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After the Move to a New Campus—Effects on Students' Satisfaction with the Physical and Learning Environment

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Abstract: Few empirical studies in higher education consider the importance of the physical environment on students' satisfaction with the learning environment. The present study first examined the effects of a move to a new campus on students' satisfaction with the physical and learning environments. Then, it examined how students' satisfaction with a physical environment affects students' satisfaction with the learning environment. It was hypothesised that the move to a new and modern university campus with better study facilities would increase students' satisfaction both with the physical and learning environment, and that these two would be linked. Results contained 771 students' assessments of the Bachelor Evaluation Questionnaire, which included students' satisfaction with five aspects of their learning environment as well as five items assessing satisfaction with the physical environment. Findings showed that students were overall more satisfied with the physical environment in the new campus than in the old campus. These differences were even greater when comparing only students in their last study year than students of all study years. Furthermore, results showed that students' satisfaction with lecturers and teaching was predicted by increased satisfaction with classrooms. The implications of these findings for the need to design physical learning environments are discussed.

Keywords: physical environment; learning environment; new campus; student satisfaction; quality of studies

1. Introduction

Learning environment research has often focused on social or psychosocial environments, rather than on physical environments [1]. However, the settings where learning takes place can be an important factor in providing the best learning environment to students [2]. The evaluation of physical learning environments can especially be of relevance when new buildings, that intend to support teaching and learning, are designed [3]. Most of the existing research focuses on primary and secondary schools [4] and the implications of buildings and use of space in higher education on teaching and learning outcomes are not well explored [5]. Therefore, higher education facilities require evaluation in order to ascertain what helps to increase positive learning and to strengthen students' study satisfaction [6]. The current paper provides insight for future evaluations of higher education learning environments by analysing the relationships between students' reported satisfaction with the learning environment and their evaluation of different infrastructure conditions in two different physical environments.

1.1. Physical Classroom Environments

According to Tanner [7], places and spaces where students learn make a difference in their achievement levels in domains such as vocabulary reading and comprehension, language, arts, mathematics, and science. Classroom conditions have been found to be positively related to students' performance and attitude [8,9]. Results also reveal that students' perceptions rely heavily on spatial attributes, such as visibility and furniture, and ambient attributes, such as air quality and temperature, which are highly influenced by the design, management, and maintenance of classrooms [10].

Furthermore, some studies demonstrate the influence of the physical environment on students' behaviour and satisfaction in higher education [11–13]. Students report higher course enjoyment, classroom learning, and instructor organisation in upgraded classrooms (i.e., tiered seating, customised lighting packages, upgraded desks) than in standard classrooms [14]. Ambient conditions of the classroom and its spatial layout and functionality enhance students' satisfaction with the course [4] and students' evaluation of teaching [15,16]. Therefore, classroom physical design seems to have a relevant impact on students' learning as well as on the overall ratings of college instructors [17,18]. However, too often, the work of higher education is considered as taking place independently of the nature of learning spaces.

1.2. Learning Spaces in Higher Education

To date, few studies have examined the impact of space at post-secondary institutions, and most have relied on analysing the conditions within classrooms. However, students at higher education institutions are more autonomous and their learning occurs as much outside of the classroom as in the classroom [3,19]. Therefore, it is important to analyse how physical environment factors other than the classroom affect students' learning environment. The literature identifies the following sub-dimensions as components of physical environment quality: (a) library facilities, (b) computer room facilities, (c) lecture room facilities, (d) university layouts, and (e) social factors [20]. To that end, the link between the physical environment and learning seems to be complex, including many possible factors.

Research that analysed the moderating impact of ambient conditions on students' satisfaction can hardly be found [4], but an impact of the built environment factors on learning progress and students' general well-being, such as increased self-esteem, a sense of ownership, more exploratory behaviours, and social interactions among students, might be assumed [21]. It is possible to estimate the proportionate impact of built environment factors on learning progression, considering all influences together, and this amounts to a 25% contribution on average [22]. It also appears useful to include physical environment aspects in order to examine students' overall perceptions of service quality [20]. However, the wide range of factors involved in this holistic approach still leaves a significant design challenge [22].

Given the investment that is put into higher education infrastructures, and their potential impact in students' learning and satisfaction, it can be relevant to understand the relationship between students' satisfaction with the physical environment on campus and how it affects their learning in higher education. Therefore, the aim of the present study was to assess how changes in the physical environment, as well as students' satisfaction with it, affect students' satisfaction with their learning environment. To achieve this, students' satisfaction with their physical and learning environments were assessed before and after moving from a cramped and less modern campus to a new and state-of-the-art campus. It was hypothesised that the move to the new campus, with supposed better facilities and wider space, would increase students' satisfaction both with the physical (i.e., library, computer rooms, lecture rooms, and workplaces) and with the learning environment (course climate, course requirements, learning promotion, lecturers and teaching, and skill acquisition). Furthermore, it was hypothesised that students' satisfaction with the physical environment would affect students' satisfaction with the learning environment.

