

Article

Design and Validation of a Questionnaire on Influence of the University Classroom on Motivation and Sociability

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Abstract: In recent years, the changes experienced in the educational and social field have been reflected in the growing interest in defining how the attributes of the learning space affect students. This study seeks to determine the influence exerted by the design and organization of the university classroom on motivation and social interaction. The objective was to develop and validate a measurement instrument to evaluate the impact of the university classroom design on the student, considering their physical, environmental, perceptual, and motivational attributes. The questionnaire was applied to a sample of 402 students from the University of Almeria (Spain). The reliability and content validity of the construct were analyzed. Reliability was demonstrated by a Cronbach's alpha of 0.938 for the dimensions with quantitative cut items, being highly satisfactory. The Chi-square goodness of fit test analyzed the qualitative items. Content validity was subject to expert judgment. It is concluded that the presented instrument meets the required technical attributes, to be considered a reliable and valid educational tool for measurement.

Keywords: questionnaire; validation; classroom; motivation; sociability; higher education



Citation: González-Zamar, M.-D.; Jiménez, L.O.; Ayala, A.S. Design and Validation of a Questionnaire on Influence of the University Classroom on Motivation and Sociability. *Educ. Sci.* **2021**, *11*, 183. <https://doi.org/10.3390/educsci11040183>

Academic Editor: James Albright

Received: 21 March 2021

Accepted: 8 April 2021

Published: 13 April 2021

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1. Introduction

Starting from the concept of the human being as the central axis of the learning process, the educational space of the classroom is considered as the place where students live, coexist, transfer knowledge, and, therefore, are formed as free citizens and protagonists of society. Nowadays, learning spaces are not understood as a simple volumetric container of activities, but their concept goes beyond a mere architectural object. This, being appropriated by students and teachers, manages to influence academic motivation, behavior, and social relationships [1].

Even though practically any place could be used to teach and learn, the design and organization that acquires a space explicitly proposed for this purpose manages to favor the cultural exchange of norms and values, in addition to experiential and attitudinal learning. To this day, the classroom continues to be the physical setting that symbolizes school pedagogy par excellence. It is the traditional basic cell and the cornerstone in the construction of school buildings [2].

In recent decades, both the progress made in educational theories and paradigms and the introduction of innovative pedagogical strategies and information and communication technologies (ICT) have generated the need to rethink changes in educational research. All of them focused on investigating the transformations that the design, structure, and organization of learning spaces should undergo. In this sense, universities must implement new methodologies adapted to ICT and the physical, environmental, technological, and social needs and conditions of classrooms and their students [3,4].

The university, in its institutional role as a social and cultural space par excellence, requires imminent actions, even more so after the implementation of the Bologna Plan in 2010 and its European Higher Education Area (EHEA). Its implementation required a leap in quality, requiring a new positioning before society as an architectural, environmental,

and sustainable paradigm [5]. The transformation of university learning spaces and their campuses is a need to which institutions must respond. For this, new alternative learning modalities to the master class must be implemented, giving way to innovative pedagogical formats that require adequate didactic spaces to house them.

It is interesting to mention that this research work was carried out prior to the arrival of COVID-19. In this context, COVID-19 has entered the lives of human beings, causing devastating effects on the health and life of a large part of the world population, affecting the social, economic, and educational spheres of the planet. The impact of COVID-19 on teaching has led to the suspension of face-to-face classes and social contact, adapting the learning process, classes, exams, or virtual encounters to virtuality [6,7].

In this scenario, the university classrooms, when they reopen, will not be the same, nor will their campuses or educational spaces, having to adapt to new circumstances and providing flexibility and adaptability when organizing and using them [8–10]. COVID-19 and the state of confinement will increase the need to know what the return to physical spaces will be like, what measures will be adopted, and what design the landing spaces require to ensure virus-free enclosures [11].

In the literature review carried out, studies that address this issue have been found, so that the research question refers to analyzing whether certain qualities of the classroom affect the ways in which those who inhabit it relate and motivate themselves.

Consequently, the objective was to develop and validate a measurement instrument carried out ad-hoc to evaluate the impact of the design of the university learning space on the student, considering their physical, environmental, perceptual, and motivational attributes. It is of interest to know the influence of the classroom design on the motivation and social relations of the students and, ultimately, on the teaching processes, to adapt the educational ecosystems to the new requirements.

This study is structured as follows. Section 2 reveals the importance of the research topic, conducting a review of its basic concepts. Section 3 explains the methodology applied to carry out and validate the questionnaire. Section 4 shows and analyzes the results in context. Section 5 includes the discussion. Finally, Section 6 presents the limitations of the research and Section 7 the conclusions.

2. Backgrounds

2.1. Physical Dimensions of the Classroom

The changes experienced in recent years in the educational and social field have been reflected in the growing interest in knowing the variables that intervene in the academic act. This is supported by research that has addressed the relationship between the attributes of physical space, the methodology used, and the influence that both have on the teaching–learning process and the students [3,12,13].

The design, quality, and adaptation of the learning spaces favor students to maintain positive emotions, feel integrated and valued, and thus experience more favorable academic results [14]. Academic achievement is influenced by the articulation between the physical and architectural conditions of the building, and the social and perceptual environment that students appreciate about them, affecting their performance and motivation [15].

