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INNOVATION IN ARCHITECTURE
The Role of Digital Technologies and Social Networks in Academic Education

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ABSTRACT

This research analyses the role of certain social networks as educational tools in learning architecture, specifically in project workshops focused on parametric design, a method closely linked to the conceptualization and application of computational design.
The research focuses on the question of whether these digital experiences can match social interaction in design workshops, an aspect considered essential by several education experts for the development of technical and creative skills.

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1. Introduction. Aim of the Research

The purpose of this research is to explore and deepen the understanding of the role of social networks in the field of education, specifically in relation to the learning of architecture. In particular, it focuses on project workshops using parametric design, a working method that is becoming increasingly important in contemporary architectural practice due to its ability to address the complexity of modern architectural projects. This method is closely linked to the conceptualisation and application of computational design.

The interest in social media as an educational tool stems from the observation that these platforms, often seen primarily as a means of communication and socialisation, have significant potential to support academic processes. They can facilitate collaboration, information sharing, real-time feedback and access to a vast network of knowledge and resources.

By focusing on project workshops, the research recognises the importance of practical experience and experimentation in architectural education. Parametric design workshops, using specialist software and computational design techniques, provide an ideal context for exploring how social networks can complement this academic scenario. This is illustrated through the analysis of a specific case: the project workshop at the Faculty of Architecture of the National University of Colombia, Medellin, where students work in teams on digital models.

The study examines how Twitch, a platform originally designed for streaming video games, is being used at this university to promote socialisation, collaboration and educational interaction. Students and teachers can share their design processes, facilitating feedback and instant dialogue, which has a positive impact on the educational process and student outcomes.

The analysis of such a scenario can provide a better understanding of the current dynamics between digital culture, pedagogical practices and design learning in project workshops. Furthermore, it provides guidance on how to maximise the pedagogical potential of social media as innovative learning platforms, adaptable to the needs and challenges of 21st century architecture education.

Several concepts are integral to this paper, and the definitions that guide the analysis and discussion are outlined below:

Computational design: Design based on digital tools that exploit the full capabilities of computers in the design process (Oxman, 2017).

Parametric design: A design process that uses algorithmic thinking and parameters/rules to constrain it (Jabi, 2013). Associated with BIM methodology, which uses parametric design in concepts of associative geometry and topological relationships (Gerber & Pantazis, 2016). In this study, parametric design is applied to a cloud-based model that facilitates virtual collaborative work.

Social networks: Structures composed of nodes (individuals or organisations) connected by relationships driven by information and communication technologies (Castells, 2009).

Digital culture: Practices, values and knowledge that emerge from interaction with digital technologies. Characterised by the creation, sharing and modification of content on digital platforms, as well as communication and social connectivity through the Internet and digital devices, it represents a new form of social and cultural organisation (Castells, 2009).

The research aims to analyse the relationship between digital technology and contemporary architectural visual culture. This includes exploring how new social media tools and platforms have facilitated access to visual content production, enabling wider participation in the creation and dissemination of architectural ideas. It also seeks to understand how artificial intelligence and generative design, combined with the practice and execution of computational design, have enriched architectural aesthetics and currents, leading to the emergence of new visual and conceptual forms in architecture (Simon, 1969).

One of the aims is to explore the influence of social networks as mediators in the production, distribution and consumption of visual culture in architecture. Not only have they transformed the dynamics of interaction between professionals in the field and their audiences, but they also serve as platforms for exhibiting and critiquing architectural works, providing access to vast amounts of visual and textual data that are essential for feeding and training artificial intelligence algorithms. These algorithms, in turn, are fundamental to the development of generative design systems, enhancing their ability to produce creative and accurate variations on architectural projects.

2. Background

Social interaction has been widely recognised by theorists such as Lev Vygotsky and Jean Piaget as a fundamental component of educational processes, important not only for the cognitive and emotional development of individuals (Vygotsky, 2012), but also for their integration into their culture and society at an early age. When applied to higher levels of professional education, this takes on particular significance, especially in the field of architecture. In this context, social interaction becomes an important action for developing technical and creative skills, promoting collaborative work and implementing self-evaluation, criticism and self-criticism of projects.

