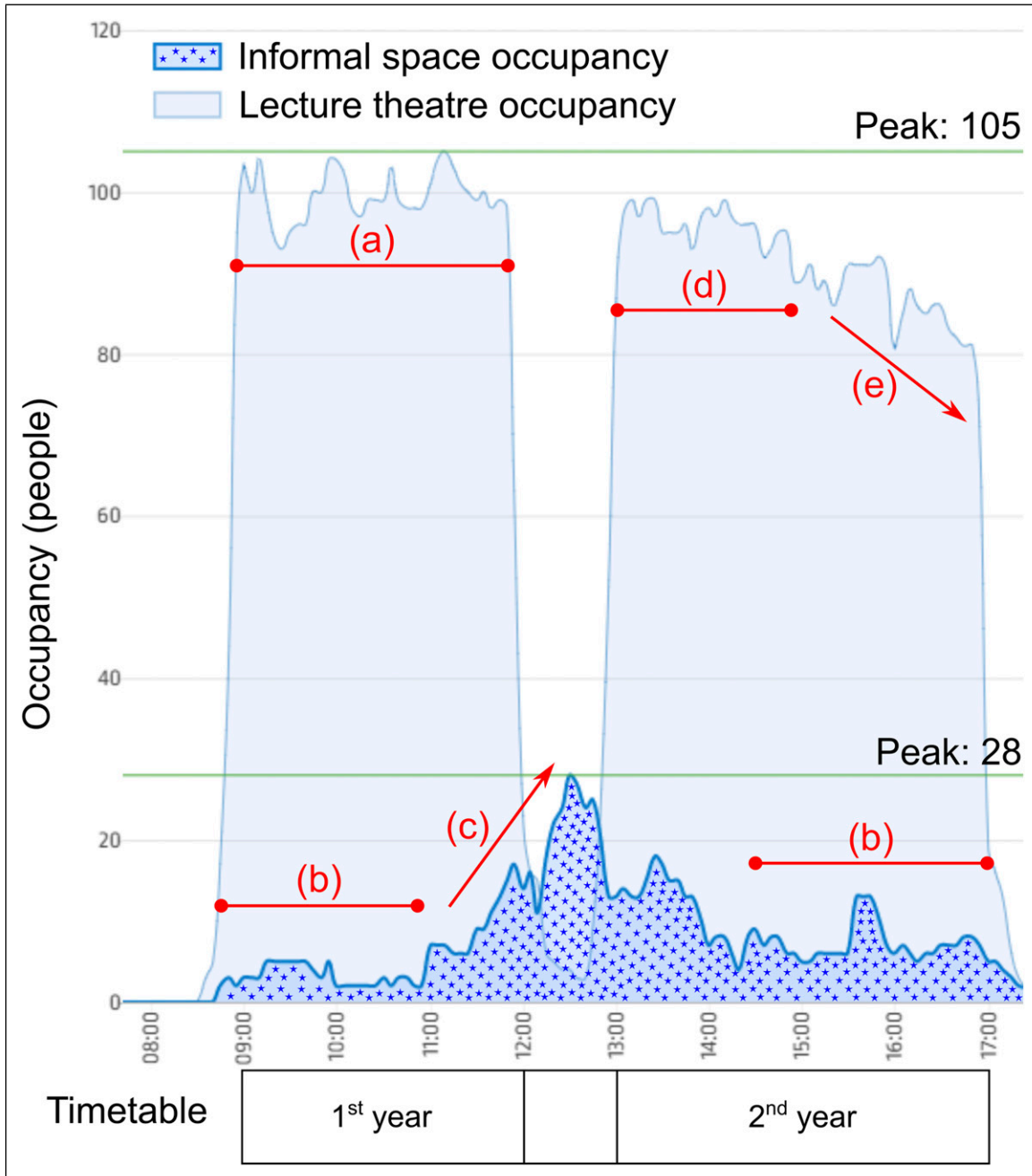


Figure 1. Lecture theatre and adjacent informal space occupancy plotted against time with first and second year timetabled lecture sessions and interpreted occupancy trends (a)-(e) superimposed.

longer periods without committing the resources required for observation..

