Involving end users in retrofit of higher education buildings

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Involving end users in retrofit of higher education buildings.

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Abstract
Although the importance of end user participation during building improvement design is widely accepted, selecting the best approach for the engagement of users in design processes is a significant challenge. This paper assesses how qualitative end user engagement during retrofit planning can aid the design process of energy retrofits in higher education institutions. The application of this early stage approach to make design decisions is presented via a case study, carried out in the Faculty of Architecture Building at the Middle East Technical University, Ankara, Turkey. The proposed method uses semi-structured interviews with individual end users along with group interviews, to qualitatively assess priorities for a retrofit scheme of works. Utilising qualitative textual analysis software, specific elements to consider in the retrofit design process are defined, along with particular areas in need of focus, to best enhance user experience and energy efficiency gains. Using a case study approach, this research looks to showcase this method and highlight key elements of successful early design end user engagement, utilised to promote successful retrofit project completion. Findings highlight that retrofit project end users require engagement to aid articulation of requirements, along with the utilisation of engagement strategies to promote project buy in.

Keywords: end user engagement, university sector, retrofit, refurbishment.

1. Introduction

Many ageing university buildings are now in need of modernisation to improve their environmental performance and to remain competitive and attractive. This is in conjunction with the need to provide a comfortable indoor working environment, which promotes high quality outputs of research and teaching. The process of energy efficiency retrofit, where energy conservation measures can be implemented to reduce an existing building's energy consumption, is regularly seen as a practical, less disruptive and more affordable route to demolition and reconstruction.

The sustainable retrofit pathway can provide a working environment, which benefits occupants offering a comfortable and productive environment [1], a flexible response to changes in building requirements [2] and an improvement in building performance, as well as providing a valuable marketing tool for the university. Although these multiple benefits evidently present a persuasive argument to carry out energy efficiency retrofit, the decision making process to arrive at a coherent plan of retrofit action can be far from straightforward. The complexity of requirements, schedules and budget mean inevitable compromises and conflicting demands. Moreover, there are other issues acting as potential barriers to retrofit success such as the intricacies of an existing building, and the need to retain existing functionality.

Improving the decision process can eliminate barriers to retrofit success, via adequate communication, engagement and participation with end users, along with reducing building operation costs, minimising reliance on non-renewable energy sources, decreasing greenhouse gas emissions, and importantly increasing occupant comfort alongside the energy improvement. Existing business evaluation practices for retrofit decision making lack commonality, along with a deficit in the level of end user and wider stakeholder participation which could be possible [3, 4]. Additionally, there is a challenge in appropriately managing this participation, as in many cases user knowledge and experience of how to improve the efficiency and comfort performance of a building, is not present [5, 6, 7]. Moreover, building owners may not possess engineering insight, or have the financial measures to thoroughly evaluate the building and its needs from an end user perspective [8].

This research seeks to enable insights into the value of providing a pathway to user participation in the planning of building retrofit, to enhance energy efficiency and boost comfort levels simultaneously. Consequently, this research is aimed at assessing to what extent end user engagement and management during retrofit planning can aid the process of higher education retrofit and achieve end user satisfaction, as well as providing a high value project. To achieve this aim, a case study approach is adopted, in which end user views on building usage, performance, space utilisation and indoor environment were investigated.

2. Literature review

2.1 Retrofit in higher education buildings

Higher educational buildings are properties designed for a variety of activities within higher education and can include numerous functions, with high levels of occupancy. The prominence of considering energy efficiency and indoor environment quality of higher education buildings has been detailed in numerous articles [9, 10, 11], with the environmental impact of educational facilities discussed on an international platform as early as 1972, within the Stockholm Conference on the Human Environment.

Acknowledging the importance of energy saving means an increase in elements such as thermal insulation has been seen within some higher education buildings [12]. However, this focus has in turn raised issues of the deterioration of indoor environmental quality, building performance, occupant satisfaction, and health [13, 14].

Within higher education, the context of the institute is highly specific, and very different to both the public and private sectors. With knowledge development considered as a key profitable enterprise, higher education establishments are now seen as dynamic multifaceted environments for enterprise and research [15], and not simply as spaces for education. This multidimensional nature and the growing level of global competition within the sector, highlights the need to provide high quality facilities [16].

Understanding end user requirements, roles, and demands from the outset of a project’s conception is vital to appreciate individual and group cultural and social values, which are integrated within their worldviews [17]; activity systems [18]; and, social interactions [19]. The difference of priorities between the owner of the building (university in most cases) and end user is a potential barrier to success within the higher education refurbishment context. In this sense, a lack of engagement and communication with end users can result in unsuccessful projects [19]. Furthermore, academic staff, admin staff, students, the university management and other end users might also have very different views from each other regarding space use. Therefore, end user engagement during retrofit planning needs to be extensive to highlight the prioritisations different individuals or groups have. This will enable further communication and discussion on possible conflicting elements and convergence of views [20].

What is more, this wide range of building users also means patterns of occupancy, routines and timings differ for each individual using a building. The role of occupants within a building can be seen as two-fold with their latent heat influencing the building, alongside energy usage behaviours impacting elements such as window openings, doors, lighting, taps and fans. The impact of occupancy on building energy use has been well documented in the areas of air-conditioning, lighting and ventilation [21, 22, 23]. Furthermore, this impact has meant up to 85% inconsistency in predicted and actual energy consumption, which can be dependent on occupancy and related behaviours [24]. What is more, variables such as CO_2 concentration and indoor air temperature are also significantly impacted by occupancy trends [25]. More specifically in the case of higher education buildings, generating an insight into occupancy variations is considered as vitally important, as there can be a significant range of occupant types, profiles and also equipment being used [26, 27, 28, 29].

Consequently, the strategy proposed here to enable enhanced building retrofit is to take into account the highly multifaceted environment of a higher education facility [30], along with the numerous disparate and parallel types of user, roles, and viewpoints within the pre-retrofit design stages [31]. The crucial nature of this early stage engagement has formed the research route here, and influences the data sought after and captured.

2.2 Energy retrofit decision-making and building occupancy

The decision process for an energy retrofit scheme of works generates information on how to assess the economic, social environmental factors related to the proposed changes [32]. The aim of the process as identified by Gatton et al. [32] is to determine the potential energy consumption reductions via the selection of the most cost effective route. This basic process consists of a three-step approach. The first step includes the examination of a building's existing use. The second step scrutinises the specific building elements, which could be altered by the potential retrofit. Thirdly, a detailed assessment is performed to determine the implementation costs. These basic steps offer guidance to the decision makers in defining which building upgrades should be used.

