13rd, 14th, 15th March 2024

ESCUELA TÉCNICA SUPERIOR DE EDIFICACIÓN
UNIVERSIDAD POLITÉCNICA DE MADRID
Avda. Juan de Herrera, 6 - 28040-MADRID

ABSTRACTS BOOK
LIBRO DE ACTAS

CINIE 2024

DEPARTAMENTO DE TECNOLOGÍA DE LA EDIFICACIÓN

CINIE

International Conference of Educational Innovation in Building

Congreso Internacional de Innovación Educativa en Edificación

VII INTERNATIONAL CONFERENCE OF EDUCATIONAL INNOVATION IN BUILDING

CINIE 2024

ESCUELA TÉCNICA SUPERIOR DE EDIFICACIÓN
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GREETINGS

VIII INTERNATIONAL CONFERENCE OF EDUCATIONAL INNOVATION IN BUILDING (CINIE 2024)

March 13, 14 and 15, 2024

It is the eighth edition of the CINIE and, on this occasion, the objective has focused on promoting the exchange of knowledge and experiences in educational innovation within higher education. Primary aspects such as continuous improvement in teaching, the latest advances and research, or the search for new motivation proposals for students mean that, year after year, this International Congress represents a good meeting point for the educational community.

The organization of the CINIE 2024 program includes different innovation activities in educational methods, oral communications, posters and virtual exhibitions in different thematic areas such as Active Teaching Methodologies in Building Education, Educational Innovation in Technical Education, New Challenges / Trends in Higher Education or 3D Technologies in Education, as well as differentiated actions in the BIM environment.

As in previous editions, we want to highlight the quality and involvement of all participants, nearly 70 communications in which more than 250 speakers from a multitude of different places have trusted CINIE 2024 to make their progress in educational innovation.

To all who have participated in one way or another, thank you.

The Organizing Committee

SALUDOS

VIII CONGRESO INTERNACIONAL DE INNOVACIÓN EDUCATIVA EN EDIFICACIÓN (CINIE 2024)

13, 14 y 15 de marzo de 2024

Es la octava edición del CINIE y, en esta ocasión, el objetivo se ha centrado en promover el intercambio de conocimientos y experiencias en la innovación educativa dentro de la educación superior. Aspectos primordiales como la mejora continua en la enseñanza, los últimos avances e investigaciones, o la búsqueda de nuevas propuestas de motivación para el alumnado hacen que, año tras año, este Congreso Internacional represente un buen punto de encuentro para la comunidad educativa.

La organización del programa CINIE 2024 incluye diferentes actividades de innovación en métodos educativos, comunicaciones orales, carteles y exposiciones virtuales en diferentes áreas temáticas como Metodologías Activas de Enseñanza en la Educación de la Edificación, Innovación Educativa en la Educación Técnica, Nuevos Retos/Tendencias en la Educación Superior o Tecnologías 3D en la Educación, así como acciones diferenciadas en el entorno BIM.

Como en anteriores ediciones queremos destacar la calidad e implicación de todos los participantes, cerca de 70 comunicaciones en las que más de 250 ponentes de distintos lugares han confiado en CINIE 2024 para realizar sus avances en innovación educativa.

A todos los que han participado de uno u otro modo, gracias.

El Comité Organizador

CINIE 2024 PROGRAM

ORAL COMMUNICATIONS

VIII Congreso Internacional de Innovación Educativa en Edificación

Miércoles 13

9:30-14:30	Registro/Recepción de documentación Lugar: Vestíbulo de entrada (P0)
10:15-11:00	**OPENING SESSION** Lugar: Sala de Juntas (P-1) CARLOS MORÓN *Director del Departamento de Tecnología de la Edificación* ENRIQUE GÓMEZ DE LA PEÑA *Responsable de prescripción zona centro Grupo Saint Gobain* *Profesor asociado UAH*
11:00-12:00	COFFEE BREAK & POSTER SESSION Lugar: Vestíbulo de entrada (P0)

Lugar: Sala de Juntas (P-1). Moderadora: Alicia Zaragoza Benzal

Educational innovation in technical education

12:00-12:15	**EDUCATIONAL INNOVATION FOR TFGS: INTERDISCIPLINARITY IN URBAN HEALTH**
	Ester Higueras García; María Cristina García González; Teresa Sánchez Chaparro; Patricia Sánchez González
12:15-12:30	**INTRODUCING DATA SCIENCE TO SPANISH SPEAKER STUDENTS USING THE TCLAB ARDUINO KIT**
	Lorena Quinchuela; Santiago D. Salas; Carola Flores
12:30-12:45	**USE OF INTERACTIVE PROBLEMS WITH ALTERNATIVE SOLUTIONS TO IMPROVE STUDENTS RESULTS IN FLUID MECHANICS**
	José J. Ortega; Ricardo Castedo; José María Gómez; Anastasio P. Santos; Lina M. López; María Chiquito; Marta Fernández-Hernández
12:45-13:00	**MARKET RESEARCH AS AN EDUCATIONAL ACTIVITY IN CHAIRS OF CIVIL ENGINEERING**
	Roberto A. Rojas Holden
13:00-13:15	**BALANCING THEORY AND PRACTICE IN COMPUTATIONAL MECHANICS THROUGH FREEFEM++**
	Luis Ramírez; Iván Couceiro; José París; Xesús Nogueira
13:15-13:30	**CONSTRUCTION TECHNOLOGY II, PRACTICAL TRAINING IN CLAYS THROUGH SCALE REPLICAS AS A VERNACULAR MATERIAL IN ARCHITECTURE**
	Aimee del Rocío Delgado Cruz; María José Delgado Cruz

Jueves 14

Lugar: Sala E (P1). Moderador: Daniel Ferrández Vega

New Challenges / Trends in Higher Education

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	Carlos González; Francisco Martínez
9:45-10:00	
10:00-10:15	**THE USE OF AI TOOLS AND THEIR IMPACT ON THE ASSESSMENT OF POSTGRADUATE COURSES IN THE TECHNOLOGICAL FIELD**
	Susana Hernando; Juan Diego López Arquillo; Martín Perea Álvarez de Eulate
10:15-10:30	**BORDERLINES, BORDERSCAPES, BORDERBODIES: THE CHALLENGE OF THE FOUR BORDERS IN THE SANTA CRUZ REFINERY**
	Víctor Cano-Ciborro
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	Manuel Andrés Soage Quintáns; Francisco Javier Fernández Fidalgo; Sandro Andrés Martínez; Araceli Martin Candilejo;2Juan Carlos Mosquera Feijoo; David Santillán Sánchez; Luis Cueto-Felgueroso Landeira
10:45-11:00	**ANALYSIS OF THE INTERACTION OF INTERNATIONAL EXCHANGE STUDENTS IN THE GROUP RESULTS. CASE OF THE SUBJECT OF SPANISH POPULAR CONSTRUCTION**
	Gregorio García López de la Osa; Pilar Izquierdo Gracia; Sonsoles González Rodrigo
11:00-12:00	COFFEE BREAK & POSTER SESSION Lugar: Vestíbulo de entrada (P0)

12:00-14:00	**SEMINARIO TRIMBLE – Sala Trimble (P0)**

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Lugar: Sala E (P1). Moderador: Alberto Leal Matilla

Active Teaching Methodologies in Building Education

15:30-15:45	**PROJECT-BASED LEARNING WITH COLLABORATIVE GENERATION OF WORK GROUPS BASED ON THE BEHAVIORAL ROLES OF THE MEMBERS**
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	Manuel Ramos-Martín; Ana González Uriel; Ismael García Ríos
16:15-16:30	**NEW METHOD FOR THE TEACHING-LEARNING PROCESS ON CONSERVATION AND RESTORATION OF BUILT HERITAGE: RUINS OF THE MONASTERY OF SANTA MARÍA DE RIOSECO (BURGOS)**
	Mercedes González Redondo; Javier García-Gutiérrez Mosteiro; Enrique Rabasa Díaz
16:30-16:45	**REACTIVATION OF THE CANAL DE CASTILLA THROUGH EDUCATIONAL, ENVIRONMENTAL, AND ECONOMIC MEASURES**
	Ángel Mariano Rodríguez-Pérez; Lucía Olmo-Rodríguez; Julio José Caparros Mancera; César Rodríguez González

Viernes 15

Lugar: Sala B (P1). Moderadora: Amparo Verdú Vázquez

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	José Carlos Villamuelas Álvarez; Fernando Viñado Oteo; María José Ibáñez Ayuso
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	Jesús González-Arteaga; María Segarra; David Sanz; José Manuel Cañizares; Alma Patricia Domínguez; María Dionisia Elche; Jesús Alfaro; Joaquín Fuentes; Pedro Huertas; Jorge Linuesa; Miguel Ángel López; Raquel Martínez; Víctor José Pérez; Juan Pedro Ruiz; José Luis Serrano; Enrique Torrero; David Valverde; Nelia Valverde; Juan Vicente Visier
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Educational Innovation in Technical Education

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CINIE 2024 PROGRAM

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002	**THE ERASMUS EXPERIENCE IN THE BUILDING TECHNLOGY ANDVIRONMENT RESEARCH GROUP**
	Mercedes del Río; Paola Villoria; Marina Fumo; Guiseppe Trinchese
013	**THE CHOICE OF COLOR IN THE DESIGN OF SWIMMING POOLS**
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EDUCATIONAL INNOVATION IN TECHNICAL EDUCATION

3D TECHNOLOGIES IN EDUCATION

THE ERASMUS EXPERIENCE IN THE BUILDING TECHNOLOGY AND ENVIRONMENT RESEARCH GROUP

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Keywords: *Erasmus, laboratory experience, I+D+i skills*

Abstract

Erasmus students, during their stay in the destination country, have the opportunity to access new academic resources and interact with professors different from those at their home universities. This academic exchange not only expands their knowledge but also allows them to acquire intercultural skills essential in an increasingly globalized world. It helps develop an open and tolerant mindset, contributing to their personal growth and fostering independence, adaptability, and self-confidence [1].

For the professors involved in the experience, it represents an opportunity to immerse themselves in a new educational environment, exchange best practices and teaching strategies, as well as adopt new perspectives and strengthen connections with other universities.

This has been the case with the Erasmus experiences within the research group at UPM "Building Technology and Environment (TEMA)," a group aimed at promoting sustainability in the Building sector [2]. Since 2017, the group has hosted 13 students from the University Federico II of Naples (UNINA) thanks to the collaboration of some professors from the Department of Construction, Civil, and Environmental Engineering (DICEA) of that university [3]. The students carried out their Tesinas di Laurea at UPM, and the involvement of professors from both universities not only met the goals set in an Erasmus stay but also surpassed them with more specific objectives such as initiating students into the research field and enhancing their personal skills by working in a knowledge-seeking environment. The students worked with experimental plans in the materials laboratory at ETSEM to complement their Tesinas di Laurea. This is not common in Italy, so the students opened their minds to other teaching and learning methodologies, achieving, in some cases, not only working in the laboratory conducting tests but also designing prototypes of the constructive elements proposed as innovations in their works.

Furthermore, they have addressed sustainability aspects, a value shared by both universities, such as the reduction of raw material consumption, energy, and atmospheric gas emissions [4].

Finally, with the results of the work done in the laboratory, articles and presentations were drafted, in practically all cases, allowing students to improve their oral and written communication skills.

On the other hand, the significant participation of professors from both universities has facilitated the improvement of knowledge of other educational systems, as well as the exchange of best practices through workshops held at both universities to disseminate the experience and the benefits obtained.

The experience has been very rewarding and inspiring for everyone due to the students' motivation and the common paths of work that have opened up between the two universities.

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THE CHOICE OF COLOR IN THE DESIGN OF SWIMMING POOLS

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Keywords: *Water temperature; Evaporation of water; Sustainable swimming pools; Heat absorption; Colorimetry test.*

Abstract

The color chosen for the interior lining of a pool determines the temperature of its water, as well as other factors such as location, direction, time zone, wind, ambient temperature, use, flow, geometry, projection, shadows of the adjacent elements, the materials that compose them [1] and their thermal conductivity with the ground, etc.

The temperature of the water, in particular, is a key factor to guarantee its comfort range, although this information is very subjective since it depends on the environmental conditions and the tolerance of each individual [2]. In the case of babies, the water should be at a temperature as close to body temperature as possible, the same goes for people with limited mobility. In general, the ideal water temperature should be between 24°C and 30°C. C, according to Royal Decree 742/2013, of September 27, which establishes technical hygiene standards for swimming pools [3].

The choice of temperature also depends on the use that will be given to the pool [4]. In particular, swimming at very high temperatures can lead to dehydration, excessive fatigue and water imbalance due to increased sweating. On the other hand, when the water is cold, the body goes through a thermoregulation process that can lead to hypothermia, as occurs in older adults [5].

The origin of swimming pools comes from the need to bring areas of natural water closer to those places that lacked it, so an alternative was sought to lower body temperature during the hottest months and areas.

Currently, our country has more than 1.2 million swimming pools, one for every 37 inhabitants, with Madrid being the city with the highest number of swimming pools. This is due to its distance from the nearest coastal areas and population density.

Nowadays it is very common to build personalized swimming pools for private use in single-family homes, so it is a developing market with increasingly demanding clients [6].

Specifically, Blackpool presents a notable aesthetic novelty, which allows it to integrate perfectly into the landscape environment throughout the year [7], achieving a natural effect while providing elegance and sophistication to the environment.

Although, the most significant advantage of black pools is the increase in water temperature due to the scientific principle of refraction, which explains why light colors reflect light while dark colors absorb it [8]. Furthermore, following the same principle, white pools are used in warmer areas where the temperature is more stable and the water always tends to be blue due to the Rayleigh scattering effect.

In this case, a study is carried out to quantify the percentage of heat absorption in a pool based on the color chosen for the interior of the glass, the speed at which the water evaporates [9] and other factors that directly affect it [10].

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REACTIVATION OF THE CANAL DE CASTILLA THROUGH EDUCATIONAL, ENVIRONMENTAL AND ECONOMIC MEASURES

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Keywords: *Education, Environmental Measures, Economic Support*

Abstract

In Alar del Rey, a comprehensive study was conducted, incorporating both online and in-person surveys targeted at registered and resident individuals. A concerning issue was identified concerning the widespread neglect of areas surrounding the Canal de Castilla, coupled with a lack of promotion hindering these areas from unleashing their full tourism potential. This underscores the urgency to enhance the infrastructure and long-term maintenance of the Canal de Castilla, as well as implement effective tourism promotion strategies. Community collaboration and involvement from both the public and private sectors are essential to revitalize these areas. Furthermore, the continuous collection of opinions and suggestions through surveys is imperative to adapt and continually improve the actions taken in this tourism and environmental revitalization process.

The completion of a thorough survey, addressing crucial aspects related to education, environmental measures, and economic support in the context of the Canal de Castilla, has provided an invaluable foundation for drawing significant conclusions and proposing concrete solutions to the current abandonment issues affecting this locale. This study draws upon the richness of collected data, revealing a profound understanding of the specific challenges faced by the Canal de Castilla. The obtained responses offer a comprehensive perspective, allowing for the identification of key areas requiring intervention and thereby providing a solid platform for the development of effective and sustainable engineering strategies [1], [2].

The survey gauges community engagement with environmental education, awareness, and economic support for the Canal de Castilla's preservation. It seeks opinions on integrating environmental studies in schools, participation in tree planting, and education's role in mitigating water pollution. The canal's importance for local biodiversity, water quality, and cultural activities is also assessed, alongside community participation in conservation efforts. Additionally, the survey measures willingness to financially support the canal's maintenance, educational initiatives, and conservation events, highlighting community investment in sustainable practices for the canal's future well-being.

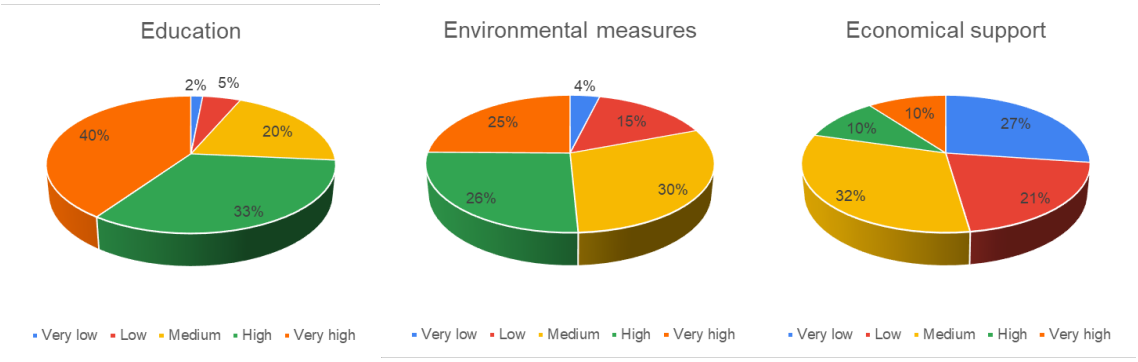

Figure 1: *Analysis results.*

The charts, Figure 1, display the perceived importance of education, environmental measures, and economic support related to the Canal de Castilla. For education, a majority (73%) views its importance as high to very high. In environmental measures, a combined 45% see it as high or very high, indicating a slightly less strong but still significant perception of importance. Regarding economic support, opinions are more evenly distributed across the spectrum, with a slight tendency towards the medium to high importance, suggesting a more varied perception of the need for financial contribution to the canal's preservation efforts.

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INTEGRATED INTER-ANNUAL PROGRAMMING OF ARCHITECTURAL DESIGN SUBJECTS WITH CROSS-SECTIONAL AND LONGITUDINAL RELATIONSHIPS BASED ON QUADRUPLE EVOLUTIONARY CONDITIONING IN DESIGN

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Keywords: *integration, architectural projects, scale, constraints, evolutionary.*

Abstract

Teaching approach in Architectural Design holistically integrates graphic abilities and technical competencies in a variable gradient with the course of projects [1]. This integration occurs both in relation to other subjects of the course (i.e., cross-sectionally) and to other courses in the architecture program (i.e., longitudinally).

The practice of innovative teaching is programmed as a referential paradigm aimed at facilitating progressive and holistic learning [2] in architectural projects through a cuadruple helix design. Thus, the programming of different Architectural Design courses, from the 2nd to the 6th year (currently, from the 2nd year in the Degree in Fundamentals of Architecture to the Master in Architecture), is conducted with three boundary conditions. First, scale [5]: from smaller to larger, this teaching practice programs a lower scale in the 2nd year (mountain refuge and single-family housing), progressing to linear associations of single-family houses and multi-family buildings in the 3rd year. In the 4th year, the focus shifts to residential complexes with neighborhood-level facilities and city-scale institutional buildings, moving to supra-municipal scale institutional buildings and broad urban interventions of regeneration and consolidation with residential and institutional elements in the 6th year.

This first condition is complemented by the second, programmatic complexity, with a progressive increase in projected surface area, functions, and uses, from the user level to the supra-urban social impact level. This programmatic complexity is intimately related to the third condition, relative urban intensity [6]. Incrementally, the location of projects in relation to the territory and the city also increases in complexity, from the natural environment of the refuge and single-family housing in the 2nd year, to metropolitan conurbation areas in the 6th year, through areas of dispersed urbanization with consolidation needs and historic centers requiring heritage protection, as well as areas needing urban regeneration and renaturalization.

Finally, the fourth condition, technology, also enriches the educational development in the field through the integration of construction, sustainability, and advanced technologies, incorporating eco-innovative materials and energy and management systems [3].