2. Materials and Methods

2.1. Procedure

Undergraduate students enrolled in the first, second, and third years of a 3-year long bachelor program in psychology at the University of Luxembourg participated in this study. Students of the three academic years completed the Bachelor Evaluation Questionnaire (BEQ; [23]), at the end of each winter term, in December. Evaluations took place at eight time points between the academic years 2011/12 and 2018/19. Students answered a paper-and-pencil German version of the BEQ. Answering the questionnaire took approximately 10 minutes and participants received no extra credits for completing the questionnaire.

2.2. Participants

Students completed $n = 771$ evaluations of the BEQ while they were enrolled in their first ($n = 327$), second ($n = 198$), and third years ($n = 239$). For seven evaluations, either the year of enrolment was not reported, or students were enrolled in additional years. Overall, $n = 643$ evaluations were from females and $n = 111$ from males. Seventeen evaluations did not report gender. Because students could take part in the evaluation several times throughout their studies (once every year), the results can contain evaluations from the same student enrolled in different years.

2.3. Learning Environment

The bachelor's in psychology at the University of Luxembourg is trilingual, and students must have a good command of German, French, and English. The course program has been offered since the academic year of 2005/06, and the studies extend over a period of three years culminating to a bachelor diploma (B.Sc.) in psychology and leading to the possibility of pursuing a Master's degree. The program has the seal of quality from the German Society of Psychology (DGPs), which is awarded to programs in psychology that meet international standards in terms of structure and content as well as scientific and research orientation. The program aims at providing a well-founded scientific background as well as knowledge in essential psychological theories that prepare students to conduct research and for the professional activity in psychology. It combines a scientific and empirical approach to psychology with a specific practical orientation. The program offers courses in the domains of fundamental psychological knowledge, methodological competences, and competences in the field of intervention. Furthermore, students have the possibility to choose some optional classes to create a personal study profile. Students can learn about different fields of applied psychology, such as clinical psychology, educational psychology, work and organisational psychology, forensic psychology, sport psychology, health psychology, and media psychology. The goals of the program are for students to acquire skills in theory, methodology, intervention, and advanced personal competences [23]. Throughout the academic years when the study program was evaluated, the program did not change on the structural level and there were few changes in lecturers (e.g., replacements during parental leaves).

2.4. Physical Environment

In 2015, the Faculty of Language and Literature, Humanities, Arts and Education from the University of Luxembourg moved from an old to a new campus. The old campus was dedicated to only that faculty, while the new campus was designed to bring together all faculties, departments, and services of the University of Luxembourg into a single campus.

The old campus was situated in Walferdange, a small town north of Luxembourg's capital. The campus was composed of seven small buildings, designated to offices, classrooms, IT rooms, laboratories, students' lounge, and logistics, surrounding a main building, which was a restored castle dating back to the year 1817, comprising the faculty's central administration, classrooms, a library, and a cafeteria. In terms of facilities, the campus had one library spread over two floors comprising collections from domains related to the faculty (language, literature, humanities, arts, and education)

and working space. Two IT rooms equipped with 30 computers each were available for teaching and for students' free use. Regarding workplaces, the campus had one main study room and several smaller places where students could work. In terms of classrooms, the campus had one big auditorium, three lecture rooms, and several smaller classrooms.

The new campus is situated in Belval, a new locality in the south of the country, which was rebuilt from an old steelwork site to become a large scientific and cultural centre in the country. The buildings dedicated to the different faculties, administration, and facilities of the University of Luxembourg are spread through the campus, among start-up incubators, research centres, governmental entities, tech and banking companies, cultural and music venues, shops, restaurants, and residences. In terms of facilities, the campus has one library that is incorporated into a big learning centre grouping collections of different domains of science, education, and culture, spread across five floors. It also has several workspaces and areas designed for individual and collaborative work, as well as many workstations equipped with computers, lecture and conference rooms, informal meeting areas, and relaxing areas. There is one main building dedicated to the central administration as well as teaching activities, which comprises five IT rooms, equipped with 30 to 60 computers each, 12 auditoriums, 60 seminar rooms equipped with interactive walls and technology to facilitate teaching, informal meeting and working areas, and exhibition spaces. Furthermore, the other buildings on campus dedicated to different faculties, each have laboratories, conference rooms, lecture halls, classrooms, working areas, and IT rooms. The campus has also five university restaurants spread through the site, a building for students' associations, and an arts and students' building that hosts cultural, artistic, and social events as well as students' organisations.