These steps of decision-making should offer opportunities for gathering and analysis of building and usage data, offering a useful stage to reduce uncertainty [33]. As such, the decision maker needs to progress through a number of stages, including; understanding, interest development, evaluation, measurement and verification of new systems, and commitment to correct usage [33]. These stages aim to improve project understanding, and offer a route to pinpointing the key areas for consideration, and routes over potential barriers. Existing research has highlighted the value of this decision-making pathway [34, 4, 35, 36, 37], however these studies have yet to fully realise the value of user needs, expectations and prioritisations within this process.

There is a need shown in the research that to reduce energy consumption, a decision process to drive an energy retrofit is of high importance. What is more, is that throughout these decision making stages from existing research, understanding or appreciating the present building is stated as important, and a primary task. The research presented here, attempts to highlight the importance of including end users and their building occupancy in establishing that understanding of how higher education building are used and operate as well as understanding the end users' needs and expectations from the building and the retrofit project.

2.3 End user engagement

Whilst a key aim of higher education building retrofit is to provide a building with enhanced physical qualities and value, a central aim should be to deliver an indoor environment, which improves the experience of end users [38]. Consequently, it is imperative to appreciate the social repercussions of a retrofit scheme of works, examining the impacts of the built environment on end users and recognising measures that enhance end-user experience whilst also increasing energy efficiency and improving building performance. From this viewpoint, any end user must be considered as an active aspect of a building, and not simply a passive recipient of indoor conditions [39].

Within the learning environment context, recent research has produced studies, which show the environment as a system, where interactions with the environment can produced meaningful learnings for users. As such, there have been suggestions that the mapping of relationships between higher education buildings and user experiences is highly important [40]. Furthermore, the context of academic libraries has also been explored and the interactions between user groups and the environment are shown to be valuable in aiding learning space design, and understanding forces shaping higher education institutes [41].

In this research area of developing learning spaces, the complex interactions between spaces, users, technologies and pedagogic practices, has been commented as important within carrying out building evaluations [42, 43, 44]. However, even though these studies suggest a move towards a systemic way in which to view buildings and their users, there is still a stated need for collaborative and formal organisational processes in which to promote holistic designs [45]. These designs in turn are suggested to prioritise the experience of users, but also take into account factors related to the building from stakeholders at varying levels. For instance, these could be budgetary limitations, issues of maintenance, and building material refurbishment, alongside the end user experience, encouraging a well informed decision-making process prioritising multiple layers of an institution [45].

Therefore, to make a novel contribution and tackle present limitations of pre-retrofit engagement, the key objectives of this research therefore are to;

- Highlight the pathway used to engage with multiple stakeholders in the retrofit planning stages. This pathway is considered to deliver the benefits of understanding the building from experiential knowledge, along with occupancy data, to best influence the retrofit decision making process, whilst taking into consideration varying requirements from the building from different stakeholders.
- Explore end user engagement and pinpoint successful approaches, which aid the establishment of a meaningful dialogue and working relationships, between stakeholders, including retrofit professionals, building owners, and end users. It is proposed that the use of early engagement with higher education building end users will enhance the understanding of the building and aid the reduction of uncertainty in the energy retrofit decision-making process.

3. Research design and methodology

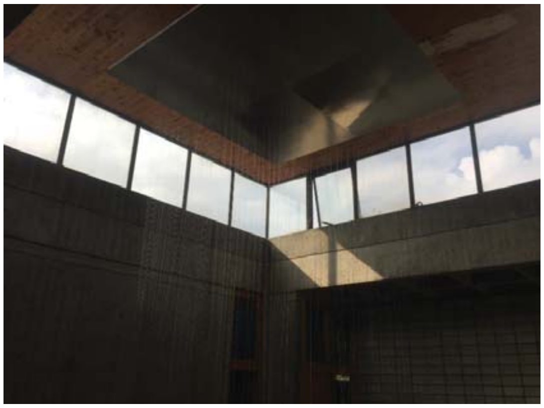
This research utilises a single-case study to investigate higher education retrofit and assesses the value of early stage end user engagement to illuminate aspects of building usage, performance, space utilisation and indoor environment for the retrofit planning. This strategy is suitable as it requires the investigation of a contemporary situation where a how or why question is being asked [46]. The fact that higher education retrofit stakeholder engagement has received minimal enquiry within the existing research, makes it a contemporary theme. Moreover, due to the complexity of retrofit projects, in terms of physical building heterogeneity, and usage variances, case studies retain the context and richness of data required to answer the how and why questions needed to ascertain how schemes of work could be implemented more effectively [47].

Although utilising a singular case study can be limited in its generalisability, it does offer exploration into a phenomenon and provide exemplar findings [46]. In this sense, this research offers insight from one case study, replication of which can be achieved via the judgement of others, related to the specific context of other cases [46]. The case study used here is the Faculty of Architecture building within the Middle East Technical University (METU), which was built in the modernist style, from reinforced concrete building in 1963.

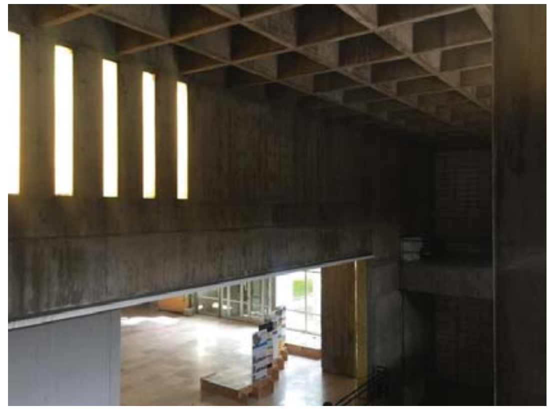
The 13000m^2 building was considered a significant achievement at the time, being constructed under strict time and budgetary constraints, with its first role being to house the university in its entirety, and then being a base for varying administrative units, and also the library. Consisting of large and complex spaces, it offers significant volume and floor area, whilst only spanning two storeys. From both an external and internal perspective, large glazed areas are used, with exposed concrete prolific, and wood used extensively throughout the inside spaces. From a technological perspective, the building makes use of novel fan coil heating systems and high-level window opening mechanisms.

The construction of the building, has led to spaces, which are utilised by students to appreciate architectural practices of enabling lights and shadow, and the use of materials and palates to best create aesthetically pleasing built structures and environments [48]. However, issues with the performance of the building and its ability to provide comfortable internal environments has also been detailed; the large volumes of glazed and bare material spaces have caused concerns for energy use to enable adequate heating, the west facing aspect of some large studio spaces have raised issues of temperature regulation, and the split levels questions of accessibility [49].