Such social interaction has migrated over the last two decades to settings other than the traditional ones. Research in the field of social and educational psychology suggests that digital technologies have changed interaction structures, giving rise to new forms of relationships that are predominantly digital. Studies suggest that for new generations, the boundaries between the digital and the physical have become increasingly blurred, with an almost total integration of digital tools into their daily lives through social networks.

Manuel Castells (2009) points out that social media represent a relatively new element in the public space of communication, which until recently was almost exclusively dominated by conventional media. Unlike the latter, social networks allow information to be processed, stored and transmitted without limitations of distance, time or volume and, above all, they allow feedback.

In the academic field, a number of doctoral theses have been carried out in recent years to study the pedagogical aspects of social networks and whether their use contributes to the acquisition of the competences required to obtain a professional qualification. Starting from the premise that they are a tool of the current knowledge society when used in training environments, they can be used to improve the teaching-learning process. Morales, G. (2015).

The change is particularly evident in the way young people interact with computer technology, not only as a communication tool, but also as a fundamental space for the development of social relations and the construction of personal identity. The so-called social, natural and computerised status of young people today and their digital relationships are of great relevance to teaching and learning processes in many disciplines and fields of knowledge, including architecture.

One social network in particular has been used as a vehicle for social interaction in the development of parametric design-based architecture workshops. This is the social network Twitch, a live streaming platform that focuses on video games, including eSports competitions, personal streams of gamers and gaming-related events, and has expanded its content to include music streams, lifestyle content and, more recently, categories that allow streamers to interact directly with their audience through 'Just Chatting'.

Originally launched in 2011, Twitch has become one of the world's leading platforms for video game streamers, attracting millions of viewers and content creators. It allows users to follow and subscribe to specific channels, participate in live chats during broadcasts, and support their favourite streamers through donations and paid subscriptions, and has played an important role in growing the popularity of eSports and online gaming culture.

Recently, at the same university, Twitch has been used by architecture students working on parametric models, where the possibilities of carrying out playful, collaborative activities and sharing an experience, formerly a game, now an architectural project, make it relevant in a different field of application from the one that motivated its creation.

3. Hypothesis

The hypothesis of this research is that the integration of a social network with a playful approach in an architectural design workshop can not only balance but also enhance the creative work. It is argued that by providing an innovative virtual environment for the development of the workshop, where social interaction - an element considered essential by educational experts for the cultivation of technical, creative and collaborative skills - is facilitated, the learning process and creative output can be significantly enriched.

4. Objectives and Justification

The relevance of this research lies in its focus on exploring relatively unexamined relationships between recently integrated components in the definition and practice of digital culture. These components, in particular computational design and the use of social networks, are increasingly influencing teaching, learning and professional practice. The incorporation of these digital tools into architectural education, particularly in project workshops, opens up new possibilities for enriching the academic experience. This not only enhances traditional teaching and learning methods, but also broadens the horizons of creative possibilities available to both students and professionals. The integration of these digital technologies fosters relationships between technological innovation and creative thinking, facilitating the spaces of experimentation and exploration that are fundamental to architectural education. The work focuses on the following objectives:

Integrating socialisation media in education: How can communication and socialisation tools and platforms widely used by new generations be adapted to educational processes? The aim is to demonstrate the effectiveness of these traditionally non-educational media as valuable pedagogical resources, regardless of their original purpose or the specific functions for which they were designed. The interest lies in understanding how these tools can be recontextualised to enrich and diversify teaching and learning methodologies.

The impact of social networks on architectural education. The aim is to understand the scope and significant influence of social networks in the contemporary educational context, with a particular focus on the teaching and learning of architecture. The aim is to explore how these digital platforms can become an integral part of architectural project workshops, especially those based on parametric design, analysing how social networks facilitate collaboration, inspiration and the dissemination of technical and creative knowledge within this educational sphere, and can even match the physical social interaction in design workshops, an aspect considered essential by several educational experts for the development of technical and creative skills.

