Revista Iberoamericana para la Investigación y el Desarrollo Educativo
ISSN 2007 - 7467

https://doi.org/10.23913/ride.v14i28.1900

Scientific articles

Diseño edilicio básico: resultados del 2.° ciclo de pruebas formales

Basic edilicio design: results of the 2nd cycle of formal tests

Projeto básico de construção: resultados do 2º ciclo formal de test

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Resumen

En este documento se presentan los resultados de la segunda prueba formal de tres tecnologías y tres baremos del DEB, cuya implementación ocurrió en las fases A y B de un taller II. En concreto, se alcanzó un aprovechamiento del tiempo para el MAC del 100 % en la fase A y del 92 % en la fase B, mientras que para el DG fue del 0 % en la fase B; y para la PrG del 92 % en ambas fases. Además, se obtuvo el 49 % en el Adp, el 0 % en la Ioe, y el 0 % en el Ae. Estos resultados se derivan de dos revisiones paramétricas realizadas a una muestra dirigida, integrada por 24 carpetas de trabajo, cada una constituida por sus respectivos anteproyectos ejecutivos y videos de presentación. Ambas revisiones tenían como meta verificar el cumplimiento de los protocolos p.1., p.3., p.9., p.2., p.4. y p.8. Las carpetas fueron elaboradas durante el periodo julio-diciembre de 2022 por 12 estudiantes del 4.° semestre del grupo 5, pertenecientes al programa educativo de la licenciatura en Arquitectura de la Universidad Autónoma del Estado de Hidalgo. Por lo tanto, estas revisiones y los resultados se consideran como la deducción de un proceso afín al enfoque mixto de investigación.

Palabras clave: Diseño edilicio básico, segunda implementación de pruebas formales, arquitectura.

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Abstract

This document presents the results of the second formal test of 3 technologies and 3 ***deb*** scales whose implementation occurred in phases A and B of a workshop II. Achieving a time utilization for the ***MAC*** of 100% in phase A and 92% in phase B; for the ***DG*** of 0% in phase B; and for the ***PrG*** of 92% in both phases. In addition to 49% in the ***Adp***; 0% in the ***Ioe***; and 0% in ***Ae***. Results obtained from 2 parametric reviews carried out on a targeted sample, which was made up of 24 Work Folders, consisting of their respective executive drafts and presentation videos. Both reviews had the goal of verifying compliance with protocols **p.1.**, **p.3.**, **p.9.**, **p.2.**, **p.4.** and **p.8.** The folders were manufactured during the period July-December 2022 by 12 students from the 4th semester of group 5, belonging to the educational program of the degree in architecture of the Autonomous University of the State of Hidalgo. Therefore, these reviews and the results are considered as the deduction of a process similar to the mixed research approach.

Key words*:* Basic edilicio design, implementation of formal tests, architecture.

Resumo

Este documento apresenta os resultados do segundo teste formal de três tecnologias e três escalas DEB, cuja implementação ocorreu nas fases A e B de um workshop II. Especificamente, a utilização do tempo foi alcançada para o MAC de 100% na fase A e 92% na fase B, enquanto para o GD foi de 0% na fase B; e para o PrG de 92% em ambas as fases. Além disso, obteve-se 49% em Adp, 0% em Ioe e 0% em Ae. Esses resultados são derivados de duas revisões paramétricas realizadas em uma amostra direcionada, composta por 24 pastas de trabalho, cada uma composta por suas respectivas minutas executivas e vídeos de apresentação. Ambas as revisões tiveram como objetivo verificar o cumprimento dos protocolos p.1., p.3., p.9., p.2., p.4. e pág.8. Os folders foram elaborados no período julho-dezembro de 2022 por 12 alunos do 4º semestre da turma 5, pertencentes ao programa educacional da licenciatura em Arquitetura da Universidade Autônoma do Estado de Hidalgo. Portanto, essas revisões e os resultados são considerados como a dedução de um processo semelhante à abordagem mista de pesquisa.

Palavras-chave: Projeto básico de edifícios, segunda implementação de testes formais, arquitetura.

Reception date: October 2023 **Acceptance Date:** April 2024

Introduction

Below, the results derived from the application of the second formal test of three theoretical technologies (concurrent architectural modeling [MAC], graphical triggering [DG], and Grantt programming [PrG]) and three scales for a strategic design course are presented. basic building, framed in the Architectural Design Workshop of Interpersonal Activities that students in the fourth semester of the degree in Architecture at the Autonomous University of the State of Hidalgo were studying.

The information collected is the product of implementation procedures considered atypical, due to the absence of standardized protocols that had been evaluated by a panel of specialists before the test. This circumstance is also attributed to the novelty of the evaluations, which do not yet have the support of experts who have a comprehensive command of the epistemological claims of the three scales, as well as the use of time that is sought to be achieved through the three technologies already mentioned. They even lack specialists familiar with the process designed to prepare executive preliminary projects for franchised properties with specific brands in a specific metropolitan area, such as those included in the sample of this evaluation.

This reality, however, does not undermine the validity of the test or suggest that implementations and applications are risky. On the contrary, they represent a triad rigorously adjusted to their own protocols, which, in turn, are the result of an adaptation of the five steps of the systematic design that is derived from the qualitative research approach (Hernández-Sampieri *et al* ., 2014).

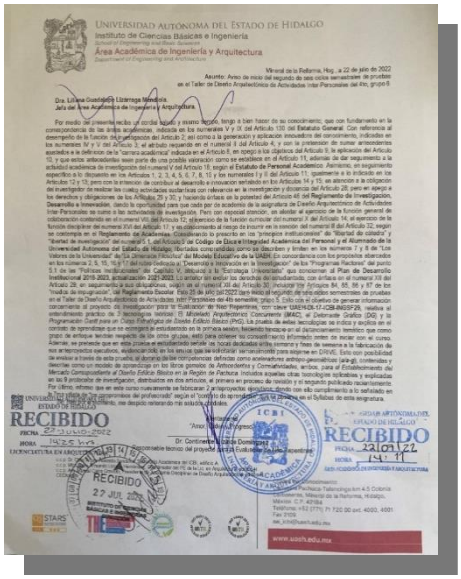
Now, although it is true that the three technologies used come from three books published in digital format with free download, it should also be emphasized that they have been subjected to exhaustive reviews, which gives them credibility. Furthermore, the three scales acquire validity because they are linked to the use of time and the reference to the degree of affinity that these preliminary projects maintain with the professional field, as well as to the level of identification between them and their users, which includes information about learning. acquired by students during the drafting process.

On the other hand, it is appropriate to mention that this research work aligns with the mixed research approach, given that the results presented have been generated from an additional adaptation of the five steps of the systematic design of grounded theory. That is, an attempt has been made to generate knowledge from the collected findings, which have been combined with

empirical data from other records whose consistency has been validated using the Cornell technique, which supports the analysis of statements or items (Hernández-Sampieri and Mendoza, 2018).

Regarding the formality of this second test, it is based on the preparation, delivery and reception of the document that internally notified its beginning, as detailed in Figure 1. In addition, it is complemented by the preparation of the Gantt diagram, in which which the course activities were previously scheduled before its start (figure 2).

Figure 1 . Image of the notification letter to begin the second formal test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Source: self made