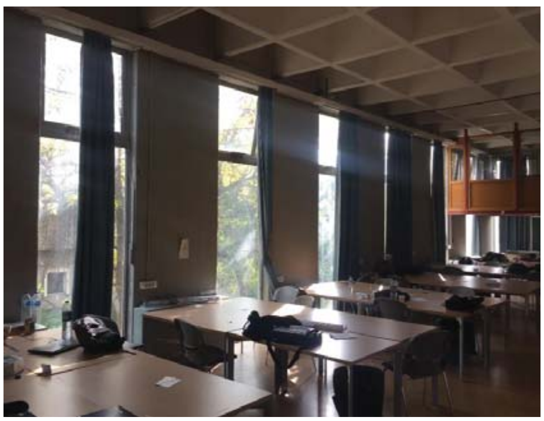
Figure 1 presents interior photographs of selected parts of the building detailing the common circulation spaces and also studio instructing rooms. The material pallette of concrete, wood and glass can be seen, along with the complex interplay of spaces, and light.



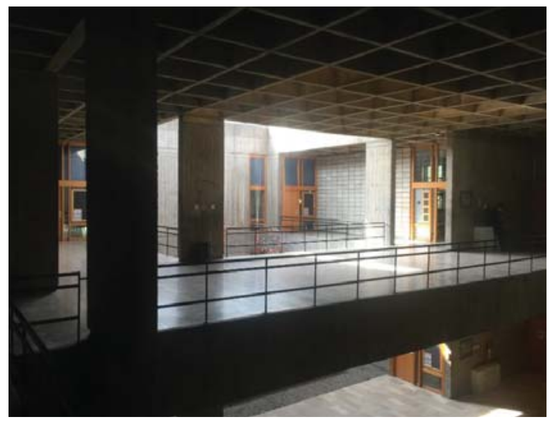
1a.



1b.



1c.



1d.

Figure 1a. Main entrance METU Architecture Building double height spaces and high level windows. 1b. Concrete form of ceiling to double height entrance light well space. 1c. Studio classroom space with full height windows. 1d. Light and dark emphasised by the light well and surrounding concreate ceiling areas. All rights reserved L Gooding, 2019.

Since the building's construction in 1966, varying elements of its construction are now experiencing deterioration. Furthermore, due to the climate, energy performance issues are a concern, with the indoor environment being suboptimal for occupants to work most productively. The building is therefore in need of a sustainable long-term retrofit plan, which will enable conservation and retention of the long-term functionality and aesthetics of the building.

In using this case study, the aim is to assess the value of end user insight in retrofit planning, with the result intended to be an informed way in which to treat the building to best enhance its performance and suitability to usage.

3.1 Data collection

Due to limited prior research, an exploratory route was chosen to investigate the role of in depth qualitative data gathering from higher education building stakeholders. This offers a pathway to maximise the discovery of ideas, opinions and experiences, and in depth understandings of social life for instance [50]. Due to the adaptability needed during data collection and the need to continually assess findings [51], semi-structured interviews were chosen to illuminate emergent themes.

Interviews provide access to others' experiences and observations [52], and are reliable in investigating concepts and events not personally experienced. They enable the researcher to discover the significances and clarifications that participants ascribe to particular phenomena [53], assisting in the identification of potential causes of these concepts [54]. Interviews conducted in this manner, provide a view into the past, and generate an opportunity to construct a detailed image of a social concept or phenomena and the drivers likely to be responsible for its development [52]. Interviews also permit the illumination of possible routes of action into the future.

Semi-structured interview format was chosen as it enables the participants to select what they wish to talk about to a large degree. This technique gives participants the option to communicate and think aloud about a variety of issues, which they may have not considered previously, thus making connections during the interview. This strategy offers the researcher the potential to control the themes, covered within the interview sessions, and probe answers with follow up questions to ensure concepts are fully formed and discussed [55]. Thus, the method provides a middle ground, to lie between structured and unstructured interviews.

The building hosts the Dean's office and three departments: Architecture Department, Industrial Engineering Department, and City and Regional Planning Department. It was ensured that all departments' views were represented in the case study. An important aspect to participant sampling for this exploratory qualitative research is to ensure the correct people are recruited [56, 57]. Consequently, this research used a judgmental sampling route to assess the value of different participants in contributing valuable experiential data [58]. As such, participant selection was based upon the level of involvement an individual has with the Faculty of Architecture, and ability to explain experiences of working and spending time within the building, this purposive technique was then buttressed with snowball sampling, and key stakeholders acted as gatekeepers to link to other potential participants. This mixed route of participant selection aims to minimise potential bias from the research team, and provide a mix of individuals gained, as detailed in table 1.

In total, 27 semi-structured interviews sessions were completed with both employed individuals working in the building and members from the student population. This mixture of types of individuals was considered vital to generate a range of views on the building, and spaces, which were regularly utilised by different members of the university. The majority of the sessions were conducted face to face, and on a one-to-one basis; however, where appropriate (if respondents worked in the same space) group's sessions were conducted. Also on one occasion due to scheduling requirement, one interview had to be cancelled and later carried out in a video call. Table 1 details the case study participants.

Table 1- Case study participants

Type of participant	Number
Architecture academic staff	10
Industrial Design academic staff	2
Post graduate student	8
City and regional planning academic staff	3
Faculty Dean	1
Department heads	3

The interview questioning consisted of two main sections:
Section 1- Background, occupancy and practice, was focused on determining the individuals' role and responsibilities within the building, the spaces they utilise in the building, their daily practices and routines when using the building over the year
Section 2: Retrofit requirements, was focused on determining the end user needs and expectations from the retrofit of the building. This section covered questions on 6 areas: 1) How satisfied the end users are with the areas they use in terms of lighting, space, electrical components, acoustics and thermal comfort; 2) Seasonal variances in the areas' performance; 3) Areas of the building which are

deemed particularly successful and unsuccessful; 4) Expectations of the end users from the retrofit including their prioritised improvement suggestions; 5) Energy efficiency (or inefficiency) of the building from end user point of view; 6) Space use in the building including the usage types, efficiency, requirements; 7) Building use during retrofit; 8) Individuals' view of the building aesthetics; 9),How the image of the building in the wider community could be altered.

The aim of covering these areas was to enhance the understanding of the building and its use, something that has been discussed within the literature as mentioned previously, but not from the viewpoint of building users. The aim of questioning around roles, building use practices and routines aids the qualitative view of the trends of usage in the building and different occupant/user profiles. In turn, in discussing user satisfaction and views of building successes and failing, key important areas for retrofit intervention can be determined. The aim of discussing the specific building performance traits (e.g. thermal performance, acoustics) then generates an experiential view of the building performance, across different building spaces, and seasons. Lastly, the aim of viewing the building from a community and energy perspective offers an overview of how the building performs in terms of its wider environmental and social responsibility and status.