The relationship between computational design and computer culture. The aim is to analyse the relationship between the practice of computational design in architectural education, teaching-learning methods and the digital culture that characterises the new generations of students. It will investigate how young people's mastery of computer technology and familiarity with digital environments influence architectural design pedagogy, promoting a dialogue between advanced computational skills and innovative pedagogical approaches that complement and relate to traditional ones.

Identify factors for the implementation of social networks in didactic methodologies. Finally, this study aims to identify and analyse the critical factors that facilitate the effective adoption of social networks as pedagogical tools in the design of high-quality didactic methodologies. It explores how these platforms can be used strategically to enrich the educational process, fostering an interactive, collaborative and adaptive learning environment that responds to the needs and preferences of today's generations of students.

This research aims to provide an understanding of the intersection between computational design, social networks, architectural education and contemporary pedagogical practices.

5. Design and Method

5.1. Formal Object

This research focuses on observing and analysing the use of a particular type of social networking platform as a communication tool within architectural workshops specialising in computational design, particularly parametric design. It is approached from a pedagogical and educational perspective, recognising the importance of socialisation as a crucial component in teaching and learning processes. This approach aims to elucidate how these platforms contribute to the contemporary training of architects, influencing both teaching methodology and student dynamics in the development of specific competences related to computational design in architecture. The research proposes to identify the dynamics of interaction, collaboration, evaluation, co-evaluation, self-evaluation and, in general, the construction of knowledge facilitated by certain social networks, analysing their impact on pedagogical effectiveness and educational quality in the field of architectural parametric computational design.

5.2. Research Type

The present research focuses on exploring the relationship between two specific variables: the use of Twitch-type social networks in architectural design workshops based on parametric computational design, and the outcomes in the architects' formative experience. Since the aim is to investigate the relationship between these variables without seeking to establish a causal relationship, this study is classified within the realm of correlational research.

The study focuses on investigating how the use of social networking platforms such as Twitch, specifically in the context of architectural workshops using parametric computational design techniques, relates to architects' perceived learning and training outcomes. The aim is not to determine whether the use of Twitch leads to improvements or changes in architectural education, but simply to explore the existence and nature of the relationship between the two, in terms of facilitating a social interaction that used to take place physically in person and now takes place virtually. This approach is consistent with correlational research that seeks to understand how the integration of digital technologies and social platforms affects educational processes in specialised fields such as architecture and provides valuable elements of analysis.

5.3. Study Scope

This research focuses on the analysis of the project workshops within the Architecture programme at the Universidad Nacional de Colombia, Medellín. These workshops form the essential core of the programme's curriculum, complemented by other fundamental areas such as theory and history, means of representation, technology and urban planning. In total, there are nine workshops that take place throughout the programme, one per semester, where students are challenged to design architectural projects that respond to real problems and needs of the national territory, offering a comprehensive and applied training to future architects.

Workshops 4 and 5, strategically placed in the middle of the academic training, between the second and third years, are characterised by the inclusion of computer design in their methodology. This pedagogical choice responds to several reasons, highlighting the ability to work collaboratively in the construction of parametric models. These models are hosted in the cloud, allowing students to interact with them remotely, a practice that not only reflects current trends in the professional field, but also prepares students for the contemporary challenges of architecture.

Incorporating the social network Twitch into this process represents a qualitative leap in the educational experience. Students, digital natives accustomed to constant interaction with technology, find in Twitch a platform that complements and enriches the collaborative design process. Twitch not only allows them to continue working on parametric models outside of class and school hours, but also extends the possibilities for interaction through specific network features such as live music streams, lifestyle content and the "Just Chatting" option for real-time conversations.

This pedagogical approach does not replace the importance of face-to-face work in workshops, but rather complements it by extending the learning space beyond the physical boundaries of the classroom. The integration of digital tools such as Twitch in the educational process not only reflects the ability of the current generation of students to adapt themselves and, at the same time, to adapt their instruments of relationship with the world, in this case the social network, to generate an innovative experience in line with the times, but also provides a richer and more diversified experience, preparing them for an increasingly digital and collaborative professional environment.