2. *Inform* planning or targeting of ethnographic observation sessions in conjunction with timetable data. For example, in Figure 1, occupancy and timetable data suggest (a) was stable first year occupancy of the lecture theatre, (b) was residual occupancy of the informal space during the lectures, (c) was students

arriving and preparing for the second year lecture, (d) was stable second year lecture attendance and (e) a drift out of the second year lecture. If any of those possible occupancy behaviours were of interest, ethnographic observations could be efficiently targeted to corroborate what the occupancy data suggests. Field interviews could be used for further corroboration and to add unobservable detail, for example in (c) were students arriving early for the second year lecture? Were they

relaxing or socialising while waiting or were they working alone or in groups? Was this work related to the timetabled lecture activity? These sorts of details can efficiently be ascertained with targeted observations and brief field interviews.

3. *Inform* planning or targeting of more formal in-depth interviews with students and/or faculty to further explore and understand intended teaching and learning behaviours and how the spaces empowered or inhibited these behaviours. For example, in [Figure 1\(e\)](#), was the apparent drift out of students from the second year lecture planned or expected? Did the lecturer set group work and expect students to leave for independent study, or was the lecture perceived by students as boring or irrelevant? Did they strategically decide to prioritise independent study? Or perhaps they simply needed a break and left for more social reasons? Such detail can be gained from more detailed interviews targeted at points of interest and relevance.

Ethnographic Observation

Naturalistic, non-participant observation ([Somekh & Lewin, 2005](#)) was used in both the formal, timetabled teaching space and informal, non-timetabled space. This discrete ethnographic approach was used because it minimised disruption to space activity and mitigated the ‘Hawthorne effect’, in which participants alter their naturalistic behaviour in the presence of an observer ([Madden, 2017](#)); this allowed us to capture an authentic account of student learning behaviour.

Ethnographic observation was targeted and informed by the occupancy data insights such that only periods of interest were observed, with some margin either side. This allowed efficient use of time, with most observations lasting between 30-90 minutes, depending on what was being observed. This was generally much shorter than the longer-term observations required in ethnographic studies whereby occupancy data does not provide overall patterns of use and possible targets of interesting pedagogic behaviour. Occupancy data in conjunction with timetable data also provide objective indications of busy periods which might be stressful and/or difficult to observe, such as planned examinations.

As is good practice in ethnography, contemporaneous observation field notes were recorded and stored securely. Subsequently, these field notes were supplemented with the generation of floorplan-based sociograms. Annotating sociograms of the spaces helped to capture detail about person-space and person-person interaction. By capturing the relative location, interaction and movement of users within the spaces, sociograms helped to add a layer of granularity not captured by the occupancy data and could be linked to these data if required. Once again, the timing of sociograms were informed by the occupancy data patterns and by the ethnographic observation. Generally, 10-minute snapshots of activity were recorded during periods of particular interest. An example of a

digitised sociogram recorded during student transition into the informal space during a first year lecture, typified by the occupancy trend in [Figure 1\(c\)](#), can be found in [Figure 2](#).

Ethnographic Field Interviews

Only so much information can be gained from observing activity. How students experience the pedagogic and other interactions in learning spaces can be better gleaned from self-reporting in brief interviews. Field interviews can therefore be used in-situ to confirm interpretations and follow up interesting observations with purposeful, structured questions. These brief questions are posed to consenting individuals or small groups and pertain to how they are using the space and what their intentions are within it. Questions can also retrieve non-observable contextual information about the participant such as the degree course they are studying and the year cohort to which they belong. This data is also not collected by the occupancy monitoring, which only registers anonymous individuals by recognising connected devices.