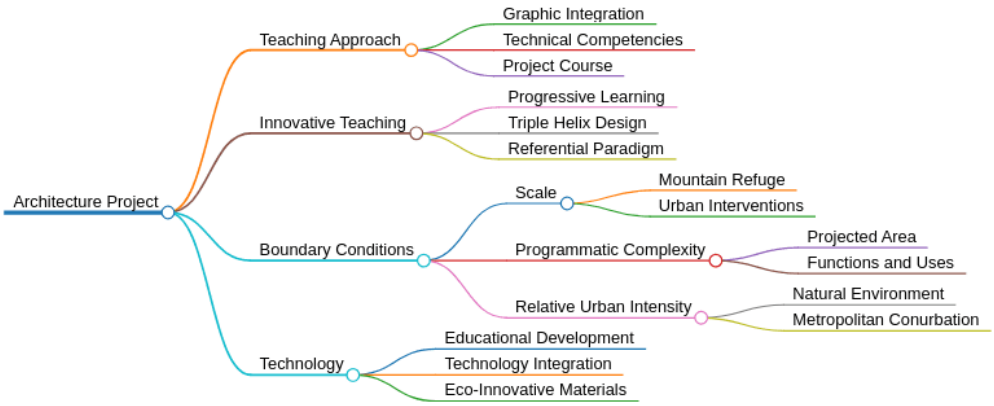

Figure 1: *structure and key elements of the Architecture Project learning sequence*

With this design of quadruple evolving conditions, progressive experiential learning in architectural projects encompasses all scales and complexities of professional architectural intervention, a deep understanding of the relationship between architecture, environment, and society, and advanced skills in digital tools and sustainable technologies [4] [7].

Tested in the 2021-22 and 2022-23 academic years, this practice has facilitated a notable improvement in both student perception (NPS surveys) and the evaluation of final projects concluding the program (PFC results), being included in various quality committees (CC) (degree, center, and employer committees) as a verification point by different interest groups, in addition to the verification obtained each year through the juries of the subjects in the area.

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A SERVICE-LEARNING PROPOSAL FOR ARCHITECTURE AND URBANISM STUDENTS: INVOLVEMENT IN EDUCATION STROLLS THROUGH MADRID

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Keywords: *Experiential learning, Service learning, Students of architecture and urban planning*

Abstract

In recent years, Service-Learning has emerged as a contemporary educational strategy in both secondary and higher education institutions. This approach integrates “learning” –focusing on the development of curriculum competencies, including knowledge, skills, and attitudes –, with "service", allowing students to gain practical insights into the needs of the social environment. Extensive literature displays the characteristics and outcomes of Service-Learning in higher education; for example, Salam *et al.* conducted a systematic review, categorizing it as a form of experiential learning and distinguishing it from volunteerism and internships. They elucidated theoretical frameworks, methodologies, integration across academic disciplines, online learning medium applications, emerging issues in implementation, potential pedagogical outcomes, and the associated benefits for students, faculty members, and community members [1]. The *Universidad Politécnica de Madrid* (UPM) has actively embraced the significance of this methodology. In 2019, the establishment of a Service-Learning Office exemplifies the university’s commitment to sharing information and documentation, while concurrently fostering initiatives such as funding for educational projects and awards recognizing exemplary practices [2].

The authors, along with professors and students from various disciplines, are part of an interdisciplinary team of educators who, alongside, implemented two informative routes in Madrid in 2023. The routes were titled “*La Ilustración Española y el descubrimiento de tres elementos químicos*” (Enlightenment in Spain and the Discovery of Three Chemical Elements) and “*Los ‘altos del hipódromo’: una zona emblemática de la ‘Edad de Plata’ de la cultura española (1868-1936)”* (The ‘Hippodrome Heights’: an Emblematic Area of the 'Silver Age' of Spanish Culture (1868-1936)). Details of these routes are documented in a prior work [3]. The objectives of this initiative encompassed: 1) Providing a holistic education for engineering students by connecting science and technology with art, history, and architecture; 2) Developing competencies such as data research, teamwork, oral presentation, and creativity in students across undergraduate, master's, and doctoral levels; 3) Establishing new channels for disseminating information for the Madrid City Council; 4) Sharing science, art, and history with a diverse audience; 5) Increasing awareness of the activities undertaken by a public university in various social contexts; 6) Enhancing knowledge of the architectural and cultural heritage accompanying a historic city like Madrid.

Currently, efforts are underway to enhance the routes and their online dissemination, tailored to specific needs. Notably, students in architecture and urban planning may find it particularly interesting. An example is an area in Madrid City named “Landscape of Light”, designated as a UNESCO World Heritage Site in 2021 in the category of Cultural Landscape. Route 1 is part of this area, offering a unique perspective by highlighting Spain's significant role in the discovery of three chemical elements during the 18th and early 19th centuries. Beyond the general objectives, architecture and urban planning student involvement –as guides and visitors– can contribute to their education by addressing specific aspects such as the urban development of Madrid City from the 18th century to the present, exploration and analysis of historical maps of Madrid City, "cast iron architecture" in the 19th century, evolution, adaptive reuse and conservation of historical buildings, and insights into the life and work of architects relevant to Madrid. For instance, in 2023, the commemoration of the centenary of the death of architect Ricardo Velázquez Bosco was held, honouring the designer of iconic buildings on the described routes, including the “School of Mines” and the former "School for Deaf Students" [4]. An intriguing aspect illustrated in Figure 1 is the study of how an area on the outskirts of Madrid, known as the “Hippodrome Heights”, transformed from the late 19th century into a prominent hub for culture, science, and education in the first half of the 20th century, continuing its transformation to the present day.

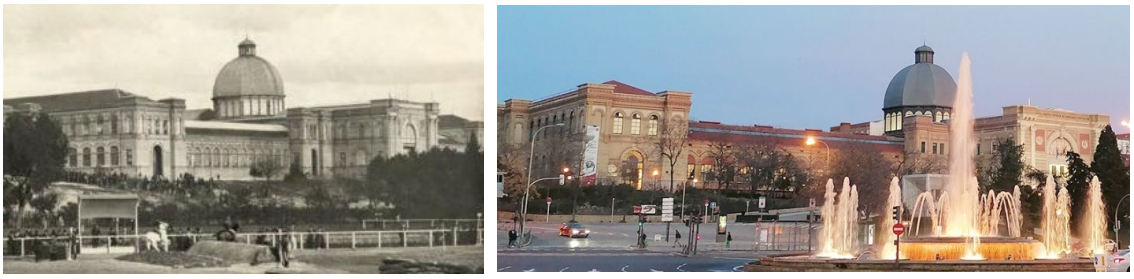

Figure 1: *Images of the 'Palace of Arts and Industry' in the early 20th century (left), and in the early 21st century (right). Sources: Unknown author around 1912 (left) and G. Laguna and J. Martín Erro (right).*

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PROJECT-BASED LEARNING WITH COLLABORATIVE GENERATION OF WORK GROUPS BASED ON THE BEHAVIORAL ROLES OF THE MEMBERS

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Keywords: *Teamwork, technical drawing, students' skills, higher education, CAD*

Abstract

A society in continuous change requires educating from uncertainty through experience and building shared knowledge generated from interaction and promoting autonomy. In this context, active learning methodologies play a very important role, including project-based learning (PBL), that is a methodological design and programming strategy that implements a set of tasks based on the resolution of questions or problems (challenges), through a research or creation process by students. This is a type of activity that requires relatively autonomous manner and with a high level of involvement and cooperation, and which culminates in a final product presented to others (diffusion). The literature indicates that PBL can have a special impact on the improvement of what are known as “soft” skills, which are those related to communication, listening and coordination among others [1, 2]. Specifically, PBL has been shown to be effective in improving work capacity in a collaborative team, as indicated in the work of Martín-Sómer et al. [3]. In addition, the way the teacher generates the groups is essential to ensure that students carry out a collaboratively work effectively and equally, since this learning plays a crucial role in improving the general quality of the student and promoting higher order learning skills. When it comes to PBL, collaborative efforts are essential for success. And therefore, effective teamwork in PBL is expected to not only improve learning outcomes but also prepare students for real-world challenges.

This work presents the results of a project-based learning methodology applied to a group activity with 56 students of the first course of Mechanical Engineering in the subject "Graphic Expression I (GEI)" and "Graphic Expression II (GEII)", in which the students worked on the design of a common mechanical element such as a hinge, where two surfaces have to be joined, letting the rotation of one or both of them. This activity consisted in making the plans of the mechanical piece in 2D (two dimensions) in GEI subject) and in 3D (three dimensions) in GEII subject. The teachers of GEI generated the groups based on the use of a questionnaire that allowed students to be categorized into

four behavioural roles (leader, collaborator, reflective and creative) [3]. So, each group contained the four roles, and the work team was maintained in both subjects.

Once both projects were completed, a survey was conducted among the students, who positively valued both the activity and the methodology of forming groups [4]. They considered that they had developed subject-specific competencies such as improving spatial vision and the ability to understand graphical representation techniques, both through traditional methods of metric geometry and descriptive geometry, and through computer-aided design (CAD) applications, as well as to work in groups effectively.

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LEARNING TO INTERPRET AND IMPLEMENT DESIGN STANDARDS IN SPECIAL RISK PREMISES: STATIONARY BATTERY ROOM AND TRACTION BATTERY CHARGING AREAS

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Keywords: *special risk premises, hydrogen, temperature, ventilation, wall openings.*

Abstract

Designing special risk areas in industrial and civil buildings often requires the use of design standards that employ formulas or empirical concepts that may be difficult to understand. This is particularly true for spaces designated for charging stationary and traction batteries.

All telecommunication installations in civil buildings are considered as such. Additionally, charging traction batteries has an average hazard coefficient in industrial buildings [1, 2].

In these rooms, ventilation, distance from hazards, and volume (if they house traction battery chargers) are determined by the emission of flammable gases generated during the charging process [3, 4].

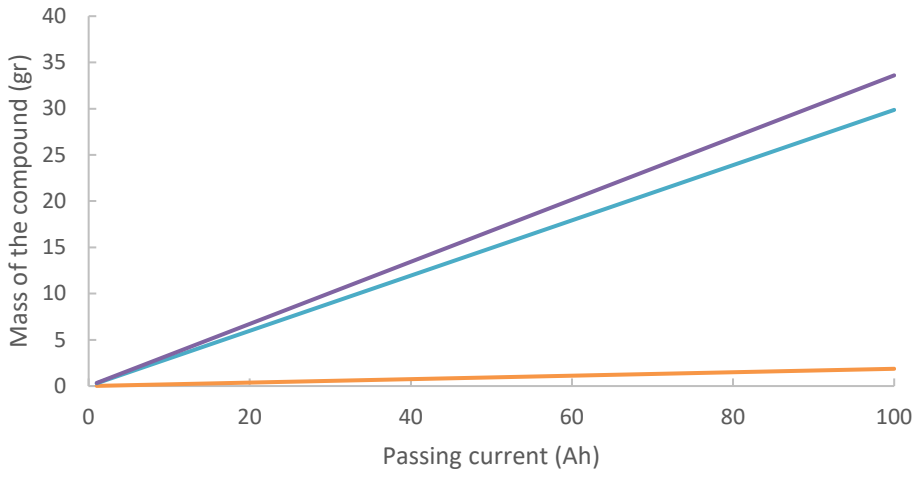

Figure 1: *Hydrolysis of water by the passage of electrical current, where the purple line refers to the decomposition of water in grams, the blue line refers to the generation of oxygen in grams and the orange line refers to the generation of hydrogen in grams. (Source: Own work)*

This work explains the origin of the empirical value for the hydrogen generation rate proposed in the standards UNE-EN 62485-2:2019 and UNE-EN 62485-3:2015, in order to enhance its comprehensibility. The study establishes a performance of 88.9% compared to the expected theoretical behaviour. Additionally, it analyses the influence of environmental temperature on the water hydrolysis process and the emissions of flammable gases.

Furthermore, it is important to take into account the creation of areas that are classified as having a risk of fire or explosion. Therefore, the UNE EN 60079-10-1 standard is also applicable, as it is included in the Royal Decree 681/2003, dated 12 June, which deals with the protection of the health and safety of workers who are exposed to the risks arising from explosive atmospheres in the workplace [5, 6].

Although UNE-EN 62485-2:2019 and UNE-EN 62485-3:2015 standards allow for a direct link with UNE EN 60079-10-1, this text presents a method for determining the rate of hydrogen generation during the charging process from battery parameters and relating it to the escape rate, a parameter used in the calculation of classified zones.

Finally, the study demonstrates that the sizes of ventilation openings, as determined by applying the standards UNE-EN 62485-2:2019 and UNE-EN 62485-3:2015, have taken into account an outdoor air speed of 0.7 m/s, which does not align with any of the standardised values in the calculation standards for classified areas.

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ROBUST STATISTICAL TECHNIQUES FOR EDUCATIONAL EVALUATION IN UNIVERSITY TECHNICAL STUDIES: MEDIAN AND WILCOXON-MANN-WHITNEY (WMW) TEST

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Keywords: *Robust statistical techniques; active didactic methodologies; problem -based learning; project -based learning*

Abstract

Technical education, including both engineering and architecture, uses active teaching methodologies in many cases. Among these methodologies, problem-based learning (PBL) and project-based learning stand out, although there are many variants and also other different active teaching methodologies [1]. However, it is usual for these active methodologies that, due to the requirements of the implementation of this methodology, the groups of students participating in each session rarely exceed 50. In PBL, it is common for there to be no more than 10 or 20 students per session, grouped in turn, due to the requirements of the methodology itself, into the working subgroups typical of this teaching methodology, often of 3 to 6 students [2]. On the other hand, the need to evaluate teaching methodologies, whether active or traditional, such as the expository method [3], is becoming more and more frequent. While the number of students in an expository method is limited mainly by operational and infrastructure issues - it is common to have more than 100 students per session, although its convenience is debatable - in the case of active methodologies it is limited by the implementation of the methodology itself. Educational evaluation, in order to test for differential academic performance between groups of learners and/or methods, may employ in its statistical techniques descriptive statistics for samples with more than 50 learners, e.g. a Student's t-test. However, these statistical techniques cannot be used in the small groups typical of active methodologies, since sample normality cannot be guaranteed. For this reason, robust statistical techniques are often used [3]. However, the use of these robust statistical techniques has a series of prescriptions and procedures that have been analysed in this paper. Specifically, two robust statistical tests have been applied in this paper: the median test [4] and the Wilcoxon-Mann-Whitney (WMW) test [5]. Using a sample of 35 students of the Master's Degree in Industrial Engineering of the University of Huelva, distributed in three academic years (2021-22, 2022-23 and 2023-24), the referred tests have been applied with respect to academic performance. There was an experimental group (19 students) and a control group (16 students). The application details of each test have been clarified, including the null and alternative hypotheses, the respective statistics of each test, and using R

the case has been solved. It is shown that there is a significant difference in the learning of the experimental group with respect to the control group, based on the median and Wilcoxon-Mann-Whitney (WMW) test.

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RETHINKING SOLAR GEOMETRY AND DESIGN EDUCATION IN TROPICAL ENVIRONMENTS: LIMITATIONS AND OPPORTUNITIES OF CURRENT TEACHING METHODOLOGIES

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Keywords: *Solar geometry, daylight quality, educational resources, learning process, tropical climate*

Abstract

Traditional architecture teaching methods in the tropics have limitations in attaining a deep understanding of solar geometry and its impact on responsive daylight design. Given the importance of environmentally responsible architecture amidst climate change, it is crucial to develop innovative educational resources to enhance students' comprehension of solar geometry, daylight quality and energy consumption. This study intends to establish a theoretical basis to surpass current limitations of educational approaches. We investigated tools and methods of common teaching practice regarding solar geometry and lighting in architecture while identifying factors that assist or hinder student´s comprehension of the subject. While a substantial body of literature exists on the role of daylighting in architecture, more research is needed on teaching methods for daylight design. We conducted a comprehensive literature review of existing tools and pedagogical approaches related to solar geometry and lighting design education in tropical environments. Our methods included a bibliometric analysis to identify relevant publications about the most cited sources and create a content analysis matrix to establish a robust theoretical framework. Additionally, we carried out a diagnostic case study assessing students' knowledge in solar geometry and lighting design at two educational institutions, located in tropical latitudes in Central America (Costa Rica) and Southeast Asia (Malaysia). We analysed the syllabus, course contents, and academic works to identify factors contributing to a lack of understanding. Our findings revealed a growing emphasis on using digital approaches for site analysis and solar simulation. Moreover, we observed an increasing recognition of qualitative aspects of lighting, incorporating virtual reality tools. Our investigation highlights a significant gap between theoretical knowledge taught in architecture programs and its practical implementation in the design process. We contribute to the current practice of architectural teaching pedagogies by offering a detailed overview of the existing methodologies and tools available for daylighting analysis in undergraduate architecture education.

INTRODUCING DATA SCIENCE TO SPANISH SPEAKER STUDENTS USING THE TCLAB ARDUINO KIT

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Keywords: *Data Science Education, TCLab, Student Perception, Multiple Correspondence Analysis.*

Abstract

Data Science techniques hold the potential of analyzing data from multiple sources, which is crucial in knowledge discovery and decision making. It is a promising career with solid demand growth. Therefore, students are pursuing efforts to understand and learn about this topic. Spanish speaker students, however, have difficulties on obtaining hands-on training about this topic in their native language, then, the production of video lectures in Spanish are desirable. This paper shows the perception of 177 students who took the "Introduction to Data Science" course produced by [1] and translated by the authors. In addition, the optional use of the Arduino APMonitor temperature control lab (TCLab) as a tool to enhance learning is studied. Multiple correspondence analysis studied the answers of the survey shown in Table 1 which was filled before and after the course. According to students' opinion, there was improvement in their abilities to program, use Python and Arduinos after finishing the course. Table 2 demonstrate there is statistical significant difference between initial and final answers since p-value is smaller than 0.05.

Table 1: *Initial and Final Survey Questions*

Question Number	Initial Survey	Question Number	Final Survey
1	Select Country	1	Select the best video
2	E-mail address	2	Select the worst video
3	Select age range:	3, 4, 5, 6	Questions 6, 7, 8, and 9 of the initial survey
4	Select profession	7	To what extent the combination of software (Python) and hardware

			(TCLab) influenced your learning experience?
5	Select Background	8	Python and Data Science are usually in English, how useful was to have these video-lectures in Spanish?
6	How would you grade your programming abilities?	9	Do you consider the video lectures interesting?
7	How would you grade your Python programming abilities?	10	How much would you recommend this activity to learn Data Science and programming?
8	How would you grade your abilities using Arduinos?	11	What would you recommend improving in the video-lectures?
9	How would you grade your knowledge in Data Science?		

Table 2: *Initial and final answers of n=121 participants who watched all video lectures*

Question	Initial Average	Final Average	p-value Wilcoxon
How would you grade your programming abilities? 1 is initial and 8 is advanced	4.30	5.37	3.3e-11
How would you grade your Python programming abilities? 1 is initial and 8 is advanced	4.55	5.67	3.3e-12
How would you grade your Arduino management abilities? 1 is initial and 8 is advanced **	1.65	5.13	3.7e-21
How would you grade your data science abilities? 1 is initial and 8 is advanced	2.02	5.58	4.7e-21

*** n=75, students who work with the Arduino TClab*

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NEW METHOD FOR THE TEACHING-LEARNING PROCESS ON CONSERVATION AND RESTORATION OF BUILT HERITAGE: RUINS OF THE MONASTERY OF SANTA MARÍA DE RIOSECO (BURGOS)

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Keywords: *Monastery of Rioseco (Spain); anastylosis; stonemasonry; heritage conservation*

Abstract

In the framework of the Sustainable Development Goals, specifically in SDG11 target 11.4 (Strengthen efforts to protect and safeguard the world's cultural and natural heritage), this document presents a methodological innovation in teaching. This is a practice to stimulate interest and improve student learning in disciplines related to the conservation and restoration of architectural heritage, involving teachers and students in the analysis and procedures for decision-making in specific actions.

This methodology is based on challenge-based learning, combining high theoretical qualification with manual and field work, and aims to provide students with an immediate encounter with the architectural and socio-cultural reality of the site, leaving the "classroom". It has been developed by professors and students of the Master's Degree in *Conservation and Restoration of Architectural Heritage* and the Stonemasonry Workshop of the ETS of Architecture of the UPM, in collaboration with the *Monasterio de Santa María de Rioseco* Foundation.