5.4. Analysis Variables

The research enables the analysis of variables that intervene in both the educational process and the learning outcomes in the context of architectural design. Although it is important to note that not all variables are considered due to time constraints in the development of this research, the analysis variables considered suitable for examination in this study are grouped into categories. These categories are proposed according to the mixed-methodological approach adopted in this research.

5.5. Variables Related to the Pedagogical Process

Types of social interaction: This involves synchronous communication through the social network, which serves as a meeting point for the students involved in the process, with no restrictions on timetable or time of use. This platform also makes it possible to record the level of participation, measured in terms of screen time. However, it does not specifically define the type of user participation, i.e. whether they are merely observing or actively engaging and interacting in the process.

Social network tools and functionalities: these are defined by the specific functions of the Twitch platform, i.e. the activities it enables. In this context, these activities include: the personal broadcasting of activities, initially focused on games, but adapted in this experience for the intervention process on the parametric model; the broadcasting of music that accompanies the work sessions, similar to what happens in the physical environment of the classroom; and the broadcasting of other types of content that, although originally conceived for playful purposes on the platform, in this case acquires an academic character, such as photographs, "stop motion" of the process and the "just chatting" section already mentioned.

Teaching methods: The pedagogical approach used in the Parametric Design Workshop, i.e. project-based learning, is taken into account. It is important to note that this approach is not exclusive to the experiences analysed in this research. In addition, collaborative learning is encouraged. However, the virtual environment introduces an innovative experience by incorporating new teaching and assessment strategies.

Educational content: this takes into account the type of materials and resources shared through the social network, their relevance and quality, as they are carried out in a virtual environment accessed from their personal computers, allowing them to have immediate and qualified access to all the resources used to create the project, which can be shared in real time with the work team.

5.6. Student-Related Variables

Levels of engagement and participation: this variable analyses the frequency and quality of students' interactions within the Twitch social network.

Technical and creative skills: measuring the development of specific skills related to architectural design and the use of digital technologies.

Student satisfaction and perceptions: students' opinions and attitudes towards the use of the Twitch social network in their learning.

Collaborative learning: quality and effectiveness of collaboration between learners within the virtual environment.

5.7. Variables Related to Learning Outcomes

Quality of architectural design projects: assessment of the final works in terms of innovation, technical complexity and fulfilment of educational objectives.

Development of transversal skills: such as teamwork, problem solving, communication and presentation skills.

Impact on academic performance: comparison of academic results before and after the implementation of the social network.

5.8. Contextual Variables

Technological environment: available infrastructure, access to social network and complementary digital tools.

Cultural and social context: influence of students' socio-economic and cultural background on the adoption and effective use of digital technologies in education.

5.9. Primary Variable

Effectiveness of the integration of the social network Twitch, initially created with a playful approach, in teaching and learning processes in the training of architects. Global evaluation of how the implementation of this specific social network affects the learning and creativity process in architectural design workshops, taking into account all the variables mentioned.

5.10. Research Techniques

The achievement of the objectives proposed by this research implied the execution of the following tasks, in accordance with the research techniques best suited to the proposed scope:

Direct observation of the development of the architecture workshops and the students whose practice was identified as closest to the phenomenon under study in the research, in order to understand how social networks are tools that can be recontextualised to enrich and diversify teaching and learning methodologies.

Through observation, it was also possible to determine how this experience through the social network Twitch could equal or complement the physical social interaction in the design workshops, which also required the use of basic statistical analysis to determine and analyse the number of individuals using the social network as a complement to collaborative work on a parametric model located in the cloud.

In order to determine how young people's IT skills and familiarity with digital environments influence architectural design pedagogy, promoting a dialogue between advanced computational skills and innovative pedagogical approaches, direct observation complemented by unstructured spontaneous interviews, direct conversations with individuals were used to obtain relevant information for analysis and discussion.