Previous literature shows clear and reliable evidence of the link between student satisfaction with their environment and the academic results obtained. In this way, if students experience personal well-being and attachment to the place where they spend a large part of their daily life, this translates into a positive impact on their attention, motivation, learning, and academic performance [16].

On the other hand, the impact that design has on learning spaces, considering it as an element that intervenes in the social connection of students, allows the promotion of social skills such as collaboration, reflection, exchange, and interaction [17]. On the contrary, if the design is insufficient, it can favor the development of childhood disorders, such as tacit muteness and the lack of social interaction. Rethinking the classroom space implies considering the time to create a new model that connects the physical space with

educational pedagogies—that is, to promote the idea that learning takes place anywhere and at any time, designing pleasant, flexible, and close meeting areas as a natural meeting point for the subjects.

The influence of learning environments on children’s cognitive development [18,19] and early literacy [20] is undeniable. The primary cognitive development of human beings occurs through the relationships that we maintain with our environment and sociocultural stimuli perceived as external information [21]. Hence, the study of the relationship between physical space and its impact on human behavioral processes is not something new.

Learning spaces are affected by variables of a very diverse nature, particularly physical, environmental, and social. Therefore, determining its impact on those who inhabit it is complex. In general, research on this topic has been limited to offering data, measurements, and levels of a merely physical–environmental nature that comply with the technical regulations in terms of compliance with minimum conditions of ventilation, lighting, acoustics, and thermal comfort, among others.

The evolution of this subject has continued in the line of relating the attributes of the physical space with the methodology used and the influence that both have on the teaching and learning process and the students.

Likewise, numerous studies have implied an important evolution in the educational field, although sometimes the results have been treated in a concise and imprecise manner. In this sense, because of the above, these works lack a holistic, integrative, and organized vision of the issue, in addition to not correlating the physical with the perceptual and impressions of the protagonists in their exchange with the environment.

The specialized literature indicates that the physical attributes of the environment and the configuration of the learning space act on the perceptions of students. In this dialogue, where the level of well-being and the functional possibilities offered by the space are related, the impact on the learning process of those who inhabit it can be positive if the conditions are [18,20,22].

2.2. Technological–Digital Dimensions of the Classroom

In the current context, the insertion of new work tools caused by technological advances has generated new virtual spaces, even more so in higher education and with the presence of COVID-19. The expansion of technology and its evolution have led to the generation of virtual classrooms, where students and teachers maintain remote communication, relying on classes and material hosted on digital platforms, and where learning processes have adapted and evolved towards new pedagogical approaches. The inclusion of the ICT and the large information network that the Internet represents today has led to a true revolution in the classroom and in education [23–26].

The spatial configuration of the classroom has had to adapt, since the classroom-classroom disappears as the only possible scenario, with the emergence of resources and other real and virtual spaces designed to meet the objective of diversifying the learning process. The virtual network space proposes a more collaborative and active work when it comes to the search for information by the students, thus taking advantage of the tools that technology offers us [27,28]; that is, there is a complete and profound transformation. In this context, where the walls of the classroom have disappeared, spaces are created, devoid of physical dimension, that constitute an online learning tool. The so-called virtual classrooms allow access to a multiplicity of cultural, informative, and relational resources, which break even more the classic concept of educational space [10,29]. These spaces have nothing to do with the meaning and characteristics, precise and complex, of the physical and material classroom, although authors agree that they should be designed offering the maximum flexibility and attention that physical spaces offer [18,20,22].

University students recognize a close language in digital interfaces. Virtual reality and augmented reality are setting a trend with great impact in various studies and proposals applied to the field of education and in its creative process [30,31]. In any case, innovation, creativity, immersion, fascination, technology, and information are words that define

and accompany learning using immersive simulation. In this educational approach, the incorporation of ICT, together with the application of new pedagogies in the classroom, has established a need to reinvent the way of teaching and learning [32].

The need for the university spaces of the third millennium to respond not only to the methodological and technological demands of the times in which its actors develop, but also to the emergence of pandemics and health emergencies, suggests the need to enhance not only the spatial and physical attributes of the classroom but also the technological and sanitary attributes of each educational ecosystem [33,34]. Research in the field of ICT and education is becoming increasingly relevant, assuming a working tool for students and teaching staff.

Research at the international level, in general, focuses on the educational levels of preschool and primary school, pointing out the connection between the learning space and the theories of children's development [35]. Otherwise, it focuses on the study of the university academic level, which is practically left aside.

Faced with this reality, the present work sets the objective of designing and validating a measurement instrument to evaluate the influence of the design of the university educational space on the motivation and social interaction of the student at the University of Almeria (Almeria, Spain), considering its physical, environmental, perceptual, and motivational attributes.

For the foundation of the instrument, prepared ad hoc, it is intended to work under the conceptual and operational definition of indicators that meet the psychometric characteristics required to check to what extent the design and organization of the classroom (physical and environmental variables) affect motivation and sociability of the students.

3. Materials and Methods

3.1. Participants

To carry out the statistical studies required in the validation of the questionnaire under study, we rely on a sample in which 402 university students participated (71.7% women and 28.3% men), between 18 and 30 years old, belonging to academic departments of the University of Almeria, during the academic year 2018–2019. The area of knowledge of education was considered due to the high number of both enrolled students and class attendance, allowing greater representativeness of the sample.