Interviews took between 45 to 90 minutes. They were audio recorded and then transcribed in a timely manner to best capture all of the data and provide an accurate representation of the respondents' views. Data was analysed systematically and organised into themes through coding, this full list of codes is provided in appendix 1. A 'bottom up' approach to thematic analysis was conducted to interrogate the data, and identify themes emergent. The analysis commenced by twice reading transcripts, and increasing familiarity with the data. Next initial coding took place, to break down the full transcripts into their component parts [59]. This included assessing sentences and parts of sentences line by line to ensure full assessment of all data. Thirdly, a refinement of the coding took place within QSR NVivo software, to re-collate themes into differing groups to ensure overlaps were not present, or themes missed. Finally a list of key elements regarding the utilisation of the case study building was generated. Memo making occurred during this process to record this exploration and capture of analysis.

Figure 2 details an example of these collations of varying codes under a singular theme, which in turn lead to the eventual identification of the factor titled; *culture of enduring uncomfortable indoor environment.*

<Files\\SOA- P14> - § 1 reference coded [2.33% Coverage]
Reference 1 - 2.33% Coverage
No I don't have an extra heater, because I like to deal with the building, I want to work with the building. I do have shading in the office, but when its hot its hot.

<Files\\SOA- P2> - § 2 references coded [0.92% Coverage]
Reference 1 - 0.64% Coverage
I said to myself you know I'm not going to put any extra you know AC, so not to change you know the overall quality of that you know to space you know so because I know it will change the building profoundly.

Reference 2 - 0.29% Coverage
I will just go downstairs and continue to suffer in my academic office.

<Files\\SOA- P6> - § 1 reference coded [0.68% Coverage]
Reference 1 - 0.68% Coverage
This is important for me so I kind of prefer maybe just complaining about it and not doing anything at all.

Figure 2; Extract from coding and collation of codes to form themes.

To ensure correct representation of the data, multiple researchers were involved in the collation of these themes to ensure elimination of bias, and to hold true to the words and meaning of the participants.

4. Findings

Utilising qualitative data analysis coding methods, the following areas emerged as the key themes from the transcript data: 1) insights into the building's use; 2) Its indoor environment; and, 3) the building into the future.

4.1 Insights into characteristics of building use

Within the semi-structured interviews, the usage of the building and demand for space was a central area discussed. These discussions also enabled a view into how individuals use space and for how long.

The first aspect of demand on space is in relation to the changing requirements of the building. When the building was designed, it was intended to operate as a teaching facility in the main, meaning the spaces are a contrast between small cellular offices for instructor use, and large studio and classroom spaces for instructing to take place. However, this setup has now begun to cause issues for the users of the building. Firstly, due to the changing demands on academic staff members, a larger emphasis has now been placed upon conducting research in addition to teaching. This means that it is necessary to spend more time in cellular offices, using computers and other electrical devices. These offices are also restricted in number, and hence most employees are in shared offices meaning that space at times can be limited and the office internal environment can be suboptimal for productive work. This concept of office space use change is highlighted by this statement;

> *In the past there wasn't so much pressure on tutors to write and publish and sit in their rooms I think there was a greater emphasis on student –instructor relationships.*
>
> Architecture academic staff

Secondly, the significant increase in student numbers means more space limitation and pressures becoming more evident. In the cases of the studios, it was stated by different participants that spaces were in many cases being utilised by numbers more than double of what they were intended for. This was considered a limitation in terms of student space for quality work production, and in terms of ensuring a working environment conducive to a healthy proactive environment.

This overcrowding of studio space in particular was highlighted as problematic, as spaces, which were initially designed as open plan rooms, with large glazed wall sections for design work, had to be subdivided using mezzanines, which has led to issues of reduced air circulation. These issues of indoor environmental quality are highlighted by the following statements;

> *In the first year studio our capacity for ventilation is not good and we spend a lot of time in the studio during the critics and panel discussions, meaning at times we have to vacate the studio.*
>
> Architecture academic staff

> *Due to the orientation of the studio in the afternoon this place is really bad because the temperature rises to 26 or 27 degrees Celsius.*
>
> Postgraduate student

> *My experiences in the studio spaces have been terrible, okay there may be lots of light for example, especially from the ceiling, but it is too hot without enough oxygen, there are too many people using the space.*
>
> Architecture academic staff

The demand on studio space has also meant that in some cases classes have had to migrate to other buildings, due to the limited time within the working week to fit all student groups within the modules. This is contradicting some styles of teaching and learning, with the traditional apprentice style requiring students to be in studios for longer periods, opposing the more modern module style of more intense learning with shorter studio periods. The divergence between these styles has led to some academic staff to have a more flexible approach to studio space usage. This flexibility is deemed to limit the number of classes, which have to be conducted in other buildings. As such, different areas of the rooms are used for different student groups, as highlighted by this statement;

> *We have introduced a very new way of using the space to provide dual use of the studio, one side of the movable partition is silent independent working space and the rest of the room is for module leading and instructing.*
>
> Industrial Design academic staff

The demand change, and intensity of use led Industrial Engineering academics to consider more innovative uses of space and in many cases move away from dedicated rooms for different years or student groups, to a more shared experience of the space.

What was also regularly evident within the interviews is the use of the building as a teaching tool, to highlight the ways in which the building uses levels, light and textures to provide a pleasant indoor environment. This high level of indoor architectural quality has been recognised by the Getty Fund as a building of outstanding quality, and therefore these increasing demands requiring room division, or the use of other buildings to teach within, detracts from this use of the building as a teaching tool. An example statement for this concept of the character of the building being intrinsic to the education of architecture is below;

> *As an architect student you are personally encouraged to become a designer not just learn how to be, I mean the teachers and the environment encourages you to infuse your identity with your profession, and therefore you need to be experiencing the space in many different ways.*
>
> Architecture academic staff

Linked to this added demand is the increased footfall within the building and the impact on the actual fabric and components of the spaces. This was particularly noted as an issue for some of the facilities in the building such as toilets. The design of the toilets was not intended for high numbers of students resulting in issues in accessing the facilities due to queues and inevitable frequent cleaning, and a significant smell problem in the building due to inadequate ventilation, resulting from original design limiting intervention possibilities coupled with building's aesthetic preservation goals. The rhetoric was also repeated for the catering area, which at times was stated to struggle to meet the needs of all students requiring its services.

> *We are aware of some issues, particularly the toilets, these are a reoccurring problem, we need to address, students have brought to me personally their issues with the toilets here.*
>
> Faculty management

4.2 Insights into the indoor environment

With the building being constructed in a brutalist style with exposed concrete surfaces and large glass panels in Ankara, where a continental climate is observed, the ability of the building to provide a year round indoor comfort is limited. Therefore, the issues of temperature, acoustics, light and shade were repeated themes within all interviews.