2.5. Measures

The BEQ [23] a 21-item inventory, was administered as a measure of students' satisfaction with the learning environment (five scales) and the physical environment (five items) during students' three-year study program.

In terms of learning environment, the BEQ assesses: course climate, which measures students' satisfaction with the course and university atmosphere (e.g., 'How satisfied are you with the course climate?', 3 items); course requirements, which measures students' satisfaction with the amount of workload (e.g., 'How satisfied are you with the required workload?', 2 items); learning promotion, which measures students' satisfaction with the development of critical thinking and learning (e.g., 'Through my current psychology studies, my willingness to question knowledge was encouraged', 3 items); lecturers and teaching, which measures students' satisfaction towards lecturers and the quality of teaching (e.g., 'How satisfied are you with the teaching presentation?', 5 items); and skill acquisition, which measures students' perceptions of the theoretical, transferable (practical), and research skills (e.g., 'Through my current psychology studies, I was able to acquire practical knowledge', 3 items).

In terms of physical environment, the BEQ has five items assessing classrooms ('How satisfied are you with the lecture halls/classrooms?'); the library ('How satisfied are you with the facilities of the library?'); IT equipment ('How satisfied are you with the communication technology equipment—computer rooms and software?'); workplaces ('How satisfied are you with the equipment in workstations?'); and rooms' capacity ('To which extent are courses suffering from overcrowding?').

Table 1 shows the descriptive statistics comprising all evaluations carried out in the eight time points (2011/12 to 2018/19) for each of the learning environment scales and physical environment items. Students answered each item, indicating their level of satisfaction on a Likert scale ranging from 1 = 'not at all' to 6 = 'fully'. Regarding students' satisfaction with the learning environment, the highest satisfaction was reported for course climate, followed by lecturers and teaching, skill acquisition, learning promotion, and course requirements. Regarding students' satisfaction with the physical environment, the highest satisfaction was reported for IT equipment, followed by room's capacity, classrooms, workplaces, and library.

Table 1. Descriptive statistics: mean, standard deviation (SD), sample size (n), and Cronbach's alpha (α) for all learning environment scales and physical environment items (all evaluations from the academic year 2011/12 to the academic year 2018/19).

	Mean	SD	n	α
Course climate	4.60	0.84	771	0.71
Course requirements	4.13	0.92	771	0.81
Learning promotion	4.54	0.83	770	0.75
Lecturers and teaching	4.57	0.57	771	0.78
Skill acquisition	4.56	0.75	770	0.64
Physical environment items				
Classrooms	4.44	1.27	770	–
Library	3.85	1.47	764	–
IT equipment	4.67	1.16	769	–
Workplaces	4.00	1.34	764	–
Rooms' capacity	4.51	1.42	767	–

2.6. Statistical Analyses

Changes from the old campus to the new campus regarding students' satisfaction with the learning and physical environment were compared using independent samples t-tests. First, students' satisfactions were compared including all evaluations of students who started and finished their studies in each campus (students from the old campus compared to those from new campus). For this analysis, to avoid confounding factors such as students' change of satisfaction across the years, evaluations from students who started in the old campus and finished in the new campus were not included. After that, to further understand the change in students' satisfaction from one campus to the other, and eliminate all effects due to students' seniority as well as repetitions, only evaluations of students in their last year of the old versus the new campus were included. This way, this analysis enabled a comparison in students' overall satisfaction from one campus to the other. Furthermore, this analysis allows the comparison of results with the analysis including all students from different years to ascertain whether seniority effects might be found.

To assess the influence of campus change and students' satisfaction with the physical environment in students' satisfaction with the learning environment, hierarchical regression analyses were conducted. Students' satisfaction with the learning environment (course climate, course requirements, learning promotion, lecturers and teaching, and skill acquisition) was regressed by first including gender (male, female) and year of enrolment (1st, 2nd, and 3rd) as control variables in the first step, then campus (old vs. new) in the second step, and z-standardised indicators of students' satisfaction with the physical environment (classrooms, library, IT equipment, workplaces, and rooms' capacity) in the third step. These regression analyses were conducted both for the group including all evaluations from students who finished and started their studies in the same campus, as well as for the group only including evaluations from students in their last year (for these analyses, all students were in their last year, therefore year of enrolment was not used as a control variable).