To select the sample, we worked with non-probabilistic samples, adjusting to the criteria and objectives set out in the research [36]. This is a random or accessibility-type sampling used in educational research, since it is easy to access as well as interesting due to the possibility of working with higher education students in the city of Almeria. Likewise, the data to be obtained will provide us with a large amount of information with maximum quality, which will provide forcefulness to the results [37].

Table 1 shows the distribution of the sample by university degree and academic year. The university degrees considered were Early Childhood Education, Primary Education, and Social Education. The academic courses to which the surveyed students belonged were 2nd and 3rd year—that is, intermediate courses in relation to a 4-year university degree.

Table 1. Sample data by university degree and course (2018–2019).

University Degree	Second Course	Third Course	Total
Infant Education	20	170	190
Primary Education	153	2	155
Social Education	32	25	57
Total	205	197	402

Source: Research data.

A pilot study carried out initially with a small sample allowed us to verify the degree of understanding of the questionnaire from a mixed, quantitative, and qualitative point of

view. In this way, the questions, indications, and doubts presented to the subjects during their completion could be adjusted.

3.2. Instrument

To address the objective pursued and be able to assess the opinion that university students have of the impact of the design and organization of classrooms in their learning process and social and motivational attitudes, the questionnaire was designed and used as a tool for data collection [38,39]. The choice of the instrument responds to the quantitative methodology and the nature of the data that we are concerned with obtaining. In our case, it is related to motivation and perception of various attributes of the classroom space [40].

The instrument, developed expressly for this study, seeks to measure and evaluate the influence of the design of the educational space on the university student and responds to the theoretical reflections derived from the bibliographic review previously carried out. In this way, it was decided to build a battery of items to determine the factors and indicators associated with the design of the classroom that affect the student. The inclusion of items related to different dimensions that are considered key during the theoretical conceptualization of the topic was considered. From here, the dimensions created were the following four: spatial, environmental, perceptual, and motivational.

In this way, the questionnaire was made up of a total of 62 items, with closed dichotomous and multichotomic questions with a single response, and questions with a Likert-type scale (1 to 6, where 1 indicates “totally disagree” and 6 “totally agree”) that students must answer (see Appendix A).

3.3. Data Collection

The completion of the questionnaires was carried out on a scheduled basis in different classes, classrooms, and work groups, and under the supervision of teachers and researchers with extensive experience, during the 2018–2019 academic year. For this, when visiting the students in person in the classes, they were provided with a web link that gave access to the virtual Google Forms tool, allowing them to easily and comfortably complete and complete the questionnaire.

In the initial part of the instrument, the students were informed of the purpose of the study and the importance of their participation in it. The doubts that arose were also explained and resolved. In addition, the voluntary and anonymous nature of their responses was emphasized, along with the confidentiality of the information obtained and the purpose of which was indicated. The estimated time to complete the questionnaire was around 20 min.

3.4. Justification for Preparing the Questionnaire: Design Variables

The literature review made it possible to develop an adequate measurement instrument, considering the variables and indicators under study that affected the group of students. In this sense, there is a large volume of research that recognizes certain design factors that intervene in the classroom and its level of impact, both in motivation [4,18] and in the social relations of students [14,35]. In recent decades, this research topic has acquired special relevance, with the publication of many works worldwide [2,13,41].

To prepare the questionnaire, the factors were grouped into four dimensions: spatial, environmental, perceptual, and motivational. This classification attends to previous studies and, in addition, it is relevant to find support in the concepts, theoretical reflections, and practical studies that emanate from them, to then translate them into observable and quantifiable dimensions and indicators.

During the use of a space, various variables, exogenous and endogenous, act, which means that the learning space can be approached according to numerous concepts. The literature review allowed us to detect research that recognizes certain design factors, which intervene in the classroom and affect its impact.

So far, although there is no single model for the definition of an optimal learning space [42], the consensus among the authors prevails when considering the physical environment of the classroom as one of the most important indicators that determine benefits in student learning [19,43,44]. The environmental and spatial dimensions have aroused the greatest interest in researchers, being of great interest to establish the relationship between the physical factors or conditioning factors of the environment and their influence on the development of learning processes.

From a holistic perspective, some authors determined a series of variables that favor student stimulation depending on the configuration and design of the classroom, considering certain parameters of the environmental design [3,44]. A relationship has been found between the physical variables of the built environment, such as lighting [45], temperature [22], thermal comfort [46], color [41], the materials [47], the noise level [44], indoor air quality, and their effects on teaching and learning processes [48].

On the other hand, the proposed spatial dimension meets the recommendations specified by Weinstein (1979) [49], who initiated studies on the impact of classroom environments on student behavior, attitudes, and achievements. For this reason, the physical distribution of the classroom is considered, including all the components that constitute it, such as spatial proportionality and dimensions, which must be considered as external learning conditions. The fixed environment defines the permanent and immobile territory of the architectural structure, in addition to conditioning and delimiting the movement and behavior of the subject inside. In this sense, the morphology of the building, the size, the enclosures, the floors and the ceilings, and the internal divisions [50] of the schools should play a role in offering a visual continuity supported by methodologies that favor participatory, active, collective learning and collaboration.