In the case of acoustics, the building in the main was stated to succeed in providing small spaces, which could be isolated from external sounds to promote silent focused working. On the other hand, the large studio spaces were stated to be poor performing spaces in relation to offering acoustic quality. The large spaces with bare concrete surfaces mean that academic staff found it challenging to get their voice to reach all students and gain communication with them in teaching sessions, as these statements suggest;

In the studio it is too bad really, because after a while and at the end of the day you will definitely have a headache because the acoustics are terrible.

Architecture academic staff

I have some trouble, people at the back cannot hear very clearly, and people cannot hear each other well but maybe it's common because the numbers are very high.

Architecture academic staff

Furthermore, due to the large spaces used as open social spaces, which were designed to be empty and serve as transitional spaces to best highlight the quality of the light and horizontal spaces, there is limited other space available suitable to carry out educational or research activities. For instance, student group work tasks cannot take place in these open spaces due to the poor acoustics preventing discussion and group work.

Another key issue related to the indoor environment is the temperature. This is a particularly complex issue for the building with differing impacting factors. Firstly, Ankara's climate experience large daily temperature ranges, meaning daily temperature ranges can be high, causing high levels of heating and cooling over a 24-hour period. In addition, seasonally, temperature ranges can be high, with summer temperatures causing overheating and winter temperature significant cooling. The brutalist construction of the building does not lend itself to deal with these large changes, with the bare surfaces acting as temperature sinks and the exposed textured surfaces inhibiting the addition of insulation. Furthermore, the heating on the university campus is provided via a centralised system, with heat being transferred over large distances via 'galleries', this means there is limited opportunity to regulate this heating delivery. The way heat enters the building also causes issues on a room-by-room basis. The heating system (added at a retrofit stage, post initial construction) for instance, runs throughout the building in an exposed piping system, meaning rooms with these services passing through can gain significant heat. The same can also be said for those rooms, which gain thermal radiation from the sun, with large glass panes, which are west facing in some cases. The way in which rooms cannot be regulated thermally is also exacerbated by undersized window openings, limited user ability to self-regulate indoor environmental conditions.

The issue of temperature is also exacerbated by the limited options to install air conditioning within the building. Due to the emphasis on design and aesthetic quality, there is widespread reluctance amongst many users to not install air conditioning units, due to their appearance. Additionally, the bare concrete construction inhibits the option to hide pipework and cabling in cavities or behind stud walls.

Linked in with the temperature issues, is that of shading, and the ability to limit the amount of thermal radiation entering a room. Due to the differing aspects of the rooms within the building, some rooms require additional shading (image 1.c), with large glass expansions causing significant thermal heat gain to the building, along with the minimal ventilation provided by the small window openings. In many cases further interventions are required due to rooms becoming unusable at certain times within the year. These shading issues are detailed by these interview extracts;

We usually use shadings because during the afternoon it is really hard to use the computer because of the light level, so we need to use shading.

Architecture academic staff

In the past we didn't have these blinds so we used to have curtains but you know they didn't work well so we had to leave the room when it got particularly bad.

Architecture academic staff

The shading and temperature elements are also linked in with the light quality of the spaces. Being a building designed for the education of architecture, light quality particularly within the studio spaces is considered highly important, and therefore regulation of light and heat entering the rooms is a process in need of improvement, as detailed here;

> *We have a serious problem with the lighting because it has this fabulous light it's really beautiful, we can take pictures of anything and you don't have shadows, but in summer you scorch, and there is no way of regulating it.*
>
> Industrial Design academic staff

4.3 Insights on the building and the future

Utilising the pre retrofit design engagement process, an understanding of the characteristics of the building and its indoor environment elements can then aid the understanding of how users view spaces. This can also inform how rooms should change into the future to best respect the character of the building and its user and culture, but also attempt to improve the building from the perspective of user comfort and energy efficiency.

The way in which the building performs was the key discussion point for interviewees. The building was considered underperforming at many levels. Firstly, in terms of suitability to the demands placed upon the spaces in the building, levels of adaptability and flexibility were not seen as adequate enough. The performance of the building was also highlighted in terms of energy use. Although not high on the agenda of the university due to energy being publically provided by the central government, it was still acknowledged that space heating and cooling were significant issues, which needed to be addressed within the building.

This level of functionality was also stated in terms of the spaces being able to provide services such as a suitable number of electrical socket, or high levels of Wi-Fi availability throughout the building. Moreover, aspects such as the function of window openings were also highlighted as suboptimal.

> *We have to use a lot of electrical extension leads to make sure all our devices work… and also I can only use my laptop on a wired internet cable connection, as the Wi-Fi isn't reliable in this office.*
>
> Architecture academic staff

The interview findings building on the previous areas, also looked at the interviewees' views on what changes should occur into the future, to help inform the priorities list of what interventions could be proposed to assist in improving the building.

The key aspect resultant is that of ensuring high level so building preservation. Although it is not a listed building, the way in which users in many ways learn from the building in their training, and indeed may return to work within the building post-graduation, means that the building aesthetically holds a significant value. The appreciation of the building also continues to reflect the fact that nationally within Turkey the building represents a key example of modernism, and therefore is considered important to preserve. From this perspective, it is deemed central to building changes that they must not detract from the building, and not affect the character of the spaces and aesthetics as the original architect intended. A complicating factor linked to this, cautioning any change, is the concept that due to competitive bidding being the route in which work is contracted to businesses to perform improvements, it is not considered suitable by some interviewees to contract works to tackle a building of such quality purely on a lowest price basis. This issue is highlighted here;

> *We have here a building of high architectural value, and if you look at some of the quality of recent work carried out around campus, due to the competitive bidding process, I am off the view, that as the situation stands it is far better to do nothing, that change things.*
>
> Faculty management individual

Nevertheless, this reluctance to alter the building does not tackle the concept that some elements of the building do require maintenance and upkeep to ensure the life time of the building is extended for as long as possible. Water ingress is a focal issue and as it stands, strategic plans to tackle this issues and other maintenance elements have not be drawn up. This highlights another aspect in need of attention into the future.

5. Discussion

Semi structured interviews enabled understanding of various issues related to the building use and comfort. These issues led to the identification of five key areas in need of change which focused on improving the performance of the building in terms of its usage, energy efficiency and meeting the needs and satisfaction of end users. The next step was to propose possible routes to breaking down barriers and enabling change to achieve improvements in these areas. These are shown in Table 2.