Field interviews help to enrich the ethnographic account by determining how the observed learning behaviour may relate to the timetabled session and other non-observable contexts and spaces. These brief, focussed in-situ interviews enable the capture of pedagogic intentions and can not only link these intentions back to the observations and occupancy patterns but can link forward to planned learning strategy. Our decision to approach users of the informal space for field interview was guided by this linkage back to the insights gained from occupancy monitoring and observation methods; exactly what we were looking for was guided by the research question(s). To demonstrate this purposeful, data-informed selection of participants, the two students field interviewed post-lecture in the informal space sociogram ([Figure 2](#)) were observed leaving the lecture session to seemingly discuss aspects of their preceding formal lecture learning; this made them ‘interesting’ candidates for helping us to better understand the research question relating to how students engaged with transitions into and out of timetabled learning. Our field interview interaction with these students was typically as follows:

Researcher: “*Sorry to interrupt, I’m a researcher in educational development. I’ve just been observing people’s use of this space. I wondered if I could take no longer than 5 minutes of your time to ask you a few questions about how you use this space?*”

Participant: “*Sure, I have to leave in 30 minutes but that should be fine*”

Researcher: “*Thank you. I observed what seemed to be you talking with your friend after your lecture together. May I ask if this was the case or if you were doing something else?*”

Participant: “*That is correct, we were both discussing concepts from the lecture because they were difficult to understand*”

