Factors that influence student's satisfaction with their physical learning environments

Purpose- To identify personality types between different university disciplines, and to establish whether there are differing requirements in the design of physical learning environment. Also to identify features of the physical learning environment that can support a sense of community. This paper seeks to investigate the relationship between student's personality and preferences of features of the built environment.

Design/methodology/approach- Quantitative questionnaires were distributed in three university disciplines based on the variables personality, elements of the physical learning environment and features that could support a sense of community.

Findings- The analysis revealed that there is differences in preferred features within the physical learning environment for the three university disciplines within a large UK based University. It can also be seen that there is differences in personality profiles between these three university disciplines. Features of the environment that could support a sense of community have been also identified.

Research implications- Those who are responsible for the design and refurbishment of Higher Education Institutions may find this research useful to improve the facilities for students. To support the development of appropriate physical learning spaces through the understanding of students requirements.

Originality/value-This paper presents a new perspective on how the development of Higher Education Facilities can be designed to increase student experience by identifying specific features of the physical learning environment students prefer.

Keywords- Higher Education; Physical learning environment; Personality; Community.

Paper type- Research paper

Introduction

Currently fees for higher education are at an all-time high, however students appear to consider that their courses are very poor value for money (Robinson and Sedgi, 2014). Consequently people are beginning to question universities importance (Ward and Shaw, 2014). Adding to the concern for universities it has also been stated that students tend not to turn up to lectures as they are able to achieve just as well at home online (Sellgren, 2014). However to develop learning communities that are vital to educational development (Bickford and Wright, 2006) bringing students back into the 'classroom' is an important issue. This could be achieved by designing space that supports students in all aspects of their learning.

User's perceptions of the physical environment have been found to play a significant role in their experiences. For example, Weinstein and Woolfolk (1981) found that students made judgements about the competencies of their teachers by the environment they are taught in. The students made more positive assessments of the teachers when the room was more orderly. If students perceive their learning environment to be of a poor standard their experience of the teaching may be negatively affected and consequently affect performance. Literature has also suggested that poor building design can increase stress and negatively impact the health of building users (Evans and McCoy, 1998). So not only do the environments students are taught in affect their perceptions of teaching, it may also affect their overall well-being. Therefore it is understandable that by improving facilities and implementing better management of existing buildings may consequent in an increase students satisfaction (Vidalakis et al., 2013). The redevelopment of physical learning environments should be managed through the gathering comprehensive information through stakeholder's evaluations (Amaratunga and Baldry, 2000). In this instance higher education institutes should explore the design of physical learning environments through student evaluation. This research will explore the design of higher education physical learning environments and how they can be developed to compliment the user's requirements.

The design of higher education physical learning environments has been broadly researched (Neary and Saunders, 2011; Yang et al., 2013; Kollar et al., 2014), and within this has identified the importance of understanding users' needs to develop a suitable learning space. For example, Guney and Al (2012) identified that space should be designed to support differences in learning strategies. Whilst Shouder et al. (2014) emphasised the importance of providing environments suitable for students management of space, for their own work productivity. However if we consider all who attend universities there is large range of individual differences (Hassanain and Mudhei, 2006). Understanding how student's individual differences affect requirements of the physical learning environment currently requires further examination (Pawlowska et al., 2014). Personality, a measure of individual differences, has been found to be a strong predictor of perceptions of the physical learning environment. Keller and Karau (2013) noted that one's personality traits are linked to perceptions and impressions of online learning communities. Furthermore, Pawlowska et al. (2014) noted a relationship between personality traits and classroom environmental factors such as 'students in class get to know each other really well' and satisfaction. Therefore identifying student's individual requirements would develop understanding of how to design higher education physical learning environments. Although it is important to consider individual requirements in the designing the physical learning environment, involvement in a learning community has been positively linked with satisfaction (Zhao and Kuh, 2004). Ellis (2005) noted that classrooms fail to lay the foundations for students relationships, therefore developing the space outside of the formal classroom could balance and allow for the disparity. Consequently, it is important to understand how personality affects user's requirements and how the design of space can develop this sense of community. This

would enable institutes to identify both the individual needs of students but also the universities as a whole. This means the physical learning environment could be redeveloped to positively increase student's learning experiences.

Personality

Personality is the individual differences in characteristic patterns of thinking, feeling and behaving (McCrae and John, 1992). There is much debate on one construct of personality theory (Zuckerman et al., 1993), however one that has gained a lot of attention is trait theory (McCrae and Costa Jr, 1999). The most influential trait explanation is the five factor model (FFM) which consists of the five traits openness, conscientiousness, extraversion, agreeableness and neuroticism (Goldberg, 1990). These traits have been found to be influential in psychology as they can explain much of the individual differences in people (McCrae and Costa Jr, 1999). Personality is therefore a useful measure of individual differences. Personality influences what a person does or will do and therefore can be useful in the understanding of life happenings (McCrae and Costa Jr, 1999). Therefore by understanding the influence of personality on preferences for features of the physical learning environment, we can better understand the impact this relationship has on the use of space. Allport (1966) ascertained that personality traits do not wait to be aroused by external stimuli, but that an individual actively seek stimulus situations that encourage their traits. Therefore the physical environment that students work in needs to suit their individual personality traits or will not be utilized by them, consequently affecting their behaviour. This research suggests that there may be a motive to identify differences between subject choices which may interact with preferences for factors within the physical learning environment.