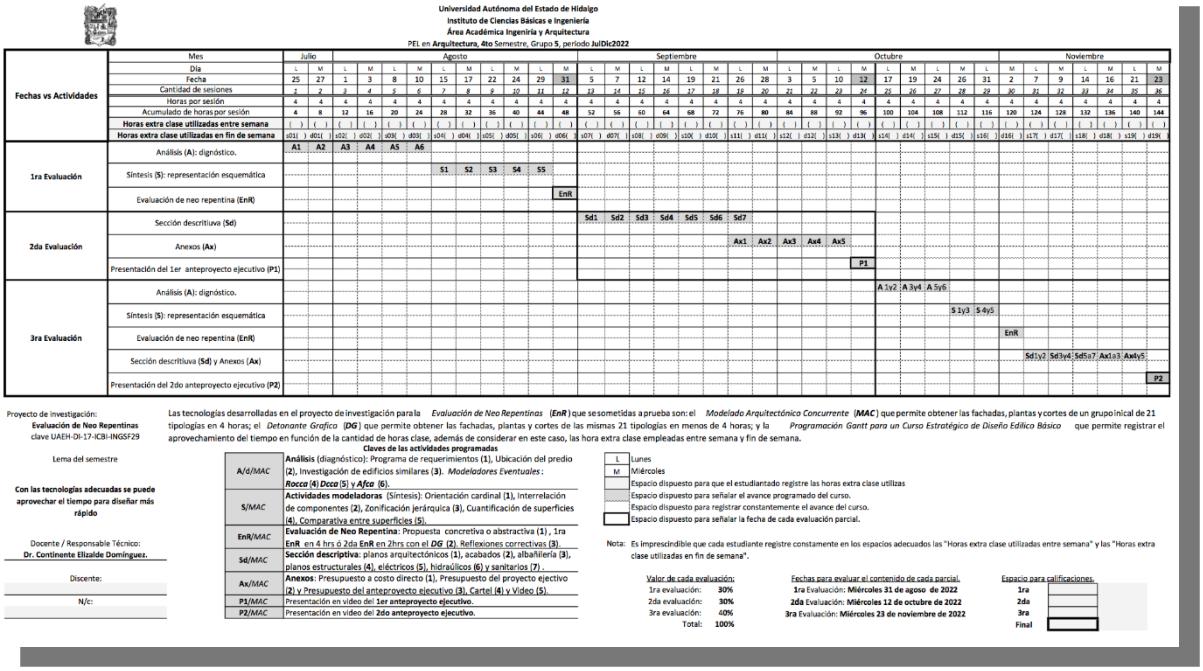
It is expected that the results obtained in this test will contribute to the continuous enrichment of information for the research project *Evaluation of neo suddenness* , which was duly registered in 2022 under the folio UAEH-DIDI-DI-ICBI-AAIA-22-001. This project, with a start date of April 22, 2017 and end date of April 17, 2023, was formally registered on August 31, 2022 with the Research Directorate of the Autonomous University of the State of Hidalgo.

With respect to the results concerning the use of the time assigned to the production of the preliminary projects, it is imperative to point out that they must be interpreted and reviewed with caution. Therefore, those who are not familiar with these results or with the application of this type

of tests can consult the texts that support them, which are presented in the conceptual framework and in the state of the art of this document.

Now, it is worth highlighting that the building design paradigm must be understood in a context where time equals money, which means that designing more efficiently could represent a significant advantage in the near future.

Figure 2 . Image of the Gantt chart from the second formal test



Source: self made

Aim

Obtain the use of time corresponding to the application of concurrent architectural modeling (MAC) in phases A and B of the manufacturing process of 24 work folders; as well as the graphic trigger (DG) in phase B, and the Gantt programming for a strategic course in basic building design (PrG) in both phases. Likewise, obtain from these folders the approach to professional performance (Adp), the identity between occupants and buildings (Ioe), and student learning (Ae).

Problem Statement

Within the framework of the research project for the evaluation of neo-sudden events (EnR), it was considered essential to expand the information related to the implementation of MAC, DG and PrG technologies , which have been designed to optimize the time allocated to basic building design. (*deb), as well as the Adp* , *Ioe* and *Ae* criteria . To do this, a new sample of work folders manufactured in two phases during a semester by students from a design workshop II had to be obtained.

The semester in question included approximately 30 sessions, during which students had the opportunity to develop and present on video, through their personal channels, two executive drafts. This schedule was developed during two weekly sessions, each lasting 4 hours. Furthermore, the manufacturing phases had to be adjusted to the number of evaluations planned for the selected design workshop.

Justification

The results achieved with the technologies and scales mentioned to develop the second formal test related to the use of time were collected in the subject Architectural Design of Interpersonal Activities. This was chosen because it consists of 36 sessions, which allowed the production of two executive drafts: in the first (phase A) approximately 22 sessions were used, while in the second (phase B) 11 were used.

Another relevant aspect for the selection of this subject was the duration of its sessions, since they coincide with the 4 hours required for neo-sudden sessions. Likewise, the focus group was made up of the students of this subject, identified as group 5 of the fourth semester of the degree in Architecture, July-December 2022 cycle.

Specifically, the focus group was able to carry out the first sudden neo in the first evaluation and the presentation of the first executive draft in the second evaluation (phase A), and the presentation of the second executive draft in the third evaluation (phase B). This provision was convenient to verify the use of time in general, specifically for those who managed to produce the two preliminary projects during the course, since fewer sessions were contemplated for the second compared to those planned for the first.

In particular, two uses of time were observed. The first occurred during the first neo-sudden, when the focus group had to solve the floor plans, cuts and facades in 4 hours. The second

use took place in the second neo-sudden, where the group had to solve the floor plans, sections and facades of another preliminary project, but this time in 2 hours.

Conceptual framework

Concurrent Architectural Modeling (MAC) is a free-access digital book that facilitates the preparation of executive draft projects with a metropolitan focus in digital formats. It is a basic building design methodology (*deb*) that consists of 24 professionalizing competencies (24cp), which are made up of a total of 2101 variables (2101v). This methodology is considered a time optimization strategy or technology, since it offers the opportunity for students to solve the floor plans, sections and facades of certain franchise typologies in a period of 4 hours (Elizalde, 2019a). Table 1 provides the relationship between the 24 professionalizing competencies and their 2101 variables, which are presented divided between the analytical and synthetic part of this strategy.

Table 1. Relationship between professionalizing competencies and number of variables

cp	Denomination	*CV*
Analytical part		
1. to	Requirements program	4
2nd to	Location of the property	5
3. a	Investigation of similar buildings	7
4. a	*Occupant requirements by component of the architectural continent* (*Rocca*), 116 variables for a single component, 1160 for preliminary projects with 10 components and 1740 variables in preliminary projects with 15 components	1,740
5. a	*Determinants of the context in the architectural continent* (*Dcca*)	174
6. a	*Formal attributes in the architectural continent* (*Afca*)	100
synthetic part		
7th	Cardinal orientation	3
8th	Interrelation of the components	4
9th	Hierarchical zoning	4
10. a	Surface Quantification	6
11. a	Comparison between surfaces	3
12th	Neo Sudden	5
13. a	Architectural plans	4
14 to	Finishing plans	6
15. a	Masonry plans	5
16. a	Structural plans	4
17. a	Electrical plans	3
18	Hydraulic plans	5
19th	Health plans	5
20 a	Gas plans	5
21st	Budgets	3
22nd	Sign	2
23rd	Work folder	3
24th	Presentation video	3
(*cp*) *professionalizing competencies* , (*cv*) *number of variables*		

Source: self made

The *graphic trigger* (DG), on the other hand, is a time optimization strategy that allows the floor plans, sections and facades of typologies aligned with the specifications of the basic building design (*deb*) to be resolved in a period of 2 hours. This method operates through a process of formal abstraction, in which the guiding or most relevant lines of certain images are highlighted. The procedure of this strategy begins with the client answering a questionnaire of 17 questions that give rise to the images, which, in turn, generate the highlighted lines. In other words, in addition to being a method to take advantage of time, DG is a strategy that allows obtaining proposals that already have the client's approval (Elizalde, 2019b).

On the other hand, *Gantt scheduling* (PrG) is a free downloadable digital resource that works as a general time optimization strategy. Its main advantage is that it facilitates the contrast between two executive drafts produced in different numbers of sessions, of which the second is prepared in almost half the time required to produce the first, although both have essentially identical content. This comparison, however, allows us to evaluate whether the students were able to prepare the second draft by themselves in less time, according to the learning obtained in the manufacture of the first (Elizalde, 2019c).

Now, what exactly is basic building design (*deb*)? This is a specific sector within the architectural design activity, defined as such in 2019. Among its objectives is the resolution and manufacturing of the preliminary projects of 21 franchise typologies , limited to surfaces of 150 m^2 to 200 m^2 , on one or two levels high, and composed of 10 or 15 interior spaces. These typologies are classified according to the cost factors of the tariff of the Federation of Colleges of Architects of the Mexican Republic (FCARM), which range between 0.58 and 2.07 (Elizalde, 2020). Table 2 offers a glossary that facilitates the understanding of this sector of study.

Table 2. Glossary of *debt acronyms*

Acronym	Meaning
17afr	*17 resulting formal abstractions*
2101v	*2101 variables*
24cp	*24 professional skills*
a/ag	*Anthropogeometric Accelerators*
aa	*Anthropic accelerators*
Adp	*Approach to professional performance*
Ae	*Student learning*
Afca	*Formal attributes in the architectural continent*
ag	*Geometric accelerators*
AC	*Architectural continent*
Dcca	*Determinants of the context in the architectural continent*
deb	*Basic building design*
DG	*Graphic trigger*
EnR	*Evaluation of sudden neo*
Ioe	*Identity between occupants and buildings*
MAC	*Concurrent architectural modeling*
p.	*Protocol*
PrG	*Gantt scheduling for a strategic basic building design course*
Rock	*Occupant requirements by component of the architectural continent*
SIV-DAE	*System to evaluate building architectural design*

Source: self made

This second formal test, mentioned in the justification, was based on two sets of protocols with the objective of providing certainty to the implementation of the technologies and scales, and guiding the registration of the activities carried out during the semester. The first comprises five research protocols obtained in 2020: protocol 1 for the use of MAC; protocol 2 for the use of the 24 professionalizing competencies (24cp); protocol 3 for the use of the practical part of the DG; protocol 4 for the use of the 17 statements (17afr), and protocol 5 for the use of the SIV-DAE (Elizalde, 2022a).