It has been implemented through two UPM projects, one on Educational Innovation (2019-2021) and the other on Service Learning (2021-2022); both have solved real problems that have ended with the reconstruction of two arches in the Cistercian monastery of Santa María de Rioseco (Burgos), a building declared an Asset of Cultural Interest (BIC) by the Junta de Castilla y León in January 2019.

Figure 1: *Initial and final states of the one of the monastery arches. (Source: MUCRPA)*

APPLYING COLLABORATIVE STRATEGIES IN A GRADUATE DIPLOMA OF STRUCTURAL DESIGN

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Keywords: *graduate diploma; teamwork skills; systematization of experience; university teaching; asynchronous class.*

Abstract

Students enrolled in the Diploma of Study in Structural Design at the Pontifical Catholic University of Peru (PUCP) are required to develop teamwork skills. This promotes effective communication, reflection, initiative, and shared responsibility within the academic group, enabling them to manage complexity. Additionally, it fosters a conducive working environment and collective decision-making, which are essential for professional development [1]. On the other hand, this diploma enables students to update their understanding, analysis, and design skills for various types of structures covered in the nine courses. The aim of this work is to explain how we have systematized our experience with didactic innovation. We have achieved this by utilizing teamwork skills to help our students improve as individuals and professionals, as well as incorporating modern tools. In the Concrete Systems for Containment Liquid Design course, which is part of our Diploma program, we use teamwork as a didactic strategy to develop a professional structural project as a practical task [2]. In addition, the course includes four videos that demonstrated the use of engineering software, such as SAP2000 [3], for the practical task. These videos serve as asynchronous classes. Finally, there is an individual evaluation that allows us to determine if the concepts taught in the classes have been learned. The evaluations from the last five editions of the Diploma in which I have participated have been compared, and optimal results have been achieved. On the other hand, students have shown a high level of satisfaction, as evidenced by the internal course evaluation and feedback on the professor who teaches the Diploma. In conclusion, the implementation of this didactic innovation has been a valuable experience, as it has facilitated the learning process and the development of competent engineering professionals.

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LEARNING PERSONALIZATION THROUGH ARTIFICIAL INTELLIGENCE

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Keywords: *Artificial Intelligence (AI), Learning Personalization, Adaptive Learning Platforms, Intelligent Tutoring Systems (ITS), Predictive Analytics*

Abstract

In the realm of education, Artificial Intelligence (AI) has emerged as a game-changer, particularly in the personalization of learning experiences. Learning personalization is an educational approach tailored to the individual needs, skills, interests, and learning pace of each student [1]. The advent of AI and machine learning (ML) technologies has significantly enhanced the capacity for delivering personalized learning at scale. Personalization in learning involves creating a unique educational pathway for each student. AI systems can analyze vast amounts of data on individual studentperformance, learning habits, and preferences. This data can be used to customize content delivery, assess learning outcomes, and provide feedback in real-time [2-4]. The result is a learning experience that is more engaging, efficient, and effective in improving student comprehension and knowledge retention. The role of AI in learning personalization can be understood through several key implementations such as Adaptive Learning Platforms, these platforms use AI algorithms to adjust the difficulty level of tasks based on the learner's performance. For example, if a student excels in a particular area, the AI can introduce more challenging material to keep them engaged and facilitate continuous learning. Intelligent Tutoring Systems (ITS), these ITS arecomputer systems that provide immediate and personalized instruction or feedback to learners, often without requiring intervention from a human tutor [5]. They simulate the one-on-one teaching experience by responding to student inputs and guiding the learning process. AI can determine the most effective order of learning activities based on the learner's past performance. This means that students do not waste time on concepts they already understand well and can focus on the areas in which they need more help, supporting the Sequencing the curriculum. Another very interesting topic isPredictive Analytics, By analyzing data patterns, AI can predict which students might facechallenges in certain subjects, allowing for early intervention and support to help them stay on track. Personalised learning resources: AI can curate and recommend resourcessuch as books, articles, videos and interactive content that match the learner's level and interests, making learning more engaging and personalised. AI has a significant role to play in education beyond just delivering personalized content. It can transform assessments by offering personalized tests and quizzes that adjust to the student's ability level, providing a more accurate measure of their understanding and progress. However, there are some challenges to consider [6-7]. The success of AI in personalization depends on the quality and quantity of data, which can raise privacy concerns. Additionally, educators need to possess the skills necessary to interpret AI insights and work alongside intelligent systems to integrate them into their teaching. In conclusion, AI-powered personalization has the potential to revolutionize education by providing a

tailored learning experience to each student's individual needs. It can increase engagement, improve outcomes, and lead to a more profound understanding of subjects. As AI technology continues to advance, it will likely become more prominent in education, making personalized learning the norm rather than the exception.

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IMPROVEMENT OF UNIVERSITY EDUCATION IN THE FIELD OF SUSTAINABILITY IN CONSTRUCTION AND INDUSTRY THROUGH INTERNATIONAL COOPERATION ACTIONS

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Keywords: *higher education, international cooperation, problem-based learning, sustainability*

Abstract

The Energy Engineering Research Group (iENERGÍA) [1] of the University of Burgos is made up of researchers focused on subjects related to efficiency, energy saving and sustainability in construction and industry. They teach subjects related to these areas, in addition to mathematics and digitalization. They also collaborate with researchers from the University of the Basque Country in the field of teaching innovation.

They have been progressively implementing a teaching method based on problem-based learning (PBL), which moves away from the traditional approach of theoretical teaching, obtaining greater student involvement and better academic results.

In addition, they participate in two International Cooperation Agreements with the Chouaib Doukkali University (El Jadida) [2] and with the Abdelmalek Essaádi University (Tétouan) [3], both located in Morocco, and a Memorandum of Understanding with the Pusan National University [4], in South Korea. Thanks to them, it has been possible to develop actions such as the exchange of students and researchers, postgraduate training in Master and Doctorate, joint participation in research and technological development projects, the dissemination of the obtained research results, and the

promotion of the transition from the laboratory to open digital educational resources in engineering. In addition, it has made it easier for postgraduate students from Morocco to carry out the experimental part of their research in the facilities of the University of Burgos.

It can be concluded that the international cooperation actions carried out to improve teaching and research in matters related to sustainability in construction and industry and have met the stated objectives:

- The training of teaching staff and students in disciplines related to energy technologies.
- The contribution to the sustainable economic and social development of their region.
- Application of Active Learning Methodologies in engineering studies.
- Prevention and safety training for teachers and laboratory technicians focused on science and technology activities.
- Wide-ranging dissemination activity through scientific contributions to congresses and publications in leading scientific journals.

These actions are also aligned with several of the objectives of the 2030 Sustainable Development Agenda [5].

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EDUCATIONAL INNOVATION FOR TFGS: INTERDISCIPLINARITY IN URBAN HEALTH

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Keywords: *interdisciplinarity, innovation, urban health, Final Degree*

Abstract

The university has in the Final Degree Disertation a valuable tool for introducing students in the research activities. Thanks to the European EELISA project, the Universidad Politécnica de Madrid has created interdepartmental and interdisciplinary groups with common objectives. This is the case of the EELISA *Health in the city* Community, where the objective is health in urban environments, addressed by architects and different engineers. The experience of the elaboration of several TFGs in Architecture co-directed by other schools (Engineering and Telecommunications) is presented, for different projects based on the innovation of Learning based on Challenges and from Service Learning (ApS). In this case, an academic collaboration agreement has been signed with the Sanitas Foundation for the collection of records, data and questionnaires in some of its care centres (hospitals and elderly homes). The experience has been very positive both for the students and for the participating entity, the Sanitas Foundation, as it has obtained a valuable approach to improve the environment of its care centres, both with spatial proposals, such as space management, acoustic or lighting conditioning or even with the contribution of new habits in the use of its facilities and open spaces and gardens.

The results have been 6 Final Degree Projects co-directed by professors of urban planning, telecommunications engineering, and industrial engineering, which propose solutions within the context of ONE Health., is an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals, and ecosystems. It recognizes the health of humans, domestic and wild animals, plants, and the wider environment are closely linked and interdependent to achieve the One Health goal, it is crucial to mobilize multiple sectors, disciplines and communities at varying levels of society to work together to foster well-being and tackle threats to health and ecosystems".

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LOOKING FOR STUDENTS ATTENTION: USING DIGITAL MEDIA FOR LEARNING BASIC PROCESSES IN STEM SUBJECTS

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Keywords: *digital media, attention, applications, microlearning, STEM subjects*

Abstract

The use of digital media in higher education is established for decades. The Covid-19 pandemic has further enhanced the digitalization of teaching, distance education and use of multimedia systems [1]. However, the abundance of resources together with the use of screens can lead to increasingly fleeting attention [2, 3]. Students are accustomed to continuous stimulation and tend to look for an immediate and simple answer to any problem [4, 5]. In STEM subjects it is required understanding and solving certain basic problems, which arises the challenge of getting students' attention [6].

Professors try to afford this situation by focusing on active learning and flipped classroom techniques [7, 8]. Despite this, it is necessary to guide students in a more incisive way through microlearning strategies, which allow to concisely acquire certain procedures and concepts [9, 10]. To do this, tools such as simulators or applications can promote students to better focus their attention on the lessons.

In this work we propose a learning strategy based on the use of small applications, simulators and algebra interfaces on digital devices. We use this approach in Civil and Mining Engineering degrees, taught at the Technical University of Madrid. Its objective is to ensure that they acquire the skills to solve basic mathematical and physical problems, necessary to define solutions in countless engineering scenarios. To this end, we propose the use of the applications during the exercise solving lessons, in periods of no more than 10 minutes and with monitoring by the teaching staff to verify their proper use.

The benefit of this strategy is twofold. On the one hand, it focuses on immediacy and the use of digital devices to capture the attention of students in classes. On the other hand, it is achieved that they learn to solve certain problems actively and not by imitation of the cases presented by the teacher. The initial guidance from the teaching staff also helps students to continue investigating autonomously and extract the full potential of the simulation tools provided. The methodology presented is well received by the students, which increases their involvement and interest in the problem solving classes, instead of being a passive agent during the lessons.

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GAMIFICATION STRATEGIES FOR CALCULUS COURSES IN ENGINEERING

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Keywords: *Gamification, Calculus, Engineering Education, Student Engagement*

Abstract

Calculus, a cornerstone of mathematics and engineering education, is often perceived as a challenging and abstract subject, leading to disengagement and low motivation among students[1,2]. Because of that, it presents as a great opportunity to incorporate gamification elements to foster a more engaging and stimulating learning environment, especially given that it usuallyappears in the early years of the degree.

Gamification is a pedagogical approach that involves integrating game elements, mechanics, and principles into non-game contexts, such as educational settings. The goal is to enhance engagement, motivation, and learning outcomes by leveraging the intrinsic appeal of games. Inthe context of Calculus courses in engineering, gamification can be a transformative strategy tomake the learning experience more dynamic and effective as shown in the literature [3]. The application of gamification principles has gained traction in recent years [4] as an effective strategy to enhance engagement, motivation, and overall learning experience in various educational settings. Applying gamification to Calculus courses in engineering involves strategicincorporation of game elements and principles tailored to the learning objectives.

In this work we will focus on a concrete example. Namely, the syllabus of a Calculus subject at the Mining Engineering School at Universidad Politécnica de Madrid is analyzed and a gamification plan in order to improve learning outcomes is proposed.

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MARKET RESEARCH AS AN EDUCATIONAL ACTIVITY IN CHAIRS OF CIVIL ENGINEERING

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Keywords: *Market research, surveys, construction fairs, technical products, teaching-learning process.*

Abstract

The Market research carried out as an educational activity with civil engineering students from the Concrete Technology, Civil Works Materials 1 and 2 chairs, from the third and fifth semester of two National Universities, are presented based on the results of the surveys carried out on students for 5 years, whether the site of the research was virtual or in-person construction fairs, where product presentations, technical talks, talks on the national reality, information on new products, their properties when applied in the construction, how the system works with the products explained, in some cases their cost was even found out. The aim was to reveal the degree of student satisfaction, the relevance of what was investigated, the applicability of what was learned, taking advantage of it to have feedback on the teaching-learning process [1]. Also taking global results of the different periods analyzed to adjust the entire semester of educational activities [2], to change and administer new teaching techniques and forms of evaluation. Above all, contact with the reality of the market for students is always a novelty that cannot be overlooked, and the opportunities to learn increase greatly, including motivation towards their career in civil engineering. At the end of the year, the evaluations by students in surveys and the results of the Academic Evaluations [2] are strong support for the teaching-learning process.

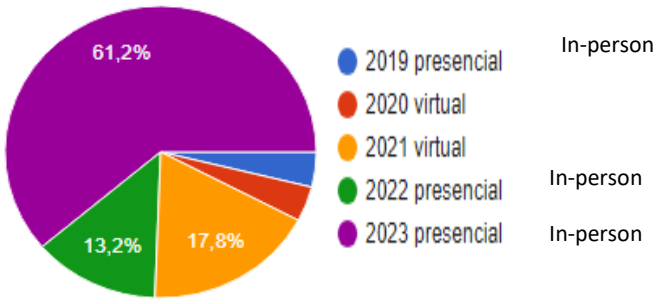

Figure 1: *Fair´s format and year of the research. (Source:[1] own research)*

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BALANCING THEORY AND PRACTICE IN COMPUTATIONAL MECHANICS THROUGH FREEFEM++

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Keywords: *Computational Mechanics; Finite Element Method; Engineering Education*

Abstract

Computational Mechanics has grown quite rapidly for the last decades and has become essential for engineers. Its interdisciplinary character, where the physical problem must be first identified, later expressed and modelled using mathematical methods, but also solved using computational science, makes the teaching of this discipline a difficult task, where there is a need to find a balance between the more theoretical aspects and its use in innumerable applications [1].

We may be tempted to conceive the teaching of Computational Mechanics exclusively from two radically opposite points of view. On the one hand, from a purely formal perspective, it can be approached as the rigorous exposition of a set of firmly consolidated mathematical methods, emphasizing their conceptual richness, but without introducing the aspects of their applicability to the resolution of real problems and the adequacy of some and other techniques to the various mathematical models that may arise, obviating any mention of the final phase of their programming on a code and the interpretation of the results. On the other hand, from a purely practical perspective, it can be seen as the exposition of a set of procedures already implemented in a closed calculation program, which can be considered as ``black boxes'', emphasizing the characteristics of the physical problems under study and the goodness of the results obtained by means of one or another technique, but without transmitting to the student the extraordinary versatile, and the consequent capacity of abstraction that allows him to contemplate this discipline as a versatile and powerful tool, capable of allowing the resolution of an extraordinarily wide range of problems.

In this work, we propose a new approach to teach Computational Mechanics, balancing the theoretical fundamentals and the application of the methods using the Open Source software FreeFEM++ [2]. The use of the software allows us to reduce the programming of most of the methods needed to solve the problem, such as the solver of a linear system, while letting the students to analyze, understand and consolidate the theory that has been previously explained.

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CONSTRUCTION TECHNOLOGY II, PRACTICAL TRAINING IN CLAYS THROUGH SCALE REPLICAS AS VERNACULAR MATERIAL IN ARCHITECTURE

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Keywords: *Clays, construction, vernacular, architecture, scales*

Abstract

The subject of Construction Technologies II, is part of the training of students of Sustainable Architecture at the Universidad Regional Amazónica IKIAM located in the Ecuadorian Amazon; this component presents a degree of complexity because it is a basic subject in the training of the architect [1], so it must incorporate practices for its understanding [2], but so far it has only been dictated theoretically, generating a gap in the constructive technical learning in vernacular materials. In view of this, the proposal is justified in incorporating activities such as practical workshops that make the student relate theory with practice, generating a formative contribution through various activities [3] such as; development of constructive systems to scale, basic tests and other uses of clay as a vernacular material used in construction. The results were a more dynamic, experiential and experimental learning, the idea is to continue implementing this practice over time and perform a verification and evaluation at the end of the course.

Figure 1: *Practical workshop of a scale mud wall. (Source: authors, 2024)*

***Figura 2**: Practical scale quincha workshop (Source: authors, 2024)*

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HUMANTECH: HUMAN-CENTERED TECHNOLOGIES FOR A SAFER AND GREENER CONSTRUCTION INDUSTRY

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Keywords: *BIM, Robotics, Exoskeletons, Autonomous navigation, Digital Twin.*

Abstract

According to the statistical classification of economic activities in the European Community, NACE, the construction sector consists of three main subsectors: first, the construction of buildings, including non-residential buildings. Second, the subsector of civil engineering, which includes construction of infrastructure like roads and railroad, but also telecommunication and energy infrastructure. Third, specialised construction activities like building site preparation including drilling and demolition, electrical installation, and the finishing steps in the building construction process like wall painting. The Gross value added of the construction sector in the EU: 5.5 % of GDP. Even though, the construction sector is an important pillar of the European economy it faces three major challenges: improve its productivity, increase the safety and wellbeing of its workforce and make a shift towards a green, resource efficient industry. To address these challenges adequately, HumanTech proposes a human-centered approach, involving breakthrough technologies such as wearables for workers' safety and support, and intelligent robotic technology that can harmoniously co-exist with human workers while also contributing to the green transition of the industry.

HumanTech aim is to achieve major advances beyond the current state-of-the-art (SoA) in all these technologies, that can have a disruptive effect in the way construction is conducted by a new generation of male and female highly skilled construction workers and engineers, working in a safe and rewarding digitally enabled environment.

These advances will include:

•Introduction of robotic devices equipped with vision and intelligence to enable them to navigate autonomously and safely in a highly unstructured environment, collaborate with humans and dynamically update a semantic digital twin of the construction site.

Visual information capturing will extend to multispectral imaging enabling detection of material composition of built structures besides geometric characteristics.

•Intelligent unobtrusive workers protection and support equipment ranging from exoskeletons triggered by wearable body pose and strain sensors, to wearable cameras and XR glasses to provide real-time worker localisation and guidance for the efficient and accurate fulfilment of their tasks.

•An entirely new breed of Dynamic Semantic Digital Twins (DSDTs) of construction sites simulating in detail the current state of a construction site at geometric and semantic level, based on an extended BIM formulation encompassing all relevant structural and semantic dimensions (BIMxD). BIMxDs will act as a common reference for all human workers, engineers, and autonomous machines.

Once developed these technologies will be demonstrated and evaluated in five different pilots. Pilot-1 will demonstrate Digital Twin for material optimization and safety monitoring, pilot-2 on Robotics and wearables for collaborative laying of concrete blockwork, pilot-3 on Remote controlled partial autonomous demolition, pilot-4 on Digital Twin for bridge inspection and monitoring, and pilot-5 on Robotic mastic application in concrete floors/roadways.

This paper aims to presents HumanTech, its goals and objectives, work methodology, current SoA of different technologies such as collaborative robots; exoskeletons; digital twins, the advances anticipated within the scope of HumanTech, and finally will brief on the different pilots planned where the advancement achieved in these technologies will be demonstrated and evaluated.

Acknowledgement

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DESIGN OF THE BUILT ENVIRONMENT FOR EXTREME HEAT EVENTS USING DESIGN THINKING AND GENERATIVE ARTIFICIAL INTELLIGENCE

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Keywords: *Design Thinking, Artificial Intelligence*

Abstract

Design Thinking, a human-centred methodology that provides tools for tackling complex problems, has gained worldwide popularity in the last decade. Originating at Stanford University, this method was initially applied to real-world challenges in education. In education, technology has transformed teaching, giving rise to disruptive technologies that not only seek to teach the use of ICTs, but also to incorporate them as learning tools to address new educational challenges. It is essential to promote flexible educational approaches that foster critical skills such as empathy, entrepreneurship and innovation, effectively using transformative digital tools to meet emerging demands [1-3]. The Design Thinking methodology includes five phases: Empathise, or understanding audience needs; Define, or reframing problems and gaining insights; Ideate, fostering collaborative work; Prototype, creating tangible solutions; and Evaluate, testing the prototype in a real environment [1].