Finally, direct observation complemented by interviews allowed us to obtain information that would allow us to discuss and analyse how these platforms can be used strategically to enrich the educational process, fostering an interactive, collaborative and adaptive learning environment that responds to the needs and preferences of current generations of students.

6. Fieldwork and Data Analysis

As mentioned above, this research focuses on the use of a specific social networking platform as a communication tool in architecture workshops specialising in computational design, specifically parametric design. This phenomenon is observed and analysed in the context of the development of the subjects Project Workshop 4 and 5 of the Architecture Programme at the National University of Colombia, Medellín Campus.

The research is part of a larger study that began in 2021 as part of the development of a doctoral thesis. Some of the data necessary for the discussion of this study was collected during the second semester of 2023, between the months of August and November. Taking advantage of their status as professors attached to the teaching staff of the aforementioned Faculty of Architecture, the researchers participated in the development of the first stage during the academic period corresponding to the first semester of 2024, between the months of February and March.

Firstly, we look directly at the students' practices and how they use social networks, specifically Twitch, to carry out architectural projects of an academic nature in their early stages. Particular attention is paid to the groups of students whose practices represent the phenomenon studied in both workshops. The most relevant observations will be recorded, showing how social networks, and Twitch in particular, recontextualise and diversify teaching-learning methodologies.

Once the study group is focused, it is observed and analysed how the experience specifically through the Twitch social network can equal or complement the physical social interaction in the design workshops. This observation will be accompanied by basic statistical analysis that will allow us to quantify and analyse the number of people using Twitch as a supplement to collaborate on parametric projects in the cloud.

Through direct observation and informal conversations, it has been possible to assess how the mastery of computer technology and familiarity with digital environments among young people, a characteristic of the current generation, influences architectural design pedagogy, and how this even promotes a dialogue between computational skills and innovative pedagogical approaches by observing the integration of these skills in the educational process.

Finally, to complement the direct observation, unstructured spontaneous interviews and direct conversations were conducted with the participants to obtain more in-depth and personal information. These interviews allowed us to gather personal testimonies and impressions that enriched the analysis, discussion and data processing.

7. Discussion of Results

The project workshops of the Faculty of Architecture of the National University of Colombia, Medellin, are the backbone of the curriculum that allows students to obtain the title of architect; this curriculum was

developed more than 5 decades ago under the premises of the teaching-learning processes established by the modern project, during the second half of the twentieth century.

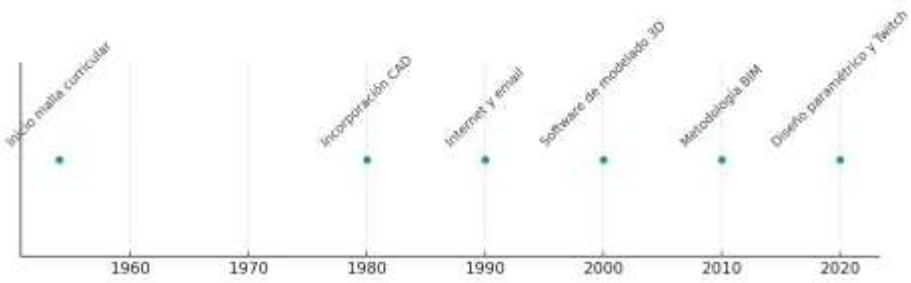
The way in which the modern project works presupposes, in principle, analogous methods of reflection and execution of the project, not only in the field of representation and communication of the project, but in all that is involved in the work in the workshop classroom. With the progress made in recent years, the methods used to carry out the project have hybridised between analogical reflection and the methodologies brought about by technological advances.

Figure 1. Comparison, teaching methods used in the project workshop subjects in the Architecture programme of the Faculty of Architecture of the National University of Colombia, Medellín campus.

Own work: Carlos Pérez, 2024.