On the other hand, the semi-fixed elements, which, by their nature, allow a greater possibility of being modified, have furniture as a protagonist and its strategic role in the classroom, showing that the typological and organizational changes in the furniture have a direct impact on the learning experience of the student and in their academic motivation [47].

The third dimension that has been addressed is the perceptual. The study is of interest because it considers the subject as an active protagonist who inhabits the school space. In this way, the student's perception is related to the level of well-being that she recognizes in the use of the space that surrounds her, impacting positively or negatively on her learning process. Hence, the impact that it has on his behavior is recognized. Pioneering studies analyze the physical environment and human performance in spaces, and the interaction between them, an aspect that would later be addressed by Environmental Psychology [51].

To study the perceptual variables of the classroom, the spatial behavior model developed by Altman (1975) [52] has been considered. This model integrates the concepts concerning the relationship between the physical-spatial dimensions of behavior and the concepts of personal space, privacy, territoriality, and overcrowding of the subject.

Finally, the motivational dimension arises from other variables widely used in research, such as academic performance. Unlike other questionnaires, this one proposes to attend to cognitive and attitudinal factors that influence student efficiency [53]. The literature review allowed the inclusion of items that recognize teaching methodologies to process information [12,14]: the responsibility of the student towards learning [3,18] and the presence of social networks as a transforming element of human behavior in relation to distraction, communication, emotions, autonomy and identity [54].

The motivational dimension attends to the ARCS Model (Attention, Relevance, Confidence, and Satisfaction); that is, the four categories explain the learning processes in relation to the theory of motivation [55,56]. Likewise, academic stress has been considered as a factor of concern in the face of evaluation and failure situations [57] and other variables that affect the student's motivation and involvement in learning.

In this way, the design used for the questionnaire (see Appendix A) allowed us to approach social reality through concrete, regular situations that permit generalization. On

the one hand, questions are exposed where the physical and environmental aspects of the learning spaces intervene and, on the other hand, it seeks to ascertain the perception and mood of the students when they are in the classrooms and the way of feeling and acting in the case that these spaces were transformed.

After reviewing the literature, the theoretical concepts were operationalized, grouping them into dimensions, indicators, or empirical variables that helped to specify items or questions (see Appendix B) [58,59]. Conceptual operationalization is the process through which the definition, delimitation, and identification of the dimensions of a concept is carried out. It consists of extracting conceptions and purposes that make up a theory and translating them into operational terms. Thus, the variables or indicators that will allow us the empirical contrast of the concept being analyzed are deduced. From here, the design of a battery of items made it possible to determine the indicators associated with the design of the classroom that affect the student. In this way, they worked with four dimensions.

4. Results

After carrying out an initial descriptive study of the answers obtained in the questionnaire, the reliability and validity of the questionnaire was studied, with the purpose of providing the data with veracity and guaranteeing the instrument [60]. No irregular behavior was found in the variability and central tendencies of the items.

Hence, the reliability of the instrument was calculated through Cronbach's alpha coefficient [61] with the IBM SPSS Statistics software package, version 25, for the most representative quantitative cut dimensions that constitute it. To achieve the optimal levels of content validity, the expert technique was used to achieve validity to the degree of adequacy of the sample in relation to what it is intended to measure [62]. Finally, the psychometric requirements were considered [63–65].

In the following sections, the instrument validation process is indicated.

4.1. Content Validity

To meet the conditions related to content validity, the variables must be representative of the construct to be evaluated [60]. In this sense, the questionnaires developed for this work have been submitted to the judgment of experts, in which ten professors from different Spanish universities participated, selected according to the criteria of being recognized in the subject under study, for their professional career, experience in research on university teaching, and, finally, university teaching experience.

The objective of submitting the construct to expert judges resides in the need to estimate the validity of its content [65,66]—that is, to demonstrate that the items are representative to evaluate the indicators and dimensions considered in the subject matter of the study. Subsequently, the group of experts was informed of the objectives and purposes of the investigation, in relation to the instrument to be evaluated.

Hence, with the sending of the first version of the questionnaire, they were asked for their opinion on the relevance and coherence of the items, their clarity, and objectivity. They were also instructed to make any observations, nuances, modifications, and cancellations that they deemed appropriate, in relation to the content and format of the questionnaire.

The initial pilot questionnaire had 43 indicators and 81 items. After the first review, the expert judges proposed to eliminate some of them, leaving the questionnaire made up of 37 indicators and 70 items (see Appendix B). The second review reduced the items to a total of 62 and proposed the inclusion of questions with a Likert scale. Therefore, the final questionnaire was defined by four dimensions and 62 items (see Appendix A).

In Appendix B, these dimensions and items eliminated are indicated by means of a strikethrough on the corresponding box. Regarding the study variables that have been considered in the research, they include, as independent variables:

- Variables of the physical teaching–learning space that include spatial and environmental factors;

- Perceptual variables that include perceptions in relation to preferences, level of well-being, and social interaction.

Academic motivation has been considered as a dependent variable. It is a variable that is influenced by the context in which the academic act takes place. Nominal qualitative variables and dichotomous and polytomous variables were also used since, in some cases, there will be variables that, by their nature, present two response modalities (yes–no) and others that present more than two modalities.