Community

McMillan and Chavis (1986) defined a sense of community as membership, influence, integration and fulfilment of needs and a shared emotional connection. With a shift towards new learning theories and the construction of knowledge , the importance of students sense of community is becoming more recognised (Dawson et al., 2006). Chavis and Wandersman (1990) developed a model to identify components that affect individual participation in their environment. It was theorised that three factors influence people in their environment and a sense of community is integral to enacting these. The factors outlined are the perceived perception of the environment, ones social relations and ones perceived control and empowerment within the community. Therefore by providing an environment that develops a sense of community allows users to identify with the environment (Anton and Lawrence, 2014). Although this research is conducted in a residential environment Chavis and Wandersman (1990) conclude that it is important to consider the development of a community in other environments. Furthermore noting that developing a sense of community stimulates satisfaction with the environment. Likewise, Zhao and Kuh (2004) note the importance of developing learning communities to encourage students engagement. Currently there is little research understanding how to develop universities to encourage this sense of community. In the design of villages, however, the benefit of architectural and structural features has been identified in encouraging a sense of community (Armstrong, 2000; Kim and Kaplan, 2004). Therefore by identifying features within university institution, concerning the architectural and structural factors would develop a sense of community.

Physical Learning environments

To understand the influence of personality on preferences and how a sense community may be developed through the design of the physical learning environments. It is important to understand

how physical learning environments are constructed. In the past teaching and learning was constructed as a teacher standing at the front of the class dictating to students. However it has been established that students should become more active learners (Lumpkin et al., 2015). Advancements in technology in recent years has enabled universities to utilise online learning communities to support students in becoming more active learners. For example, recording of lectures to watch back (Owston et al., 2011) and virtual learning environments (VLEs) to enhance engagement (O' Shea et al., 2015). The use of technologies are said to provide a more flexible and personalised environment for students to access on demand (Zhang et al., 2004). The VLE also enables students to develop a sense of community, as the allow students to work together (Melkun, 2012). Thomas (2010) noted that the separation between VLEs and classrooms is going to continue become indistinct. Where these once separate entities will have to become integrated within each other. Considering advancements in learning approaches and in technology it is recognised that the physical learning environments should encompass a range of spaces including formal and informal learning environments and VLEs (Johnson and Lomas, 2005). Spaces should be designed knowing that a range of learning activates will occur within them (Thomas, 2010). However, the current psychical learning spaces have not evolved with this, the learning spaces are still rooted in the traditional setting (JISC, 2006). Therefore identifying how space should be developed to recognise the requirements of the users appears to an important to consider.

A range of literature has found that the college environment affects the student learning experience (Chan, 2011; Kandiko and Mawer, 2013). An investigation of Chinese students identified that the perception of their college environment has a salient effect towards their educational outcomes (Chan, 2011). Furthermore, student's perceptions of their physical environment were found to be a stronger predictor of achieving learning outcomes than past academic achievement (Lizzio et al., 2002). Currently within Liverpool John Moores University there are several different building types. There is a mixture of modern purpose built buildings and old converted buildings. For example, one campus consists of the old Polytechnic and it therefore in the traditional learning environment style (JISC, 2006). Whereas on another campus there is a purpose built Art and Design building, which offers specifically designed space for the students. As these students have different types of learning environments available to them their perceptions of the environment may be effected.

Despite literature suggesting that the physical learning environment has a significant impact on students, little is understood about people's interactions with the buildings. Greattz (2006) however, suggested that there are three fundamental ideas that underlie the psychology of teaching and learning extrapolated from the environment.

1. All learning takes place in a physical environment with quantifiable and perceptible physical characteristics
2. Students do not touch, see or hear passively; they look feel and listen actively
3. The physical characteristics of learning environments can affect learners emotionally

(Greattz, 2006) stated that all learning takes place in a physical learning environment, although much research takes place in VLEs as discussed earlier this learning still occurs in a physical place. Whether this physical place be in a library or at home working at a desk, there is still an interaction with the learning environment and the physical environment. Consequently, it can be agreed that students have a psychological interaction with the physical environment that they study in. When attempting to design the physical place there are many factors that should be considered. There are numerous features within the physical learning environments physical place that have been recognised as playing a significant role in student's satisfaction. There are environmental factors,

such as, lighting, ventilation (Winterbottom and Wilkins, 2009) and temperature (Douglas and Gifford, 2001; Yang et al., 2013). The colour schemes, comfort of seating (Hawkins and Lilley, 1998), and a new wave of literature on flexibility of space is noted to influence student's satisfaction (Thomas, 2010; Holm, 2011). There are also factors that need to be considered in the general design of university buildings, such as, durability (Durán-Narucki, 2008), accessibility (Heaven and Goulding, 2002), safety (Rivlin and Weinstein, 1984) and spaciousness to avoid overcrowding (Evans and Wener, 2007). There is a large body of literature outlining requirements for individual elements of the design as discussed above. But research has not unified these features to identify, from the student's perspective, which factors are most important.