Artificial intelligence (AI) seeks to address tasks that require human intelligence, highlighting remarkable advances driven by complex algorithms, increased processing power and access to large amounts of data. One of the applications of AI focuses on automated content generation, using neural networks trained by machine learning processes, including deep learning. Generative models process complex and unstructured data, such as text, audio or images, to create new content while preserving the style of the original data [2].

This experiment was carried out during a Workshop in January 2024 with postgraduate students of the Master in Sustainable Habitat and Energy Efficiency, and PhD students of the Architecture and Urbanism Programme of the Universidad del Bío-Bío (Chile), in a hybrid event generated by the Ibero-American networks LINCGLOBAL VIbRA-IS and I-COOP VEnUS, both with CSIC funding. In this workshop they were tasked with proposing innovative architectural solutions to improve the built environment in the face of extreme heat events, using Design Thinking and Generative Artificial Intelligence.

First, the problem of overheating and its impact on human health was presented, then the challenges of the built environment during heat events were identified. In the third phase, through a brainstorming process, students were asked to propose a prompt (the way humans can interact with AI) to be used in various platforms for generative AI imaging. Phases four and five involved the use of the Midjourney platform, designed to create images from textual descriptions. Through prompts provided by the students and successive iterations, several prototypes of innovative architectural solutions were generated. Finally, the generated images were selected as final solutions. This combined approach of Design Thinking and generative AI allowed students to creatively explore and address complex problems in the built environment in a fast and agile way, promoting collaborative work and the use of new technologies that favour active learning in the educational community.

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USE OF INTERACTIVE PROBLEMS WITH ALTERNATIVE SOLUTIONS TO IMPROVE STUDENTS RESULTS IN FLUID MECHANICS

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Keywords: *Digitization, learning to learn, gamification, H5P, engineering*

Abstract

Many engineering subjects focus on the resolution of physical problems. Traditionally, students learn the mathematical procedure to solve the benchmark problems that are taught in the classroom but, sometimes, they do not train the capacity for reasoning why problems are solved in a certain way. Likewise, they may not find an answer for the possible doubts that can arise during the solution of a problem when they work at home, as they cannot ask the teacher.

With the aim to overcome these issues in a subject of Fluid Mechanics, a series of problems were developed with the digital tool H5P for autonomous homework. Concretely, the exercises were created with the tool 'Branching Scenario', which makes possible to segment the resolution of the problem by introducing questions at key points and the students must select the correct answer from a list of possibilities. For each answer, a feedback message is provided to consolidate the corresponding concept. The exercise can be design so as to have different alternative methods to solve the problem. The student follows one or other depending on the given answers to the questions, so they have to think of the better way to proceed. Due to how they are conceived, this type of exercises presents game elements that also help to motivate the students.

The effect achieved by introducing these problems in the subject was analysed by comparing the marks obtained in the two midterm exams by a control group without access to the problems and an experimental group that could use them. This was done in two different bachelor's degrees. The number of times that each student repeated each exercise was recorded as well. The results showed that there was not much difference in the distribution of marks between the control and experimental groups. However, it was found that many students of the experimental group did not really used the H5P problems. When considering only the subset of students that solved most of these exercises (23%), a clear improvement can be observed, as shown in Figure 1 for one of the exams and the degrees. An interesting result consist of the increase in the number of students that accessed most the problems for the second exam in one of the

degrees, changing their proportion in the experimental group from 15% to 31%, as they realized that this material could be useful.

Finally, the students answered a survey about how they valued different aspects of the subject, including the new collection of interactive problems. 71% of the students agreed or strongly agreed that these exercises contributed positively to strengthen the concepts of the subject. However, this level of agreement with respect to the motivation to study the subject provided by this type of resource decreased to 32%, which shows a need to improve the experience intended with this activity.

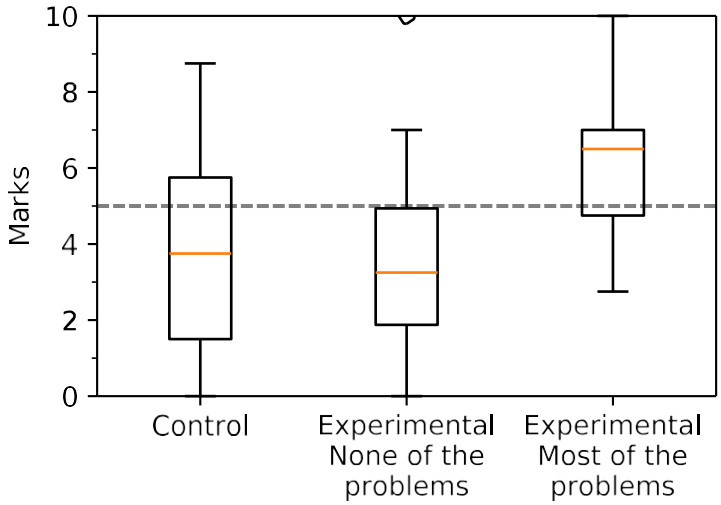

Figure 1: *Distribution of marks in an exam for the control and experimental groups.*

EXPLORING INNOVATIVE TEACHING METHODS IN GEOINFORMATION TECHNOLOGIES: EVALUATION THROUGH AN OBJECTIVE MODEL

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Keywords: *Innovation. Geoinformation technologies. Rasch model.*

Abstract

The present communication focuses on the evaluation of teaching in subjects that involve geoinformation technologies, taught in engineering degree programs, specifically in the teaching of Geographic Information Systems. It proposes a methodology based on the results of assessment tests to understand the existing reasons behind the difficulties experienced by students. The aim is to enhance teaching efficiency through an approach grounded in analysing learning outcomes using an objective model, such as the Rasch model [1].

The Rasch model simultaneously deciphers the areas of the subject with higher and lower success rates among students [2]. This is achieved by obtaining measurements that not only indicate which topics have been mastered by the majority or minority of students but also reveal the profile of those who have achieved outstanding performance [3].

Additionally, this model uses discrepancies to identify both subjects and students that do not meet expectations based on the obtained measurements [4]. This approach provides crucial information for effectively structuring the components and scheduling of the course, considering the detected level of difficulty [5].

In summary, the application of the Rasch model not only sheds light on student performance, but also helps understand the underlying causes of anomalies in both the curriculum and the evaluated students, providing a solid foundation for improving teaching.

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INITIATION OF RESEARCH ACTIVITY IN PRE-UNIVERSITY STUDENTS: ROCKS AND THEIR POSSIBLE TREATMENTS IN BUILDING CONSTRUCTION

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Keywords: *Education, Innovation, Materials, Active Methodologies, Investigation.*

Abstract

The following educational innovation intervention aims to bring the reality of scientific research closer to the students of the 2nd year of Bach. and increase their interest in it, as well as to expose the different active methodologies [1] and the implementation of the universal design of learning in order to work on some subjects and be able to achieve certain specific competences with the development of this whole process.

With this activity it is possible to introduce the content related to the study of materials, more specifically rocks, establishing parameters for their choice and use, through experimentation with these materials in the materials research laboratories of the Department of Architectural Constructions of the University of Burgos.

These concepts have traditionally [2] been difficult to work with on the part of the students, since they have usually been taught by means of the expository methodology with the inclusion of samples for viewing on some occasions, but in none of the cases was it possible to promote motivation and interest in the materials or scientific research.

By moving the students to a physical laboratory where they can observe and work with the materials and equipment that they will find in their possible future professional life, we manage to reverse the situation and introduce a certain interest and desire to develop their skills in investigation [3].

As a starting point, students will receive a series of initial theoretical sessions and materials to achieve a knowledge base that will allow them to develop the work in the laboratory. Then, they will start with the analysis, treatments and tests, following the specific regulations, of rocks as materials to be used in building. Also, it will be important to introduce topics such as sustainability [4], circular economy and analysis of the life cycle of these materials, aspects that condition the choice for their use.

In conclusion, this is an activity of educational and research nature, through which students who are in their last pre-university year acquire knowledge that lasts over time about the analysis of materials and investigative processes, making the study of these topics more interesting and motivating students in the development of their investigative facet.

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BIM METHODOLOGY IN ESTIMATING COSTS FOR THE REHABILITATION AND IMPROVEMENT OF THE THERMAL ENVELOPE IN THE TECHNICAL ARCHITECTURE DEGREE

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Keywords: *BIM, measurements and budgets, automation, architecture*

Abstract

It is proposed the implementation of BIM methodology (5th dimension) [1] for estimating costs [2] in the field of construction through the renovation of the envelope of a single-family house, through the application of an Exterior Thermal Insulation System (ETIS). The increase in productivity in cost estimation, and the reduction and control of errors derived especially from measurements are shown as the main objectives.

Two computer programs have been mainly used: REVIT for the modeling of a simple single-family house, and ARQUIMEDES [3] for creating the budget through its "Budget and measurement of BIM models" [4] module.

The exercise [5] proposes the execution of an ETIS on the building envelope for the reform and improvement of thermal insulation. The students have model an ETIS on the model initially provided in REVIT.

Once the element is parameterized in REVIT, the model has been linked to a new ARQUIMEDES work, which will in turn be associated with the Price Generator or any database compatible with ARQUIMEDES. Subsequently, the work units that belong to each element modeled in REVIT, are introduced into ARQUIMEDES by the student to be related through their corresponding code. Finally, through the ARQUIMEDES module they extract information from the Revit model to generate the measurement and structure the budget.

Main results:

1. Real-time linking of the BIM model with the budget in ARQUIMEDES.
2. Automatic updating of measurements, if the 3D model is modified.
3. Organized structuring of measurements[6] and detailed visual traceability of this.

In budgeting, the use of the BIM methodology offers greater precision and efficiency in calculating measurements, in addition to minimizing errors and automating processes.

However, it is noted that the initial learning curve requires some dedication, even with a simple model like the one proposed.

From this perspective, is the use of this methodology for estimating costs in construction budgets always appropriate?

The precision required in BIM modeling seems to clash with the main objective of increasing productivity in cost estimation when it is a simple model, as it requires an initial investment in modeling and linking time much higher than traditional methods.

It is observed that the amortization of said initial investment would increase the larger and more complex the building is, and the more susceptible to modifications it is, as long as these modifications refer to the dimensions of the elements already modelled.

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ELECTRICAL POWER FLEXIBILITY IN BUILDINGS THROUGH THE CONTROL OF THERMOSTATICALLY LOAD: A REAL-TIME SIMULATOR FOR A COMPREHENSIVE TEACHING

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Keywords: *Didactic simulator, thermostatically controlled load, real-time simulator, building power flexibility*

Abstract

In the realm of modern energy management, the adaptability of buildings to dynamically respond to fluctuations in energy demand stands as a crucial frontier. The burgeoning integration of renewable energy sources, coupled with the imperative to reduce carbon footprints, necessitates a paradigm shift in how buildings consume and interact with electrical power [1]. At the heart of this shift lies the concept of electrical power flexibility, wherein buildings possess the capacity to modulate their energy consumption in real-time, aligning with grid conditions and demand variations.

This paper introduces an innovative application aimed at bringing students closer to the intricacies of energy management. Through a user-friendly interface and interactive learning modules, the application simplifies the comprehension of buildings as "electric batteries" utilizing thermostatically controlled loads [2]. By offering hands-on simulations, it empowers educators and students alike with the essential knowledge and tools to navigate the complexities of energy management within the built environment. The interface aids in examining the impacts of environmental conditions on the A/C cycles (ON/OFF) and, consequently, the power flexibility of the building. The application appearance is the following:

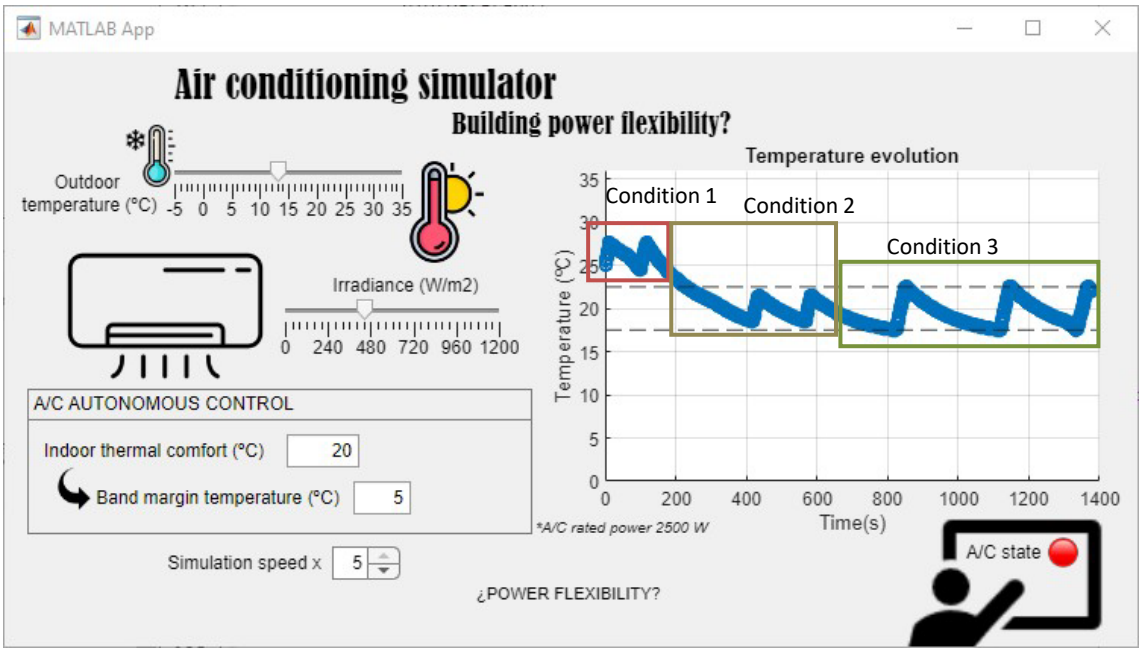

Figure 1 Application interface

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IMMERSIVE LEARNING IN PROJECT MANAGEMENT: INTEGRATING AUGMENTED REALITY AND BUILDING INFORMATION MODELING

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Keywords: *Augmented Reality (AR); Building Information Modeling (BIM); Project Management Education; Immersive Learning; Technology-Enhanced Learning*

Abstract

Project management plays a crucial role in the success of any construction endeavor, ensuring efficient resource allocation, adherence to deadlines, and the delivery of projects that meet client expectations. While traditional teaching methods have their merits, the fusion of emerging technologies like augmented reality (AR) and building information modeling (BIM) holds immense potential to revolutionize project management education.

In the realm of construction education, project management stands as a cornerstone of preparing students for the dynamic and demanding world of the industry [1]. While traditional teaching methods have their merits, the integration of emerging technologies like augmented reality (AR) and building information modeling (BIM) holds immense potential to revolutionize project management education [2].

AR is a technology that overlays digital information onto the real world, providing a unique medium for visualizing and interacting with 3D models and data. BIM, on the other hand, creates a comprehensive digital representation of a building, capturing its design, structure, and associated data. The integration of AR and BIM presents transformative possibilities for project management education, creating immersive and interactive learning environments that enhance student understanding and cultivate practical skills [3].

This study explores the feasibility and efficacy of integrating AR and BIM into project management education using Zappar, a user-friendly AR application. The specific objectives are as follows:

- To evaluate the feasibility of using Zappar to create immersive learning experiences in project management education.
- To assess the impact of using Zappar on student learning outcomes in project management.
- To identify potential challenges and opportunities in implementing AR and BIM in project management education.

The research Methodology is based on a pretest-posttest methodology [4]. It is employed to evaluate the effectiveness of using Zappar to enhance project management education. A control group received traditional instruction, while an experimental group received augmented reality-enhanced instruction, in this regard, Figure 1 shows the model developed by one of the groups. The pretest and posttest assessments measured student knowledge and skills related to project management concepts.

Figure 1: *Model elaborated by one of the groups. (Source: Own elaboration)*

The results of the study, indicate that using Zappar to create immersive learning experiences in project management education is feasible and effective. Students in the experimental group demonstrated significantly improved knowledge and skills compared to students in the control group. The AR-enhanced instruction approach was also found to be more engaging and motivating for students.

The integration of AR and BIM into project management education holds immense promise for transforming the learning experience and preparing students for success in the dynamic and demanding world of construction. By creating immersive and interactive learning environments, these technologies can foster a deeper understanding of project management concepts and cultivate practical skills that are essential for success in the industry. Further research is needed to explore the long-term impact of this approach on student outcomes and to develop more sophisticated AR and BIM integration strategies.

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SUSTAINABLE DEVELOPMENT. IMMERSION AND GAMIFICATION.

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Keywords: *Educational innovation; Sustainable Development; Project-Based Learning; Sectorial roundtables.*

Abstract

Educational innovation and new teaching methodologies in Engineering are becoming commonplace and an incipient way of modifying the student learning and assessment model [1]. In this case, the transformation of a university master's degree subject is proposed through the implementation of the methodology of Project-Based Learning (PBL) summative assessment (SA) and formative assessment (FA).

The subject to transformation, Sustainable Development, is transversal for the master's degree in Industrial Engineering and deals with three fundamental topics: (a) Climate change and sustainable transition, (b) sustainability and business and (c) circular economy. The innovation combines the master class with PBL carried out in the classroom as the contents are developed [2], and a final group activity that serves as an evaluation and the traditional written tests.

The proposed activity is a meeting of sectoral roundtables convened by a government to transpose the new European Circular Economy Directive [3]. Different economic sectors must seek, separately and together, strategies beneficial to each sector, obtain a common position and reach fair and sustainable legislative proposals. In this way, the three main blocks of the subject (a), (b) and (c) are covered.

A distinction is made between regular classroom sessions and a joint final session for decision-making. The students are divided into different groups for classroom sessions, each corresponding to an economic or productive sector. Within each sector, each student assumes the role of coordinator, secretary, documentalist or spokesperson. In these sessions, each group must elaborate on its individual position and consult between sectors if there are dependencies, always supervised by the teacher [4]. Deliverables are extracted from these sessions at the end of these sessions, from which feedback is provided and serves as FA.

The final joint session aims to negotiate between sectors to seek common agreements and proposals. It takes place in a special collaborative space that allows you to work in large groups and present in an immersive room. Each sector presents its proposals, a negotiation moderated by the teacher begins, and final agreements are sought and reached [5]. From

this session, the individual presentations of each group and a joint participation note that serves the SA are extracted as deliverables.

As a result of this experience, it is observed that, in PBL sessions, the work in cooperative groups with differentiated roles enhances the interaction promotion between the groups, generating a positive interdependence but with individual responsibility. As for the final joint session, the promoter interaction is favoured in terms of the exchange of opinions and strategies, reciprocal help and stimulation of efforts and positive interdependence with respect to the external rival.

As objective indicators to evaluate the effectiveness of PBL expertise, we use class attendance and final exam scores. By including these activities, attendance at 100% of the sessions goes from 85% in previous years (20/21 and 21/22) to 97% in the years of study (22/23 and 23/24). As for the grade on the final exam, in previous years, the average was around 6.5/10. After this experience, it shifts to 9.5/10 (Figure X).

In conclusion, it is recommended to include this type of activity both in class and in the assessment. Students rate it very positively, explore and learn about new ways of learning, and the assessment improves objectively.