For the process of selecting the experts to participate in the validation of the measurement instrument, the so-called Cohen’s kappa coefficient (k) of expert competence was used, which was obtained from the self-assessment carried out by the person to determine their expert competence in the subject matter of the research [62].

Table 2 shows, according to a series of sources of argument, the scores obtained in the Cohen’s kappa coefficient (k) of expert competence.

Table 2. Mean of the k coefficient of the selected experts.

Source of Argumentation	k
Theoretical analysis carried out by the expert	0.7
Experience gained	0.8
Study of works on the subject by Spanish authors	0.7
Study of works on the subject of foreign authors	0.7
Own knowledge about the state of the problem abroad	0.7
Expert intuition	0.8

Hence, if the value of the Cohen’s kappa (k) is greater than 0.8, it is understood that there is a high influence from all sources, while, if the value of k is less than or equal to 0.8 and greater than 0.7, the influence of all sources is considered medium [62]. Once the experts had been selected, their task consisted in validating the correspondence between the objective of the study with the items of the instrument, the quality of the language, and the representativeness.

4.2. Reliability

To check the reliability of the instrument, due to its mixed format, the quantitative questions corresponding to the perceptual dimension (questions 38 to 47) and the motivational dimension (questions 54, 55, 60, 61, and 62) were calculated by applying the Cronbach’s alpha coefficient (α). This measure of internal consistency expresses that the items measure the same construct and are highly correlated with each other [67]; that is, it indicates that the instrument performs stable and consistent measurements [68]. These questions obtained a value of $\alpha = 0.938$, which shows high reliability according to [61], who consider values higher than 0.70 to be very reliable.

Table 3 represents the Chi-square test. The qualitative cut questions corresponding to the spatial and environmental dimensions were analyzed using the goodness of fit test, calculating the Chi-square. All the questions present dispersion of the answer, with an asymptotic significance value of $p < 0.001$, so that their approach is correct and adequate. Question number 52 is the only one that does not meet significance, with a value of 0.509. The observed responses are grouped around the expected responses, their difference being minimal and therefore being considered a non-discriminatory question.

Table 3. Reliability of the instrument: Chi-square test.

Item	Chi-Squared Test	Degrees of Freedom	Asymptotic Significance
1	157.142	2	0
2	556.988	2	0
3	295.269	3	0
4	235.95	2	0
51	662.229	4	0
52	1352	2	0.509
60	245.04	5	0
61	264.11	5	0
62	263.39	5	0

Source: Research data.

5. Discussion

Considering that there is a large volume of research that recognizes certain design factors that intervene in the classroom and in their level of impact, both in motivation [4,18,19] and in the social relations of students [14,35], its study is unavoidable.

Systematic pedagogy manifested the influence of the physical and environmental characteristics of the school environment on the social interactions and other psychosocial aspects of the student [69]. Since then, numerous authors have continued to address the question using a psychological and physical approach [49].

In this line, recent studies have considered the impact of the design of the learning space on the behavior of those who inhabit it [70]. This study showed the importance of physical variables and how students better perceive group cohesion, commitment to tasks, and cooperation when the size and organization of the seats is in small groups and allows the visibility of the rest. This allows them to easily interact with other colleagues. In this way, group discussions, discussions, and activities are favored. Flexibility and functionality are two qualities that design professionals look for. The generation of open and diaphanous spaces that promote collective work and foster personal relationships is the initial premise of any school architectural project.

Regarding the second dimension of the questionnaire, the spatial variables, recent studies [71] demonstrated the need to conceive educational spaces as cultural tools, prioritizing the design, construction, and use made of them, together with the harmonious performance of the pedagogical discourse, making the environment, together with the teachers, become the third teacher [72]. Currently, university learning spaces require a greater transformation than in other levels of education. The need to include new pedagogical formats and give way to the design of spaces that consider ICT and satisfy students in aesthetic terms [41], of functionality, flexibility, and versatility [36], is nothing new.

Regarding, the third and fourth dimension of the questionnaire, the perceptual and motivational variables, researchers highlight the choice of location when sitting in the classroom, agreeing that the place is decisive in the perception that the student has. Hence, sitting in the front rows turns out to be more motivating for the student [73]. Paying attention to the preference of the company when it comes to sitting is important. Studies reveal that sitting with friends generates positive differences in motivation and social relationships. All this affects the learning of those who sit next to unknown colleagues [36]. The proximity or closeness of students to each other and to the teacher can generate comfort or just the opposite [74]. The visuals towards an attractive landscape act as a source of inspiration, and it has been shown that the interaction of the person with the environment favors the development of cognitive and emotional capacities [75].

6. Limitations of the Research

Although the results of this study meet the technical and psychometric attributes required to be considered a reliable and valid measurement tool, it is necessary to show some of the limitations. This study has been developed only at the University of Almeria, so

it would be advisable to expand the sample size, extending the research to other territories, national and international, and degrees from other areas of knowledge.

Another of the limitations recognized in this research work is in relation to the fact that the results achieved were obtained at a time preceding the COVID-19 pandemic. This makes the results achieved differ from others that would have been obtained by submitting the questionnaire to university students during the pandemic. In this case, although the new measures to be adopted in university classrooms are specifically ignored, some recommendations can be made that will make learning spaces safer against the virus. Finally, the posing of combined quantitative and qualitative questions made the analysis and interpretation of the obtained results difficult, where the answers could not be analyzed by means of an exploratory factor analysis.