Although there are a number of factors within the physical learning environment that are important to reflect upon when designing space, this is a number of features to prioritize in a building. Holm (2011, pg. 178) suggested that, *'most workplaces need a kit of parts, to cater for different work styles and to provide a diversity of settings that individuals can self-select to maximise their own productivity'*. Accordingly the design of space should be undertaken with all of these features in mind however specific factors may be chosen by the end users as being most important. Therefore this advocates the necessity to understand how to design university physical learning environments, to best correspond to the user's requirements.

Aims/Objectives

It appears that considering features of the physical learning environment seems only sensible when understanding the influences of student's satisfaction. Additionally, understanding physical learning environments may need to suit many different requirements at once. A summit on the design of higher education space concluded that although literature does exist on designing physical learning environments, this rarely informs actual planning and design processes (Rullman and Van den Kieboom, 2012). So identifying specific factors that can inform the design of buildings simply appears to be absent from current knowledge. Overall it is established a focus should be placed on forming a functioning model of the design space.

From the overview of the literature it can be seen that these three facets of research, the physical learning environment, personality and community interlink as they effect students satisfaction and perceptions of the environment. Exploring these factors could enhance the physical learning environment beneficially for students. There is currently a gap in the literature for these elements, although there is a large body of literature focusing on the design of Higher education institutes there is no student focussed preference model for the design of space. Therefore to begin to identify how the design of space could be enhanced for student satisfaction this research will aim to identify factors that have currently been overlooked. This research will firstly aim to identify if there are differences in personality traits between disciplines. This will then develop to identify if these individual differences has a relationship with preferred factors in the physical learning environment. The final aim of this research is then to identify factors of the design that could support a sense of community for students. These aims are outlined to help the research identify factors of the design that should be considered when developing new, and refurbishing old higher education physical learning environments.

H- This research hypothesises that there will be a relationship between personality and preferred features of the physical learning environment

Methodology

Design

In this research the aim was to identify factors of the physical learning environment that are most important to students and to identify if this has a relationship with personality. Therefore a qualitative design, utilising self-report surveys was decided upon. As there is a large body of literature that identifies factors that are important when considering the design of space ranging from residential to educational (for example; (Rivlin and Weinstein, 1984; Heaven and Goulding, 2002; Evans and Wener, 2007; Winterbottom and Wilkins, 2009). This was used to inform on the framework of the research and consequently the construction of the surveys.

Research tools

Learning environment- To identify factors of the building environment that are most preferred by students in their physical learning environment, a questionnaire was constructed. The questionnaire was constructed from an extensive literature review identifying empirical research of factors of the built environment were found to affect student satisfaction. The question consisted of 33 item which were constructed around three features of the environment modified from the design quality indicator (Gann et al., 2003), Build, Functionality and Environment. Within the build element of the survey factors such as 'lecture halls' and 'specialist teaching rooms' were included. Within the functionality element of the survey factors such as, 'clear signs in building' and 'motivating environment' were identified. And finally for the Environment section of the survey factors such as 'natural lighting' and 'comfortable furniture' were included. The questionnaire was scored on a five point Likert scale scored from Unimportant to Very important.

Personality- To measure personality the Big five measure of personality was used, the Five Factor Model (FFM) (Goldberg et al., 2006). This measure of personality was chose as it has been found to be a highly reliable and valid questionnaire on personality over many ages and cultures (Ciorbea and Pasarica, 2013; McIlroy et al., 2015). This survey is constructed of questions measuring the five personality traits identified through empirical research, Openness, Conscientiousness, Agreeableness, Extraversion and Neuroticism (Emotional Stability). These traits are the broad characteristics encapsulating many personality attributes. The survey asks questions about yourself, which is then scored on a five point Likert scale, very inaccurate to very accurate.

Community- To identify factors of the environment that the students identify as factors that could improve their sense of community, a questionnaire was constructed. This contained to factors that, through the literature review were identified as perhaps increasing student's sense of community. For example items that were included were 'variety of social spaces' and 'clear signs to define space on campus. The survey was scored on a five point Likert scale, Unimportant to very important.