Table 2: Case study: Required improvements and potential solutions

Key Areas in need of change	Routes of addressing issues
Space utilisation/flexibility requirements	Split rooms/hot desking/communal areas used for computers or study/ change of studio education
Bathroom and catering room limitations	Bathroom modernisation/increase in facilities
Temperature and lighting control	Window alteration/ opening apertures/ shading elements
Indoor air quality	Improve room ventilation
Heating system	Modernisation of heat infrastructure and room controls for heat delivery
WIFI and electrical output availability	Increase in routers and electrical sockets

Involvement of end users was critical in the decision making process of an energy retrofit not only because of the identification of the key areas for improvement but also the identification of the building elements which are considered changeable or unchangeable. For example, due to the strong view of preservation of the building's aesthetic qualities, it was determined that any retrofit intervention that alter the simplistic concrete building look internally or externally were completely off bounds. This led to the removal of some intervention options such as internal and external building insulation, or new air conditioning or mechanical ventilation with visible outside units. Likewise, the importance of retaining the clean simple lines and textures of the walls and ceilings meant that installation of additional electrical sockets or wireless internet boosters would have to be hidden from view. It was clear that any technology intervention which did not abide with the preservation centric viewpoint held by the building occupants, would lead to a strong sense of dissatisfaction. As such, the optimisation of retrofit improvements versus building preservation was significantly aided by end user involvement.

Involvement of users in the decision making process made it possible to provide a package of interventions, which are able to tackle multiple requirements, and thereby ensuring a route to optimisation of alterations. This optimisation can be a pathway to combining energy efficiency benefits, along with end user satisfaction. In this case study, for instance it can be seen that with space usage alterations, WIFI and electrical point provision, along with indoor room temperature management, need to be considered in terms of the new proposed usage of rooms and space. Additionally, retrofit interventions involving windows, need to also consider their impact on ventilation, to jointly tackle air quality issues.

The findings from this case study highlighted the value of gathering the anecdotal evidence from the end users as they have the full experience of using the building leading to the identification of areas considered to be suboptimal, which would not likely be picked up otherwise. This variety also details that not all areas deemed in need of alteration are energy related issues. Nevertheless, this in depth end user involvement in retrofit planning offers a route to view the building in a wider sense, resulting in energy upgrades from different angles together with improved occupant comfort leading to a higher satisfaction. On the other hand, the involvement of end user insight also can detail areas where energy upgrades may detract from the experience of using the building or reduce the comfort level, and hence should be avoided.

Although the heritage element of the case study building and its exposed concrete nature means insights directly drawn here have limited replication to other higher education buildings, they do provide important lessons when viewed in a wider angle. Firstly, this case study indicates usage patterns and routines of use, particularly highlighting overcrowding and space availability issues, something experienced by many higher education institutions. This provides a beneficial view point to energy retrofit improvements and offers an improved pathway to ensuring student and staff satisfaction. Secondly, intricacies of a user's routine exposed in the interview technique here offers important insight into potentially hidden issues. Examples to this are WIFI availability, where students have to be strategic in where they can work and gain internet access, or bathroom preferences due to poor quality facilities in some areas. The same can also be said for seasonal temperature changes within some spaces, meaning routines change depending on the month, outdoor temperature or time of day. Architecture studio occupation was stated to be particularly impacted by indoor thermal comfort issues, with some rooms having significant glazed facades. In other higher education facilities, this might apply to other teaching facilities such as laboratories, computer rooms or auditoriums. Thirdly, in generating interview data which detailing extended building use, insights can be made into previous retrofitted interventions, and their outcomes. This was of note with the heating system installed in the case study building, providing hot spots and poor aesthetics of pipework. In discussing these elements there is also the case for retrofit planning engagement to ensure issues of the past are not repeated, or to offer an opportunity to improve poorly designed prior interventions.

Throughout this process the on-going dialogue with building owners and end users, provides a platform in which to offer a prioritisation of the areas considered most important to alter via retrofit, and areas considered most important to retain as original. It is considered that the qualitative interviews utilised here, offer a platform to determine a range of requirements for the building, from differing groups such as building owners and end users. Using this database of requirements it is then possible to offer an insight into possible priorities, and central requirements. Moreover, this priority list can also be used to ascertain no-go areas, of building elements, which much remain as they are, thereby ensuring preferences of possible change or conservation are upheld.

6. Conclusion

This paper offers a demonstration as to how stakeholders can offer an important element to the retrofit planning of higher education buildings, enabling a pathway to increased building performance, occupant satisfaction and indoor environmental quality. The presented qualitative method provides a holistic method that obtains an understanding of the building, its inherent usage culture, issues of usage and in turn priorities to change. In the case study, these elements were evident due to the heritage aspect of the building as well as the strong community operating within the spaces. This method therefore offers a valuable way to appreciate the ways in which higher education buildings operate. Moreover the variety of processes taking place within university buildings also means that actors and users cover a large variety of roles meaning a qualitative investigation, such as the one presented here, can gain insight into the backgrounds of these individuals and build a picture of their reasoning for their views and priorities of building change. This is also important to detail the areas of the building that users do or do not use, permitting an informed view of the spaces interviewees can reliably form opinions based on experience.

The qualitative interview approach also enables an in depth appreciation of the requirements being placed upon a building. In this case study, needs and wishes from different groups were wide ranging, such as; electrical supply infrastructure improvements, shading enhancements, temperature regulation capabilities, toilet facility improvements, increased ventilation and space flexibility. This qualitative approach enables in-depth enquiry into these different requirements and the way in which they could impact the building, and the level of agreement between respondents on each requirement.

In the case study, the contradiction was evident between the wish for the modernisation of the building and the wish for preservation of the buildings original architectural design. The interaction with the end users at the retrofit planning stage in order to identify their requirements from the building performance also enables the end user engagement; hence, the sense of inclusion. This assists the interviewees to consider their needs and priorities more deeply by distilling them during communication, which also allows the appreciation of opposing views. The engagement also plays a significant role during the retrofit stage as the more engaged the occupants are in the earlier stages, the less opposition or resistance they will have for the changes, whether temporary or permanent, they will be faced with during the retrofit implementation stage and afterwards.

In assessing indoor environmental quality at the retrofit planning stage, a view of the building from a cross-seasonal viewpoint can be formed, including the idiosyncrasies of the building and its different spaces. Further, with a heritage building, specific components can be assessed in terms of how they impact different end users, highlighting how experiential data is vital to discover how a building operates on a daily basis throughout the year.

The resultant benefit of this approach is the widening of the lens via which retrofit can be considered, offering an enhanced strategy in which to promote social, environmental and economic benefits within higher education organisations, ensuring these influential institutions stand at the forefront of modern society. What is more, it is considered that into the future, this approach could be adapted to utilise in other buildings, where occupants spend extended period of time, for instance in public buildings, government instructions or indeed more widely in commercial office spaces. Offering a platform within these environments to give occupants a space to discuss their views on indoor environment quality, patterns of space usage and views of how it could be in the future, could enable increased success for retrofit schemes.