For the same reason, comparisons and relationships between the items and with the questionnaire B could not be carried out completely. However, for the case in question, the appropriate aspect consisted in the descriptive and inferential analysis of the data obtained. The previous question corresponds to the cross-sectional design since no causal relationships were established between the observed variables. In this sense, the generalization of the results has been carried out from the subjective perspective, recommending in future studies to include such relationships. Finally, it is necessary to add that the measured data refer to the students' perceptions of a specific situation; that is, these are subjective data offered by the subjects. This circumstance can lead to the presence of sampling errors.

7. Conclusions

In recent decades, the growing interest in educational spaces has led to changes both in design and in organization and morphology. In higher education, this evolution has not occurred in the same way, thus postponing this transformation. Despite the relevant pedagogical role that space acquires as a facilitator of learning, instruments that allow the evaluation of the impact that they have on the motivation and social interaction of university students are lacking.

The results obtained express the satisfactory metric quality of the questionnaire, thus presenting an instrument based theoretically and operationally defined, considering four relevant dimensions: spatial, environmental, perceptual, and motivational. This approach is relevant and differentiated, in relation to other instruments, both in its theoretical approach and in its operationalization in items, demonstrating its consistency. The analysis of its technical characteristics shows adequate global reliability in terms of internal consistency, which facilitates its applicability in different contexts.

On the other hand, the instrument presents an optimal content validity, guaranteed by the consistency and rigor of the theoretical work and the evaluations that the selection of experts from university education and research professionals conferred in the configuration of the instrument items.

In this sense, it is necessary to point out that the proposed instrument represents a relevant contribution from a theoretical approach due to the approach in the elaboration and dimensions that it addresses, especially the perceptual and motivational ones, considering that most of the instruments focus on evaluating environmental and of student academic performance. Likewise, the university educational level to which it is directed is innovative because most of the instruments are made to measure dimensions in Secondary and Primary Education.

As a final reflection and considering that the results of this research work preceded the presence of COVID-19, the research on the effects of COVID-19 in university classrooms and, ultimately, in people, must continue to develop, incorporating new and productive lines of research related to other disciplines. In this sense, researchers can point to multidisciplinary research work that combines education, psychology, and architecture.

Due to the multidisciplinary nature of the COVID-19 research front and the multitude of data sources, an urgent quantification and a global characterization, even if descriptive, would help science professionals to understand and visualize an informative phenomenon

which we must face in the coming months, returning to the physical spaces of the classrooms and university campuses. In this sense, the analysis and pilot tests carried out in different educational centers are of interest since they have made it possible to verify successes and errors in the implementation of specific labor actions.

Future lines of research on this topic will focus, among others, on studying the impact of classroom design and its impact on personal attitudes and the generation of motivating behaviors towards learning, which has changed forever and has incorporated digital tools as allies. Likewise, the extent to which physical variables influence the cognitive and emotional processes of students will be addressed in interactive learning and in the improvement and transformation of learning communities, considering the relationships between motivation, perception, and student learning outcomes.

Author Contributions: Conceptualization, methodology, software, validation, formal analysis, investigation, resources, data curation, writing—original draft preparation, writing—review and editing, visualization, supervision, M.-D.G.-Z., L.O.J. and A.S.A.; project administration, funding acquisition, M.-D.G.-Z. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A. Questionnaire Used in the Present Study

Appendix A.1. Spatial Variables

1. What type of floor surface corresponds to your daily classroom?
 - 1.1 The ground is flat and continuous.
 Yes
 No
 - 1.2 The ground is sloping.
 Yes
 No
 - 1.3 The classroom has a platform for the teacher.
 Yes
 No
2. Which of the following geometric shapes corresponds to your everyday classroom?
 Square (provided).
 Rectangular (elongated).
 Polygonal.
3. What is the number of students in your daily classroom?
 <30
 30–45
 46–60
 >60
4. What is the approximate area in square meters (m²)?
 <75
 75–100
 >150

5. How many students regularly attend your class?
 - <20
 - 20–45
 - 45–60
 - >60
6. What furniture (table) do you have in your everyday classroom?
 - Fixed individual (anchored to the ground).
 - Individual not fixed.
 - Fixed continuous board (anchored to the ground).
 - Group not fixed.
7. What furniture (chair) do you have in your everyday classroom?
 - Fixed individual (anchored to the ground).
 - Individual not fixed.
 - Fixed continuous seat (anchored to the ground).
 - Continuous seat not fixed.
 - Individual with wheels.
8. What arrangement or distribution of furniture (table and chair) corresponds to your daily classroom?
 - In rows.
 - In the shape of a "U".
 - Individuals.
 - Group scattered.
9. What percentage of the furniture is damaged: broken or scratched?
 - <15%
 - 15%–30%
 - >30%
10. What type of vertical enclosures delimit your classroom?
 - Fixed vertical partitions (walls).
 - Mobile vertical partitions (panels).
 - Others.
11. How are the access doors to your daily classroom?
 - Simple sheet.
 - Double blade.
 - Other.
12. Does your classroom have a WIFI connection?
 - Yes
 - No
13. What ICT possibilities does the daily classroom have?
 - 13.1 Does it have a computer for the teacher?
 - Yes
 - No
 - 13.2 Does it have a computer for the students?
 - Yes
 - No
 - 13.3 Does it have a projector?
 - Yes
 - No