Sample

To collect a diverse population of data from students, the research used three different disciplines with different building types within Liverpool John Moores University. The school of Built Environment who reside in an inappropriate building, the school of Art and Design that have a purpose built environment and the school of engineering who have a long established building. This will aim to identify if students from these different disciplines have differing personalities. Utilising students from the different disciplines will also provide a range of understanding and perceptions of the requirements from the learning environment. For example a student from the purpose built Art and Design academy may appreciate certain elements that work well whereas students from the Built Environment may identify different things that they identify as being important. Although this

research is conducted only in Liverpool John Moores University the research cannot be generalised to other universities. However this does allow this research to understand specifically what students from this university prefer from their physical learning environment. To the enable a larger scale research project in the future. The research obtained 140 participants through the use of an online survey tool, Qualtrics.

Analysis

Analysis was conducted using SPSS. Firstly descriptive statistical analysis was conducted on the data. This provides means and standard deviations allowing for the quality of the data to be assessed. The data was also analysed using tests such as ANOVA and Kruskal-Wallis to identify any statistically significant relationships. Post hoc tests were conducted to further analyse relationships between statistically significant data sets. Additionally Factors analysis was used to identify correlated variables. To establish unobserved variables, factors, that may explain how to design the physical learning environment.

Results

Learning environments

To identify the factors of the physical learning environment that students rate most important, analysis was conducted on the learning environments section of the survey. This stage of the analysis was conducted to evaluate the top preferences in the learning environments. The data was also split into the three university disciplines to enable a comparison of preference factors. Table 1 displays the descriptive statistics for the learning environment section of the questionnaire.

Table 1 top 10 means for Art & design, Built Environment and Engineering

In table 1 highlighted are the top ten items, which were chosen to identify what preferences were foremost in importance and if there was a difference in these top factors. The highlighted sections are the factors that appeared in the top 10 for the students from each of the disciplines. Table 1 displays the spread of the top ten preferences for each school. From this it can be seen that 6 items are in the top 10 of all three university disciplines, ‘Access to libraries’, ‘Access to suitable clean toilets’ , ‘Spaciousness to avoid overcrowding’, ‘up to date technology’, ‘Comfortable temperature’ and ‘Access to technology’. As can be seen from the table there are however items that only appear in the top ten on one school. For the Art & Design students the ‘layout of the room allowing for both group and independent learning’, the ‘Ability to adjust furniture to meet your needs and ‘Control of environmental factors’ are rated to be most important when the other disciplines have not. However for engineering students they marked ‘Access to refreshments’ to be in the top ten but the other disciplines did not. From this table we can appreciate that although there is a general consensus on some of the preferences factors there are differences in requirements for different university disciplines. Furthermore this table suggests that students from the school of the built environment and the school of engineering a very similar in their preferences for factors in the learning environment. In contrast it can be seen that students from Art and Design differ a lot from the other two university disciplines.

A Kruskal-Wallis analysis was then conducted on the variables, the three schools and the items on the learning environments questionnaire. This test was conducted to identify if there was a statistical difference between preferred factors in the physical learning environment. Statistical differences were found between the schools on several items of the questionnaire. A statistical difference was found for the item layout of room allowing for both group and independent learning

(p<0.05) Pairwise comparisons revealed that the differences lay between the schools Engineering and Art &Design (p<0.05) and also between Built Environment and Art & Design (p<0.05). A statistical difference was also found on the item 'ability to adjust furniture to meet your needs' (p<0.05), A pairwise comparison showed the differences occurred between Built Environment and Art & Design (p<0.001) and between Environment and Art & Design (p<0.05). A difference was also found on the item 'Colour and textures of flooring furniture and surface finishes', the pairwise comparison revealed differences between just Engineering and Art & Design (p<0.05). A difference was also found on the item 'View out of windows', the pairwise comparison revealed that the differences lay between Engineering and Art & Design (p<0.01) and Built Environment and Art & Design (p<0.01). A difference in preference was found on the item 'Up to date technology' (p<0.01), the pairwise comparison found differences between preferences in both Built Environment and Art & Design (p<0.05) and Built Environment and Engineering (p<0.01). A difference in preference was found on the item 'Access to technology', a pairwise comparison revealed a difference between Built Environment and Engineering (p<0.05). A difference in preference was found on the item 'Natural lighting' (P<0.01), a pairwise comparison revealed a difference between Engineering and Art & Design (p<0.05). Overall it can be seen that students from different schools within the University do have some differing preferences in term of their physical learning environments.

Personality

As has been identified there are differences in preferences for factors in the physical learning environment. To identify if there is a difference in personality traits between university disciplines, analysis was conducted to identify any differing traits.

Table 2 Descriptive statistics FFM

The quality of the data was firstly examined, table 2 displays the descriptive statistics for the personality section of the survey. The table shows a good internal consistency for the Five Factor Model questionnaire α>7, (range= 0.81-0.88) this is therefore a good indicator of quality data. It can also be seen that there are low levels of kurtosis (-0.59 to 1.53), although Openness is slightly high, it is still within the criterion for significance (1.96). The low levels of skewness also suggest that is normal distribution within the data (-0.90 to 0.11). The mean scores on the Five Factor Model (FFM) are all above the midpoint of 30, within the parameters of 30 to 40. There is a large SD of factors (6.15 to 7.70) which infers that there is a considerable amount of individual differences within the sample. This further suggests that the data is of good quality.