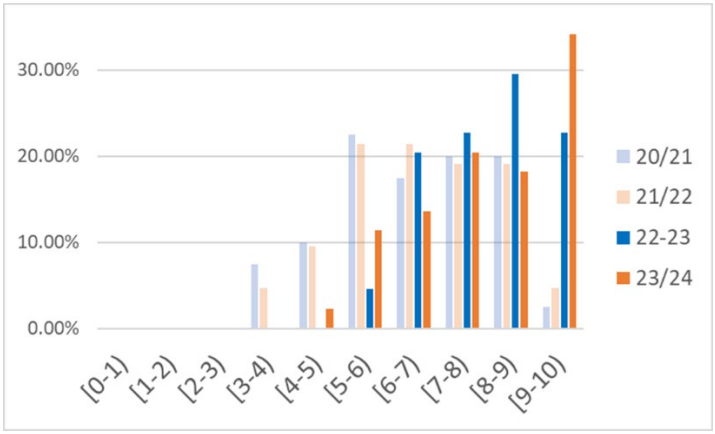

Figure 1: *Final exam results before (20/21 and 21/22) and after including PBL activities (22/23 and 23/24)*

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GRAPHIC EXPRESSION TO INCREASE AWARENESS OF THE PHYSICAL SPACE OF THE CLASSROOM IN SCHOOL CHILDREN

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Keywords: *Graphic Expression, Perception, Physical Space Awareness, Classroom, School Children*

Abstract

Teaching spaces must meet the pedagogical and well-being needs of their occupants, both physically and psychologically. The application of different teaching methodologies in different contexts, together with the fact that they vary according to time and circumstances, forces the classroom today to have a greater capacity for adaptability than has traditionally been required [1]. On the other hand, contemplating the classroom as a dynamic resource leads to studying its relationships with those who use it. Environmental psychology plays a fundamental role in this. The interaction of students and teachers with the classroom can take place consciously or unconsciously, in the latter case affecting emotions [2][3], attitudes [4][5][5] and behaviour [6][7][8]. Ultimately, it is found that learning outcomes themselves can be affected by classroom design [9][10][11].

Within this context, classroom users can make the most of the space they inhabit if they are previously able to learn about the environment and its possibilities. The aim of this article is to present a pilot experience aimed at promoting awareness of the physical environment of the classroom through a reflection on its current state followed by a graphic representation of its ideal projection. The study is carried out in 8 classrooms of Primary and Secondary Education in a school in the Community of Madrid. The methodology combines group reflection, data collection through online questionnaires and graphic representations of the imagined spaces.

The productions of the participating students demonstrate a variety of approaches both in the subject matter and in the chosen method of representation. Beyond the existence of aesthetic aspects or the personalization of the physical space, the conclusions also point to other issues such as the expected use of the classrooms or the well-being of the students themselves. This non-probabilistic sampling leads the authors to think that a more in-depth study or one that includes the teaching staff could serve to detect the real needs of the users themselves and ultimately evaluate the state of the classrooms at the municipal or regional level.

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PROMOTING SUCCESS THROUGH COLLABORATIVE WORK IN BUILDING ENGINEERING: DEVELOPMENT AND STRENGTHENING OF PROFESSIONAL SKILLS

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Keywords: *Collaborative learning; building engineering; transversal and professional skills; teaching experience*

Abstract

The business involvement and the introduction of technologies have transformed education and learning in the European Higher Education Area (EHEA) [1]. Consequently, providing solutions tailored to the training demands of the 21st century and preparing students for the acquisition and development of strategies, skills, and competencies are considered a fundamental responsibility of current educational institutions [2]. The research conducted examines the suitability of Collaborative Work and the EHEA, fostering interaction among students and the development of social and professional skills.

The didactic strategy used during the experience impacts the mode of learning and facing challenges [3]. Its implementation, both synchronously and asynchronously, promotes student autonomy and facilitates the exchange of information. Teachers act as facilitators, guides, and collaborators, abandoning the traditional role of knowledge transmitters. This implies that students take on an active and responsible role, allowing teachers to perform integral functions [4]. In this context, the aim is to achieve democratic and shared learning, redefining educational dynamics to meet new demands.

The main objective of this research focused on enhancing cross-cutting competencies through collaborative work. A total of 150 students, (approximately 50 on average per academic year), participated in this project within the subject of Valuations and Appraisals, spanning three academic years over a semester's duration.

In this study, the necessity to implement improvements and advancements in teaching led to the proposal of an innovation in the teaching-learning system with the aim of achieving effectiveness. To achieve this, a basic characterization of the identified situation in both the teaching and professional performance realms was conducted [5]. The comparison between the two allowed for the identification of differences and the search for points of convergence.

From a professional perspective, the field of real estate appraisal as a specialty requires highly specific knowledge and practice. Professionals involved must be subject matter

experts capable of addressing the diverse scenarios demanded by each case and purpose [6]. Additionally, in such professional activities, the workflow does not follow a linear sequence in difficulty; it does not correlate with an increase in complexity based on time, training, and the technician's knowledge.

The results of the innovative experience confirm the necessity and importance of implementing structured approaches in learning to address solutions related to professional topics, with a particular focus on the benefits derived from interaction among members of the same group. The recognition of skills during teamwork and the ability to solve problems and address workplace situations become evident.

The conclusions affirm that this methodology contributes to enhancing the quality of teaching by providing an excellent formative opportunity, implementing competencies and content into the learning process.

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LEARNING AND SERVICE EXPERIENCE FOR ENVIRONMENTAL EDUCATION THROUGH TYRE RECYCLING AND RECOVERY

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Keywords *Service-Learning (SL), environmental education, undergraduate and postgraduate, end-of-life tyres (ELT)*

Abstract

Large cities generate a strong environmental impact as a consequence of the progressive accumulation of solid waste produced daily by their inhabitants and industries. End-of-life tyres occupy a special position among these waste materials due to the complex management process of these products, as well as their slow process of environmental degradation. Although tyres disposal is regulated and controlled by the authorities, many tyres are illegally dumped in landfills, on roadsides or dumped in the sea. It is estimated that by 2030 the number of discarded tyres worldwide will reach around 1.2 billion units [1], which is a challenge for the sustainability of the planet.

Education for sustainable development must integrate not only technical and specialised training but must also incorporate an awareness of the environment and a commitment to training in values [2]. In this sense, the environmental problems caused by the progressive accumulation of end-of-life tyres (ELTs) in cities can serve as a starting point for carrying out an educational experience that involves students in solving current problems.

The Service-Learning (SL) methodology is presented as a current educational tool that allows university students to become involved in solving problems close to their environment [3]. In this paper, we present the guidelines used to carry out an APS experience aimed at environmental education, and which takes the recovery, recycling and revaluation of NFU as its central axis. The proposal has been designed by teachers of the E.T.S. de Edificación de Madrid and has had the support of the organisation SIGNUS Ecovalor S.L. and has been carried out from the 2022/23 academic year to the present day with undergraduate and master's degree students.

Firstly, students are introduced to the problem of solid urban waste management and become aware of the importance of taking action to mitigate the environmental impact of large cities on the planet. At this point, they have the support of the collaborating

entities and it is related to some of the contents of the syllabus. Subsequently, undergraduate students are in charge of designing possible business models based on an innovative use of the by-products obtained from the treatment of NFU, and postgraduate students carry out laboratory tests with the aim of characterising and analysing the technical and economic viability of these new sustainable materials.

The final result is a multidisciplinary work that concludes with a series of business proposals for the application of the NFU in the construction sector, as well as several technical reports drawn up by the Master's students that serve to inform and raise awareness through their subsequent dissemination. It has been possible to see how the application of this methodology in the classroom has been motivating for the students and has been a challenge for the teaching staff, who have had to progressively monitor the tasks in order to successfully complete the project developed.

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DESIGN THINKING: EMPOWERING SUSTAINABLE DEVELOPMENT IN CONSTRUCTION

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Keywords: *Design thinking, Challenge-based learning, Sustainability, SDGs, Buildings*

Abstract

The significant environmental impact of buildings in terms of CO2 emissions makes the sector one of the most relevant in the fight against climate change. Likewise, current European legislation is promoting actions to promote energy efficiency and the renovation of the building stock in order to achieve zero or near-zero consumption buildings through initiatives such as the European Green Pact. In this context, the Innovation Group in Physics Applied to Building is promoting the training of students in energy efficiency in building through the Design Thinking methodology, linking the SDGs of the 2030 Agenda as the fundamental pillars in this multidisciplinary educational approach [1-2].

The project seeks to apply Challenge-Based Learning to students of Building and Business Administration, as well as the Master's Degree in Technological Innovation in Building, focusing on solving real challenges related to building monitoring, promoting skills such as critical thinking and the use of free software. The aim is to improve communication, take advantage of laboratory resources and encourage student autonomy in collaboration with the Monitoring and Technological Innovation in Building Group. The transversal integration of the subjects involved strengthens the experience, and, through the Design Thinking methodology, the motivation and environmental commitment of the students is boosted [3].

The Challenge-Based Learning methodology promotes the resolution of relevant social problems, aligned with the Sustainable Development Goals (SDGs), involving students in the process. It highlights its ability to raise awareness of environmental issues and foster collaborative and multidisciplinary research. Students learn to identify problems and propose solutions, improving interdisciplinary understanding. On the other hand, Design Thinking strengthens the integration of contents and competences, addressing difficulties in relating concepts in different subjects. This methodology boosts curiosity and the desire to learn in both students and teachers, promoting a more holistic and transversal teaching.

The project focuses on the elaboration of reports to monitor the actions carried out, with the aim of creating a methodological guide of good practices at the end of the

project. This guide will help future teachers and university colleagues to implement similar initiatives in their classrooms, including difficulties encountered, timing, evaluation systems, level of achievement of objectives and proposals for improvement.

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COMPARISON OF THE ADJUSTMENT TO THE GMPM BSSA 14 FOR THE REGION OF SPAIN WITH THE EARTHQUAKE RESISTANT DESIGN REGULATIONS IN SPAIN

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Keywords: *GMPM, GMPE, BSSA 14, Calibration*

Abstract

Seismic activity in any case represents a danger to society due to the different effects that it can bring to buildings and infrastructure and therefore to the lives of the living beings that live in them.

There are two modalities that are generally used to estimate or establish seismic events and effects. Both work with a database of records with which they establish a series of statistical analyzes that allow us to have an idea of the different parameters that make up an event of this random nature. The first is the DSHA, the second is PSHA, being a probabilistic analysis that is estimated using all the possible locations of the hypocenter and the seismic magnitude that the movement can generate.

The PSHA is based mainly on the ground motion prediction equations (GMPE) [1], which are equations that work from different parameterized coefficients to adjust the response spectra that can be calibrated depending on the site. These equations, formerly called attenuation laws, today a large number of authors have generated these equations with different limitations that can be applicable to various areas or specific sites. Being able to obtain a response spectrum adjusted to the seismic data of the region allows structural designers to generate designs that are based on the performance of the structure in the face of these actions, making it more efficient.

One of the biggest problems in creating or generating a GMPEs is having sufficient data to allow for statistical robustness in terms of the calculations and the different regressions to be carried out [2], since these equations try to predict the behavior of the soil in the event of an event that is Random in nature in every sense, having as much information as possible will establish a greater range of possibilities for predicting a site's response to these events. However, there are places whose geographical locations with respect to the tectonic plates separate them from seismic activity, making their seismic records poor and therefore presenting great difficulty when creating a GMPEs.

With this problem, it is necessary to use alternative methodologies that allow obtaining a response spectrum characteristic of the region. One of the methodologies that is

currently being used is the use of a reference model to analyze its behavior with less robust data than that used for its creation.

Following the residual methodology we have been able to create a GMPEs adjusted to Spain, using the seismic data provided by the National Geographic Institute to calibrate the BSSA 14 model [3][4][5], which adjusts to the characteristics of the information. Using this methodology, obtaining as a result a 5% damped response spectrum that adjusts to the seismic parameters found in the region of Spain.

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MEASUREMENT OF AMBIENT NOISE IN THE PROTECTION PERIMETER OF ANDALUSIAN SPAS: A MULTIDISCIPLINARY EDUCATIONAL INNOVATION PROPOSAL

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Keywords: *Teaching-learning; collaborative learning; sustainable development; interdisciplinarity.*

Abstract

Fieldwork in higher education represents an opportunity to promote hands-on learning beyond the classroom [1]. At the same time, it facilitates the encounter, interaction, and exchange of knowledge among students from different disciplines in the geographical space where teaching practices take place. In this context, an exchange of experiences and knowledge is proposed among students from three degrees at the University of Granada: Degree in Geography and Territorial Management, Degree in Building, and Degree in Law. The main aim is to measure ambient noise in the legal protection perimeter of the spas in Lanjarón and Alhama de Granada (Granada, Spain) and evaluate whether acoustic quality objectives are met. In multidisciplinary working groups, it is proposed to characterize the equivalent continuous sound pressure level (L_{eq}) based on on-site measurements for assimilation to the $L_{eq\text{-}day}$ noise index. Subsequently, the obtained values are compared with the acoustic quality objectives for noise applicable to existing urbanized areas, in A-weighted decibels (dBA), according to the Decree 6/2012, of January 17, which approves the Regulation on Protection against Acoustic Pollution in Andalusia [2]. In this way, joint work will allow for the analysis and comparative assessment of noise pollution levels within a sector of the territory predominantly used for tourist purposes, such as the surroundings of a spa. Simultaneously, there are special protection needs within the perimeter to ensure environmental conservation and prevent noise pollution in ecologically valuable spaces that host the mentioned spas.

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THE USE OF AI TOOLS AND THEIR IMPACT ON THE ASSESSMENT OF POSTGRADUATE COURSES IN THE TECHNOLOGICAL FIELD

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Keywords: *Artificial Intelligence (AI), Practical Activities, Skills Assessment, Educational Impact.*

Abstract

The objective of this paper is to experimentally quantify the extent to which the utilization of freely accessible AI by students in the Postgraduate Master's Program in Renewable Energies at the Universidad Europea de Canarias can substitute their anticipated effort when undertaking proposed and graded practical activities. The aim of this analysis is to draw final conclusions that will facilitate the adoption of various strategies aimed at maintaining the necessary level of essential knowledge and technical skills of the graduates for the development of their profession, taking into account that this Master's program is currently highly valued by both students and the demanding job market in the field of renewable energies.

Our study is based on the proposed activities in the "Renewable Energies Startups" module, which lasts for a quarter and carries 6 ECTS credits. These practical problems were solved with the assistance of various AI tools. The evaluation of these automated results was conducted using the same criteria - assessment rubric - employed for scoring students in a previous edition where the AI tools used in the experiment were not publicly available.

An analysis of the responses that would have been given to the questions posed in the exam by users who had fed the specialized tools being analyzed with the contents of the official syllabus was also carried out. Additionally, the time used was compared with the minimum time stipulated in the study plan developed by the University for mastering the syllabus and completing the module.

The results, weighted identically to the overall module evaluation, allow us to assert that the indiscriminate use of AI tools in their current configurations may, unethically for the student, reduce the time needed for exercise development. However, this comes at the expense of poor outcomes, both in learning and grades, especially in a technical module like the one that served as the basis for this study, to the extent that it may hinder the student from successfully completing it.

POURQUOI DES PROFESSEURS?: REEXAMINING GEORGE GUSDORF'S WORK IN RESPONSE TO THE CHALLENGES FACING MODERN UNIVERSITIES

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Keywords: *Relativism; Humanities; University; Technology; Teaching Identity*

Abstract

The appearance of ChatGPT in 2023 highlighted one of the major concerns arising from emerging technologies, particularly Artificial Intelligence in education: the role of teachers [1]. In this regard, the question arises of what value a teacher brings compared to the perfection of AI and robotics as educators. In this context of uncertainty, we mark the 60th anniversary of the publication of the work "Why Teachers?" by French philosopher Georges Gusdorf, reissued in Spain in 2019 [2]. The aim of this research is to analyze the role of the University, and more specifically of the professor, in the face of methodological and technological imperatives. Specifically, this study seeks to find insights in his work to rethink teaching identity in the 4.0 world. To achieve this, a hermeneutic-interpretative analysis is conducted, drawing on the author's Theory of Education, also supported by another lesser-known work, "L'Université en question". The study results allow three considerations of teaching identity around three major axes: the fragmentation of knowledge, the erosion of authority, and truth. Firstly, Gusdorf emphasizes that the teacher is not simply called upon to teach their particular science, but through their teaching, they must help students connect that science with other disciplines, so that the student truly acquires a worldview at the university. Secondly, in an era where educational horizontality is advocated, Gusdorf's work allows us to rethink what the authority inherent to the teacher means and how this authority is ontologically different from the authority that an AI may have. Thirdly, it questions whether AI and its purported neutrality are the best paradigms for education. Conclusion: The question posed by Gusdorf at the beginning of his work, "What am I here for, what do my students come here to do, what do I expect from them, and what do they expect from me?", is a question that has always been present among those dedicated to teaching, but one that now urgently needs to be addressed and compared with the response that an AI may provide as an educator. The results of this study shed light on this comparison from the perspective of a philosopher not widely known in our time, whose work deserves renewed attention.

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BORDERLINES, BORDERSCAPES, BORDERBODIES: THE CHALLENGE OF THE FOUR BORDERS IN THE SANTA CRUZ REFINERY

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Keywords: *Santa Cruz de Tenerife, Refinery, Borders, Urbanism, Cartography*

Abstract

The teaching methodology outlined here operates within the "Santa Cruz Verde 2030" initiative, a collaboration between the municipality of Santa Cruz de Tenerife and CEPSA. This collaboration explores the transformation of the Refinery's grounds into a 576,000 m2 urban expansion, a space larger than 168 New York Central Parks. Despite positive intentions, the political and economic realities of concessions and urban constructions introduce interests that could thwart this opportunity for Santa Cruz. Acknowledging this, the European University of the Canary Islands entered a collaboration with CEPSA in 2022, committing to generating ideas presented on June 10, 2024, at the Tenerife Architects Association.

In this context, the Urbanism department of the European University of the Canary Islands has aligned the courses of the 3rd (Territorial Planning), 4th (City Workshop), and 5th year (Territory and Landscape) during the fall semester of 2023. The goal is to propose ideas for the Refinery area and explore connections with existing parts of the city and the sea. This is encapsulated in the project "BORDERLINES, BORDERSCAPES, BORDERBODIES: The Challenge of the Four Borders in the Santa Cruz Refinery."

Urban design centers around "delimiting," setting boundaries that distinguish and create physical or imaginary distances between territories, cities, or neighborhoods. This seemingly innocuous line can materialize into invisible, impactful borders leading to complex urban situations.

These studio courses recognize the imperative need to experiment and analyze these borders to comprehend the city. This involves understanding the "Borderlines," the landscapes they create –"Borderscapes"–, and the human and non-human entities that inhabit them –"Borderbodies"–. Four distinct borders have been identified and will be studied through various contemporary spatial dynamics (Fig.1):

1. Eastern Border - "**Economic-Cultural Border**": Defined by the presence of the Meridiano shopping center or the cultural space El Tanque.

2. Southern Border - "**Maritime Border**": Where the TF-4 highway acts as a boundary between the refinery and a coastline as abrupt as neglected.

3. Northern Border - "**Social Border**": Expanding and creating an isolating zone fluctuating between industry and four residential blocks intersecting with the TF-5 highway.

4. Metaborder - "**Landscape and Recreation Border**": A steep ravine traversing the refinery from northwest to southeast.

Groups are formed, each selecting one border to work on three stages:

1. **Border-Cartographies:** FollowingFélix Guattari's concept of the "Three Ecologies," the aim is to visualize physical, social, and affective infrastructures. This entails not only mapping visible city layouts but also the invisible lines forming affective and relational networks.

2. **Border-Proposal:** Once the cartography is complete, a spatial understanding of tangible dimensions (morphological and infrastructural) and intangible dimensions (affective, sociological and ecological) is achieved. Time to cross the border line and engage in urban design linked to the population necessities.

3. **Proposal Detail:** The final part of the submission is involving a detailed exploration -architectural scale- of on one of the areas proposed.

Navigating through these stages, students cultivated a holistic approach, taking into account physical, social, and affective dimensions. This paper aims to showcase the outcomes and highlight their potential benefits.

Figure 1: *Santa Cruz Refinery and its four borders. Triggering of the project. By the author, 2023.*

ARCHITECTURAL, URBAN AND VIRTUAL MATERIAL INTERVENTION IN TOURISTIC ENVIRONMENTS FOR COMMUNITY INTEGRATION FOR RESIDENTS AND VISITORS

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Keywords: *integration, tourism, residents, psychological, perception*

Abstract

Visitors perception of urban environments is variable, with its main determinants being architectural design, the quality of social spaces, and environmental respect and commitment [1]. These three parameters play a fundamental role in the visitor's conceptualization of a secure, sustainable, and appealing city to visit. However, these may not always be the priority parameters for residents in these areas.