Appendix A.2. Environmental Variables

14. What type of lighting predominates in your everyday classroom?
 - Daylight.
 - Artificial light.
 - Mixed.
15. What are the windows like?
 - Fixed windows.
 - Practicables (opening).
 - On the ceiling (skylights).
 - There is no natural light.
16. What orientation/cardinal point are the windows?
 - North.
 - South.
 - East.
 - West.
17. Does your classroom have mechanisms for regulating natural and/or artificial lighting?
 - Natural light: regulation with blinds.
 - Natural light: dimming with louvers.
 - Artificial light: manual dimmer.
18. Does your classroom have ventilation/air renewal systems?
 - Natural ventilation.
 - Forced renewal (air extraction).
 - Mechanical renovation (grids).
19. How is the interior temperature (hot/cold) regulated?
 - Centralized air conditioning.
 - Individual control (from the classroom).
 - Not regulated.
20. In which season do you consider the interior temperature the most appropriate?
 - Fall.
 - Winter.
 - Spring.
21. Which of the following indicators do you think predominates and leads to the noises that affect your daily classroom?
 - Internal noises (students, computers, ventilation machines).
 - External noise (parking, coffee shops, proximity to the airport).
 - Echo.
 - Using microphones.
 - Insufficient acoustic insulation in enclosures and carpentry.
22. What is the predominant color of the walls in your classroom?
 - Warm colors (beige, salmon, ocher).
 - Cold colors (light blue, gray, purple).
 - White color.
23. How are the coatings (finishes and materials of the vertical surfaces)?
 - Rough surface walls (brick, concrete).
 - Smooth surface walls (paint, veneer).
 - Paneling.

24. How are the paving/flooring materials?
 Ceramic stoneware.
 Continuous vinyl flooring.
 Terrazzo.
25. How is the ceiling?
 Drywall suspended ceiling.
 Continuous plastered and painted suspended ceiling.
 Metal panel suspended ceiling.
 Mixed.
26. In what elements of your classroom or close to it do you detect the worst hygiene and maintenance conditions?
 In the classroom (furniture and floors).
 Next to the classroom (toilets).
 Next to the classroom (stairs and corridors).

Appendix A.3. Perceptual Variables

27. What is your companion preference when sitting in a class?
 Isolated: single.
 In a group with acquaintances.
 In a group with new/unfamiliar peers.
28. What is your choice of location?
 In front.
 In the middle.
 Behind.
 Center.
 Lateral.
29. What preference do you have regarding the possibility of site variation?
 Always in the same place.
 I vary in location and perspective.
 I have no preference for where I sit.
30. What is your level of well-being in front of a group of people in the classroom?
 Comfort in front of large classes (>60 students).
 Overwhelmed or anxious in front of large classes (>60 students).
 Preference for small classes (<30 students).
31. Which of the following indicators do you think favors social interaction within the classroom, both with teachers and with classmates?
 Verbal language (oral expression).
 Non-verbal language (physical connection: tactile, visual, and gestural).
 Emotional expression.
 Combination of the above answers.
32. Which of the following social relationships do you think is most favored by having a suitable classroom design?
 Teacher-student relationship.
 Student-student relationship.
 It has no incidence.
33. Which of the following social relationships do you consider the most influential on your motivation during the learning process?
 Teacher-student relationship.
 Student-student relationship.
 It has no incidence.

34. What is your level of personal-space reference in the classroom?
 Proximity brings me comfort.
 The invasion brings me comfort.
35. What is your level of appropriation of personal space?
 High.
 Medium.
 Low.
36. Which of the following indicators do you prioritize in the interior visibility of the classroom?
 Blackboard.
 Teacher.
 Access/exit points (doors).
37. Which of the visuals of the outdoor environment do you consider preferential when sitting in a class?
 Towards the Mediterranean Sea.
 Towards green areas.
 Towards other buildings on the Campus.
 I do not consider them.
38. The visuals of the environment influence stimulation during the teaching-learning process.
39. An adequate design and organization of the classroom favor the development of learning actions such as participation and collaborative learning.
40. The arrangement of furniture in the classroom influences motivation during the teaching-learning process.
41. The possibilities of adaptation and movement of the furniture in the classroom favor cooperative work, dialogue and participation.
42. The comfort of the furniture benefits the physical well-being and predisposition to remain in a classroom and therefore in the academic results.
43. Adequate natural and artificial lighting in the classroom influences the physical and emotional well-being of students, favoring concentration and academic performance.
44. The interior temperature of the classroom affects behavior, social relationships and personal comfort.
45. Inadequate ventilation and air renewal conditions in the classroom generate discomfort and health problems in students.
46. Noise (external or internal) in the classroom hinders concentration and efficient academic performance.
47. Your learning process depends on your interaction and social integration.