The second set includes four protocols obtained in 2021: protocol 6 for the use of learning activities (dA); protocol 7 for the use of guidelines related to typologies and technologies (dr:tyt); protocol 8 for the use of activities/guided activities (a/ag); and protocol 9 for Gantt scheduling of the *deb course* (Elizalde, 2022b).

State of the art

The work of disseminating the *deb* and its products has been a task that includes more than 70 participations in various events from 2013 to the end of 2022, with 10 additional events for the second half of this last year, which include some direct and indirect ones. In this section, the topic related to the research problem focuses on the work of these two aspects of dissemination, as well as on references to some DEB evidence *and* other external evidence that, together, enrich the study of the peculiarities investigated. in the field of building design workshops.

Direct and indirect disclosure

Direct disclosures occur when the *debt* has been the central subject or part of the main subject in the holdings. For example, in the keynote conference titled *Advantages when designing franchise real estate projects through a competency process* , the 24 professionalizing competencies (24cp) of the MAC were specified as that set of merits (Elizalde, 2022c). Similarly, in the keynote conference called *Specific commercial aspects for monitoring the production, sales and construction of real estate projects* , these advantages were offered as part of the commercial aspects (Elizalde, 2022d).

It should be noted that the reference books for this conference were *Background for the establishment of the market corresponding to basic building design in the Pachuca region* (Elizalde, 2019d) and *Correlativities for the establishment of the market corresponding to basic*

building design in the Pachuca region (Elizalde, 2019e), both digitally edited and available for free download.

In addition, it is worth mentioning the keynote conference entitled *Report of results of the 1st forum for franchise real estate projects* (Elizalde, 2022f), presented within the framework of the sudden organized by the College of Architects of Hidalgo, AC, and on the 7th .º Let's Talk about Architecture Congress, organized by a group of researchers and teachers from the UAEH. These events took place in the months of September and November 2022, respectively, where the *deb* stood out as the basis of the strategies that allow us to take advantage of time.

Indirect disclosure took place at events where mention was made of the *debt* , any of its products or properties. For reference, the panels from two events held in 2022 stand out. At the beginning of that year, at the 1st Forum for Franchisee Real Estate Projects (Autonomous University of the State of Hidalgo , 2022a), a panel for professionals entitled *Costs and sales of franchise real estate projects from the tariff of the College of Architects of Hidalgo* (Autonomous University of the State of Hidalgo , 2022b), and a panel for teachers called *Teaching of franchise real estate projects in schools in the area near Pachuca* (Autonomous University of the State of Hidalgo , 2022c). In both panels, the *deb* was specified as part of the design teaching contained in the educational program of the UAEH degree in Architecture, information that can be verified on the official microsite of said event.

Likewise, at the end of 2022, the *deb* was referred to in the two panels of the 1st Colloquium for the Real Estate Projects Market (Autonomous University of the State of Hidalgo, 2022a), which had a panel for professionals called *Commercial Attributes for monitoring the production, sales and construction of real estate projects* (Autonomous University of the State of Hidalgo, 2022b) and a panel for teachers entitled *Architecture schools in the monitoring of the commercial attributes of the production, sales and construction of the real estate projects* (Autonomous University of the State of Hidalgo, 2022c). In this context, the *deb* was highlighted for covering some of the typologies observable with the monitoring of the production, sales and construction of real estate projects in the Metropolitan Zone of Pachuca (ZMP). Additionally, other events have been mentioned where *deb* is addressed in a limited way.

Table 3 details the 10 disclosure events in the second half of 2022.

Table 3. Disclosure of the basic building design.

N	Title/date/link
61	*General criteria for reviewing subdivision projects* [c1] Aug 12 , 2022
62	*Tutor in the 1st* [Sudden] *, Rethink Recreate 2022* [r1] *September 21, 22 and 23 , 2022*
63	*Results report of the 1st* [Forum] *for Franchisee Real Estate Projects* [c1] *23/ sep /2022* [dd]
64	*CONARC and standardization in the* [c1 architecture] *Oct 17,* [2022]
65	*Commercial attributes for monitoring the production, sales and construction of real estate projects* [r1] *Nov 10, 2022* [di]
66	*Architecture schools in monitoring the commercial attributes of the production, sales and construction of real estate projects* [r1] *Nov 10, 2022* [di]
67	*Real estate monitoring entities* [r1] *Nov 10, 2022* [di]
68	[R1] *monitoring functions* *Nov 10, 2022* [di]
69	[R1] *monitoring periods* *Nov 10, 2022* [di]
70	*Specific commercial aspects for monitoring the production, sales and construction of real estate projects* [c1] *Nov 10, 2022* [dd]
71	*Results report of the 1st* [Forum] *for Franchisee Real Estate Projects* [c1] *Nov 10, 2022* [dd]

(N) Disclosure event number. Conferences, keynote addresses, presentations or similar ([c1]). Presentations of books, articles or exhibitions of work ([p1]). Participation in panels, round tables or other support ([r1]). Registration or endorsement of procedures ([p2]). Direct disclosure. ([dd]). Indirect disclosure ([di]).

Source: self made

Thanks to the information generated in the 1st [Forum] for Franchisee Real Estate Projects, it was concluded that there are three courses of action to follow. Firstly, the lack of precise data on the production, sales and construction of the franchise typologies , as well as all the typologies or construction genres contemplated in the FCARM tariff, was identified. Secondly, it was pointed out that these data would be useful for architecture schools in the Metropolitan Area of Pachuca to consider learning about the most in-demand projects in their design workshops. Finally, as a result of the two previous points, it was inferred that regional or metropolitan understanding should be the main focus of the strategies or technologies aimed at optimizing the time allocated to the *debt* (Elizalde, 2022g).

This event was inaugurated by Dr. Liliana Guadalupe Lizárraga Mendiola, head of the Academic Area of Engineering and Architecture of the Institute of Basic Sciences and Engineering of the Autonomous University of the State of Hidalgo; and by Architect Edna Zerón García, president of the College of Architects of the State of Hidalgo, AC

The total attendance was 40 students, of which 19 belonged to the Autonomous University of the State of Hidalgo in face-to-face mode, 4 to the National Technology of Mexico (Pachuca campus) in face-to-face mode, 4 to the European Cultural Center for University Studies of Hidalgo in virtual modality, 1 to the Autonomous University of Guerrero in virtual modality, 10 to the Autonomous University of Sinaloa in virtual modality, 1 to the Doctorate in Architecture and Urbanism in virtual modality, and 1 to the Doctorate in Design, Planning and Conservation of Landscapes and Gardens from the Metropolitan Autonomous University of Azcapotzalco in person.

Likewise, 8 teachers attended: 5 from the Autonomous University of the State of Hidalgo in face-to-face mode, 1 from the National Technology of Mexico (Pachuca campus) in virtual mode, 1 from the European Cultural Center for University Studies of Hidalgo in virtual mode, 1 from the Autonomous University of Guerrero in virtual mode, and 2 from the Autonomous University of Sinaloa in virtual mode.

In addition to the above, the panel for professionals had the participation of 8 members, distributed as follows: 2 in person mode, which represented the Autonomous University of the State of Hidalgo, 1 in virtual mode from the Technological Institute of Pachuca, 1 in virtual mode from the European Cultural Center for University Studies of Hidalgo, 2 in person mode from the College of Architects of the State of Hidalgo, AC, and 2 in person mode from the Metropolitan College of Architects of the State of Hidalgo, AC

On the other hand, the panel for teachers had 9 participants, including the same 8 members of the previous panel, along with the participation in virtual mode of a representative from the Autonomous University of Sinaloa (figure 3).

Figure 3 . Image of the panel for professionals and the poster of the 1st forum

Source: self made

In general terms, there was the participation of 3 schools of architecture from the Metropolitan Zone of Pachuca (ZMP), 2 from other states, as well as the presence of the 3 state colleges of architects in charge of the professional practice of architecture. This was possible thanks to the inaugural conference, directed by Architectural Engineer David Mateo Campero Campos, which led to the participation of the College of Architectural Engineers of the State of Hidalgo, AC and the city council of Pachuca de Soto (Campero, 2022).