Prior to data interpretation, different additional analyses were conducted: comparisons comprising all evaluations including those who started and ended their studies in different campuses, comparisons with no repetitions analysing only students in their first year, and comparisons of the change among those who started in one campus and finished in the other (i.e., moved to the new campus in between their first and second year or in between their second and third year). Because these analyses yielded similar results to the ones listed above or did not offer additional information contributing to the interpretation of results, and for parsimony of data presentation, these analyses were not included.

3. Results

3.1. Differences in Students' Satisfaction with the Learning and Physical Environments in the Old and New Campus

Including all evaluations from students who started and finished their studies in the same campus (Table 2), students were overall statistically more satisfied with their learning and physical environments in the new campus than in the old campus. Regarding satisfaction with the learning environment sub-scales, students were statistically more satisfied with lecturers and teaching in the new campus than in the old campus but not in the other aspects. Regarding satisfaction with the physical environment sub-scales, students were statistically more satisfied with the classrooms, library, and workplaces, but not with IT equipment and rooms' capacity.

Table 2. Means, standard deviations (*SD*), *t*-values, significance levels, and effect sizes (ES; Cohen's *d*) of students' satisfaction with their learning environment (total, course climate, course requirements, learning promotion, teacher and teaching, and skill acquisition) and physical environment (total, classrooms, library, IT equipment, workplaces, and rooms' capacity) in the old campus (old) versus the new campus (new). All evaluations from students who started and finished their studies in the same campus are included.

	Old n **= 258**		**New** n **= 349**			
	Mean	**SD**	**Mean**	**SD**	***t*-test**	**ES**
Total learning environment	4.40	0.46	4.55	0.49	$t(605) = 3.87$ ***	$d = 0.34$
Course climate	4.53	0.83	4.67	0.84	$t(605) = 1.95$	$d = 0.17$
Course requirements	4.13	0.93	4.08	0.90	$t(605) = 0.67$	$d = 0.05$
Learning promotion	4.59	0.80	4.52	0.86	$t(605) = 1.06$	$d = 0.08$
Lecturers and teaching	4.53	0.53	4.63	0.60	$t(605) = 2.11$ *	$d = 0.18$
Skill acquisition	4.59	0.72	4.57	0.77	$t(605) = 0.42$	$d = 0.03$
Total physical environment	4.06	0.82	4.60	0.79	$t(605) = 8.09$ ***	$d = 0.67$
Classrooms	4.00	1.24	4.90	1.13	$t(604) = 9.38$ ***	$d = 0.76$
Library	3.36	1.41	4.40	1.41	$t(601) = 8.90$ ***	$d = 0.74$
IT equipment	4.67	1.20	4.81	1.10	$t(605) = 1.42$	$d = 0.12$
Workplaces	3.80	1.30	4.35	1.32	$t(598) = 5.10$ ***	$d = 0.42$
Rooms' capacity	4.49	1.46	4.52	1.44	$t(604) = 0.29$	$d = 0.02$

*$p < 0.05$, ***$p < 0.001$.

Including only evaluations of students in their last year (Table 3), students were again overall statistically more satisfied with their learning and physical environments in the new campus than in the old campus. Regarding satisfaction with the learning environment sub-scales, students were statistically more satisfied with the course climate, course requirements, and skill acquisition in the new campus than in the old campus but not with learning promotion or lecturers and teaching. Regarding satisfaction with the physical environment sub-scales, students were statistically more satisfied in all aspects assessed: classrooms, library, IT equipment, workplaces, and rooms' capacity.

Table 3. Means, standard deviations (*SD*), *t*-values, significance levels, and effect sizes (ES; Cohen's *d*) of students' satisfaction with their learning environment (total, course climate, course requirements, learning promotion, teacher and teaching, and skill acquisition) and physical environment (total, classrooms, library, IT equipment, workplaces, and rooms' capacity) in the old campus (old) versus the new campus (new). Only evaluations of students in their last year are included.