Considering tourist interest in urban environments in the Canary Islands involves a well-established setting where residents and visitors coexist [2], a pedagogical practice of research, selection, and urban improvement projection has been carried out. This approach focuses on intervention in existing elements and inner regeneration as a means of integration through the consensus of both resident and visitor communities [3].

In this practice, extensive research has been conducted on a sample of residents and visitors in the historic center of the town of La Orotava. The investigation has focused on objective parameters that have psychological implications on the perception held by residents and visitors of the built environment. The conclusive results of this study highlight categories of intervention linked to the sustainable revitalization of the historic center, its heritage using ecological materials and energy-efficient technologies as positively perceived conditions forming the foundation of urban enhancement for tourist interest. This convergence of interests between residents and visitors, as identified in the initial study, is corroborated by various external research studies.

Therefore, students propose tourism improvement processes that include sustainable construction materials for public spaces, typically associated with high-resistance surfaces. They also advocate for the use of traditional techniques for heritage restoration and conservation, the implementation of active and passive systems to optimize energy consumption in heritage buildings, improvements in insulation, shading systems, and the use of renewable energies. These projects enable the incorporation of

multimedia virtual reality tools to simulate the final image of the environment, allowing for the assessment of the degree of appreciation by both the local community and visitors without the need for prior material development. This approach enjoys a higher level of acceptance, leading to greater engagement from the resident community and better appreciation and loyalty from visitors [4].

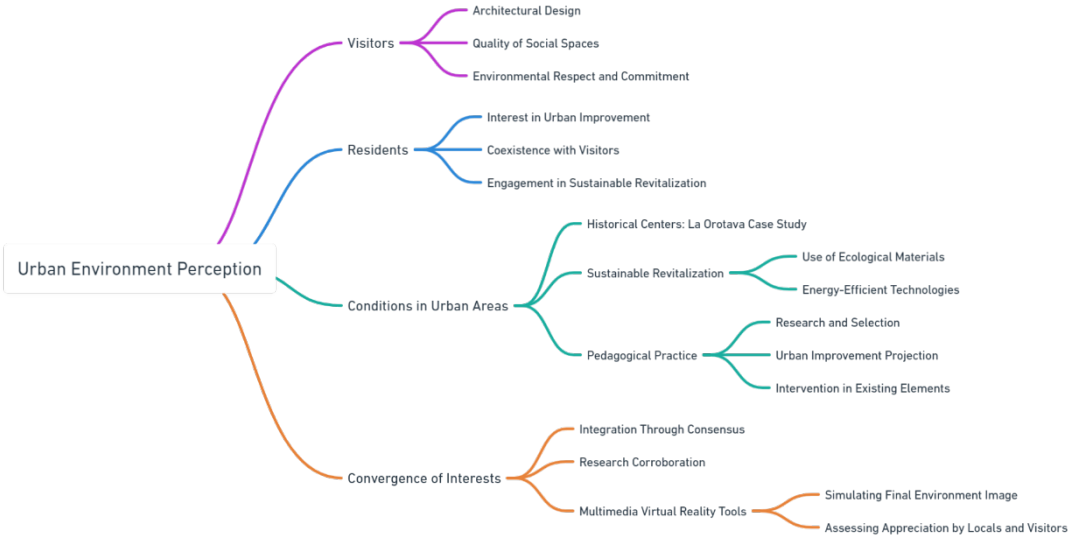

Figure 1: *structure and key elements of perception systems in urban environment*

Designed and tested in the 22-23 academic year, this practice fosters collaboration between the public and private sectors, the inclusion of all stakeholder groups within the resident population, and an enhancement of the tourist perception [5]. It also improves the practical application of various subjects such as Heritage Intervention, Architectural Projects, and Urban Planning in a real-world context, aligning with the experiential learning methodology.

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BUILDING RESIDENCE HALLS TO CREATE LEARNING COMMUNITIES

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Keywords: *Residence Hall, University, Learning, Building, Architecture*

Abstract

The transformation of university education in the last three decades is palpable: the proliferation of new degrees and specializations, the progressive digitalization of education, remote teaching and the loss of materiality in the student experience.

In this context, the Colegios Mayores Universitarios in Spain are claimed as spaces of university education, recognized as such in the last Organic Law of the University System.

In addition, the Colegios Mayores, as non-profit educational institutions, aim to be a "lived university" [1]. In contrast to the forms of accommodation in residences that prioritize the separation and individualization of students, the Colegios Mayores continue to offer a rich community life, shared accommodation and a rich offer of activities that promote encounters.

The architecture of the Residence Halls must also be cared for if they are to fulfill their purpose as a university institution. An architecture that fosters coexistence, a space that is an environment for dialogue and encounter is essential to fulfill the formative mission of the Colegios Mayores. Architecture should provide in the university and in the Colegios Mayores "An area of freedom in which to deploy one's own personality by founding areas of interaction with the environment" [2].

An interaction with the environment that not only results in a unilateral enrichment, but in the creation of authentic university communities in which learning takes place on a daily basis. A community in which each of the members is not dissolved in the mass, but has its own place and identity.

An architecture that allows community living and at the same time privacy and seclusion is fundamental to fulfill the mission of the Colegios Mayores. An architecture that preserves the space of each of the students and offers meeting places will allow the College not to fall into communitarianism, but to forge an authentic university community [3].

In short, the role of the Colegios Mayores and their architecture in the current Spanish university scene is of special relevance if we want to promote the synthesis of knowledge, mutual.

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UPDATE AND INNOVATION OF TEACHING METHODOLOGICAL STRATEGIES IN THE CURRICULUM OF THE DEGREE IN BUILDING ENGINEERING (DIAGNOSTIC PHASE)

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Keywords: *Building Engineering, Methodological strategies, Curriculum, Training needs.*

Abstract

The Degree in Building Engineering (DBE), established in the 2009-10 academic year at the University of Castilla-La Mancha, has successfully navigated all accreditation and renewal processes as stipulated by Royal Decree 1393/2007. This period has witnessed significant transformations in the economic, technological, cultural, social, and political structures of our environment, which have had profound impacts on the construction and building sector. Furthermore, in alignment with Royal Decree 822/2021, the continuous enhancement of the teaching-learning process necessitates the development of specific pedagogical innovation strategies. These strategies, which are to be updated in existing university degrees, will influence the array of subjects comprising the curricula.

Nonetheless, any modifications to these curricula must uphold the objectives, competencies, and learning outcomes as defined in Order ECI/3855/2007, dated December 27. This order delineates the verification prerequisites for official university degrees that qualify individuals for the Technical Architect profession (BOE 29/12/2007).

Consequently, before embarking on the development of coordination strategies designed to stimulate activities that optimize the teaching-learning process, a preliminary diagnostic phase is required. This phase will lay the groundwork for an update or modification of the current Curriculum of the Degree in Building Engineering at UCLM. This paper outlines the process of gathering and analyzing information related to three strategic areas:

1. The development of new, specific pedagogical innovation strategies (student-centered teaching, learning, and evaluation, and the training of teaching staff in these methodologies, such as project-based learning or practical case studies).

2.The identification of training needs associated with emerging technologies (e.g., BIM, Artificial Intelligence, interdisciplinarity and versatility, collaborative and cooperative work, etc.).

3. The adaptation to new, alternative fields that align with some of the Sustainable Development Goals (SDGs), particularly in the areas of sustainability, energy efficiency, and the circular economy.

THE VIRTUAL LEARNING OBJECT AS A STRATEGY FOR TEACHING ENVIRONMENTAL CULTURE TO UNIVERSITY STUDENTS

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***Keywords**: Virtual learning object, Moodle, H5P, Environmental culture, University students*.

Abstract

Information and Communication Technologies [ICT] have had a strong presence for several decades in the educational field, which has made possible the emergence of digital tools such as virtual learning objects, a resource used as a didactic strategy that can achieve a high level of knowledge and performance by students. One way to combine the use of technology in education is through the use of the so-called Virtual Learning Objects [VLOs] which, in terms of Moreira (2021), is defined as a set of digital resources, self-contained and reusable, with an educational purpose, consisting of at least three internal components: content, learning activities and contextualization elements. In this regard, Rossetti, García, Rojas, Morita and Coronado (2020) agree that the components of an VLOs have the purpose of promoting self-study, reinforcing the knowledge seen in class, motivating learning and improving the academic performance of young university students. In this sense, the purpose of this work was to design a Virtual Learning Object [VLO], developed in Moodle and H5P for learning about environmental culture of students in an undergraduate academic program at the Autonomous University of Sinaloa [AUS]. The study was developed under a qualitative, descriptive, non-experimental and cross-sectional design, which was carried out with a sample of 7 AUS students. The results indicate that 86% of the students responded that the purposes of the VLO were clear, while 14% disagreed. In addition, students recognize the ease of learning, the agility and dynamism of the activities, the feedback and acquisition of knowledge, the diversification of learning methods and the improvement of education. In conclusion, the VLO, designed with H5P technology in a Moodle, benefits both teachers and students by optimizing the didactic material and the teaching-learning process in environmental education topics for university education.

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THE USE OF PRACTICAL CASE TO SUPPORT ACTIVE WORK IN HIGHER EDUCATION

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Keywords: *practical case, students, higher education, active participation, social work*

Abstract

The profile of university students has undergone significant changes in the last decade. In most cases, they consider that working as social educators is an alternative. A plan b. For this reason, Higher Education teachers must possess the skills and opportunities to implement constructivist pedagogical approaches that foster intrinsic motivation and collaboration among students. At the University of Granada, a teaching innovation was carried out in the degree of Social Education. This initiative focused on solving different practical situations that could occur in their professional work - case studies - through group work and in a collaborative manner. This way of proceeding contributed significantly to the creation of a relaxed atmosphere, as well as promoting the active participation of all students in the subject.

CASE STUDY 1:

You are a social educator working in a reception centre for unaccompanied minors. A minor, Luis, arrives at the centre and confides in you that he has escaped from a situation of labour exploitation and human trafficking. He is visibly frightened and does not want anyone else to know about it.

How would you apply the code of ethics in this situation?

If tables and / or figures are necessary, use the following format:

Figure 1: *Educational innovation resource 1: Practical case study 1 (Source: Own elaboration)*

CASE STUDY 2:

Imagine the situation of a social educator working in a centre for people with disabilities. He comes across the case of Ana, a young woman with an intellectual disability who has been teased and excluded by her peers in the institution where she lives.

How would you apply the code of ethics in this situation?

Figure 2: *Educational innovation resource 1 Practical case study 2 (Source: Own elaboration)*

INHABITING LEGACY SPACE: STUDENT REPUBLICS AS SPACES OF UNIVERSITY EDUCATION

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Keywords: *residential institutions; university; democratic learning; architecture*

Abstract

Diverse phenomena such as waves of youth violence, political polarization, or the increase in mental health disorders among new generations challenge the ability of educational systems to fulfill the democratizing promises of teaching [1]. In this regard, various international organizations are insisting on the importance of generating educational experiences that promote critical thinking, civic participation, and tolerance among new generations, both in formal and non-formal education at various levels of teaching [2].

In recent years, various critical voices have emerged pointing out that university education has focused too much on its professionalizing function to the detriment of also providing students with broad cultural education that enables them to place their profession in a broader context: that of the common good [3]. In this panorama of "higher education's loss of direction" [4], it is necessary to seek spaces and educational practices that have resisted this professionalizing drive and continue to offer students experiences that enable them for life in democracy. One of these spaces is undoubtedly the student residences. These residences, established in the late 19th century, not only shape the architecture of the University of Coimbra but are also an integral part of its history. Recognized as historical and cultural assets by the City Council of the city, they represent a deeply countercultural lifestyle in an era marked by individualism. Considered by the University of Coimbra as centers that invigorate cultural and academic life, each republic brings together twelve students in an environment of freedom, equality, and plurality [5]. Their self-managed character and political activism, particularly during the resistance to the Estado Novo regime and the academic crisis of 1969 against Salazarism, have transformed these spaces into unique places for democratic learning [6]. The concept of legacy and heritage plays a fundamental role in the educational experience of these residential spaces, where self-government and architecture go hand in hand to generate a experiential imprint on the residents.

The objective of this research is to carry out a qualitative study through the analysis of paintings from various student residences and interviews with their residents, in order to analyze the impact of this architecture on university identity. The results highlight the importance of spaces as places of rootedness where, in the face of the loss of grand

explanatory narratives of reality, they allow students to enter university from a community that provides an explanatory sense of reality. Thus, drawing on Giussani's work [7], it is concluded that the architecture of residential accommodation can offer a working hypothesis on university identity from which to give meaning beyond professional qualification to the university experience.

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CHARACTERISATION OF THE COLOMBIAN HIGHER EDUCATION OFFER IN ARTIFICIAL INTELLIGENCE

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Keywords: *Artificial Intelligence (AI), Higher education, educational offer, educational trends, Colombia*

Abstract

At the end of 2022, with the public and open launch of ChatGPT, the first Chatbot created in the 1960 (LIZA) [1] was left behind, bringing with it convergent and divergent positions on its incorporation into the classroom [2][3]. Despite its notable current positioning [4], it is important to bear in mind that artificial intelligence encompasses other types of developments and applications that have been part of our lives for years. An example of this can be found in search engines such as Yandex, recommendation systems such as those found in Netflix or Amazon, and at the organizational level, there are pre-existing developments from companies such as Oracle, IBM, among others. Therefore, AI in its strict sense is not a novelty, it is an area of development that has been evolving and today offers a space for articulation between the productive and professional training scenarios, bringing with it challenges, disruptions and repercussions [5][6][7]. In this context, our objective was to characterize the offer of academic programs focused on Artificial Intelligence within the higher education system.

Methodology: A descriptive study was carried out based on closed categories taken from the classification pre-established by the National Higher Education Information System (SNIES)[8]. The sample included all higher education programs that reported to SNIES under a single inclusion criterion: "specific mention of Artificial Intelligence in their final degree" with a total population of 19 active and inactive programs that constituted the sample (n=19). Closed categorization techniques were used for analysis and data were analyzed using descriptive statistics and graphical analysis.

Results: The supply is concentrated in institutions of private origin (95%), the majority of which are active (89.5%), whose recognition by the Ministry is distributed as follows: 5% have high quality accreditation, 10.5% have no recognition, and 84.5% have qualified registration. Taking into account the year of registration, we find that the programs were registered in the last five years as follows: in 2019 (32%), 2020 (16%), 2021 (16%), 2022 (10%), 2023 (16%) and 10% are undated (inactive). As for the level (undergraduate and postgraduate), 74% belong to the postgraduate level, while the undergraduate level represents 26%. The majority of programs are face-to-face (58%) with a concentration of 47% of all programs in the capital city, with an average cost per year at undergraduate

level of 8,348,333 Colombian money and at postgraduate level of 22,001,098 Colombian money, with a difference of 38% between the annual costs according to level.

In conclusion, the national higher education system has a process of articulation with the demand for programs focused on Artificial Intelligence that begins in 2019, mainly at the postgraduate level concentrated in the capital city. Its offer is mainly of private origin through qualified registration, with a cost that varies between levels (undergraduate and postgraduate) by 38%. However, future research is needed to establish the articulation and absorption of the country's productive system.

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RETHINKING AND CREATING URBAN SPACE FROM A GENDER PERSPECTIVE: A DIDACTIC PROPOSAL

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Keywords: *feminist approach, women, urban planning, city*

Abstract

Being a woman and inhabiting the urban space entails a very different spatial reality perception and interpretation compared to the experience of the male collective. Cities should be designed based on the experience of the people who inhabit them, attending to their complexity, diversity, and collective demands. However, urban planning and management have not traditionally taken into account the experience and knowledge of women. Therefore, the incorporation of a gender perspective as an analytical category in urban planning is crucial to create inclusive urban spaces that enable the right to the city for all individuals. In this context, the objective of this work is to bring this gender approach to the teaching-learning processes in the classroom through a didactic proposal that allows measuring gender inequalities in the urban policy of Granada (Spain). For this purpose, the seven thematic lines proposed in the Action Plan of the Urban and Rural Agenda 2030 of Granada are analyzed: urban and territorial model, natural and cultural heritage, population and territory, economy and society, environment, climate change and energy, mobility and, ICT and smart territory. Additionally, key aspects in urban planning are considered: the use of public space, security and urban identity. In order to carry out the activity, work groups are formed, in which each student must critically review and thoroughly assess a specific theme line. Subsequently, the conclusions and value judgments are presented to obtain a comprehensive and detailed view of the document, enabling collective debate among students. The results show a positive assessment from the students regarding the activity, as they state that it allows them to rethink their immediate urban space. At the same time, urban space is not neutral and incorporating a feminist approach into the development of urban policies is essential to rethink the city and create new, more equitable, inclusive and sustainable urban models. In conclusion, this didactic proposal contributes to reflect on the visualization, among students, of gender inequalities in urban public policy in a more practical and proactive way. Students become protagonists as social actors shaping the territory and active agents in the integration and promotion of gender equality in the environment they inhabit.

ANALYSIS OF THE MOTIVATION OF UNIVERSITY STUDENTS IN CROSS-BORDER ENVIRONMENTS AS A VARIABLE IN THEIR PSYCHOSOCIAL-EDUCATIONAL PROFILE

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Keywords: *motivation, university students, cross-border environments, gender, religion*

Abstract

Students' motivation plays a very important role in their learning and career development because it drives them to overcome challenges and maintain the commitment to continue learning throughout their lives. Motivation can be influenced by external factors such as gender, religion, or the nature of the studies being pursued, especially in contexts such as cross-border contexts where very diverse people with different backgrounds and religions converge [1–3]. In these contexts, teachers must encourage students' motivation to foster their critical sense. Therefore, we propose to analyze the variables of religion, age, university degree, access route, and gender, and relate them to motivation [4–6]. A descriptive, exploratory, cross-sectional study was carried out with a total of 137 students enrolled in the degrees of Social Education, Early Childhood Education, and Primary Education at the Ceuta and Melilla Campuses of the University of Granada, aged between 18 and 52 years old. The selection of the participants was carried out by stratified random sampling with a master error of 0.05. To define the socio-demographic variables, a self-reporting questionnaire was developed, in which the students could register their age, gender, religion, university degree, and educational pathway of origin (baccalaureate, vocational training, over 45, etc.). The Academic Motivation Scale [7](Vallerand et al., 1992) was used, which measures student motivation with 28 items, each of which is assessed on a Likert scale from 1 to 7. Seven dimensions are measured, each with 4 items. The dimensions are Intrinsic Motivation directed to knowledge, Intrinsic Motivation directed to achievement, Intrinsic Motivation directed to stimulating experiences, Extrinsic Motivation/external regulation, Extrinsic Motivation/introjected regulation, Extrinsic Motivation/identified regulation and demotivation. Data analysis was performed using IBM SPSS® 26.0 statistical software. For basic descriptive data, frequencies were used, while for the relational study, after checking that the distribution complied with the normality criteria, the parametric Student's t-test was used for dichotomous variables and the one-factor ANOVA for the contrast in polytomous variables. Finally, Pearson's bivariate correlation was used to establish the relationship between variables. The students of the Early Childhood Education degree are the most intrinsically motivated, corresponding to the vocational nature of the degree. The motivation of education students in this study does not depend on gender due to the low rate of males taking

the degree, nor on religion because a majority of students participate in a religion. Students' degree affects their level of motivation, especially as it relates to student regulation [8–10]. In addition, intrinsically motivated students, those driven by personal interest and satisfaction in learning, maintain a constant level of motivation. This type of learner is not demotivated and does not rely on external motivation, such as recognition and rewards, to keep them motivated and engaged [11,12].