References

[1]. Paul, W. and Taylor, P. (2008). A comparison of occupant comfort and satisfaction between a green building and a conventional building. *Building and environment*, *43*(11), 1858-1870.

[2]. Vimpari, J., Kajander, J., and Junnila, S. (2014). Valuing flexibility in a retrofit investment. *Journal of Corporate Real Estate*, *16*(1), 3-21.

[3]. Moghadam, S. T., & Lombardi, P. (2019). An interactive multi-criteria spatial decision support system for energy retrofitting of building stocks using CommuntiyVIZ to support urban energy planning. *Building and Environment*, *163*, 106233.

[4]. Liang, X., Peng, Y., & Shen, G. Q. (2016). A game theory based analysis of decision making for green retrofit under different occupancy types. *Journal of cleaner production*, *137*, 1300-1312.

[5].Bevan, W., Lu, S. L., and Sexton, M. (2020). Skills required to deliver energy efficient school retrofit buildings. *Engineering, Construction and Architectural Management*.

[6]. Azizi, N. S. M., Wilkinson, S., & Fassman, E. (2015). Strategies for improving energy saving behaviour in commercial buildings in Malaysia. *Engineering, Construction and Architectural Management*.

[7]. Jones, B., & Bogus, S. M. (2010). Decision process for energy efficient building retrofits: the owner's perspective. *Journal of Green Building*, *5*(3), 131-146.

[8]. Everett, G., and Lamond, J. E. (2018). Considering the value of community engagement for (co-) producing blue–green infrastructure. *WIT Transactions on the Built Environment*, *184*, 1-13.

[9]. Corcoran P., Calder W., and Clugston R. (2002). Introduction: higher education for sustainable development. Higher Education Policy; 15:99-103.

[10]. Bernheim, A. (2003). How green is green? Developing a process for determining sustainability when planning campuses and academic buildings. Planning for Higher Education:99-110.

[11]. Bakke, J.,Wieslander, G., Norbäck, D. and Moen, B. (2008). Atopy, symptoms and indoor environmental perceptions, tear film stability, nasal patency and lavage biomarkers in university staff. Int. Arch. Occup. Environ., Health 81 (7), 861–872.

[12]. Al-Homoud, M. (2004). The effectiveness of thermal insulation in different types of buildings in hot climates. *Journal of Thermal Envelope and Building Science*, *27*(3), 235-247.

[13]. Jaggs, M., and Palmer, J. (2000). Energy performance indoor environmental quality retrofit—a European diagnosis and decision making method for building refurbishment. *Energy and buildings*, *31*(2), 97-101.

[14]. Iqbal, I., and Al-Homoud, M. (2007). Parametric analysis of alternative energy conservation measures in an office building in hot and humid climate. *Building and environment*, *42*(5), 2166-2177.

[15]. Doiron, R, and Asselin, M. (2011). "Exploring a New Learning Landscape in Tertiary Education." New Library World 112 (5/6):222-235.

[16]. Sheikhneshin, A. G. (2008). Higher Education and the Challenge of Growth and Sustainability. EDU-COM International Conference, Sustainability in Higher Education: Directions for Change, Edith Cowan University, Perth Western Australia, November, 19-21.

[17]. Ireland, V., Rapaport, B., & Omarova, A. (2012). Addressing wicked problems in a range of project types. *Procedia Computer Science*, *12*, 49-55.

[18]. Checkland, P. (1981). Systems Thinking, Systems Practice. Chichester, Sussex: J. Wiley.

[19]. Kpamma, Z. E., Adjei-Kumi, T., Ayarkwa, J., and Adinyira, E. (2016). An exploration of the choosing by advantages decision system as a user engagement tool in participatory design. *Architectural Engineering and Design Management*, *12*(1), 51-66.

[20]. Weisenfeld, U. (2003). "Engagement In Innovation Management: Perceptions And Interests In The Gm Debate1." Creativity and Innovation Management 12 (4):211-220.

[21]. Erickson, V., Carreira-Perpinan, M. and Cerpa, A. (2011). OBSERVE: occupancy-based system for efficient reduction of HVAC energy, in: IEEE 10th International Conference on Information Processing in Sensor Networks (IPSN), pp.258–269

[22]. Leephakpreeda, T., Thitipatanapong, R., Grittiyachot, T., & Yungchareon, V. (2001). Occupancy-based control of indoor air ventilation: A theoretical and experimental study. *Science Asia*, *27*(4), 279-84.

[23]. Guo, X., Tiller, D. K., Henze, G. P., & Waters, C. E. (2010). The performance of occupancy-based lighting control systems: A review. *Lighting Research & Technology*, *42*(4), 415-431.

[24]. Menezes, C., Cripps, A., Bouchlaghem, D. and Buswell, R. Analysis of electricity consumption for lighting and small power in office buildings, in: CIBSE Technical Symposium, DeMontfort University, Leicester, UK, 6th and 7th September, 2011.

[25]. Yang, Z., and Becerik-Gerber, B. (2014). The coupled effects of personalized occupancy profile based HVAC schedules and room reassignment on building energy use. *Energy and Buildings*, *78*, 113-122.

[26]. Bourdeau, M., Guo, X., & Nefzaoui, E. (2018). Buildings energy consumption generation gap: A post-occupancy assessment in a case study of three higher education buildings. *Energy and Buildings*, *159*, 600-611.

[27]. Gui, X., Gou, Z., and Zhang, F. (2020). The relationship between energy use and space use of higher educational buildings in subtropical Australia. *Energy and Buildings*, *211*, 109799.

[28]. Pritoni, M., Woolley, J. M., and Modera, M. P. (2016). Do occupancy-responsive learning thermostats save energy? A field study in university residence halls. *Energy and Buildings*, *127*, 469-478.

[29]. Rafsanjani, H. N., & Ahn, C. (2016). Linking building energy-load variations with occupants' energy-use behaviors in commercial buildings: non-intrusive occupant load monitoring (NIOLM). *Procedia Engineering*, *145*, 532-539.

[30]. Johnson, C., and Lomas, C. (2005). Design of the learning space: Learning and design principles. *EDUCAUSE review*, *40*(4), 16.

[31]. Storvang, P., & Clarke, A. H. (2014). How to create a space for stakeholders' involvement in construction. *Construction Management and Economics*, *32*(12), 1166-1182.

[32]. Gatton, T. M., Lee, Y., Beaudry, M. A., & Jaeger, S. (1995). *Expert system to determine energy-saving retrofit potential of public buildings* (No. CONF-950624-). American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA (United States).

[33]. Ruiz, R. R. 2005. "On the Adoption of Improved Energy Efficiency in Buildings: Perspective of Design Firms." Strategic Planning for Energy and the Environment, 66–69.