	Old $n = 48$		**New** $n = 78$			
	Mean	**SD**	**Mean**	**SD**	***t*-test**	**ES**
Total learning environment	4.18	0.43	4.66	0.51	$t(124) = 5.40$ ***	$d = 1.02$
Course climate	4.22	0.91	4.72	0.79	$t(124) = 3.30$ **	$d = 0.59$
Course requirements	3.80	1.08	4.31	0.87	[a] $t(84) = 2.77$ **	$d = 0.52$
Learning promotion	4.62	0.77	4.81	0.83	$t(124) = 1.26$	$d = 0.24$
Lecturers and teaching	4.55	0.51	4.72	0.59	$t(124) = 1.68$	$d = 0.31$
Skill acquisition	4.62	0.65	4.87	0.69	$t(124) = 2.05$ *	$d = 0.37$
Total physical environment	3.42	0.79	4.48	0.96	$t(124) = 6.46$ ***	$d = 1.21$
Classrooms	3.35	1.23	4.87	1.30	$t(123) = 6.47$ ***	$d = 1.20$
Library	3.08	1.24	4.10	1.58	$t(117) = 4.04$ ***	$d = 0.72$
IT equipment	4.19	1.02	4.88	1.12	$t(124) = 3.51$ **	$d = 0.64$
Workplaces	3.02	1.42	4.28	1.54	$t(124) = 4.60$ ***	$d = 0.85$
Rooms' capacity	3.46	1.52	4.28	1.47	$t(124) = 3.02$ **	$d = 0.55$

[a] Test values for equality of variances not assumed. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

3.2. Effects of Students' Satisfaction with the Physical Environment on Students' Satisfaction with the Learning Environment

Students' satisfaction with the learning environment was first regressed on the control variables gender (male, female) and year of enrolment (1st, 2nd, and 3rd), then in a second step on campus (old vs. new), and in a third step on the *z*-standardised items of students' satisfaction with the physical environment (Table 4). Results are hereby presented for each category of satisfaction with the learning environment, first including all evaluations from students who started and finished their studies in the same campus (a), then including only the evaluations of students in their last year (b).

Regarding course climate, the models including the control variables were significant predictors of students' satisfaction (a: $R^2 = 0.02$, $p < 0.01$; b: $R^2 = 0.04$, $p < 0.05$), with gender being the only significant predictor in the way that female students were more satisfied with course climate. Adding campus, the model remained significant but only for the analysis including only students in their last year (a: $\Delta R^2 = 0.00$, $p = 0.19$; b: $\Delta R^2 = 0.08$, $p < 0.01$), such that students in the new campus were more satisfied. Gender remained a significant predictor in both types of comparisons (a and b). The addition of students' satisfaction with the physical environment significantly improved the fit of the model only for the analyses including evaluations from all years (a: $\Delta R^2 = 0.05$, $p < 0.001$; b: $\Delta R^2 = 0.06$, $p = 0.18$). Within the analyses including evaluations from all years, being a female student, satisfaction with classrooms, and satisfaction with IT equipment were significant positive predictors of course climate satisfaction. Within analyses including only evaluations from students in their last year, campus and gender were no longer significant predictors of course climate satisfaction, nor were any other predictors.

Table 4. Three-step hierarchical multiple regression analysis for variables predicting students' satisfaction with the learning environment (course climate, course requirements, learning promotion, teacher and teaching, and skill acquisition). Predictors: campus (old vs. new), *z*-standardised classrooms, *z*-standardised library, *z*-standardised IT equipment, *z*-standardised workplaces, and *z*-standardised rooms' capacity. Upper table: All evaluations from students who started and finished their studies in the same campus are included. Control variables: gender (male, female) and year (1st, 2nd, 3rd). Lower table: Only evaluations of students in their last year are included. Control variables: gender (male, female).