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ANALYSIS OF SPANISH EDUCATION REGULATIONS: FROM CONTENT-BASED EDUCATION TO EDUCATION BASED ON TRANSVERSAL COMPETENCIES

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Keywords: *content, competences, education, regulation, cross-cutting.*

Abstract

Legislation is the backbone of education policy. Depending on what the educational regulations stipulate, some principles or others will be applied. This research work employs a qualitative design, based on the content analysis of Spanish sighted regulations in educational matters, taking into account the pre-constitutional legislative background and its evolution up to the current Organic Law for the Improvement of the Organic Law on Education, commonly referred to as LOMLOE [1]. For this purpose, all the organic and ordinary laws, legislative decrees, decree-laws, and ministerial orders that totally or partially affect the Spanish education system have been selected. The aim is to analyse the content and evaluation of the regulations in relation to learning at each stage of education. The importance of acquiring and developing skills, abilities, and competences, always aligned with those established by the regulations, is highlighted. Each stage of education is examined in detail, from Early Childhood Education through Vocational Education and Training to university studies, highlighting objectives, pedagogical approaches and educational transitions. Successful assessment at each stage leads to qualifications leading to various options, such as access to the labour market or the pursuit of higher education. Vocational Training, including Basic, Intermediate, Higher and Dual Vocational Training, is presented as a relevant option for those with specific employment preferences from secondary school onwards. The exhaustive analysis of Spanish educational regulations reveals a notable contrast between the legislative stagnation during the Franco dictatorship and the overabundance of regulations in the democratic era. The main findings of this research highlight, on the one hand, that the educational assessment system has evolved from an assessment centred on theoretical knowledge to an assessment centred on the competences that students have to acquire at each educational stage. Moreover, educational assessment has evolved from quantitatively measuring the curriculum to focusing on the competences developed. On the other hand, there is an excessive production of regulations in the Spanish educational field, which causes alterations in the different subsystems that make up the educational system. This regulatory excess has turned education into a major source of political power, generating instability in the education system by constantly enacting and reforming regulations. Similarly,

depending on the educational segment, some competences are worked on (key competences in primary, secondary and baccalaureate) or others (professional, personal, and social competences in vocational training). This study contributes to building specific training programmes for university students focusing on the competences they will need in their future professional work for which they are being trained. Limitations include the constant modification of regulations with political changes and the divergence of regulations between educational stages. Future research could address the comparison with European regulations and other European education systems.

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THE ROLE OF HISTORY IN THE AGE OF CANCEL CULTURE: ENHANCING DEMOCRACY THROUGH UNIVERSITY ENGAGEMENT

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Keywords: *democracia; humanidades; cancelación; ética; ciudadanía activa*

Abstract

In the face of the current culture of cancellation and political correctness, we are witnessing strong phenomena of content suppression in educational curricula and the cancellation of speakers on campuses worldwide. This urges us to consider the role of historical memory in educational curricula [1]. These cancellation phenomena run parallel to others resulting from the infiltration of mercantilist logics into educational curricula due to soft national policies in which recommendations from international organizations such as the OECD play a significant role [2]. This has led to prioritizing applied training in the form of so-called "competencies" at the expense of cultural content [3]. All of this leads to a context where the focus is on "training in morally neutral competencies," displacing humanistic content from university education. The aim of this research is to contemplate the role that history and cultural content play in university education and their relationship with the maintenance of democracies, as well as to examine the criticism of those who label these contents as potentially indoctrinating in a context of pedagogical neutrality. To achieve this goal, a hermeneutic-interpretative methodology typical of the Theory of Education is employed, examining the thoughts of Robert Spaemann, Fabrice Hadjadj, and François Bellamy as critical apparatus. The results allow for the presentation of five arguments to defend the importance of transmitting cultural content in university education and the danger posed to the maintenance of democratic systems by yielding in this transmission. The results of this study position us in a current debate that not only involves the inclusion or exclusion of history from university education, but also the reinterpretation of potentially sensitive or offensive episodes. In this debate, it is important to remember that History, with its lights and shadows, should not be confused with a chronological accumulation of facts, but rather, through them, it opens up the possibility of deep educational reflection: not all lives that are possible to live are equally valuable. Advocating for the ethical criteria with which to guide professional and personal life constitutes an essential task of university education, and therefore, the Humanities in general, and History in particular, must maintain an important role in university curricula.

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THE ACADEMIC PERFORMANCE OF BACHELOR'S DEGREE STUDENTS AT THE MICHOACAN UNIVERSITY OF SAINT NICHOLAS OR HIDALGO

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Keywords: *academic performance, higher education, public policy.*

Abstract

In order to ensure the right to education and make it available and accessible, the state of Michoacán provides educational services through institutions whose structure and composition have evolved over the years by incorporating or adapting new elements to meet the educational needs of society. (Comisión Nacional para la Mejora Continua de la Educación, 2021).

Michoacan University of Saint Nicholas of Hidalgo (MUSNH) is the institution of higher education with the largest enrollment in the state of Michoacan, and it ranks eighth among the 35 state public universities in terms of enrollment.

University students expect that by becoming competent professionals, they will be able to integrate into both the labor and social spheres, placing their trust in the educational system in which they are enrolled. This implies that university education, from an ethical standpoint, must ensure quality in all dimensions, both personal and professional, for academic and subsequent career performance

Therefore, it is crucial to understand the challenges that university students face during their academic journey. In this context, this work focuses on the issues related to the factors influencing the academic performance of undergraduate programs at MUSHH.

Regarding the evolution of academic performance in the region, over the past five years, there has been a consistent trend in the 8.0 to 8.9 scale. These data correspond to the level of performance obtained in each of the four areas evaluated by the National Assesment Center. (CENEVAL [2016, 2017, 2018, 2019, 2020, 2021]), considered satisfactory performance.

The information will be obtained through a questionnaire whose construction was carried out through of independent variables and one dependent variable, using a Likert-type scale (1932). Additionally, the pilot test and the results derived from it will be presented to assess the validity and reliability of the questionnaire.

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AI APPLICATIONS THAT IMPROVE THE ACADEMIC PERFORMANCE OF STUDENTS LIVING IN AREAS OF SOCIAL EXCLUSION TO PREVENT THEM FROM DROPPING OUT OF SCHOOL

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Keywords: *social exclusion, academic performance, AI applications*

Abstract

Educational institutions face a challenging challenge in attracting students who can effectively meet their academic demands. This is a difficult task to achieve, as academic performance outcomes are influenced by a variety of factors such as cultural, demographic, social and economic factors. In particular, pupils living in areas of social exclusion are more likely to drop out of the education system early. However, in recent years, the application of Artificial Intelligence (AI) in teaching and learning processes to improve students' academic performance has been scarce. Numerous studies confirm the advantages of AI, as it helps students to learn more effectively and improve their academic performance through personalised learning, as it adapts to the individual needs of each person. On the other hand, it also enables the development of critical thinking, creativity and problem solving.

In this sense, personalising the teaching-learning process allows access to material resources, tools and strategies adapted to specific interests and needs, thus optimising learning experiences and improving academic performance. Likewise, such performance is better when educational attention is personalised because it allows students to be attended to according to their characteristics. Therefore, the application of AI in educational institutions at risk of social exclusion requires careful planning and adequate training of educational staff.

Taking into consideration the aforementioned, the aim of this paper is to describe Artificial Intelligence applications aimed at improving the academic performance of students at risk of social exclusion. To this end, we have resorted to a literature review for the extraction of AI applications considering a series of selection criteria. Finally, it is concluded that AI applications improve the academic performance of vulnerable groups, thus preventing school dropout.

ON THE USE OF TABLET AND AI TOOLS TO ENHANCE STUDENT LEARNING IN STRENGTH OF MATERIALS

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Keywords: *higher education quality, AI in higher education, tablets in learning, engineering undergraduate instruction, strength of materials*

Abstract

We have witnessed the soaring use of tablet devices in higher education, revolutionizing the accessibility and versatility of educational resources, and providing students with immersive learning experiences that transcend traditional classroom boundaries [1-3]. Focusing on structural mechanics, tablet-based applications offer an array of interactive tools and simulations that enable students to visualize and comprehend complex mechanical behaviours [4]. For instance, virtual experiments allow students to explore stress-strain relationships, vibration modes, deflected shapes, and material properties in real-time, fostering a deeper understanding of theoretical concepts through hands-on exploration [5].

Integrating tablet devices and artificial intelligence (AI) tools has emerged as a transformative approach to enriching student-learning experiences in courses like Strength of Materials [6, 7]. This study tackles with the innovative application of tablet and AI technologies to facilitate and enhance student learning in Strength of Materials, a core subject in engineering curricula. By harnessing the capabilities of these technologies, educators can create dynamic, interactive, and personalized learning environments tailored to the needs of diverse student populations [8].

Complementary to tablet-based teaching and learning, AI-powered tools offer intelligent adaptive features that personalize the learning journey for each student. Machine learning algorithms analyze student performance data to identify individual strengths and weaknesses, enabling the delivery of tailored learning materials and targeted interventions. In the context pedagogical development, AI algorithms can generate adaptive quizzes, provide instant feedback on problem-solving exercises, and offer personalized study recommendations based on each student's progress and learning style [9].

To illustrate the practical application of these technologies, consider an example scenario where students use tablet devices equipped with AI-powered apps to analyze

structural failures in real-world engineering case studies. Through interactive simulations, students can investigate the causes of structural failure, identify stress concentrations, and propose design modifications to enhance structural integrity. Additionally, teachers can lean on AI algorithms to prepare exams, analyze historical failure data to predict potential failure modes, and recommend preventive measures, enabling students to apply theoretical knowledge to real-world engineering issues.

Furthermore, collaborative learning experiences facilitated by tablet and AI technologies foster peer-to-peer interaction and knowledge sharing among students. Virtual study groups, discussion forums, and collaborative projects provide opportunities for students to collaborate on assignments, exchange ideas, and engage in collective problem-solving activities. By leveraging social learning features, educators can cultivate a supportive learning community where students collaborate, innovate, and inspire one another to excel in their studies [10].

The findings of our study show that integrating tablet devices and AI tools holds immense potential to enhance Strength of Materials education, offering students dynamic, personalized, and collaborative learning experiences. Through interactive simulations, personalized feedback, and collaborative projects, students can develop a deep understanding of mechanical principles and cultivate the critical thinking skills needed to succeed in engineering. As technology continues to evolve, educators must embrace innovative pedagogical approaches that harness emerging technologies' power to empower tomorrow's engineers [11].

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ARTIFICIAL INTELLIGENCE AS A TOOL FOR BUILDING STUDENTS

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Keywords: *Artificial intelligence, Building students, Innovation tool, Motivation*

Abstract

Constructive Attitude Educational Innovation Group is carrying out a project called "Build with artificial intelligence" in which we propose activities to be carried out in various subjects using artificial intelligence (AI). These activities aim to demonstrate the potential of AI to improve efficiency and accuracy in various areas of education. Some examples are the following:

- In the subject of Measurements and Budgets, students will be divided into two groups to carry out a typical practice of the discipline. One group will use traditional methods, while the other will employ AI. The objective is to compare the results obtained by both groups and evaluate the advantages that AI can offer, such as the use of real prices from databases.
- In Advanced Passive Systems Design, students are encouraged to use AI to determine the most appropriate passive strategies for a specific climate or location. The results obtained will be compared with those of usual methods, including classical solar charts.
- In the subject of Construction Materials II, an activity will be proposed in which students will use AI to analyze its potential in the quality control of construction materials and in the interpretation of the current regulatory framework.

Finally, in Planning and Programming of Works I, a practice will be carried out in which students must reduce the deadlines for a work at the lowest possible cost, both with the traditional Pert-Cost method and with AI. The ability of AI to improve accuracy in time estimation will be analyzed.

Through these practices, students will be able to experience first-hand the benefits and challenges of implementing artificial intelligence in their fields of study.

EDUCATIONAL ENERGY CHALLENGE: DEVELOPING SUSTAINABLE LEADERS FROM VOCATIONAL TRAINING TO UNIVERSITY

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Keywords: *energy certification, challenge based learning, SDG, collaborative learning*

Abstract

The main objective of this project is to strengthen and improve teaching processes and learning outcomes in various subjects through innovative methodologies. It seeks to improve continuous assessment through the integration of mini-challenges, offering students dynamic and attractive assessment opportunities. In addition, it is intended to increase student participation and support through group activities in the mini-challenges, fostering a collaborative learning environment. Student motivation will be enhanced through creative and experimental activities, especially designed to facilitate the participation of those students who face greater difficulties [1,2].

The project focuses on facilitating the development and evaluation of transversal competencies, such as responsibility, oral and written communication, and teamwork. It also seeks to cultivate specific skills related to planning, organization, cooperation and entrepreneurship, preparing students for practical applications in real-world scenarios. Intended to serve as a model for future educational innovations, it aims to successfully extend this methodology to other subjects, providing a template for tomorrow's education. The mini-challenges will not only promote the development of ideas linked to alternative and sustainable energy, but will also contribute to the understanding of the Sustainable Development Goals (SDGs) [3,4].

The products resulting from this project include an energy audit and certification of a real building, specifically the IES Antonio Machado de Alcalá de Henares, a manual of improvement measures to be carried out in the building analyzed with the collaboration

of the Passivhaus Building Platform (PEP) and the measurement of different parameters through sensors that will be performed by a master's thesis student. These collaborations not only enrich the learning experience for the students but also establish a framework for future extensions and collaborations with external agents.

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INCLUSIVE LEARNING FOR SUSTAINABLE FUTURES

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Keywords: *Service learning, social responsibility, innovative methodologies, collaborative learning, participatory methodology.*

Abstract

The subjects of Installations I and II of the Bachelor's Degree in Building Engineering and the Double Degree in Building Engineering+ADE, look at aspects related to the design, calculation and sizing of the different installations found in residential buildings. For this reason, a technical vision of the content of both subjects is developed, which is based on the study of the regulatory regarding the building installations and apply it to the building process, an ability to develop the building's installations in a structural way, to control and plan their execution and to verify the service, reception, and maintenance tests.

This learning and service project proposes to develop an itinerary with actions to avoid that not only do families suffer from energy poverty, but also promote a consciousness-raising about the water consumption. To this end, a "Guide of Basic Techniques against the fight against energy poverty and the correct water consumption" (good practice guide) will be written in order to improve the information, training and empowerment of consumers to control and save energy consumption, on energy services, providing additional help for those consumers who may need it.

It is important to mention that the good practice guide will be the result of a collaboration between students from the Polytechnic University of Madrid and students with disabilities from Focus Labora program. Therefore, this project also encourages the inclusion of those student who, apparently, have less opportunities. This edition has received a higher interest from students which not only do they participate in the guide's elaboration, but also in other type of activities with Focus students.

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MAIEUTICS COMBINED WITH ONLINE COMPUTER APPLICATIONS AS AN EDUCATIONAL STRATEGY TO LEARN TO LEARN (LtL)

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Keywords: *Learning to Learn (LtL), Modern Maieutics, Teaching Software, Logical Inference, Logical Answer*

Abstract

Currently, one of the most challenging educational challenges is teaching how to acquire knowledge [1]. This problem has its origin on the one hand in the high amount of information to which the student is exposed, and on the other hand in the ease of obtaining this information highly “digested” on the Internet [2]. This combination means that students are used to receiving information that is simple to consume in a very direct and fast way. The student no longer needs to develop the skills of analysis, critical understanding, and logical deduction of information provided in a restricted amount. This supposes that the student can quickly find and absorb specific concepts, instead, they do not have the necessary skills to know how to learn a new discipline [3]. This lack of capabilities to know how to Learn to Learn (LtL) can have a very negative impact on the student's educational career. It is necessary to include new programs that reinforce LtL in the educational strategy. In this article, we propose a methodology to acquire LtL skills. This methodology is based on the combination of Socratic maieutics and online computational applications.

Maieutics was used by the philosopher Socrates as a form of education. It consists of the teacher asking questions about a certain subject, and the students acquire knowledge through logical responses to these comments [4]. The Socratic theory indicates that knowledge of any subject is locked in the essence of the human being. Without going into philosophical considerations, it is evident that the exercise of answering questions helps develop learning expertise.

Nowadays there are many online computer applications, completely free and easily accessible. As examples, we can cite "the Comway game", "the rock-paper-scissors game with Machine Learning (ML)" or "parabolic shot calculation applications" among others [5]. These applications have a very easy-to-use interface and allow an infinite number of tests to answer the questions.

For example, by combining maieutics with the application of "rock-paper-scissors" the teacher can formulate increasingly complex questions: *are you able to win? why are you not able to win? What strategy are you using? What happens if you don't use strategy? Do you think you can beat the machine?* The student's answer to these questions will provide knowledge about ML, strategy, and random numbers. However, the most relevant aspect of the use of this methodology is to transmit LtL in a way that is easily recognizable by the student.

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THE IMPORTANCE OF SPORTS IN HIGHER EDUCATION

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Keywords: *Sport, University education, frustration, anxiety*

Abstract

There is no doubt that the University stage is one of the most important phases in a person's life, but at the same time, one of the most stressful. Obtaining good performance, good grades, can generate frustration and anxiety.

That is why it is necessary to improve physical and mental condition and one of the most recommended ways is to practice sports, through which the body and mind face the challenges generated during study time more positively.

There are many hours that a student spends sitting in class or studying at home, so sport also helps prevent diseases related to a sedentary lifestyle, and makes the brain much more active and attentive, increasing its performance.

The University is committed to sports and must continue to support it. It creates new sports spaces and constantly encourages students to be members of a sports team and/or to participate in interuniversity competitions, improving their teamwork skills, motivation and effort. Benefits that also have an impact on their later professional stage, where they demonstrate the ability to adapt to changes and work under pressure.

In short, in the same way that sport is a fundamental and mandatory part of the previous educational stages, primary and secondary, it should be integrated into the university stage, which is much more intense and, at times, frustrating. Presenting it as just another subject and establishing it as an *"academic, teaching and training asset in which activities are established based on the degree and group of students"* [1].

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ANALYSIS OF THE INTERACTION OF INTERNATIONAL EXCHANGE STUDENTS IN THE GROUP RESULTS. CASE OF THE SUBJECT OF SPANISH POPULAR CONSTRUCTION

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Keywords: *student, exchange, group, erasmus, magallanes.*

Abstract

This paper presents the results of the analysis about the data obtained from the performance of the students in the optional subject of Spanish Popular Construction, Updated to academic year 2022-2023. Specifically, the aspects related to the presence of exchange students from the programs ERASMUS and MAGALHÃES.

The subject was taught in the 2013-2014 [1][2][3][4] academic year for the first time. Regarding the presence of exchange students, they have been incorporated in the last nine years, representing a substantial percentage of the total students.

For these exchange students the attractiveness of the subject lies in the fact that it is optional. This allows to them more curricular plastic possibilities. In the other hand the subject is properly dedicated to the Spanish field. This is especially indicated to satisfy the curiosity for a different culture for them. And finally, nevertheless refers to a universal technology such as construction, therefore, easily integrated into their own knowledge.

In this work have been essential the factors related to the interaction between students who are exchange and those who are not. Looking for conclusions that allow to guide the exchange student. Not only in the development of the subject, but in the way of face it and for work with the rest of the students [5].

To pass the subject of Spanish Popular Construction it is necessary to carry out an individual work and another in a group (team) [6][7]. The first will deal with a building of its own kind of heritage. Carrying out a detailed analysis of the physical characteristics and the constructive strategies chosen to face or respond to the conditioning factors of the environment in which it is located. In the second, the group one (teamwork), they are asked to elaborate an analysis of the environmental, geographical, geological,

climatic, historical, and economic factors of one of the historical regions of Spain and a catalogue of the constructive solutions that respond to these characteristics.

Then, to success in this subject group work (teamwork) is therefore substantial [8]. Its demand from the students a close relationship of work, exchange, discussion, and collaboration. Initially, it is not required that the working groups be mixed in gender and nationality. Therefore, teams are formed in which the components are all exchange, teams with both types and teams without exchange students. Although the recommendation is made that the groups be mixed, asymmetrical and culturally and linguistically varied.