In the event gallery you can view some of the preliminary projects manufactured in phases A and B of the first cycle of formal tests of the *deb* , as well as their respective presentation videos, posters and Gantt charts (Autonomous University of the State of Hidalgo , 2022d). Likewise, information is offered about the workshop led by Architect Miguel Nolasco Sánchez, whose objective was to teach the use of the FCARM tariff to obtain the cost of projects through mobile devices and online calculators (Nolasco, 2022). The calculators used belong to the Colegio de Arquitectos Chiapanecos, AC (CACh , 2022) and ADI Consultores, an architecture firm with physical headquarters in the city of Pachuca (ADI Consultores, 2022).

On the other hand, with information from the 1st Colloquium for the Real Estate Projects Market, it was possible to identify the sources of the missing hard data in the ZMP. For example, the monitoring of production, sales and construction of these projects was highlighted as the primary sources of said data. In addition, the attributes of these sources that would be monitored were highlighted, as well as the entities responsible for carrying out this work and the functions

they would perform. Among the most relevant data, it was identified that 14 architecture schools operate in this metropolitan area, supervised by 7 municipal construction offices, and have the influence of 3 state professional associations for the practice of architecture (Elizalde, 2022h), such as shown in figure 4.

Figure 4 . Image of the panel for professionals and the poster of the 1st colloquium

Source: self made

The event was inaugurated by Dr. Liliana Guadalupe Lizárraga Mendiola, head of the Academic Area of Engineering and Architecture of the Institute of Basic Sciences and Engineering of the Autonomous University of the State of Hidalgo; and by Architect Edna Zerón García, president of the College of Architects of the State of Hidalgo, AC

Regarding attendance, a total of 52 students were registered: 24 from the Autonomous University of the State of Hidalgo in virtual mode, 21 from the Latin American Technological Institute in virtual mode, 1 from Elise Freinet in virtual mode, 1 from the Vizcaya University of the Americas of Tulancingo in virtual mode, and 5 from the Universidad La Salle Pachuca in face-to-face mode.

In addition, 11 teachers attended: 3 from the Autonomous University of the State of Hidalgo in face-to-face mode, 1 from the National Technology of Mexico (Pachuca campus) in face-to-face mode, 2 from the Latin American Technological Institute in virtual mode, 2 from the La Salle Pachuca University (1 in face-to-face mode and 1 in virtual mode), 1 from the Vizcaya University of the Americas of Tulancingo in virtual mode, and 1 from the Autonomous University of Tamaulipas in virtual mode.

Revista Iberoamericana para la Investigación y el Desarrollo Educativo
ISSN 2007 - 7467

, given by Dr. *Diana* to a group of entities that can serve as a reference to carry out monitoring and described several of their functions (González, 2022) (figure 5).

Figure 5 . Image of the initial and master conference of the 1st colloquium

Source: self made

Own tests

The work carried out to test the strategies intended to take advantage of the time assigned to the *deb* stands out for two main applications: one carried out in 2019 with the group of the Architectural Design of Interpersonal Activities subject, and another carried out in early 2022 with the same group . The 2019 application constituted the second informal test of these strategies and was characterized by its informality due to the lack of implementation of the Gantt schedule (PrG), the graphic trigger (DG), the 9 research protocols, as well as other strategies or measurable technologies, such as the approach to professional performance (Adp), the identity between occupants and buildings (Ioe) or student learning (Ae). However, the MAC was used to produce two executive drafts during the July-December semester.

The focus group was made up of 14 students from the 4th semester of the UAEH architecture degree, of which 12 managed to design and present their two complete preliminary projects in the three semester evaluations. This resulted in the production of 14 executive drafts in the 26 sessions of phase A, and 12 in the 10 sessions of phase B, with a use of time for the MAC of 100% in phase A and 86% in phase phase B.

Among the information and communications technologies (ICT) used for these preliminary projects are the modeling *software Revit and* SketchUp , the electrical design *software* Dialux , as well as the Digital Map of Mexico and Google Maps , which facilitated the georeferencing of the

properties located in different cities in Mexican territory and other countries around the world. In addition, other technologies were used that allowed the digital presentation and consultation of the preliminary projects, such as the possibility of printing them in formal document format (PDF) for publication on pages with high visibility such as WIX, and the presentation from the personal channels of the students on YouTube.

In table 4 you can see some of the executive drafts and videos of phases A and B of this second informal test, carried out during the July-December 2019 semester.

Table 4. Some preliminary projects and videos of the second informal test

ae / *vp*	Links
From phase A	
ae	https://edreamerygs.wixsite.com/website
vp	https://youtu.be/HcvqDUUy4po
ae	https://jeniferarteagag.wixsite.com/website
vp	https://youtu.be/0Vcubna8YdM
ae	https://ca353080.wixsite.com/mysite
ae	https://jhonn27511.wixsite.com/searq
ae	https://beto1012mexico.wixsite.com/blackglare
ae	https://cmorenomucio.wixsite.com/website
ae	https://chochosparamore.wixsite.com/website
vp	https://youtu.be/VKTP8Nn8BXo
ae	https://aleman1302andany.wixsite.com/misitio/blog
ae	https://monserangelalvarad.wixsite.com/website
vp	https://www.youtube.com/watch?v=YNaOdSRTdss
From phase B	
ae	https://edreamerygs.wixsite.com/website
vp	https://youtu.be/2wMs1BNux1I
ae	https://jeniferarteagag.wixsite.com/website
ae	https://ca353080.wixsite.com/mysite
ae	https://jeemks77.wixsite.com/firstclassarchitectu/blog
vp	https://www.youtube.com/watch?v=Wj89Y3na33A&t
ae	https://beto1012mexico.wixsite.com/blackglare
ae	https://cmorenomucio.wixsite.com/website
ae	https://chochosparamore.wixsite.com/website
vp	https://youtu.be/Bl25OYmgafA
ae	https://aleman1302andany.wixsite.com/misitio
ae	https://monserangelalvarad.wixsite.com/website
vp	https://www.youtube.com/watch?v=o7EGRZaMWyM
(*ae*) *executive drafts* , (*vp*) *presentation videos*	

Source: self made

The first informal test was carried out during the January-July 2019 semester, where only the MAC and the DG were applied. The directed sample was composed of 21 executive drafts placed and presented online, manufactured with the MAC in phases A and B, for which the DG was implemented in 9 of the drafts of phase B.

As for the first formal test, this was carried out during the January-June 2022 semester, with a directed sample made up of 38 executive preliminary projects manufactured in phases A and B. These were developed by group 6 of the fourth semester, composed of 19 students from the UAEH Bachelor of Architecture educational program. This test acquired a formal character because a time utilization for the MAC of 26% was achieved in phase A and 53% in phase B; for the DG it was 32% in phase B; and for PrG of 32% in both phases. In addition, 73% was obtained in Adp , 59% in Ioe and 60% in Ae . All this accompanied by compliance with the implementation protocols p.1., p.3., p.9., p.2., p.4. and p.8. (Elizalde, 2022i).

Other tests

The context of testing conducted on groups of design students encompasses a variety of purposes. For example, Guevara (2013) examines the teaching-learning process of the architectural project in the educational environment, using a qualitative, descriptive, exploratory and transversal methodological approach. Their research is based on case studies and information collection, with a focus group made up of various design workshops of different levels. Their findings point to a lack of future projection in didactic terms in the professional training of architecture.

For his part, Fernández (2019) evaluates the synergy between teaching and learning in the architectural workshop, analyzing the situation of the evaluation process in a design workshop. Their study is framed in the interpretive paradigm and uses a qualitative methodology, for which it follows a case study design. The sample consisted of students from the A6 Architecture Workshop subject. Their conclusions highlight the importance of subjectivity in the teaching, learning and evaluation process of design.

Likewise, Isla (2022) investigates the relationship between architectural design and the use of ICT using basic research with a non-experimental design of a correlational nature and cross-sectional in time. Their sample included 70 architecture students from a national university in Peru. The results indicate that the relationship between architectural design and the use of ICT is significant, although low.

Finally, Chambi (2022) determines the impact of the model for the conceptualization of architectural design (MCDA) on the learning of architectural design. To do this, it uses causal quantitative research in order to establish relationships between variables in two groups: one experimental and the other control. His study group was made up of 41 students from the subject Architectural Design Workshop IV. The results of this work lead the author to conclude that the impact of the MCDA model is significant in the learning of architectural design.