	Course Climate		**Course Requirements**		**Learning Promotion**		**Lecturers and Teaching**		**Skill Acquisition**	
Variables	β	**SE** β	β	**SE** β	β	**SE** β	β	**SE** β	β	**SE** β
Step 1										
Gender	0.29 **	0.10	−0.09	0.11	0.19	0.10	0.13	0.07	0.08	0.08
Year	−0.03	0.02	−0.02	0.02	0.07 ***	0.02	−0.00	0.01	0.10 ***	0.02
Step 2										
Gender	0.28 **	0.10	−0.09	0.11	0.19	0.10	0.12	0.07	0.08	0.08
Year	−0.02	0.02	−0.03	0.02	0.07 ***	0.02	0.01	0.01	0.10 ***	0.02
Campus	0.06	0.07	−0.09	0.08	−0.02	0.07	0.09	0.05	0.06	0.06
Step 3										
Gender	0.27 **	0.10	−0.15	0.11	0.17	0.10	0.09	0.07	0.05	0.08
Year	−0.01	0.20	−0.01	0.02	0.08 ***	0.02	0.01	0.01	0.11 ***	0.02
Campus	0.03	0.08	−0.23 **	0.09	−0.14	0.08	−0.01	0.05	−0.06	0.07
Classrooms	0.10 *	0.04	0.08	0.04	0.06	0.04	0.12 ***	0.03	0.10 **	0.03
Library	−0.03	0.04	0.09 *	0.05	0.07	0.04	0.04	0.03	0.04	0.04
IT equipment	0.13 **	0.04	−0.12 **	0.05	−0.01	0.04	0.01	0.03	0.02	0.04
Workplaces	0.03	0.04	0.12 *	0.05	0.09	0.04	0.01	0.03	0.04	0.04
Rooms' capacity	0.02	0.03	0.09 *	0.04	−0.04	0.03	0.01	0.02	−0.01	0.03
Step 1										
Gender	0.47 *	0.22	−0.17	0.25	0.40	0.21	0.30 *	0.14	0.16	0.18
Step 2										
Gender	0.44 *	0.21	−.020	0.25	0.39	0.21	0.29 *	0.14	0.15	0.18
Campus	0.49 **	0.16	0.51 **	0.18	0.17	0.15	0.17	0.10	0.24	0.13
Step 3										
Gender	0.38	0.21	−0.34	0.24	0.33	0.21	0.27	0.14	0.09	0.18
Campus	0.32	0.18	0.10	0.20	0.02	0.18	0.03	0.12	0.04	0.15
Classrooms	0.07	0.08	0.15	0.09	0.01	0.08	0.14 *	0.05	0.11	0.07
Library	−0.08	0.10	0.01	0.11	−0.03	0.10	−0.02	0.07	0.03	0.08
IT equipment	0.19	0.10	−0.01	0.11	0.10	0.10	0.04	0.07	0.01	0.08
Workplaces	−0.03	0.09	0.12	0.10	0.10	0.09	−0.02	0.06	0.01	0.07
Rooms' capacity	0.10	0.08	0.21 *	0.09	0.01	0.08	−0.02	0.05	0.07	0.06

Note. Standardised coefficients are shown. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Regarding course requirements, none of the models including the control variables were significant predictors of students' satisfaction (a: $R^2 = 0.00$, $p = 0.45$; b: $R^2 = 0.00$, $p = 0.51$). Adding campus, the model remained not significant for the analysis including evaluations from all years (a: $\Delta R^2 = 0.00$, $p = 0.27$) but became significant for the analysis including only students in their last year (b: $\Delta R^2 = 0.06$, $p < 0.01$), such that students in the new campus were more satisfied with course requirements. The addition of students' satisfaction with the physical environment significantly improved the fit of the model for both analyses (a: $\Delta R^2 = 0.05$, $p < 0.001$; b: $\Delta R^2 = 0.13$, $p < 0.01$). Within the analyses including evaluations from all years, being on the old campus, having lower satisfaction with IT equipment, and having higher satisfaction with the library, workplaces, and rooms' capacity were significant predictors of course requirements satisfaction. Within analyses including only students in their last year, campus was no longer a significant predictor but students' satisfaction with rooms' capacity positively predicted satisfaction with course requirements.

Regarding learning promotion, the model including the control variables was only significant in the analyses including evaluations from all years (a: $R^2 = 0.03$, $p < 0.001$; b: $R^2 = 0.02$, $p = 0.06$), with year being the only significant predictor in a way that students enrolled in later years were more satisfied. Adding campus did not improve the fit of the models (a: $\Delta R^2 = 0.00$, $p = 0.75$; b: $\Delta R^2 = 0.01$, $p = 0.25$), but year of enrolment remained a significant positive predictor in the analyses including evaluations from all years. The addition of students' satisfaction with the physical environment significantly improved the fit of the model only for the analyses including evaluations from all years (a: $\Delta R^2 = 0.03$, $p < 0.01$; b: $\Delta R^2 = 0.04$, $p = 0.41$). However, in the analyses including evaluations from all years, only year of enrolment remained a significant positive predictor of learning promotion and none of the aspects of satisfaction with the physical environment were significant predictors.

Regarding lecturers and teaching, the model including the control variables was only significant in the analyses including evaluations from students in their last year (a: $R^2 = 0.01$, $p = 0.15$; b: $R^2 = 0.03$, $p < 0.05$), such that female students were more satisfied with lecturers and teaching. Adding campus did not improve the fit of the models (a: $\Delta R^2 = 0.01$, $p = 0.06$; b: $\Delta R^2 = 0.02$, $p = 0.10$), and evaluations from female students remained a significant positive predictor of satisfaction with lecturers and teaching in the analyses including only evaluations from students in their last year. The addition of students' satisfaction with the physical environment significantly improved the fit of the model only for the analyses including evaluations from all years (a: $\Delta R^2 = 0.05$, $p < 0.001$; b: $\Delta R^2 = 0.05$, $p = 0.24$), with students' satisfaction with classrooms significantly predicting satisfaction with lecturers and teaching. In the analyses including only evaluations from students in their last year, even though the model was not significant, students' satisfaction with classrooms was a significantly predictor of satisfaction with lecturers and teaching and gender was no longer a significant predictor.