Personality was then analysed for students from the three university disciplines, Engineering (E) Built Environment (BUE) and Art and Design (A&D). This analysis was conducted to identify if there was difference in personality traits between the university disciplines surveyed.

Table 3 Descriptive statistics FFM and subjects

Table 3 expresses the means and standard deviations of the FFM across the three university disciplines, the table suggests that Engineering had the highest mean for extraversion (m=33.73) however this is closely followed by BUE students (m=33.25) and A&D students (m=31.85). It can however be seen that for emotional stability BUE students had a mean (m=32.65) that was considerably higher than A&D students (m=28.97) with Engineering students sitting in the middle of these scores (m=30.79). From the table the means on the Openness scale also differ Engineering students scored much higher (m=38.64) than BUE students (m=34.78).

Inferential Analysis of personality and the three university disciplines

As the data was normally distributed ($p>0.05$), a one-way ANOVA was conducted between the FFM and the three disciplines, No significant variance in scores were found between Extraversion and the disciplines ($F=0.77$, $P=0.46$), Agreeableness and the disciplines ($F=2.86$, $p=0.06$) and Conscientiousness and the disciplines ($F=0.73$, $p=0.73$). There data did however suggest a variation in personality score for Emotional stability and the disciplines ($F=3.12$, $P<0.05$) and Openness and the disciplines ($F=5.12$, $P<0.05$).

A Post Hoc analysis was conducted using the Bonferroni adjustment revealed that Art and design students differed significantly to the built environment students on their emotional stability ($p<0.05$). It also revealed that for openness Art and design students differed significantly from Built environment students ($p<0.05$) and Built environment students differed from Engineering students ($P<0.05$). Therefore we can conclude that students from the three different university disciplines do differ significantly on certain personality traits.

Personality and physical learning Environments

Analysis was conducted on the individual factors of the physical learning environment to identify specific if factors of the learning environment interact with personality.

** Correlation is significant to 0.01 level * Correlation is significant to 0.05 level

Table 4 Bivariate correlations- physical learning environment and personality

Table 4 displays the factors of the preferences of factors in the physical learning environment that correlate with personality traits. It can be seen that no items on the questionnaire correlated significantly with Extraversion, however factors such as open social areas and informal learning spaces correlate significantly with agreeableness ($p<0.05$). Open social areas also correlate with agreeableness ($p<0.05$) and conscientiousness ($p<0.05$).

The highlighted factors are the factors that lay in the bottom half of the preferences table (Table 1). For example, although informal learning spaces appears in the bottom half of the table for its mean preference, a positive correlation between students who score highly on the agreeableness trait of the FFM also score highly on their preference for Informal learning spaces ($p<0.05$). This is the same for the factors, open social areas which correlate with Agreeableness ($p<0.05$) and conscientiousness ($p<0.05$), private social area which correlate with Agreeableness ($p<0.05$) and Openness ($p<0.05$), Clear signs in building which correlate with Agreeableness ($p<0.05$), Conscientiousness ($p<0.05$) and Openness ($p<0.05$) and View out of windows which correlate negatively with emotional stability (Neuroticism) ($p<0.05$). This consequently suggests that although factors may appear low on the list of preferences (Table 1), people with certain personality traits prefer factors that the general population on students don't find as important, therefore this suggests a relationship with personality and individual factors within the physical learning environment. Consequently supporting the hypothesis.

Community

The questionnaire was analysed to identify any notable factors that seemed important to student to boost their sense of community.

A positive correlation was found between students who took part in extracurricular activities ($X^2(1)= 0.18$, $p<0.05$) and feeling a sense of community.

Table 5 Descriptive statistics for community and identity factors in universities

Table 5 displays the descriptive statistics for the community factors of the physical Learning Environment. The means for factors of community and identity in university buildings range from 4.11-3.39 which are all above the mid-point suggesting that these factors may all be important to consider when designing university buildings. The descriptive statistics reveal that a welcoming environment (m=4.11), plenty of social space for both studying and socialising (m=4.10) and group workspace (m=4.09) are most important. This is closely followed by feeling part of the school you are from (m=3.86). From the data it suggests that students have a lower preference for signage on buildings as a clearly named home building for your school (m=3.39) and Clear signs to define space on campus (m=3.55) have lower means.

As these item were all above the mid-point of 3 (moderately important) a factor analysis was conducted to identify if there were any underlying themes that could be identified that may be important in establishing a feeling of community in the university. As the factors of the community were all rated between moderately important and very important a factors analysis was conducted on the factors to identify if there are and overall themes that could be identified to increase a sense of community,

Factor analysis for community factors

Table 6 Factor analysis for community factors in the university.