Methodology

PrG technologies , as well as for the Adp , Ioe and Ae scales , were based on two parametric reviews. The first consisted of describing the events related to the implementation of the six protocols of these technologies and scales, with special emphasis on five global aspects. The second review, called *path* , involved recording the 2101 variables of the 24cp observed in the sample to then evaluate the satisfaction of four expectations. Thus, the description of the implementation of the protocols provided qualitative support, while the recording of the variables provided quantitative support.

The qualitative support of the technologies focused on the implementation of p.1, which describes the use of the MAC; from p.3, which describes the use of the DG; and p.9, which describes the use of the PrG . Additionally, this qualitative support focused on the implementation of protocol p.2, which describes the Adp ; of the protocol p.4, which describes the application of the Ioe ; and protocol p.8, which describes the application of Ae .

On the other hand, the quantitative support was based on the registration and quantification of the variables, but based on the satisfaction of the four expectations that occurred in four moments of project production, one in each of the two sudden stages of the course. and one in each of the two deliveries of the executive drafts.

The research was divided into five steps: in step i, a sample was integrated by summarizing the links to the pages where the preliminary projects were placed and the links to their presentation videos, called *work folders* . Step II included the review of the implementation of the six protocols based on their five global aspects. In step III , the 24cp variables observed in the work folders were recorded. In step iv , the variables were counted to distinguish which folders managed to satisfy the four expectations. Finally, in step v, the results of the three technologies and the three scales were obtained, for which compliance with the implemented protocols and the contrast between the

variables of the work folders that managed to satisfy the four expectations were taken as a reference. compared to those who did not.

Development

A total of 24 work folders were integrated. With the first parametric review, the implementation activities of the six protocols were recorded until their consistency was determined, which made it possible to indicate that the qualitative support is favorable. The second review allowed the registration of the 2101 variables of the 24cp observed in the 24 work folders, which were prepared in phases A and B with averages that reach 1035 and 994 variables, respectively. Of these, only 12 executive drafts in phase A achieved the first two expectations, while in phase B only 4 of 12 achieved the third expectation and 11 achieved the fourth.

Sample Integration

Regarding the sample, in step i, it is important to highlight that it is not statistical in nature and is made up of 24 work folders. These folders, in turn, are made up of 12 executive drafts manufactured in phase A, along with their respective presentation videos, as well as another 12 executive drafts manufactured in phase B, which also have their respective videos.

The initial focus group consisted of 16 students; However, two abandoned the subject during the semester and two accredited it, but delivered outside the scheduled dates, so their preliminary projects were not considered as part of the test. This subject, called Architectural Design Workshop of Interpersonal Activities, was taught to the fifth group of the fourth semester in the educational program of the degree in Architecture of the Autonomous University of the State of Hidalgo during the June-December 2022 cycle. In table 5 You can see the folders that make up the sample.

Table 5. Sample integration

Work folders		
Phase A		
1	*ae*	https://ca420727.wixsite.com/dcarquitecto
	vp	https://youtu.be/6bl3bcj9WnU
2	*ae*	https://mo294851.wixsite.com/hestia-design-studio
	vp	https://www.youtube.com/watch?v=9k9rBdyoBgY
3	*ae*	https://ch295563.wixsite.com/arc-connect
	vp	https://youtu.be/E9dke68pcmk
4	*ae*	https://sites.google.com/view/luisybarra/inicio?authuser=0
	vp	https://youtu.be/ZnBtJkraYQQ
5	*ae*	https://ya335053.wixsite.com/garquitectos
	vp	https://www.youtube.com/watch?v=wVcW8uUa8YI
6	*ae*	https://es450650.wixsite.com/oliver/blog
	vp	https://youtu.be/Av5gUYJX05c
7	*ae*	https://michelle2001913.wixsite.com/inefablearq/post/librer%C3%ADa-farmbook
	vp	https://youtu.be/Ni6nkh_h5yU
8	*ae*	https://te434547.wixsite.com/my-site
	vp	https://youtu.be/KMrScZk_qkY
9	*ae*	https://go413415.wixsite.com/arq-dgb
	vp	https://youtu.be/fM95FhioQVA
10	*ae*	https://634d6698b3bb5.site123.me/
	vp	https://youtu.be/qacKyNEG99g
eleven	*ae*	https://or421665.wixsite.com/uaehdeliveries-1
	vp	https://m.youtube.com/channel/UC6B60ymiB1iqB0u5odHd7PA
12	*ae*	-
	vp	-
Phase B		
1	*ae*	https://ca420727.wixsite.com/dcarquitecto/projects-1/miau-catfecito
	vp	https://youtu.be/Gpiy0xHocpY
2	*ae*	https://mo294851.wixsite.com/hestia-design-studio
	vp	https://youtu.be/-4EuwG7OQGw
3	*ae*	https://ch295563.wixsite.com/arc-connect
	vp	https://youtu.be/g8rY4I4i2kQ
4	*ae*	https://sites.google.com/view/boutiquemancha/programa
	vp	https://youtu.be/bii5WDf-vow
5	*ae*	https://ya335053.wixsite.com/garquitectos
	vp	https://youtu.be/4Gnhk-Mx4Us
6	*ae*	https://es450650.wixsite.com/oliver
	vp	https://youtu.be/zUjnC5BB6zs
7	*ae*	https://michelle2001913.wixsite.com/inefablearq/post/quetzal-coffee
	vp	https://youtu.be/KLLWI_NDW-E
8	*ae*	https://te434547.wixsite.com/my-site
	vp	https://youtu.be/J6dakAm-G0M

9	*ae* *vp*	https://go413415.wixsite.com/arq-dgb https://www.youtube.com/watch?v=3RVlyOIFIFM
10	*ae* *vp*	https://jesusjosafat101.wixsite.com/my-site https://youtu.be/4imr1tAn5g4
eleven	*ae* *vp*	https://or421665.wixsite.com/entregasuaeh https://youtube.com/channel/UC6B60ymiB1iqB0u5odHd7PA
12	*ae* *vp*	https://ro343931.wixsite.com/are-arquitectos https://youtu.be/iKuTCGlASQc
(*ae*) *executive draft* , (*vp*) *presentation video*		

Source: self made

Implementation of protocols

The implementation described corresponds to step ii of the methodology and the first parametric review. This review covers the five global aspects of the protocols, which are divided as follows: objective (u.1.), contextual considerations (u.2.), recommendations for implementation (u.3.), collection and analysis of the data (u.4.) and interpretation of the results (u.5.). These elements allow the protocol implementation activities to be recorded, which gives the test procedure verifiable qualitative support, since it allows the implementation to be evaluated as favorable or unfavorable, according to the content of a consistency table.

Application of the MAC regarding p.1

- *debt* activity was evaluated .
- (u.2.1.) The MAC was completely executed.
- (u.3.1.) An advance schedule was established in a Gantt chart for the two executive drafts of the semester.
- (u.3.2.) This programming was carried out considering the instructional design of the subject to anticipate the production of the preliminary projects and the preparation of the two neo-sudden ones, which allowed the manufacturing to be carried out in the first two thirds of the course. of the first set of preliminary projects, and the second set at the end of the last third.
- (u.3.3.) The two neo suddens were executed at the end of the analytical parts, which are part of the research process.

- (u.3.4.) Throughout the course, individualized teaching reviews were carried out, thereby obtaining the expected group repercussions.
- (u.3.5.) The use of paper and the construction of physical models were dispensed with.
- (u.3.6.) Necessary reviews were carried out to ensure that the content of the drafts was complete, especially before submissions.
- (u.3.7.) Before the first neo sudden, each member of the group created their orthogonal grids, some of which had shapes other than square or rectangular.
- (u.3.8.) The proposals for floor plans, facades and sections of the first neo-sudden were resolved without resorting to conceptual formal abstractions.
- (u.3.9.) The two neo-sudden sessions, located at the end of the synthetic parts, were carried out both in person and remotely, synchronously and asynchronously.
- (u.3.10.) Although the formats and lists of the analytical parts were not perfectly completed, the three budgets were included in most of the preliminary projects.
- (u.3.11.) The sample drafts manufactured by the students were presented in PDF format, placed on high-visibility pages, and presented on video from their personal channels.
- (u.4.1.) The proposals in which the floors, facades and sections were resolved in periods equal to or less than 4 hours of the two neo-sudden events were recorded and quantified.
- (u.5.1.) Only 4 of the 12 preliminary projects met the expectations of the two neo-suddens.