Regarding skill acquisition, the model including the control variables was only significant in the analyses including evaluations from all years (a: $R^2 = 0.06$, $p < 0.001$; b: $R^2 = 0.01$, $p = 0.36$), such that students enrolled in later years were more satisfied with skill acquisition. Adding campus did not improve the fit of the models (a: $\Delta R^2 = 0.00$, $p = 0.35$; b: $\Delta R^2 = 0.03$, $p = 0.06$), and year of enrolment remained a significant positive predictor of satisfaction with skill acquisition in the analyses including evaluations from all years. The addition of students' satisfaction with the physical environment significantly improved the fit of the model only for the analyses including evaluations from all years (a: $\Delta R^2 = 0.04$, $p < 0.01$; b: $\Delta R^2 = 0.06$, $p = 0.20$), with students' satisfaction with classrooms significantly predicting satisfaction with skill acquisition and year of enrolment remaining a significant positive predictor.

4. Discussion

Learning is at the centre of the academic experience and to foster students' learning it is important to understand different factors that influence it. Even though research on the influence of physical spaces in students' learning in higher education is scarce [4], it is known that the spaces where students learn have an impact on their satisfaction with the learning environment and even with how they

perceive the quality of learning [14]. For these reasons, it is beneficial that higher education institutions become aware of how important it is to evaluate students' perceptions of their physical environment and understand how they affect their learning environment.

The first aim of this study was thus to assess whether the move from an old and not modern campus to a new and state-of-the-art campus would affect students' satisfaction with their physical environment as well as with their learning environment. To do that, first all evaluations from students who had started and finished their studies in the same campus were compared. Then, the same comparison was carried out including only evaluations from students in their last year.

We found that overall, students' satisfaction was higher in the new campus compared to the old campus. In terms of learning environment, comparing evaluations from all students, only students' satisfaction with lecturers and teaching yielded a significant difference but with a low effect size. Comparing only students in their last year, students were more satisfied with course climate, course requirements, and skill acquisition. In terms of students' satisfaction with the physical environment, not only did students' overall satisfaction increase from one campus to the other, but also, their satisfaction with classrooms, the library, and the workplaces improved significantly. For those in their last year, the increase in satisfaction was reflected at all levels: classrooms, library, IT equipment, workplaces, and room's capacity.

Taken together, these results are in agreement with previous research that demonstrates that upgraded learning spaces are linked to an increase in students' satisfaction with the physical environment (e.g., [11]) and to some aspects of students' satisfaction with the learning environment (e.g., [14]). We found that students' satisfaction varied the most depending on which group was analysed (all students from different years or only students in their last year). Overall, we found more differences in student's physical and learning environment satisfaction between campuses when including only students in their last year than when including students of all years. This can indicate that some aspects might become more relevant to students in their later years or that having a global overview of their study program might enable students to become more critical. However, combining the analyses from these two groups together, we could not show that simply moving to a more modern campus was related to students' increased satisfaction with their learning promotion or lecturers and teaching.

To ascertain whether the change to a new campus, as well as the satisfaction with the physical environment, played a role in students' satisfaction with the learning environment, we tested different regression models. We found that in terms of control variables, evaluations from female students significantly predicted satisfaction with course climate in both comparison groups and satisfaction with lecturers and teaching in the comparison including only evaluations from students in their last year. However, this effect disappeared once physical learning environment variables were added. Previous studies have found that gender plays a significant role in the assessment of physical attributes [24], and that age and gender bias students' evaluations of teaching [25]. Thus, our results only partially confirm these previous results, demonstrating that gender only played a significant role, beyond the role of satisfaction with physical environment, in students' satisfaction with the course climate. Regarding the effect of seniority, we found that students' increased satisfaction with learning promotion and skill acquisition in later years went beyond their satisfaction with physical environment aspects. Considering that learning promotion and skill acquisition are directly linked to improved learning and accumulation of knowledge, it is not surprising that these increase with study years [23].