A principle axis rotation factor analysis was conducted on the community questionnaire. The Kaiser-Meyer-Olkin measure confirmed the adequacy of the sampling for the analysis (KMO=.86), The Bartletts Test of sphericity also presented a significant result ($p<0.001$) furthermore supporting the adequacy of the data. Table 6 displays how the components were divided into factors. The factor analysis divided the factors into three components, these have been renames 'Social space' which explains 25.92% of the variance, 'Sense of belonging' which explains 15.59% of the variance and 'Signage' which explains 14.63 % of the variance in scores. The results from this section of the analysis suggests that there may be specific factors should be consider when deigning physical learning environments, that may improve a sense of community in the university.

Discussion

The present study offers a unique understanding of how students perceive factors of their physical learning environment to be important. Currently there is a gap in the literature and understanding about the perceived features of importance in the design of physical learning environments (Rullman and Van den Kieboom, 2012). However, by identifying factors of the physical learning environment that increases student satisfaction and universities could increase institutional interest (CABE, 2005).

This research identified the factors of the physical learning environment that students identified as most important to them. From this, markedly it was noted that there was differences in student's ratings of importance for factors in the physical learning environment between the university disciplines. Another focus of this research explored the relationship between personality and university discipline. It was found that there was a difference in personality traits between the studied disciplines. Additionally to this different personality traits were found to have a relationship with certain factors of the physical learning environment. Therefore accepting the overall hypothesis of this research. Finally factors of the environment that could be incorporated into the design of university physical learning environments top develop a sense of community were identified.

Firstly this research identified factors that were most important to students. As it can be seen in table 1 for all three university disciplines this included access to libraries, access to suitable clean toilets,

spaciousness to avoid overcrowding, up to date technology, access to technology and comfortable temperature. It is not surprising that technology is rated the most important factors for all three university disciplines as technology is not so integral in day to day life (Lomas and Oblinger, 2006). Access to libraries is also not unexpected, as literature suggests that this is a very important part of students learning (Kuh and Gonyea, 2003). A library is also a place for students to meet which is important for the social side of academia (Damerest, 2004). Although access to suitable clean toilets may not come to mind when thinking of important factors in the physical learning environment, it has been noted that this may affect students wellbeing (Muhammad et al., 2014). Furthermore a vast body of research focuses on the environmental temperature of buildings (Douglas and Gifford, 2001; Yang et al., 2013), therefore this research supports the value of understanding the intricacies of such research. The current research also sheds light upon those factors that are most preferred by students when they are evaluating a physical learning environment to be suitable or not for them. The practicalities for such understanding, is that these features should have focused placed upon them in the designing of higher education institutes. These basic features are expected by all students to make their environment a satisfactory place to work in and therefore should be considered in the design process.

This research did furthermore, highlight that there may be differences in preferences for factors in the physical learning environment, for students from different university disciplines. This is shown through the Kruskal- Wallis analysis conducted on features of the environment and the preferences of students from different schools. This showed a statistical differences between preferences. For example, students from Engineering and Art & Design showed a statistical difference in preferences for 'Colour and textures of flooring furniture and surface finishes'. This difference may be explained by research conducted by Mendolia and Walker (2014) who found that personality was correlated with subject choice. Therefore students who pick different subjects have specific personality traits which therefore affect preferences for factors of the physical learning environments different to those from different subjects. These research findings consequently support the hypothesis of this research that there is a relationship between personality and preferences for factors within the physical learning environment. This has implications in the design process of buildings, this research stresses the importance to design the facilities specifically and compatibly with the students the building is intended for.

At the next phase of this research the personality of the three university disciplines was investigated a difference was found in personality traits for students from the three disciplines. This can be seen in the inferential statistics for the personality factors. For example students from art and design scored significantly lower on the emotional stability trait than students from the BUE. So students from the school of art a design portrayed lower levels of neuroticism. This supports a limited body of current literature that suggests that there may be a difference in personality between different subjects (Mendolia and Walker, 2014). This research however furthers current knowledge and highlights the differences in personality traits between subjects. This occurrence of personality differences between university disciplines may be due to the types of learners attracted to a specific subject. Duff et al. (2004) found that personality moderately determines one individual learning approach. This could affect ones subject choice as you choose a subject that compliments your approach to learning. Yueh et al. (2013) corroborates this by exploring the differences between engineers and scientists. Finding that they approach learning in very different ways. For example engineering scholars approach are more imaginative and creative than scientific scholars (Charyton and Merrill, 2009). This goes someway to explaining why there may be significant personality differences between university disciplines.