Application of the DG regarding p.3

- (u.1.) An improvement could be seen in the use of the time assigned to the *debt* through the implementation of the MAC.
- (u.2.1.) This improvement was especially evident during the practical application of the DG.
- (u.3.1.) During this phase, it was observed that only some proposals had the 17 questions of the three formats specified on pages 818, 819 and 820 of the DG.
- (u.3.2.) The answers to these questions were recorded digitally, and the client roles were played by members of the same subject.
- (u.3.3.) The images that matched the answers were placed following the examples provided on pages 822, 823 and 824.

- (u.3.4.) However, the representative lines of each response were not highlighted in the images.
- (u.3.5.) The 17 guide lines next to the source images, as indicated in the instructions, were also not included.
- (u.3.6.) This resulted in the guides, or *afr* , not being fully used during the second sudden neo.
- (u.3.7.) As a consequence, these *afr* were not reflected in the floor plans, facades and sections of the preliminary projects of phase B.
- (u.3.8.) To begin the second neo-sudden, most of the students drew auric section grids over the dimensions of their properties.
- (u.3.9.) Although not all the proposals in the preliminary projects of phase B had conceptual abstractions, a higher degree of difficulty was perceived compared to the preliminary projects of phase A.
- (u.4.1.) In this second phase, only 4 of the 12 proposals managed to resolve their facades, floors and sections in periods less than or equal to 2 hours.
- (u.4.2.) The format of table 345, located on page 864 of the DG, was not used during the study.
- (u.5.1.) Although an improvement was observed in the use of time, due to the lack of use of representative formal abstractions, it is estimated that there is only a theoretical relationship between these and said use.
- (u.5.2.) None of the 12 proposals used any of the 17 *afr* .

Application of the PrG regarding p.9

- (u.1.) A Gantt chart was used to organize and evaluate the activities of the *deb course* .
- (u.2.1.) Both the teaching staff and the students were informed about the Gantt schedule, the definition of the *debt* , the scope of the MAC and the objectives of the DG.
- (u.3.1.) In the Gantt chart, the course content was included in the initial columns and upper rows.
- (u.3.2.) A coding based on the acronyms of *deb* , MAC and DG was used to refer to the activities planned in the course.

- (u.3.3.) The manufacturing processes of the two executive drafts, including their respective neo-suddens, were programmed in the Gantt chart. The first draft was planned to be developed two-thirds of the course, while the second would be produced in the final third.
- (u.3.4.) The activities scheduled for the first two thirds of the course, intended for the production of the first draft, were adequately managed and referenced by their respective acronyms.
- (u.3.5.) Similarly, the activities planned for the last third of the course, which led to the production of the second draft, were also managed and referenced by their corresponding acronyms.
- (u.4.1.) However, not all Gantt charts used by students recorded progress or delays in course activities.
- (u.5.1.) Although the recording of the scheduled activities was not complete in most of the Gantt charts, it is considered that the course was satisfactory, since the activities were completed almost in their entirety within the established time .

Obtaining the Adp regarding p.2

- (u.1.) The Adp of the executive drafts was measured.
- (u.2.1.) This measurement was based on the use of the 2101v observed from the 24 MAC work folders.
- (u.3.1.) The progressive compliance of the 24 work folders was supervised during the development of the executive drafts.
- (u.3.2.) Simultaneously, progressive compliance with 2101v was sought.
- (u.4.1.) The students recorded the use of the 24 work folders in the executive drafts as part of a co-evaluation.
- (u.4.2.) Similarly, under the same co-evaluation system, the students recorded the use of the 2101v of each preliminary project.
- (u.5.1.) Most of the executive drafts complied with the Adp .

Obtaining the Ioe regarding p.4

- (u.1.) The Ioe value was measured as a percentage.
- (u.2.1.) This process was carried out exclusively using the DG 17 Afr quantitative approach.
- (u.3.1.) The format of table 345 on page 864 was not used, which resulted in the omission of the underlining of the qualitative references indicated in section 6.8.2.6.1. from page 863 of the DG. Nor were the Me, the CDs, or the premises of the 17 Afr highlighted in the executive drafts.
- (u.3.2.) Likewise, the lack of use of the format of table 345 on page 864 prevented the marking with *x* of the quantitative references indicated in section 6.8.2.6.2. from page 863 of the DG. However, the theoretical consideration was maintained that 100% of the Ioe corresponds to the total use of the 17 Afr in the executive drafts.
- Ioe were not indicated . Therefore, a quantitatively recorded value was not obtained.
- (u.5.1.) As a result, it is estimated that theoretically the same value is assigned to both the limit of intellectual vision and the uniqueness of CA.

Obtaining the Ae regarding p.8

- (u.1.) The measurement of student learning was carried out using the DG competencies.
- (u.2.1.) However, none of the anthropogeometric accelerators (a/ag), which are divided into 12 anthropometric accelerators (12aa) and 5 geometric accelerators (5ag), were employed. This was due to a lack of understanding of the 17 Afr of the DG as cognitive competencies.
- (u.3.1.) This lack of understanding caused the communication channel between teachers and students to not be strengthened.
- (u.3.2.) Consequently, the function of the a/ag was not explained or timed, nor were references made to pages 26 to 30 of the *Background book and the Correlativities* book in the same page numbers.
- (u.3.3.) In the second sudden neo, the time spent using the *AAs* during the first hour and a half was not recorded, nor was the content of pages 26 to 30 of the *Background book* and the book mentioned. of *Correlativities* in the same numbers of pages.

- (u.3.4.) Similarly, in that second sudden neo, the time spent in the use of the *ags was not timed* during the last 30 minutes, which were intended to arise during the resolution of the facades, floors and cuts of the second executive drafts. Furthermore, no mention was made of the content of pages 26 to 30 of the *Background book and the Correlativities* book in the same page numbers.
- (u.4.1.) These circumstances prevented the use of table 07 to compile the individual data of the *AA* , located on page 27 of the *Background* and *Correlativity books* .
- (u.4.2.) Likewise, these circumstances prevented the use of table 08 to collect the individual data of the *ag* , located on page 31 of the *Background* and *Correlativity books* .
- (u.5.1.) Unfortunately, the absence of the a/ag prevented obtaining an adequate estimate of Ae .

Consistency of qualitative implementation of protocols

The descriptions carried out and not carried out on the parametric reviews of these 5 global aspects of the protocols (p.1., p.3., p.9., p.2., p.4. and p.8.) are They are detailed in Table 6, which follows the Cornell technique, commonly used to verify compliance with the items. Although most of the activities indicated in the 5 global aspects of the protocols were executed, the qualitative aspect of their implementations is considered favorable. This, even though p.4. presents an equal number of activities carried out and not carried out, and even the implementation of p.8., which has a majority of activities not carried out.

Table 6. Consistency of protocol implementations

u./p.		Technologies			Let's scale		
		p. 1.	p. 3.	p. 9.	p. 2.	p. 4.	p. 8.
u.1.	1.	r	r	r	r	r	r
u.2.	1.	r	r	r	r	r	n
u.3.	1.	r	r	r	r	n	n
	2.	r	r	r	r	n	n
	3.	r	r	r	-	-	n
	4.	r	n	r	-	-	n
	5.	r	n	r	-	-	-
	6.	r	n	-	-	-	-
	7.	r	n	-	-	-	-
	8.	r	r	-	-	-	-
	9.	r	r	-	-	-	-
	10.	n	-	-	-	-	-
	eleven.	r	-	-	-	-	-
u.4.	1.	r	r	n	r	n	n
	2.	-	n	-	r	-	n
u.5.	1.	r	r	n	r	r	r
	2.	-	n	-	-	-	-
(s) qualitative aspect realized, (n) qualitative aspect not realized, (-) numeral without qualitative aspect							

Source: self made

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ISSN 2007 - 7467

Registration of variables

The second parametric review facilitates the recording of the 2101v of the 24cp observed in the 24 work folders that were manufactured in phases A and B. The average of the 2101v of the 24cp of the MAC used to manufacture the first 12 work folders of phase A was around 1035v, with a recorded minimum of 1106v and a maximum of 2027v, according to the records in table 7. On the other hand, the average of the 2101v of the 24cp of the MAC used to manufacture the second 12 work folders phase B was around 994v, with a recorded minimum of 823v and a maximum of 1869v, according to the data provided in table 8.