Regarding the role of campus and physical environment aspects on students' satisfaction with the learning environment, we found that comparing evaluations from all years, the change in campus did not predict higher satisfaction but that different aspects of satisfaction with the physical environment did. Notably, higher satisfaction with IT equipment predicted lower satisfaction with course requirements. This result is in line with previous research that found that technology may have no impact and even have a detrimental one on students' learning experiences [26]. In addition, being in the old campus was linked to higher satisfaction with course requirements. Regarding predictors of students' satisfaction

with lecturers and teaching, it was found that students' satisfaction with classrooms was the only significant predictor. Similarly, satisfaction with classrooms also significantly predicted students' perceived skill acquisition. These results support previous research showing that despite lecturers and the contents being taught remaining the same, students tend to evaluate teaching more positively in upgraded classrooms than in traditional classrooms [14]. This may be because well-designed classrooms, which offer more communication possibilities between lecturers and students, enable lecturers to teach in more diverse learning styles [27].

Comparing only evaluations of students in their last year, we found that, when taking gender into account, the change in campus was a significant predictor of increased satisfaction with course climate and course requirements. However, when adding the physical environment factors, only the rooms' capacity became a significant predictor of satisfaction with course requirements and again, similarly to the comparison including evaluations from all years, students' satisfaction with classrooms was a significant predictor of increased satisfaction with lecturers and teaching.

Overall, these results indicate that new and modern buildings and infrastructure are indeed related to an increase in students' satisfaction with their physical environment. However, the link between increased satisfaction with the physical environment and increase in the learning environment is less clear. Some aspects such as students' satisfaction with lecturers and teaching do seem to be related to specific physical aspects such as classrooms' satisfaction. However, for other learning environment aspects, it seems that it may depend rather on which student's cohorts we are comparing. The fact that we found more effects related to the physical environment if we included all students independently of their year of studies instead of only students in their last year, may suggest that students of different years are differently impacted by the physical environment in their learning. This further suggests that students in their earlier years may be more influenced by aspects of physical environment in their learning environment satisfaction than students in their later years.

The present results offer some implications that may be relevant for the design of physical learning environments. The results pave the way to a better understanding of how the physical environment in higher education can play a role in students' academic development and learning. Furthermore, because students' satisfaction is a key variable in explaining the holistic evaluation of a course [4], the findings throw light on the need of managerial decision-making about space issues affecting the learning of students.

4.1. Future Directions

Even though the present results provide us with a better understanding on how students' satisfaction with their physical and learning environments may change depending on facilities and infrastructure, as well as how these relate to increased learning satisfaction, there are still aspects that remain to be answered. From our study, we could not ascertain which aspects of the new campus made students' satisfaction increase. It could be the fact that the buildings are new, that there is a cleaner and brighter environment, that there are more facilities and wider spaces, or even that, because all faculties are re-grouped, there are more students around and more vibrant student life. Furthermore, new building evaluation methodologies are required to understand in detail how learning environments could support educational programs [6]. Hence, further research is needed to clarify the relationship between space and learning and teaching effects. Additionally, students' satisfaction with the learning environment may not lead to better study outcomes. Indeed, in Hill and Epps's [14] study, they found that increased satisfaction with the classroom was linked to an increased satisfaction with teaching but that it did not increase students' performance. Future studies should consider expanding the research on this topic by including students' evaluations of courses as well as indicators of students' academic performance.

4.2. Limitations

The present study also presents some limitations. The first limitation is that the present study centred on only some aspects of satisfaction with the physical environment that might influence students' satisfaction with learning. There are many other potentially influential factors that were not considered, such as students' attitudes, expectations, relations to peers, and interaction with lecturers. Related to this, is also the limitation that most of our R square values were much lower than 1, most not exceeding 0.10. This indicates that our models predicting students' satisfaction with the learning environment did not include many other factors that are relevant to explain it. Thus, future studies should consider including other factors, which may make the predictive models more effective and accurate. Another limitation is that even though changes in lecturers was not systematic, there were some changes across the years that could not be taken into account. Additionally, one should consider that the different campuses may attract different students, thus influencing their evaluations. Finally, it must be noted that the present results reveal cross-sectional relations and that a longitudinal analysis, considering changed attitudes of the same students moving from one campus to another, could provide further insight into the effects of physical environments in students' satisfaction with learning.

5. Conclusions

The present findings show that regarding changes in students' satisfaction from an old to a new campus, students were overall more satisfied with the physical environment in the new campus than in the old campus. Furthermore, results showed that students' satisfaction with lecturers and teaching was predicted by increased satisfaction with classrooms. However, increased satisfaction with the learning environment from one campus to the other and the link between physical and learning environment aspects (other than lecturers and teaching) depended mostly on the student cohorts being analysed. Overall, these findings are a few steps closer to understanding the diversity of aspects influencing students' academic learning. However, further research is needed to understand the link between physical spaces and learning in higher education institutions.

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