In conjunction with the difference in personality traits, this research also found that personality traits had a significant relationship with preferences for factors within the physical learning environment. This can be seen in table 4, for instance 'clear signs' in buildings had a relationship with conscientiousness and the personality trait openness had a relationship with 'open social areas'. 'Private social areas' was also found to have a relationship with those who had the traits agreeableness and openness. These relationships may be down to the features of the particular traits, for example those who are conscientious are organised and efficient (Goldberg, 1990). Therefore perhaps having clear signs appeals to this personality trait as it allows one to navigate easily around a building. More interestingly certain factors of the environment that did not appear to be rated very high overall by the students, in the first stage of analysis, had a significant relationship with certain personality traits. For example 'view out of the window' appeared in the bottom half of overall preferences however this was had a significant relationship with neuroticism. Therefore proposing that although, overall, this factor is not of high importance, but for those who score low on neuroticism this is important. This relationship between students who score low on neuroticism and a preference for the view out of the window may be due to high self-assurance (Turban and Lee, 2007). Therefore, perhaps they have confidence in the work they are doing so do not find having views out of windows distracting but interesting. This finding has an important impact of the design of higher education physical learning environments as confirms the importance of designing physical learning environment specifically for the intended users

Alongside the research there is a diverse range of students with differing personalities in university and it is important to integrate them all into the university community. In the analysis of features of the community, the findings identified a positive correlation between students who took part in extracurricular activities and feeling a sense of community. This suggests that students who partake in extracurricular activities have a better sense of community within the university than those who did not partake in any. This is unsurprising and is concurrent with current literature (Bickford and Wright, 2006). However there is a large body of students who attend university who do not take part in these extra-curricular activities, therefore for these students it would be interesting to how the environment could enhance their sense of community (McMillan and Chavis, 1986). This research identified three factors that may be essential when designing learning space to allow for the development of a sense of community. As shown in table 6, Social space, Sense of belonging and Identifying with buildings were highlighted. These were identified through a factor analysis as features that could contribute to developing a sense of community through the physical learning environment. These findings identify well with existing theory on a sense of community. McMillan and Chavis (1986) noted that sense of belonging and identification is important for one to develop a sense of community. Furthermore they noted that fulfilment of needs and shared emotional connection is important to develop a sense of community. From this research social spaces would provide students fulfilment of needs and having an identity may provide the shared connection. Social space allows for the planned and spontaneous meeting of students The International Personality Item Pool and the future of public-domain personality measures (Damerest, 2004), this can support community by managing encounters between individuals safely and efficiently (Temple, 2007 cited by Kok et al., 2011). When people have a sense on interdependence and feelings that you are part of a dependable structure it has been suggested that a Psychological sense of community can be realised (McMillan and Chavis, 1986; Burroughs and Eby, 1998; Rullman and Van den Kieboom, 2012) . By integrating a sense of belonging through the design of space, for example, being able to relate to others on your course through social spaces and by displaying work, this may increase a sense of community for the students.

If university buildings are developed and refurbished with users' needs in mind this this would hopefully future proof the lifespan of the building. The impact of developing and refurbishing

university institutions, taking into consideration the needs of the students may also have economic significance. If institutions are designed efficiently the first time, redevelopment and further refurbishment would be minimized. By providing spaces that satisfy student's requirements and not following a 'fad' in design the physical learning environments would be practical now and in the future.

Limitations

Although this research has offered the opportunity to investigate students from different university disciplines, the research is limited by the use of just three disciplines. By only using participants from Built Environment, Engineering and Art and Design the research cannot be generalised to other populations within universities. Furthermore the analysis shows students from Engineering and Built environment rated factors of the physical learning environment similarly and also had similar personality traits. This may be because they are very similar in their course structures and pedagogy. Therefore in subsequent research students from other university disciplines should be included to understand if there are larger differences in different subject types. In future research it is suggested that another subject, not from a science technology engineering and mathematics (STEM) subject should be included. This research is also affected by the differences in buildings that students reside in. As noted previously the physical learning environment affects students perceptions of quality (Kandiko and Mawer, 2013). Therefore the types of buildings that the students in this research learning in may have effected what they perceive as important. Students who are in the purpose built building may have been influenced in by their surroundings; rating factors of higher or lower importance because they have them available. Whereas students from the redesigned buildings may focus on specific things from their environments. This may therefore have skewed the findings. To address this it would be valuable to conduct this research with other universities. With the aim of identifying if the same cohort of students from other institutions identify the same features as important.

Future research and conclusions

This current research approached the design of higher education learning space from a new perspective. By focusing on students requirements in their physical learning environments it will offer the opportunity to design space to suit the users' needs. Instead of relying solely on how practitioners think space should be designed. This research notes that it is important to consider the users of the physical learning environments when designing the space and facilities. Personality appears to influence student's preference for factors of the design. Therefore by considering this in the design process the suitability of the space will be inherent in the structure that is developed. This could consequently lead to a more satisfactory environment for the students but could also help to reduce post- completion adaptations. Future research should aim to capture the preferences of the physical learning environment more completely by using qualitative data collection. Although the current research provided the opportunity to understand if there was differences in preferences and captured features of the physical learning environment students consider important. Qualitative data collection would allow for the research to understand why students may have differences in preferences and why certain factors are important to them in the design of physical learning environments. Ultimately the aim of this research is to develop information that could be utilised to influence sectional policy. Universities nationwide could adopt such policy to develop and refurbish their institutional buildings.