Appendix A.4. Motivational Variables

48. What is your family's educational level?
 None.
 Primary.
 Secondary.
 Professional Training Technician.
 Academic.
 Postgraduate.
49. What is the approximate monthly income (€ gross) in your family?
 <1100 €
 1100 €–1800 €
 1801 €–2700 €
 >2.700 €

50. What is your average mark (average) obtained in the Selectivity exam?
 With honors.
 Outstanding.
 Remarkable.
 Approved.
 Fail.
51. What is your average grade (average) obtained in the previous academic year?
 With honors.
 Outstanding.
 Remarkable.
 Approved.
 Fail.
52. What is the relationship between the interest shown in a subject and its difficulty?
 Direct (more difficulty, more interest).
 Inverse (more difficulty, less interest).
 Indifferent.
53. What is the degree of influence of academic stress on exam periods?
 High.
 Medium.
 Low.
54. Personal attitudes influence your motivation during the learning process.
55. An adequate design and organization of the classroom reinforces positive attitudes and predisposition towards learning.
56. Which of the following expressive skills do you master?
 Oral expression.
 Written expression.
 Body expression.
 All previous answers.
57. How do social networks influence your academic performance?
 High.
 Medium.
 Low.
 Indifferent.
58. How many hours a day do you dedicate to studying (excluding the hours of face-to-face classes)?
 <2
 2–4
 >4
59. What is the level of influence that the organization and scheduling of tasks have on your motivation?
 High.
 Medium.
 Low.
60. Academic excellence requires the interaction between classroom design and teaching methodologies.
61. The arrangement of furniture in the classroom favors the application of active teaching-learning methodologies.
62. The ICT integrated into the classroom influence student satisfaction and involvement.

The questions 3–47, 54, 55, and 60–62 are measured using a Likert scale with five response options:

- 1 = totally disagree
 2 = disagree
 3 = agree and disagree
 4 = agree
 5 = totally agree

Appendix B. Table of Dimensions, Indicators, and Items Included in the Instrument for Evaluation before Expert Judges

Table A1. Dimensions, Indicators, and Items.

Dimension	Indicators	Item
Space	Ground surface	Floor slope level
	Morphology	Geometric shape
	Capacity	Ratio (length/width)
	Size	Number of students
		Area (m ²)
	Furniture layout	List of students who attend class regularly
		Distribution and position of tables, chairs and shelves
	Furniture: Table	Preference for use according to type
		Mobility/Displacement Preference
		Size and shape preference
	Furniture: Chair	Preference for use according to type
		Mobility/Displacement Preference
		Material/comfort preference
	Degree of deterioration of the furniture (scratched and uneven tables, broken chairs)	
	Comfort level of table and chair	
	Enclosure limit preferences/adaptability possibility	
	Possibility of entry/exit	
	Possibility of connection to the internet/electrical network	
	Use of hardware in the learning process	
	Number of plugs	
	Digital display	
	Classroom adaptation	
	Adaptation of the immediate environment (building)	
Environmental		Origin of enlightenment
		Type (and location) of openings
	Illumination	Orientation of openings
		Level/possibility of lighting regulation
		Degree of openness
	Ventilation	Air renewal system
		Air purification
		Possibility of control/regulation
	Indoor temperature	Level/degree of temperature adaptation, depending on the season of the year (hot/cold)
		Impact of energy consumption
		Degree of internal noise
	Degree of external noise	
	Echo/reverb	
	Vertical and horizontal surface finishes	
	Color	
	Coatings: finishes and materials	
Materials and aesthetics	Flooring: materials	
	False ceilings	
	Level of decoration/interior design	
	Cleaning frequency	
Hygiene	Cleaning areas	

Table A1. Cont.

Dimension	Indicators	Item
Perceptual	Company	Preference when sitting
	Location within the classroom	Choice of location
		Possibility of movement
	Agglomeration	Level of well-being in front of a group of people
		Physical and mental conditions
	Social interaction	Languages
		Connection level: tactile behavior
		Connection level: visual behavior
	Appropriation of personal space	Posture
		Facial expression
Emotional expression		
Spatial reference level		
Degree of personal involvement		
Comfort-Postural hygiene	Membership level	
	Privacy	
	Participation	Degree of motivation when participating
	Visibility	Interior
		Exterior
Outward visuals	Ergonomic level: tables	
	Ergonomic level: chairs	
Motivational	Family socioeconomic origin	Social stratification: social classes
	Family socio-professional structure	Professional category of parents: level of educational studies completed by parents
	Family economic structure	Economic availability: monthly income or (income level per capita)
	Grade in secondary education	Average mark (average) obtained in Selectivity
	Higher education qualification	Average mark (average) obtained in the previous academic year
	Motivation	Level of general and specific interest in the subjects
		Effort
	General interest in learning	Degree of motivation/concentration according to difficulty of the subject
	Intellectual aptitude	Information processing strategies: learning styles
		Skills and abilities
Responsibility towards learning	Distribution of study time: number of hours devoted to study/day	
	Task organization/scheduling level: set goals	
Distraction	Level of influence of Social Networks	
	Degree of concern about evaluation or examination situations	
Anxiety—Academic stress	Fear of failure	
	Collaborative learning	
Learning actions	Master sessions	
	Oral presentation	

Source: Research data. Note: the “crossed out” indicators and items were eliminated after the first review by the experts.

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