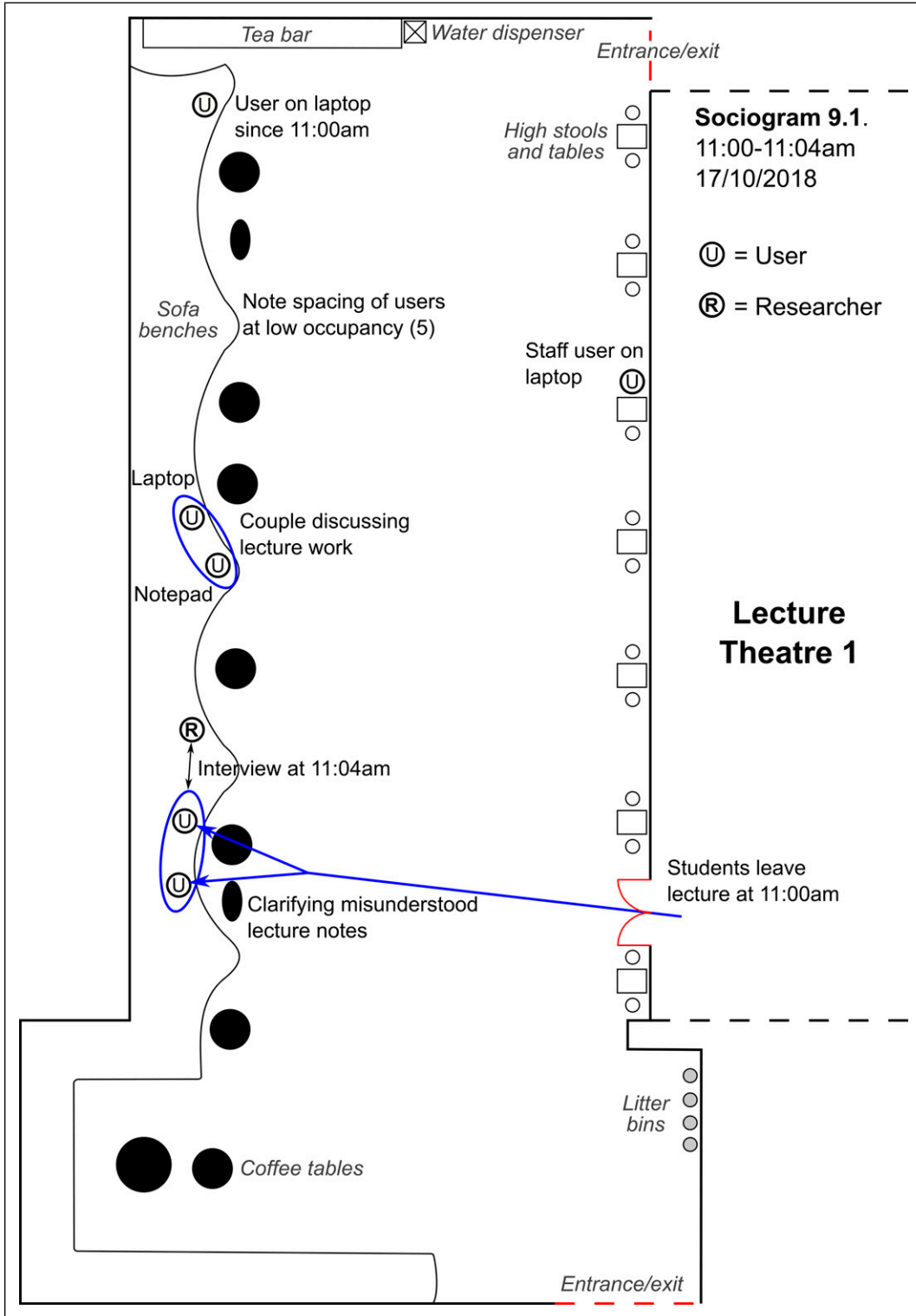


Figure 2. Digitised sociogram of the informal space showing learning behaviour immediately after a timetabled lecture session in the adjacent lecture theatre.

The field interview allowed us to understand student intent behind the observed behaviour. In some instances, users who diverged from the 'expected' behaviour or intention required us to transition back to occupancy data or observation to confirm or deny a new pattern across larger datasets. The short length (5–10 minutes) of field interviews mean they generally assume a structured style, asking closed questions to minimise disruption to the participants (Madden, 2017). Whilst this short style precludes an in-depth, purposeful exploration of experiences, the in-situ nature encourages useful reflection about action in immediate social context (Somekh & Lewin, 2005).

In-Depth Interviews

Longer (30–60 minute) in-depth interviews can be used when appropriate to add further depth to the data when seeking to better understand why the learning spaces are used in certain ways. By adopting a semi-structured style, these interviews permit a deeper reflection about the impact of the space on pedagogic activities. Whilst field interviews generally only require informal, verbal consent from participants who are approached ad-hoc in-situ, in-depth interviews normally require formal informed consent protocols in which participants agree to pre-arranged, mutually convenient questioning. Unlike field interviews where audio recording the interaction can present practical and ethical challenges, in-depth interviews have the advantage of enabling digital recording and subsequent transcription to capture the data in more accurate detail. Furthermore, in-depth interviews ensure the participant better understands the research intentions by having read the 'research information sheet'. This arguably results in a set of conditions more appropriate for open questioning and participant reflection across space and time, which can inappropriately consume participant time and be harder to manage in field interviews. The in-depth interview method is flexible and can be conducted just as successfully remotely as in-person, depending on the needs and constraints of the participant and researcher.

In-depth interviews can be conducted with participants who were not observed and/or previously field interviewed. However, what proved most effective in the research was the recruitment of participants from observed lecture cohorts, such that observed instances could be targeted and investigated with the participant in interview. For example, in [Figure 1\(c\)](#), why were students arriving at the informal space so early before the second year lecture session? Was it something about the space which made it feel welcoming, or rather a shared behaviour within that cohort? Posing these nuanced questions during the research produced useful responses about the participant's engagement with the spaces, for example within the typical quote below extracted from a transcribed 1-hour formal interview with Jessica (pseudonymised to indicate gender and ethnicity), a second year undergraduate chemical engineering student:

Participant: "I tend to arrive early before the lecture because it can be a good opportunity to see my friends and share things about our course or general university experience".

Example of Combining Methods

A convergent mixed methods design (Creswell, 2002) was used during both the planning and execution of research data collection. This meant qualitative and quantitative data being collected concurrently, and a transition between two worlds: an open, experimental world in which many participant voices existed, and a more objective, time- and space-bound world (Clifford & Marcus, 1986). This mix of inhuman, data-driven methods with human, relativistic interpretation of that data has proven powerful when understanding student engagement with transitions between learning spaces. An example of the application and progression of methods used in the research can be seen in [Table 1](#).