[34]. Ruparathna, R., Hewage, K., & Sadiq, R. (2016). Improving the energy efficiency of the existing building stock: A critical review of commercial and institutional buildings. Renewable and Sustainable Energy Reviews.

[35]. Woo, J. H., & Menassa, C. (2014). Virtual Retrofit Model for aging commercial buildings in a smart grid environment. Energy and Buildings. https://doi.org/10.1016/j.enbuild.2014.05.004

[36]. Gultekin, P., Anumba, C. J., & Leicht, R. M. (2013). A cross-case analysis of decision making environments for deep retrofit projects. In Computing in Civil Engineering - Proceedings of the 2013 ASCE International Workshop on Computing in Civil Engineering.

[37]. Tuominen, P., Klobut, K., Tolman, A., Adjei, A., & De Best-Waldhober, M. (2012). Energy savings potential in buildings and overcoming market barriers in member states of the European Union. Energy and Buildings. https://doi.org/10.1016/j.enbuild.2012.04.015

[38]. Shah, S. (2012). Sustainable Refurbishment. Wiley-Blackwell.

[39]. Cole, R., Robinson, J., Brown, Z., & O'shea, M. (2008). Re-contextualizing the notion of comfort. Building Research & Information,, 36(4), 323–336.

[40]. Thompson, K., Ashe, D., Carvalho, L., Goodyear, P., Kelly, N., & Parisio, M. (2013). Processing and visualizing data in complex learning environments. *American Behavioral Scientist*, *57*(10), 1401-1420.

[41]. Johnson, W. M., & Khoo, M. J. (2018). Analysing the learning commons in the digital age. In *Spaces of Teaching and Learning* (pp. 105-128). Springer, Singapore.

[42]. Radcliffe, D., Wilson, H., Powell, D., & Tibbetts, B. (2009). Learning spaces in higher education: Positive outcomes by design. In *Proceedings of the next generation learning spaces 2008 colloquium*.

[43]. Pearshouse, I., Bligh, B., Brown, E., Lewthwaite, S., Graber, R., Hartnell-Young, E., and Sharples, M. (2009). A study of effective evaluation models and practices for technology supported physical learning spaces (JELS).

[44]. Brown, M., Initiative, E. L., Cevetello, J., Dugdale, S., Felix, E., Holeton, R., and Meyers, C. (2013). Learning space rating system. *Educause*, 56.

[45]. Watson, K. J., Evans, J., Karvonen, A., & Whitley, T. (2016). Re-conceiving building design quality: A review of building users in their social context. *Indoor and Built Environment*, *25*(3), 509-523.

[46]. Yin, R. (1994). Case Study Research: Design and Methods. 2nd ed.. ed. Thousand Oaks: Sage Publications.

[47]. Mariotto, F., Zanni, P., and Moraes, G. (2014). What is the use of a single-case study in management research? *Revista de Administração de Empresas*, *54*(4), 358-369.

[48]. Sargın, G. A., & Savaş, A. (2016). A University is a society': an environmental history of the METU 'campus. *The Journal of Architecture*, *21*(4), 602-629.

[49]. Kortan, E. (1974). Architectural movements and their criticism in Turkey 1960-1970. METU Faculty of Architecture publication no:23, p.122-126.

[50]. Given L. editor. (2008). The Sage encyclopedia of qualitative research methods. Los Angeles (CA)/London: SAGE.

[51]. Moen K, Middelthon A. (2015). Qualitative research methods, In Laake P, Benestad HB, Olsen BR, editors. Research in medical and biological sciences. Amsterdam: Academic Press. p. 321–378.

[52]. Weiss, R. (1994) Learning from Strangers. New York: Free Press.

[53]. Blaikie, N. (2010). Designing Social Research, Cambridge, Polity Press.

[54]. Yin, R. (2009). Case study research: Design and methods 4th ed. In *United States: Library of Congress Cataloguing-in-Publication Data*.

[55]. Platt, J. (2002). The History of the Interview. *Handbook of interview research: Context and method*, 33.

[56]. Creswell J. (2003). Research design: qualitative, quantitative, and mixed methods approaches. California (USA): Sage.

[57]. Silverman D. (2011). Intrepreting qualitative data. London: Sage Publications Ltd.

[58]. Quinlan. (2011). Business research methods. Andover (UK): Cengage.

[59]. Bryman A and Bell E. (2011). Business research methods. Oxford: Oxford University Press.

Appendix 1. Coding from all interviews, grouped into relevant parent and child nodes.

Aspects of Indoor Environmental Quality			
	Acoustic Issues		
	Electrical requirement demands changed through increased IT reliance		
		Electric outages an issue	
		Electrical cabling aged and insufficient	
		WIFI coverage and quality problems	
	Good quality inside outside transition		
	Good quality open space		
	Increased energy efficiency needed		
	Light quality good, but issues of glare		
		Artificial light needed	
		Shading required	
		Sunlight issues	
	Poor building maintenance and previous refurbishment changes		
		Water ingress	
	Room divisions inhibiting quality of space		
	Temperature problems		
		Air conditioning required	
		Heating system suboptimal	
		Radiator issues	
		Seasonal indoor environment differences large	
	Toilet issues		
	Window openings and ventilation problems		
Characteristics of Building Use			
	Building designed as a teaching centric building		
		Pedagogy of the building central to architecture education	
	Culture of enduring uncomfortable indoor environment		
		Not working in building due to temperature	
		Resistance to adding elements to improve comfort	
	Research and more demands on academics, meaning space demands changing		
	Sharing of space and community feel		
		Use of all spaces	
	Significant feeling of community and ownership of building		
		Recognition of the building internationally as an asset to architectural heritage	
			Building considered a key asset to the University
		Trend of returning academics and staff highlighting the culture and community	
	Student number increases an issue		
		Space insufficient so others buildings have to be used	
		Studio and class spaces regularly overcrowded	
Priorities into the future			
	Bathroom improvements important		
	Energy efficiency and sustainability		
	Focus on preservation as building internationally recognised		
		Focus on restoring back to original	
		History of changes occurring to the building	
		Return building to architects original design and true intentions	
		Significant heritage value	
			High quality exposed textures
	Increased focus needed on current needs and requirements		
		Hot desking areas required	

Increased space flexibility needed
Innovations not yet ready to deal with building
Competitive Bidding not producing quality
Invisible changes needed to not impact building design
Requirement of technical innovations to deal with complex challenges
Link the building and users with business and industry to become more competitive
Making changes continually
Making changes personally
Need for functionality
Increased accessibility
Stakeholders being involved in decisions
Strategic interventions needed
Maintenance and strategic plan to preserve building needed
University wide focus on new buildings not refurbishment
Minimal funds available for renovations