This is why, in recent years, workshops have been transformed according to the new demands of professional practice, but also because of the digital culture that the new generations of students bring with them, as they have an implicit relationship with digital media and computer processes that inevitably leads to their application in almost all areas of their daily lives, including education (Figure 1). The incorporation of digital media into the curriculum has been gradual; the demands of professional practice, but also the impetus of the new generations and their relationship with technological advances, have forced their incorporation into the various stages of education over the last few decades (Figure 2).

Figure 2. Evolution of the incorporation of technological advances in the curriculum of the Architecture programme at the Universidad Nacional de Colombia, Medellín campus, from its foundation to the present day.



Own work: Carlos Pérez, 2024.

Having completed the first two years of training, which are traditionally taught in an analogue manner, the architecture students of the faculty in question move on to the third year, in which design is addressed through computational processes, specifically parametric design, which in turn is supported by the so-called BIM methodology, for which the students are already qualified at this stage of their training (Figure 1).

Parametric computational design, based on the BIM methodology, is carried out through the collaborative development of a parametric model located in the cloud, where students belonging to a given work team make modifications synchronously from a remote terminal, almost always their personal computer, whether they are in the classroom, at home or elsewhere.

This is where the main actor of the present research enters the stage, the social network Twitch, which, as explained above, is designed for socialising in the field of "gamers" and video games. Given its playful approach and its ability to easily share between connected users a wide range of everyday situations, including those of an academic or creative nature, this tool becomes an ideal resource for socialisation

between the students participating in the workshop, especially when the work is done virtually synchronously outside class time.

It is important to note that the group of students participating in the scenario described during the observation phases is small compared to the total number of participants in the two workshops where the observations and fieldwork are carried out. However, it is important to clarify that the quantity is not considered relevant in this context, since the aim is not to validate the phenomenon as a trend, but rather to identify it as a scenario conducive to improving and promoting the use of social networks for the benefit of teaching-learning processes in the field of architecture, especially in the project workshop.

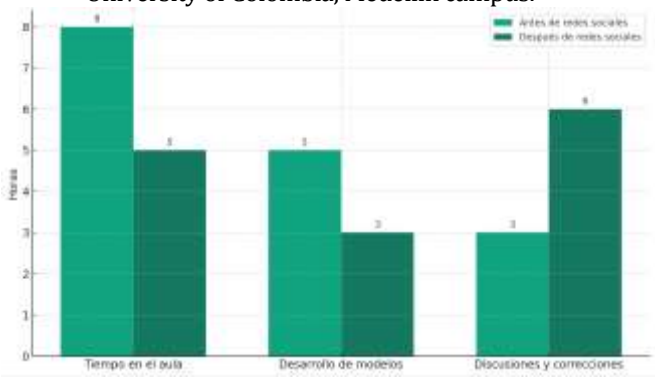
It is noticeable that the focus group of students, when working in the classroom and concentrating on the parametric model in the cloud, tend to isolate themselves from the rest of the group, making it difficult to socialise face to face. This is because students use headsets to interact with their work computer, which can be annoying to other workshop colleagues who are not using the same social network. This situation seems to arise because of the attractive features that Twitch offers, such as the ability to listen to music or make comments that are immediately visible to other peers, thanks to the extended social networking capabilities that this platform offers.

The configuration of the working environment by the group that does not use the Twitch social network is remarkable. The students adopt a contemporary approach that reflects the concept of "multitasking", which refers to the ability to effectively carry out several activities at the same time. This is similar to what the social network Twitch offers. In this working environment, while developing the workshop project, students listen to music, chat with their peers about non-academic topics, play a film on a screen with voice-over, and have one or more social networks open on alternate devices. This situation sheds light on why this type of social networking, which integrates the above elements and more in a collaborative working environment, fits the way the current generation of students relate to each other.

It has been observed that other groups of students use social networks with similar characteristics to those offered by the Twitch platform, such as the Discord social network. This is also used for the same purpose and could be considered as part of the current research.