The research focus in this example was on understanding student transitions between formal, timetabled and informal, non-timetabled learning. Our identification of occupancy spikes in the informal space, like in [Figure 1\(c\)](#), indicated that the informal space was perhaps being used by students ahead of their timetabled lecture. This occupancy insight when interpreted alongside timetable context led us to target observations of lecture sessions (as in [Table 1](#)) with non-timetabled space either side, so that we could observe and better understand the informal behaviours of students during these transitional periods. Our interest in active learning behaviours (as guided by institutional strategy and scholarly evidence) subsequently led us to approach individuals or small groups for field interview who seemed to be exhibiting such learning behaviours (such as in [Figure 2](#)). Our data collection discovered that students were learning collaboratively in the informal space before and after timetabled learning in the adjacent lecture theatre, and that the design of the informal space impacted the way students were able to engage in this learning. These findings later informed the redesign of similar informal learning spaces in other institutional settings using participatory design approaches (Streule et al., 2022). In-depth interviews with students who had used these redesigned spaces before and after renovation enabled an exploration of how the change in space supported or inhibited transitions to active learning.

The potential application of the mixed method can be adapted based on the question being addressed, with [Table 1](#) demonstrating one example. Being privileged with a large and continuous occupancy dataset in which there is infinitely more opportunity to analyse patterns and test hypotheses than having to physically visit and observe the spaces, can reveal patterns and longer-term transitions which span the academic term and year. This can offer opportunity for understanding longer-term transitions at the level of space refurbishment, curriculum reform and culture change.

Table 1. Example of Mixed Methods Application Used in the Research Study.

Method(s)	Activity	Phase
Timetable data Occupancy data	Select and target appropriate lecture session for observation using timetable and occupancy data	Pre-field
Observation Sociogram Field interviews	Attend informal space 15–20 minutes prior to lecture session, e.g., during Figure 1(c) , and complete optional sociogram Carry out field interviews with individual students or small groups exhibiting interesting learning behaviour in the informal space	Pre-lecture observation
Observation	Observe lecture session	Lecture observation
Observation Sociogram Field interviews	Observe informal space for 15–20 minutes after lecture session, e.g., Figure 1(e) , and complete optional sociogram Carry out field interviews with students exhibiting interesting learning behaviour in informal space	Post-lecture observation
Occupancy data In-depth interviews	Retrospectively analyse occupancy data to corroborate with ethnographic snapshots and to target further observation or interviews Carry out in-depth interviews with students and staff involved in planning, delivering and/or attending the observed lectures	Post-field

Uses and Limitations

The use of each method independently has limitations and advantages. Occupancy data has the advantage of minimising time and resource required for insight, including the time needed for planning observations with session leaders or seeking of informal consent from appropriate faculty staff. However, although the occupancy data captures data 24/7, it cannot identify individuals and capture contextual detail and nuances in individual and group learning behaviour within spaces, forcing the interpreter to make assumptions about user status and behaviour. This additional context about users had to be retrieved using ethnographic observation. Equally, ethnographic observation is limited by our human ability to capture the full scale and duration of a cohort's activity. Human attention deficit after 90 minutes of continuous observation is mitigated by the occupancy data and inference of patterns which allow a targeting of shorter periods of observation at relevant times. Whilst 30 observations (30–90 minutes in length) and 25 field interviews (5–10 minutes in length) were carried out in the research setting in [Figure 2](#), 120 hours of occupancy data were able to be analysed in a fraction of the time.

The variation in characteristics and dispositions of individuals ([Bronfenbrenner, 1988](#)) affects their experience of learning spaces and requires the retrieval of participant context. Nonetheless, whilst occupancy data and ethnographic observation were feasibly carried out with minimal interruption to participants, field interviews impinged on other people's time. Occupancy data allowed us to better direct this method and reduce the risk of wasting people's time, including the researchers. Whilst field interviews help to capture missing contextual detail and perception from participants in a real

time, in-situ context, the method is less capable of capturing individuals' reflective responses possible with longer in-depth interviews. In contrast, formal in-depth interviews which are time consuming and more difficult to arrange and manage, are less able to reliably capture the real time, in-situ reaction or experience, but can be used when appropriate to explore motivation and intent more deeply. These interviews can also be used to sample different actors within such physical and timetabled spaces, such as the expectations and motivations of both teachers and students within a common pedagogic interaction; data triangulation was therefore most effective when participants were recruited from observed cohorts.