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ISSN 2007 - 7467

Table 7. Record of *v* per *cp* for the 12 work folders of phase A, JD2022

ae / vp cp	01	02	03	04	05	06	07	08	09	10	eleven	12
01	4	-	4	-	3	4	-	3	4	4	4	-
02	5	-	5	-	5	4	-	5	5	5	5	-
03	4	-	5	-	6	5	-	6	4	5	7	-
04	1,677	-	1,311	-	1,501	881	-	1,501	897	0.000	1,340	-
c-01	*129*	-	*97*	-	*100*	*82*	-	*100*	*62*	*89*	*100*	-
c-02	*129*	-	*89*	-	*101*	*82*	-	*101*	*79*	*89*	*91*	-
c-03	*129*	-	*88*	-	*102*	*83*	-	*102*	*70*	*70*	*90*	-
c-04	*129*	-	*93*	-	*95*	*79*	-	*95*	*76*	*70*	*95*	-
c-05	*129*	-	*100*	-	*106*	*81*	-	*106*	*69*	*70*	*102*	-
c-06	*129*	-	*96*	-	*97*	*82*	-	*97*	*68*	*70*	*98*	-
c-07	*129*	-	*95*	-	*100*	*77*	-	*100*	*63*	*70*	*97*	-
c-08	*129*	-	*96*	-	*101*	*80*	-	*101*	*65*	*70*	*98*	-
c-09	*129*	-	*96*	-	*101*	*78*	-	*101*	*61*	*70*	*98*	-
c-10	*129*	-	*91*	-	*103*	*74*	-	*103*	*60*	*70*	*93*	-
c-11	*129*	-	*96*	-	*99*	-	-	*99*	*64*	*70*	*98*	-
c-12	*129*	-	*93*	-	*100*	-	-	*100*	*59*	-	*95*	-
c-13	*129*	-	*91*	-	*99*	-	-	*99*	*37*	-	*93*	-
c-14	-	-	*90*	-	*100*	-	-	*100*	*64*	-	*92*	-
c-15	-	-	-	-	*97*	-	-	*97*	-	-	-	-
05	173	-	161	-	152	143	-	152	133	153	161	-
06	98	-	92	-	94	75	-	94	66	68	92	-
07	2	-	2	-	3	3	-	3	2	3	3	-
08	3	-	4	-	4	4	-	4	4	4	4	-
09	4	-	4	-	4	4	-	4	4	3	4	-
10	6	-	6	-	6	6	-	6	6	6	6	-
eleven	3	-	0	-	3	3	-	3	3	3	3	-
12	5	-	5	-	5	5	-	5	3	5	5	-
13	3	-	4	-	4	4	-	4	4	4	2	-
14	5	-	4	-	0	6	-	0	6	5	3	-
fifteen	4	-	0	-	0	4	-	0	0	4	5	-
16	4	-	4	-	4	4	-	4	4	4	4	-
17	3	-	3	-	3	3	-	3	3	3	3	-
18	5	-	5	-	4	5	-	4	5	4	3	-
19	5	-	5	-	5	4	-	5	4	5	3	-
twenty	5	-	5	-	0	5	-	0	5	0	0	-
twenty-one	3	-	3	-	3	3	-	3	3	3	3	-
22	2	-	2	-	2	2	-	2	2	2	2	-

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23	3	-	3	-	3	3	-	3	3	3	3	-
24	3	-	3	-	3	3	-	3	3	2	3	-
Total	2,027	0.000	1,640	0.000	1,817	1,174	0.000	1,817	1,173	1,106	1,668	0.000

Source: self made.

Table 8. Record of *v* per *cp* for the 12 work folders of phase B, JD2022

ae / vp cp	01	02	03	04	05	06	07	08	09	10	elev en	12
01	4	-	4	-	3	4	-	4	4	4	4	4
02	5	-	5	-	5	5	-	5	5	5	4	5
03	2	-	5	-	6	5	-	6	4	5	3	7
04	1,520	-	1,311	-	1,501	836	-	1,124	897	808	698	747
c-01	*116*	-	*97*	-	*100*	*77*	-	*101*	*62*	*89*	*88*	*77*
c-02	*116*	-	*89*	-	*101*	*77*	-	*101*	*79*	*89*	*58*	*87*
c-03	*116*	-	*88*	-	*102*	*77*	-	*103*	*70*	*70*	*64*	*83*
c-04	*116*	-	*93*	-	*95*	*79*	-	*99*	*76*	*70*	*59*	*87*
c-05	*116*	-	*100*	-	*106*	*81*	-	*106*	*69*	*70*	*61*	*82*
c-06	*116*	-	*96*	-	*97*	*77*	-	*100*	*68*	*70*	*62*	*68*
c-07	*116*	-	*95*	-	*100*	*76*	-	*102*	*63*	*70*	*62*	*68*
c-08	*118*	-	*96*	-	*101*	*76*	-	*104*	*65*	*70*	*60*	*68*
c-09	*118*	-	*96*	-	*101*	*78*	-	*102*	*61*	*70*	*62*	*68*
c-10	*118*	-	*91*	-	*103*	*81*	-	*105*	*60*	*70*	*63*	*59*
c-11	*118*	-	*96*	-	*99*	*77*	-	*101*	*64*	*70*	*59*	-
c-12	*118*	-	*93*	-	*100*	*80*	-	-	*59*	-	-	-
c-13	*118*	-	*91*	-	*99*	-	-	-	*37*	-	-	-

c-14	-	-	*90*	-	*100*	-	-	-	*64*	-	-	-
c-15	-	-	-	-	*97*	-	-	-	-	-	-	-
05	173	-	161	-	152	135	-	152	133	153	141	-
06	98	-	92	-	94	76	-	94	66	68	67	-
07	2	-	3	-	3	3	-	3	2	3	3	3
08	3	-	4	-	4	4	-	4	4	4	4	4
09	4	-	4	-	4	4	-	4	4	3	4	4
10	6	-	6	-	6	6	-	6	6	6	6	6
eleven	3	-	3	-	3	3	-	3	3	3	3	3
12	5	-	5	-	5	5	-	5	3	5	4	5
13	3	-	4	-	4	4	-	4	4	4	4	4
14	5	-	4	-	0	6	-	0	6	5	5	6
fifteen	4	-	5	-	0	4	-	0	0	4	4	0
16	4	-	4	-	4	4	-	4	4	4	3	4
17	3	-	3	-	3	3	-	3	3	3	5	3
18	5	-	5	-	4	5	-	4	5	4	5	5
19	5	-	5	-	5	4	-	5	4	5	5	5
twenty	5	-	5	-	0	5	-	0	5	0	3	0
twenty-one	3	-	3	-	3	3	-	3	3	3	2	0
22	1	-	2	-	2	2	-	2	2	2	3	2
23	3	-	3	-	2	3	-	3	3	3	3	3
24	3	-	3	-	3	3	-	3	3	2	3	3

Total	1,869	0.000	1,650	0.000	1,817	1,232	0.000	1,441	1,173	1,106	827	823

Source: self made

Satisfaction of expectations

Both parametric reviews lead to step IV , where the number of variables allows us to identify the folders that meet the 4 expectations, which are distinguished among the 24 work folders: firstly, those in which the plants were resolved, facades and cuts in the 4 hours of the first sudden neo; secondly, within the first work folders presented on the scheduled date; thirdly, where the floors, facades and cuts were managed to be resolved in the 2 hours of the second sudden neo; and fourthly, in those second work folders presented for the second date.

- 1. to expectation. In phase A, for the first evaluation, the 12 students solved their floor plans, facades and sections in the 4 hours of the 1st neo-sudden; This is evident in table 9 with the numbers 1 to 12.
- 2. to expectation. In the second evaluation, the 12 members punctually presented their work portfolios using the MAC; This is seen in table 9 with the numbers 1 to 12.
- 3. to expectation. With the DG in phase B, of the 12 participants, 4 resolved their floors, facades and sections in the 2 hours of the second sudden neo; This is seen in table 9 with numbers 4, 7, 8 and 10. However, in no proposal were the 17 *afr used* .
- 4. to expectation. Finally, with the second application of the MAC, of the 12 students, only 11 presented their second portfolios of work for the third evaluation; This is reflected in table 9, where the number 11 indicates the folder that was not presented on the scheduled date.