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Table 1- Descriptive statistics- Art & design, Built Environment and Engineering			
	Art and design	Built Environment	Engineering
	Mean	Mean	Mean
Formal learning spaces	3.64	3.92	3.73
Informal learning spaces	4.15	3.71	3.94
Lecture halls	3.58	4.06	3.94
Specialist teaching rooms (e.g. labs)	4.15	4.10	4.48
Access to libraries	4.54	4.35	4.36
Access suitable and clean toilets	4.75	4.48	4.58
Open social areas	3.98	3.77	3.55
Private social areas	3.58	3.56	3.58
Access to refreshments	4.32	4.00	4.24
Spaciousness to avoid overcrowding	4.59	4.21	4.33
Room layout allowing for easy visibility of teacher	4.15	4.15	4.42
Layout of room allowing for both group and independent learning	4.32	3.85	3.85
Ability to adjust furniture to meet your needs	4.34	3.35	3.67
Clear signs in buildings	4.17	4.06	3.91
Colour and textures of flooring furniture and surface finishes	3.41	3.04	2.73
Motivating environment e.g. Bright colours	3.47	3.21	2.97
Creating a natural environment e.g. Plants, plenty of windows	4.07	3.73	3.48
Comfortable furniture	4.25	4.10	4.30
View out of windows	4.14	3.27	3.24
Up to date technology	4.69	4.33	4.85
Access to technology (e.g. plugs, computers etc.)	4.73	4.42	4.85
Control of environmental factors e.g. Noise, lighting	4.34	4.06	4.09
Comfortable temperature	4.46	4.27	4.39
Natural lighting	4.56	4.19	4.06

Table 2- Descriptive statistics FFM					
	Mean	SD	Alpha	Skewness	Kurtosis
Extraversion	32.77	7.69	.88	-.28	-.30
Agreeableness	39.23	6.84	.88	-.72	.57
Conscientiousness	33.82	7.02	.82	.11	-.59
Emotional stability	30.66	7.70	.85	-.08	-.25
Openness	36.96	6.15	.81	-.90	1.53

Table 3- Descriptive statistics FFM and subjects			
FFM	School	Mean	SD
Extraversion	E	33.73	7.09
	BUE	33.25	7.79
	A&D	31.85	7.95
Agreeableness	A&D	40.49	6.62
	E	39.64	6.03
	BUE	37.40	7.22
Conscientiousness	BUE	34.42	6.52
	E	33.82	6.67
	A&D	33.70	7.65
Emotional stability	BUE	32.65	6.66
	E	30.79	7.39
	A&D	28.97	8.37
Openness	E	38.64	4.46
	A&D	37.81	6.88
	BUE	34.78	5.66

Table 4- Bivariate correlations- learning environment and personality					
	Extra	Agree	Consc	ES	Open
Informal learning spaces		.17*			
Access to libraries		.18*			
Access to suitable clean toilets		.29**	1.8*		.23**
Open social areas		.23**	.20*		
Private social areas		.20*			.19*
Access to refreshments		.28**			.19*
Spaciousness to avoid overcrowding		.21*			.17*
Clear signs in building		.18*	.17*		.21*
View out of windows				-.22*	
Up to date technology		.17*		-.18*	.22**
Access to technology		.24**		-.17*	.19*
Comfortable temperature		.18*		-.20*	

Table 5- Descriptive statistics for community and identity factors in universities		
	Mean	Standard deviation
Welcoming environment	4.11	0.82
Plenty of social space on campus for both studying and socialising	4.10	0.87
Group workspace	4.09	0.86
Feeling part of the school you are from	3.86	1.05
Inside space to socialise	3.77	1.01
Outside space to socialise	3.66	1.03
A hub where students from your school can go to work or socialise	3.62	1.04
Feeling part of the whole university	3.60	1.16
Don't have to travel far from home building to sessions	3.58	1.11
Clear signs to define space on campus	3.55	0.97
Variety of social spaces	3.45	1.06
A clearly named home building for your school	3.39	1.14

Table 6- Factor analysis for community factors in the university.						
Component	Factors	Factor Loading	Eigen Value	Cumulative Percentage variance	% of Variance Rotated	Rotation Cumulative %
1 Social space	Inside space to socialise	**.77**	5.22	43.47	25.92	25.92
	Outside space to socialise	**.77**				
	Variety of social spaces	**.68**				
	Plenty of space available on campus for both socialising and studying	**.63**				
	Group workspace	**.51**				
	A hub where students can go to work or socialise	**.51**				
	Welcoming environment	.44				
2 Sense of belonging	Feeling a part of the school you are from	**.74**	1.33	51.61	15.59	41.51
	Feeling a part of the whole university	**.66**				
3 Identifying with the buildings	Clear signs to define space on campus	**.80**	1.03	5.05	14.63	56.14
	A clearly named 'home' building for your school	**.68**				
	Don't have to travel far from home building to sessions	.43				