The indicative data and insights presented from the research study have demonstrated how the mixed method was used to leverage the strengths of each individual method. In thinking about the wider applicability of this mixed method, only a select number of HE institutions possess occupancy monitoring technology, within which only certain building spaces are included in the campus zoning due to institutional financial constraints. This limitation in occupancy data availability was experienced in the broader research, during which other settings were studied that did not have the technology installed. In the absence of occupancy monitoring technology or similar 'smart' tools which automatically track utilisation of space, manual interventions such as class registers or space occupancy surveys might substitute for this type of occupancy data, but perhaps not with the ease and accuracy offered by automated 24/7 monitoring systems. Regardless, the availability of such quantitative space occupancy data can significantly benefit the directing of subsequent research resource by more effective targeting of ethnographic observation, field interviews and in-depth interviews.

Raes (2022) argues that we should now be attempting to understand learning in the ‘hybrid classroom’ within which both on-site and remote students are connected and taught synchronously. Traditional ethnographic observation methods are limited in only capturing the in-situ activity of students physically present in the classroom. Nonetheless, the increasing student ‘presence’ in both physical and virtual learning spaces may require different monitoring or self-reporting methods to capture and understand this engagement (Scavarelli et al., 2021).

Conclusion

The increasingly active and self-directed nature of learning (driven by strategy and evidence-based pedagogy) requires an understanding of learning not only in formal classroom settings, but increasingly in informal learning spaces. As learning spaces become more hybridised and less ‘controlled’ by institutions, there is a need to identify the learning spaces in which students can effectively learn independently and collaboratively. This paper has presented a mixed methods, phenomenological approach which can be used to understand student perception of and engagement with this learning space. Whilst these methods alone have their limitations, a convergent mixed methods design can combine the strengths of each method in a way to offset the weaknesses of each. Indicative data and examples from a recent research study, which applied the full spectrum of mixed methods, demonstrated the potential for understanding student engagement with transitions between formal, timetabled and informal, non-timetabled learning spaces. The hermeneutical phenomenological approach underpinning the mixed methods meant an open investigation – which drew upon the contextual experience of the researchers – of how the learning spaces were actually being used and experienced.

With progression through the mixed methods from occupancy data to naturalistic ethnographic observation and field interviews to in-depth interviews, the approach becomes increasingly qualitative, focussed and time-/resource-intensive. In the reverse direction, the approach becomes more quantitative, 24/7, anonymous and time-/resource-efficient, given the capabilities of automated occupancy monitoring. This progression enabled collection of increasing information about participants and their authentic engagement with these spaces. Finding the ‘sweet spot’ on this spectrum should be determined by the question being addressed. If a superficial insight about *what* may be occurring in the space is needed, then perhaps the occupancy data alone is appropriate. However, with the increasing need to understand which people are using campus learning spaces and *how*, naturalistic ethnographic observation may also be required to provide some necessary identification of users and their behaviours. It can then be useful to determine *why* these learning spaces are being used and if they are suitable for the observed interaction and activities, at which point the user’s perspective can be gained using ethnographic field interviews. If appropriate,

subsequent more in-depth interviews using open questions can then be employed to, for example, determine whether learning spaces enhance or inhibit intended or unintended learning and teaching approaches. Employing the full spectrum of methods has potential in understanding longer-term change and transition, such as campus space refurbishment, curriculum change and culture change.

The growing need to monitor and understand both formal and informal learning space requires a targeted, sophisticated mixed methods approach. To monitor learning space activity as often as possible using resource-intensive ethnographic methods is wasteful. Equally, relying upon occupancy monitoring data alone leads to assumptions about participant status, behaviour and intent, which is better captured using qualitative methods. The convergent mixed methods approach presented in this paper has proven fruitful in both empirical research and in generating findings to inform the remodelling of the campus estate for transition to more active learning. The strategic need to understand, evaluate and (re) design learning spaces, coupled with the increasing availability of campus space datasets like occupancy data, allow for mixed methods which are flexible in their application, effective in their investment of resource and time, and when used together provide insightful data that are pragmatic in how they can inform design, practice and use of pedagogic and infrastructural resources.

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