Some variations in the development of workshop activities can be observed when using the social networks mentioned above. For example, the time spent by the students in the classroom is reduced, as there is the possibility of continuing to work remotely in conditions similar to those in the physical space of the workshop. Similarly, although it cannot be said that this is exclusively due to the use of the aforementioned social networks, it can be observed that the development of the parametric models takes less time, leaving more time for discussions and corrections with teachers and classmates (Figure 3).

Figure 3. Impact of the use of social networks in the project workshop of the Architecture programme at the National University of Colombia, Medellín campus.



Own work: Carlos Pérez, 2024.

During the construction of the parametric model, the students, immersed in a virtual environment, were able to quickly and accurately access complementary information, case studies, preliminary analysis, references, authors and other resources using search tools, artificial intelligence and databases. The students' ability to quickly access, use and relate the information needed to improve the architectural project development process is striking. In addition, teachers, although in many cases lacking the skills to use digital tools or to assimilate the large amount of information available, are quickly involved in the process. Understanding the importance of this phenomenon, they not only accept it, but also adopt the students' way

of working. This creates a two-way learning dynamic where the teacher's experience and knowledge merge with the students' relationship and mastery of digital tools.

When interviewed on this topic, students talked about using social networks and developing parametric models as a matter of course. This is evidence of the new generations' inherent attitude towards the digital world. Although they mentioned some initial difficulties in getting teachers to accept this approach in the workshop through social networks, they feel more confident and comfortable in being able to continue teamwork outside the classroom and the established timetable, maintaining similar conditions to those in the classroom. They also highlighted an increase in productivity and project quality, as the earlier development of the parametric model frees up time for other activities. Some even perceived an improvement in their quality of life.

8. Conclusions

The research on the integration of social networks, specifically Twitch, in the project workshops of the Faculty of Architecture of the National University of Colombia, Medellín, reveals a significant evolution in the pedagogical methods applied to the teaching of architecture. This adaptation responds not only to the new demands of professional practice, but also to the digital immersion of new generations of students. The curriculum, established more than five decades ago according to the principles of the modern project, has demonstrated its capacity to evolve by incorporating parametric computer design and BIM methodology from the third year of training. This evolution reflects a balance between tradition and innovation, ensuring that architectural education remains relevant and effective.

The use of digital tools and social networks to facilitate remote collaboration and teamwork represents a paradigm shift in pedagogical approach. The ability for students to work synchronously on a parametric model in the cloud, regardless of their physical location, underlines the importance of digital literacy in contemporary architectural education. The recontextualisation of platforms originally intended for entertainment, such as Twitch, for educational purposes highlights the flexibility and adaptability of students and teachers to new means of communication and collaboration.

The transition to a pedagogy that integrates social media and digital tools presents both opportunities and challenges. The research identifies an improvement in the productivity and quality of architectural projects, as well as the quality of life of students, thanks to the flexibility and accessibility offered by these tools. However, it also recognises the need to address the potential effects of reduced face-to-face socialisation and multi-tasking in the work environment.

The difference in work dynamics between students who use social media and those who do not suggests a diversity of learning and collaborative styles that need to be understood and managed by teachers. The ability of teachers to adapt and use digital tools is crucial to maximising the benefits of these technologies for learning. The research highlights the importance of pedagogy that not only adapts to digital tools, but also promotes the development of critical and collaborative skills.

The incorporation of digital technologies and social media into architecture education is a natural evolution in response to social and technological changes. As these tools become more deeply integrated into educational processes, further research is essential to fully understand their impact on the learning and development of architecture students. This study paves the way for future research into how to optimise the integration of digital technologies in architectural education, ensuring that it adequately prepares students for the challenges of the future profession.

9. Acknowledgements

This research is part of a broader study initiated in 2021 as part of the development of the doctoral thesis entitled "Computational Design in the Training of Architects, Influence of computational design in university education between 2008 and 2020", which aims to analyse how computational design has influenced the training of architects in the main universities of Europe and North America since 2008, and, from there, to interest universities in Latin America in carrying out their own developments and how it, combined with the ingenuity and creativity of the architect, can contribute to solving problems that arise during the development of a project in different socio-cultural spheres.

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