Table 9. Record of compliance with the 4 expectations of phases A and B

ae	TO	b	Data from the second sudden neo
	1e/2e	3e/4e	
1/1	H.H	n/s	*hi* =12:30 hrs ; *ht* =2:43 hrs ; *afr* = -- ; *total* = 2:15 h with -- from *17afr* (n)
2/2	H.H	n/s	*hi* =10:30 hrs ; *ht* =14:30 hrs ; *afr* = -- ; *total* = 4:00 h with -- from *17afr* (n)
3/3	H.H	n/s	*hi* = --:-- hrs ; *ht* =--:-- hrs ; *afr* = -- ; *total* = 0:00 h with -- from *17afr* (n)
*4/4	H.H	H.H	*hi* =9:30 hrs ; *ht* =11:15 hrs ; *afr* = -- ; *total* = 1:45 h with -- from *17afr* (n)
5/5	H.H	n/s	*hi* =22:00 hrs ; *ht* =1:30 hrs ; *afr* = --; *total* = 2:30 h with -- from *17afr* (n)
6/6	H.H	n/s	*hi* =20:25 hrs ; *ht* =22:48 hrs ; *afr* = -- ; *total* = 2:23 h with -- from *17afr* (n)
7/7	H.H	n/s	*hi* =24:03 hrs ; *ht* =2:16 hrs ; *afr* = -- ; *total* = 2:13 h with -- from *17afr* (n)
*8/8	H.H	H.H	*hi* =17:00 hrs ; *ht* =19:00 hrs ; *afr* = -- ; *total* = 2:00 h with -- from *17afr* (n)
*9/9	H.H	H.H	*hi* =18:05 hrs ; *ht* =19:52 hrs ; *afr* = -- ; *total* = 1:47 h with -- from *17afr* (n)
*10/10	H.H	H.H	*hi* =12:23 hrs ; *ht* =14:19 hrs ; *afr* = -- ; *total* = 1:56 h with -- from *17afr* (n)
11/11	H.H	-/n	*hi* = --:-- hrs ; *ht* =--:-- hrs ; *afr* = -- ; *total* = 0:00 h with -- from *17afr* (n)
12/12	H.H	n/s	*hi* =4:50 hrs ; *ht* =7:05 hrs ; *afr* = -- ; *total* = 3:20 h with -- from *17afr* (n)
(*ae*) executive drafts; (1e) 1st ^{expectation}, (2e) 2nd ^{expectation}, (3e) 3rd ^{expectation}, (4e) 4th ^{expectation}, (*hi*) start time, (*ht*) end time, (h) hours duration, (s) expectation achieved, (n) expectation not achieved (*) students who achieved the 4 expectations in the 3 evaluations.			

Source: self made

Results

With step v, the values for the technologies and scales applied in this second formal test were obtained. Regarding the technologies, a 100% utilization was recorded for the MAC in phase A and 92% in phase B. However, for the DG a performance of 0% was observed, since none of the 17 afr It was used. Likewise, 92% utilization was obtained for PrG in both phases. Regarding the scales, a level of 49% was reached in the Adp , while both the Ioe and the Ae registered a use of 0%.

Results of the application of the three technologies

With respect to the data in Table 9, in phase A a 100% use of time was observed due to the application of the MAC. In the 12 executive preliminary projects evaluated, the two established expectations were met: resolving the floors, facades and sections within 4 hours of the first sudden change for the first evaluation, and promptly delivering the first preliminary projects for the second evaluation, as can be seen in the preliminary projects classified from 1/1 to 12/12.

In phase B, the use of time with the second application of the MAC was 92%, since in 11 of the 12 preliminary projects the expectation established for the third evaluation was reached, except in the preliminary project classified as 11/11, according to the table 9.

Regarding the application of the DG, a 33% use of time was recorded, since only 4 of the 12 participants resolved their floors, facades and sections in the 2 hours of the second sudden neo, as can be seen in the preliminary projects classified as 4/4, 8/8, 9/9 and 10/10 in table 9. However, it is important to note that this percentage value is imprecise because none of the 17 afr were used in the proposals of the sudden neo seconds.

Finally, with the application of the PrG in both phases, a time utilization of 92% was achieved, since 11 of the 12 work folders were presented online as indicated on the dates scheduled for the second and third evaluation. The draft that was not presented online is classified as 11/11 in table 9.

Results of the application of the three scales

Since the closest average to 2101v is found in phase A, with 1035v, it can be concluded that 49% was reached in Adp . However, due to the absence of records on the use of any of the 17 afr in the proposals of the second neo sudden, it was not possible to determine the shortest time to assume the use of the 12 *aa* and the 5 *ag* . Therefore, their respective percentage values could not be calculated, resulting in a value of 0% for Ioe . In this same sense, the Ae value was also 0%, since the *ag were not used* .

Discussion

Based on this second formal test, and the four already mentioned, it can be stated that the classrooms of the building design workshops are the ideal laboratories to carry out experiments. This statement makes sense when highlighting that all the tests were carried out within the classrooms and included samples of students previously assigned to the project work. Although these five tests differ in their objectives, methodologies, research approaches and results, they also present similarities and differences.

Now, in the midst of these contrasts, four tests are related to the teaching-learning dynamics, while the remaining one focuses on the use of ICT. Two of these tests implement apparently original procedures, such as the MCDA and the *deb technologies and scales* . All are aligned with a qualitative research approach, one is characterized as basic research and three are applied in a single workshop, while two cover workshops of different degrees. However, only in this test is the issue of time use specifically addressed.

When comparing the results of the other four tests with those of this second cycle, it is evident that the lack of future projection indicated by Guevara (2013) can be corrected with the application of the MAC, since this technology considers self-employment as a main futuristic alternative. of financial income. Regarding subjectivity in design identified by Fernández (2019), the DG allows us to overcome this challenge by promoting co-design with clients.

Likewise, in relation to the low but significant use of ICT found by Isla (2022), it is clear that the implementation of technologies and debt scales *increases* and makes the use of ICT more relevant. Although the results of this second cycle of tests are not as favorable as expected, which is similar to the conclusion of Chambi (2022) with the implementation of the MCDA model, it is highlighted that design learning in the workshops continues. being significant. This is important,

since perhaps with the application of strategies exclusively developed for learning building design, new paths can be found to make it even more meaningful.

Considering that the results of the first formal test have recently been published and that the parametric reviews of the two informal tests of 2019 have not yet been carried out, which could provide an idea about the application of the three technologies and the three scales, it is pertinent It should be noted that the results obtained in this second formal test are the second of their kind. However, it is evident that the lack of use of the 17 afr has resulted in values of zero for the DG, the Ioe and the Ae ; despite the fact that the MAC has had a very satisfactory performance in fulfilling its mission in both phases, which has had an impact on the good result of the PrG .

As a recommendation for future tests that involve these two triads of technologies and scales, it is important to emphasize the application of the 17 afr , but without this representing an obstacle for students instead of an advantage. Finally, it is evident that the inconsistent application of the protocols p.3., p.4. and p.8. coincides with the percentage results for their respective technologies and scales.

Conclusions

Although the DG, the Ioe and the Ae recorded percentage values of zero due to the lack of use of the 17 afr , it is essential to highlight the excellent performance of the MAC. In fact, in both applications, the MAC demonstrated favorable time utilization, which is reflected in the fact that four phase B preliminary projects were manufactured in less than two hours. Furthermore, this success contributed to the positive outcome of the PrG .

However, it is crucial to note that the achievement of four satisfactory results in the second neo sudden without the use of the DG and its 17 afr is food for thought. Therefore, first of all, the need for a more detailed explanation and more precise custody of the implementation of the protocols p.3., p.4 is highlighted. and p.8. Secondly, it is imperative that the application of 17 afr be explained, applied and rigorously monitored . This means using your formats with answers, placing images and highlighting them appropriately, as well as making sure they are present in all the sudden neo second proposals. Otherwise, it could be perceived that these applications do not contribute to the use of time.

Future lines of research

Talk of implementing time-saving testing in more building design workshops could be seen as promising a host of new benefits. However, before making such a statement, it is essential to expand knowledge about the contemporary application of other tests.

To achieve this objective, collection dynamics must be used that allow, first of all, to identify, number, classify and monitor a significant group of building design workshops. Secondly, those workshops where the tests will be applied must be selected and, thirdly, the participation of the teaching staff must be encouraged by publishing their results. Likewise, it should be noted that appropriate filters must be established to validate the procedures and results of all tests.

This task, predictably challenging, also represents a call to collaborate in a network with other educational entities and related research projects. In addition, *software* specialized in qualitative and quantitative research approaches must be available to guarantee the effectiveness and validity of the results.

Thanks

At the Autonomous University of the State of Hidalgo, to the Institute of Basic Sciences and Engineering, to the Academic Area of Engineering and Architecture and to the PEL in Architecture for the facilities granted to carry out the application of this second cycle of formal tests. Likewise, to the CED Architecture Firm for the support granted to sponsor the expenditures made.

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