This freedom allows us to analyse results from teams with different compositions. For the overall analysis, factors such as the proportion of total exchange students, individual qualification, average group grade, discriminated average grade, average grade of the teams in relation to their composition, etc.

It has been observed that group work generally improves qualifications compared to individual work [1][2][3][4].

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#SOROLLA-ETSEM ECO-LEADERS. ApS FOR SUSTAINABLE EDUCATION IN BUILDING

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Keywords: *Design thinking, Challenge-based learning, Sustainability, SDGs, Buildings*

Abstract

In today's rapidly evolving environment, the pressing issue of energy consumption in buildings looms large, accounting for almost 40% of the European Union's energy usage. This staggering statistic underscores the urgent need to address sustainability concerns and safeguard both the environment and the well-being of citizens. It's imperative to cultivate a culture of sustainable development among university and pre-university students, empowering them to devise innovative solutions for optimizing energy efficiency within urban environments. This is where Service-Learning emerges as a powerful tool, bridging the gap between theory and practice by immersing students in real-world scenarios.

The Escuela Técnica Superior de Edificación de Madrid stands at the forefront of this movement, advocating for the integration of Service-Learning methodologies into higher education. This advocacy is exemplified in a recent initiative aimed at tackling energy efficiency challenges at an Adult Education Center. Leveraging the technical prowess of students enrolled in the Master's Degree in Building Management, collaborative efforts are underway to minimize energy consumption and modernize facility infrastructures through interdisciplinary collaboration.

The Service-Learning project is meticulously designed, encompassing preliminary training for university students in areas such as Heritage Management, Operation, and Maintenance, and for adult education center students in Technology-related subjects. Led by university faculty, environmental awareness workshops are conducted on both campuses, bolstered by unwavering support from institutional leadership. Subsequently, master's degree students translate theoretical knowledge into practical solutions, devising comprehensive maintenance and rehabilitation plans critical to the center's longevity. Simultaneously, adult education students extend their impact

beyond the classroom, championing sustainable practices within their communities and crafting a compendium of best practices for local buildings.

The results speak volumes about the efficacy of Service-Learning initiatives in university settings, underlining the transformative potential when supported by strategic planning and stakeholder collaboration. Enhanced academic performance, reduced absenteeism, and heightened student engagement underscore the tangible benefits witnessed firsthand. This endeavour not only outlines the implementation process but also serves as a blueprint for educators seeking to integrate Service-Learning methodologies, fostering sustainability within educational ecosystems and paving the way for a brighter, more environmentally conscious future.

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PROBLEM-SOLVING APPROACH AS AN ALTERNATIVE TO REGULATORY CHANGES IN TECHNICAL CURRICULUM.

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Keywords: *Normative changes, construction structures, flipped classroom, problem-oriented learning.*

Abstract

The teaching of subjects related to the construction of structures involved in construction work in technical careers is complex [1,2]. The knowledge and competencies to be acquired come from two sources: a scientific-technical one, related to structural analysis, which allows understanding how what is intended to be built works, and another regulatory one, understood positively as the agreement reached by the profession, represented by its most eminent technicians, to facilitate the verification of safety, complying with simple rules.

Regarding the first point, it is necessary to dedicate some time, not initially contemplated in the curriculum of construction subjects, to develop some elementary concepts of structural analysis. This ensures that the student does not perceive the subject as a mere catalog of details, without understanding in which cases and why they should be used. Concerning the second point, the situation is more complex. It is necessary to make a great effort for the student to understand that these are not arbitrary rules and an absurd obligation to fulfill [3].

When a regulation has been established for some time, the authors themselves or other experts in the field, through official application guides, develop reasonable explanations for the reasons why these rules have been adopted [4,5]. Therefore, when a regulation already incorporated into the teaching content undergoes a significant change, the problem worsens. Firstly, because reasonable explanations for the reasons for the change are not yet available to provide to new students. On the other hand, repeating students who studied in previous years with the previous regulations are difficult to convince that it is not coercive, but rather aims to be a help in decision-making.

In this second case, the critical thinking of the student, which has been so difficult to develop, turns against the change for which accessible explanations have not yet been developed. Moreover, at this stage, when attempting to gather this type of explanations, what is obtained are different opinions from the authors that are not always consistent with each other, given that the different agreements have been

reached through discussions involving very different interests representing the different agents of the construction process.

The subjects of Steel and Concrete Structure Construction in the Building and Technical Architecture degrees have recently undergone one of these dramatic changes. On November 10, 2021, the Structural Code came into force, replacing the previous EHE and EAE. Its inclusion in the BOE consists of 1789 pages and currently lacks any guide for the application of the entire document.

Faced with these difficulties, exacerbated by the limited time dedicated to classroom work in these subjects in the curriculum, a problem-oriented teaching approach under the flipped classroom format has been adopted. A problem is posed for the student to work on at home. In this way, it is intended to both interest the student in the topic prior to discussing solutions and to bypass the rejection of the application of rules, which in this case are presented as aids in decision-making. Once this preliminary work is completed, a correction is carried out in class for each student of their own practice carried out with the guidance of the teacher, fostering the discussion process.

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METHODOLOGICAL STRATEGIES TO DYNAMIC THE LEARNING OF STRUCTURE SUBJECTS

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Keywords: *concrete, steel, innovation, conferences, workshops*

Abstract

Reflecting on the learning process is essential to generate active learning, with high levels of student involvement and motivation, based on their interests and expectations [1]. Students' satisfaction with the contents, the way they are taught and the type of evaluation developed in the subjects has a decisive influence on the way they approach them and the interest and time they invest in them [2]. Starting from these premises, the objective of the work is to analyze the strategies used in various structure subjects taught at the Escuela Técnica Superior de Edificación of the Universidad Politécnica de Madrid, to energize their learning and reflect on them based on the results of the surveys. made to the students.

Below are the students' evaluations regarding the active methodologies used and the subjects (Figure 1). As can be seen, both the active methodologies used and the subjects have a high rating, both in degree and in the master's subjects.

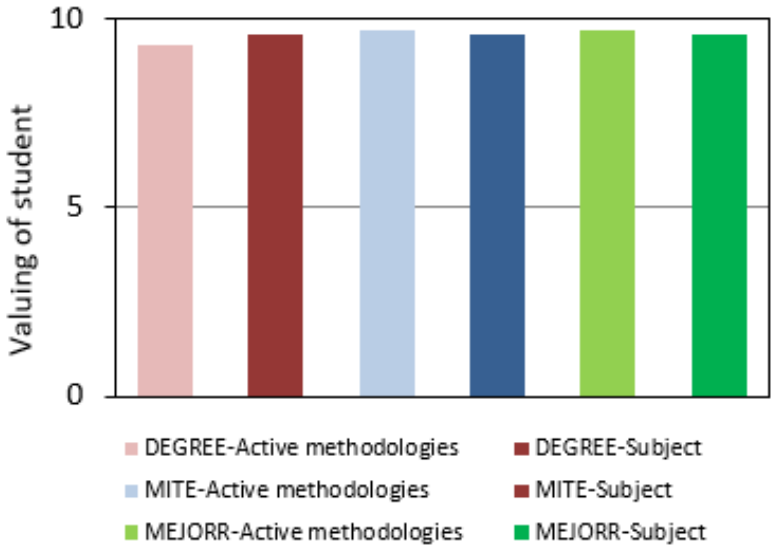

Figure 1: Student evaluations regarding active methodologies and subjects

Table 1 shows the active methodologies used in the Degree and Master's subjects. Depending on the degree and the credits of the subjects, some activities or others are established. In all of them, the active participation of the student is sought, their approach to the reality of the works and knowledge of the most innovative technologies in the field of building structures. To this end, conferences, seminars, workshops, visits and the use of computer applications have been organized, which increased the students' motivation and interest in the subjects.

Table 1: Strategies to achieve the active participation of students in learning and the subjects

<table>
<tr><td colspan="2">Subject of “Grado en Edificación”</td><td colspan="5">Subject of Máster Universitario in “Innovación Tecnológica en Edificación (MITE)” and of Máster Universitario in “Ejecución de Obras de Rehabilitación y Restauración (MEJORR)”</td></tr>
<tr><td colspan="2">Conferences of companies in the sector</td><td colspan="3">Conferences of companies in the sector</td><td colspan="2">Visits</td></tr>
<tr><td>ANDECE</td><td>HOLCIM</td><td>MAPEI</td><td>HOLCIM</td><td>ANDECE</td><td>OFICEMEN</td><td>HOLCIM</td></tr>
<tr><td>MAPEI</td><td>SIKA</td><td>OFICEMEN</td><td>SketchUp</td><td>SIKA</td><td colspan="2">Workshops</td></tr>
<tr><td colspan="2">Seminars</td><td>PEIKKO</td><td>WÜRTH</td><td>TRIMBLE</td><td>SIKA</td><td>MAPEI</td></tr>
<tr><td>HOLCIM</td><td>MAPEI</td><td>INACOM</td><td>PRETERSA</td><td>GRAITEC</td><td colspan="2">Computer applications (SIKA, MAPEI, PEIKKO, WURST, TRIMBLE, GRAITEC)</td></tr>
</table>

From the previous results, it can be concluded that the active methodologies used have had a positive effect on the students, motivating them and making the learning results obtained very satisfactory, with an average of more than 85% of the students who followed the subjects passing and with very low dropout rates.

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PLAYFUL LEARNING: TRANSFORMING THE EDUCATION IN KEY SUBJECTS

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Keywords: *Gamification, gamified learning, education, video games*

Abstract

Gamification, or playful learning, has emerged as an innovative educational tool, employing elements from various games to enhance engagement and understanding across multiple academic areas. Applying these principles to disciplines within Business Administration and Management such as Finance, Production, Quality, and Logistics can prove particularly beneficial, and various video games and applications such as MoneyTown, The Founder, Omnes Viae, Factorio, Logistical2, and Capitalism Lab exemplify this approach.

Finance with **MoneyTown**: this application offers a simulation where players manage the economy of a city. This game provides fertile ground for teaching financial concepts such as budgets, investments, and economic risks. Students can apply these principles in a realistic virtual environment, fostering informed decision-making and practical understanding of finance.

Figure 1. Screenshot of Money Town (Source: Bankinter)

Production with **Factorio**: excels in simulating factory management and the supply chain. Players are presented with challenges related to production efficiency and resource optimization. This game thus becomes a valuable educational tool for teaching

production principles and supply chain management, allowing students to experience interactively.

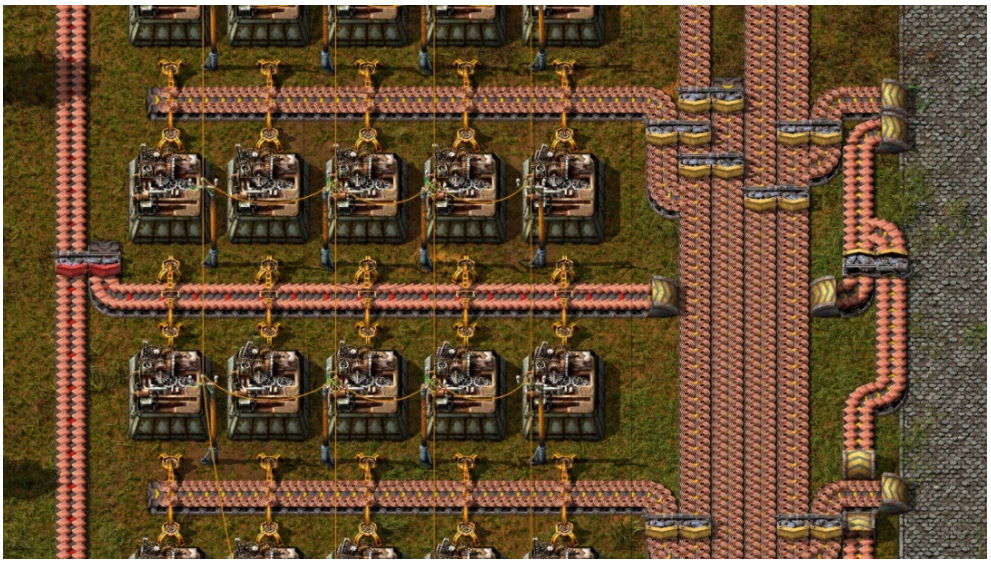

Figure 2. Screenshot of Factorio (Source: steampowered.org)

Quality and Logistics in **Logistical2**: focused on Logistics and the supply chain, Logistical2 provides students with the opportunity to tackle challenges related to quality, transportation, and efficient product distribution. This playful approach gives students a deep understanding of logistics management and the importance of quality in the business context, promoting strategies to optimize the flow of goods and services.

Figure 3. Captura de pantalla de Logistical2 (Fuente: steampowered.org)

Entrepreneurship in **The Founder**: it stands as a business simulator where students can develop and manage their own virtual businesses. Through this game, entrepreneurship concepts, strategic decision-making, and resource management are instilled. Practical experience in business decision-making contributes to the development of entrepreneurial skills and understanding the complexity of the business environment.

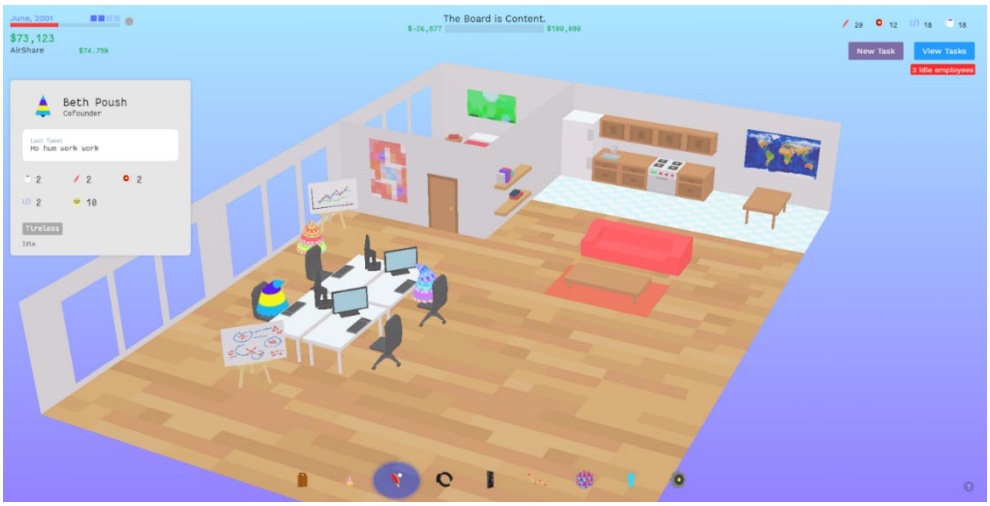

Figure 4. Screenshot of The Founder (Source: thefounder.biz)

Network Construction in **Omnes Viae**: focuses on the construction of roads and transport networks, providing students with a platform to apply network planning and design concepts. This game allows students to understand the importance of efficient infrastructure in logistics and distribution, encouraging the optimisation of the flow of goods and services.

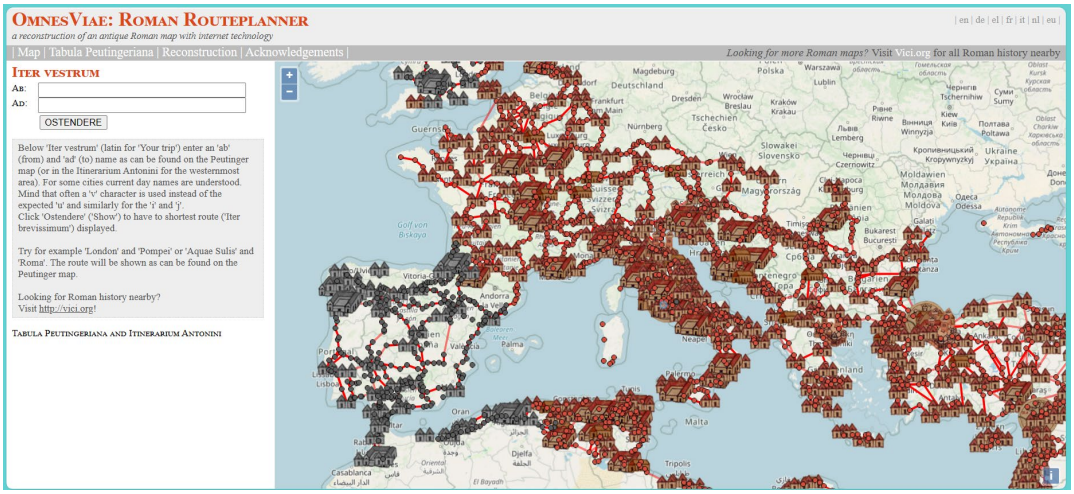

Figure 3. Screenshot of Omnes Viae (Source: omnesviae.org)

Business Simulation in **Capitalism Lab**: offers an advanced economic simulation, where players manage companies in a virtual environment. This game allows students to apply business management principles, financial decision-making and competitive strategies in a simulated context. The hands-on experience enhances understanding of business concepts and prepares students to address challenges in the world of work.

Figure 6. Screenshot of Capitalism Lab (Source: capitalismlab.com)

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METHODOLOGICAL FRAMEWORK FOR INTEGRATING PROFESSIONAL WORKFLOW THROUGH BIM WITHIN AN EXPERIMENTAL WORKSHOP ON ARCHITECTURAL INFOGRAPHICS AND GEOMETRIC MODELING

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Keywords: *BIM, Architecture, Experimental Workshop, Collaborative Workflows, Method*

Abstract

The Infographics and Geometric Modelling Workshop is a first-semester subject offered at the School of Architecture of Madrid. With a workload of 6 ECTS, it provides hands-on training with graphic software used in architecture, introducing students to essential tools and concepts they'll use throughout their studies. Activities evolve annually to keep pace with technological advancements, encouraging diverse experimentation and producing innovative results through interdisciplinary collaboration, led by experienced faculty.

The implementation of BIM began in 2023 under the direction of Associate Professor Miguel Ángel Alonso-Rodríguez, who organized an initial proposal for modelling and generating 2D/3D views. The present work expands previous proposal, with a particular emphasis on collaboration among different students on a single model and the BIM capability to interface with other software.

BIM tools facilitate creating 3D models integrating diverse data, enabling collaboration among stakeholders in architectural projects, offering a comprehensive vision. This allows architecture students to address cross-cutting contents of future subjects. Digital BIM requires common standards to promote collaboration across the building lifecycle [1]. The educational sector explores BIM's potential, defining a Building Execution Plan (BEP) with construction management, engineering, and architecture students [2].

This standardization effort requires a precise initial BIM Specification of models adapted to their Level of Development (LOD) and aimed at providing a Common Data Environment, which does not allow us to speak of a single protocol, but rather of procedures widely endorsed by professional experience. Building Smart Association [3] has been doing a great labour of divulgation and analysis of novel proposals for Open Standards since 2012, and this has enabled numerous Spanish architecture, engineering, development, and construction teams to implement the use of these tools through various Guidelines [4] that effectively synthesize the most essential issues to consider.

The proposal prioritizes order and precision in drawing, underlining the crucial connection between CAD and Revit tools. The course initiates with a preliminary session to acquire fundamental building projections. Students will work on a simple architectural model from past workshops, customizing it individually. Subsequently, each student will develop their own BIM model, navigating through various tool usages across different stages.

We apply theoretical contents to each student's model, and we provide a design guide aligned with these six key objectives:

1, Definition of Geometric LOD 200 model —similar to a Basic Project, according to the definition of CTE [5]—, enabling students to distinguish between disciplines and hierarchize information; 2, Generation of Images to verify the architectural outcome, using both Revit and Lumion [6]; 3, Obtention of flat projections, and customization of line codes and graphical parameters; 4, Presentation of all developed information, including internal and external information; 5, Demonstration of workflows between Rhino and Revit, and exploration of Dynamo's possibilities for visual programming; 6, Integration of each student's model into an urbanization, fostering collaborative work.

This methodology aims to equip students with knowledge to address professional building information models. We evaluate results through surveys and tests for each thematic block to assess the degree of knowledge acquired.

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