

## ***21st Century Education Model: We Need Museums Now More Than Ever***

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The Paris Conference on Education 2022  
Official Conference Proceedings

### **Abstract**

The accelerated development of digital technologies highlights the necessary transformation of educational models towards one based on competencies and capable of breaking with linear and deductive thinking. At this juncture, museums are reconsidered and redefined as cultural spaces capable, from artistic practices and new technologies, of breaking with the linearity and rigidity of the scientific method. From the experience of the MUI (Interactive Urban Museum) in Puebla, Mexico, the case of educational innovation is analyzed from a new museology approach. In it, experiential and challenging learning situations are developed for university students who participate in exhibition projects and visual and museographic strategies with social impact. From the exhibitions produced between 2020 and 2021, it is possible to observe and identify a positive change in the domain of skills derived from artistic, museographic practice and visual content creation. It is concluded that this change in the level of mastery is related to the commitment that students develop with the projects, as a high degree of experimentation can develop in the museum.

Keywords: Challenge-Based Learning, Competency-Based Education, New Forms of Content Delivery, Professional Education

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## Introduction

The 21st century gathers the complexities that the phenomena, of any kind, present in the future of our species, have been adding over time. The education that we are obliged to manage and build today is marked by the need to train individuals in skills that are capable of understanding and solving the high complexity of global phenomena. The complexity is accompanied by the technological revolutions that we have experienced, thus the change, direction and way in which education must be built from this second half of the 21st century is a consequence of the last of the revolutions, the digital one that through its technologies They warn of training in "new" skills to be able to break with the logical-deductive-traditional thinking, unsuccessful in dealing with global emergencies. A kind of "throw away and leave behind" is embraced as the germ of being in institutions, such as museums and cultural spaces, that are built in the educational field.

In this narrative, museums, one of the oldest institutions we know, are reconsidered, and redefined from the idea that artistic practices and new technologies are the means capable of breaking with the linearity and rigidity of the scientific method. Thinking of these spaces as those that go beyond a university classroom and a training that transitions to inter/trans disciplinarity seems to be a prudent response to the call of our high complexity. University museums play in this last point a fundamental safeguard factor for the experimentation of languages, civil passions, and basic activism that, through artistic practices and from the so-called new museology, potentiate and strengthen in people in training, skills that university educational models seek to develop. These new museum roles have allowed them to be part of the so-called new cultural centers, given that for training in skills, they become meeting places, networks, communities and student and citizen organizations; They carry out collaborative cultural practices based on participation and activism, as an interface between the university and the city, and building spaces for comparison, dialogue and reflection.

From the experience of the MUI (Interactive Urban Museum) in Puebla, a university museum of the Tecnológico de Monterrey, a case of educational innovation is analyzed that develops experiential and challenging learning situations from a new museology for university students who participate in exhibition projects and of visual and museographic strategies of social impact between 2019 and 2021. The purpose of the implementation of this educational innovation was to observe and identify a positive change in the mastery of skills derived from artistic, museographic practice and visual content creation. This change is related to the commitment that students develop with the projects, as a high degree of experimentation can develop in the museum.

The article begins with a referential and theoretical-methodological review and reflection from the new museology, a museological current that places museums as creators of an impactful cultural and artistic practice, to the function of the so-called new cultural centers in a new context of university work in the public space; and where it is located, the participation of 215 students in professional practices and social service in the museum from courses related to visual strategy and creation of new content. Next, significant findings are presented that support the initial assumptions about artistic practices and education in skills from university museums.

## **Education in competencies, flexible educational models, and new spaces for learning: the university museum for challenge-based learning**

The need to define educational models that form professional profiles capable of facing highly complex global challenges reveals the crisis of the current university system and in it the urgency of reconnecting universities with public spaces so that their impact and incidence permeate not only in student training but also in the regeneration of urban space. With this, one more university mission to be fulfilled is defined. This is how the concept of competence and the need to train them professionally (Getting Smart, 2018) acquires priority.

The model that accompanies this educational construction places students in challenging and experiential experiences and outlines them as the designers of their learning under a logic of flexibility and adaptability in coherence with exponential technology in a way that overcomes technical barriers and promotes their own design challenge. Challenging and experiential situations from this learning logic take on meaning and opportunity (Malmqvist, Rådberg and Lundqvist, 2015) to be developed by students in spaces outside the classroom, whose ecosystems foster the formation of skills and competencies specific to the disciplines and transversal to them, so that they produce innovative learning and high social impact.

In the same way that university education begins its crisis, the economic system has exacerbated a global crisis since 2009 and that, experienced first in many European countries, opened the door to reflection and understanding of the function and role that institutions and cultural centers had in the articulation of more collaborative practices, pointed out by Sachs (2006) as the viable path, and based on participation and activism, whether in the cities and in the countryside, as well as in the so-called South as in the north. These new cultural centers, according to Niessen (2019), were built as spaces for comparison and crucial safeguards for the experimentation of new languages, civil passions, and civic participation. In addition to being crossed by hundreds of thousands of people. Thus, they constitute an unprecedented opportunity for the creation, such as experimental libraries, of regenerated places or community centers and artists' residences. They are configured as a world that we still need to know, study and tell more about.

The complexity that we denote in the intersection of the university and economic crisis is the gateway to focus attention from two areas in the university museum. The first in its ability to develop the practices that characterize the new cultural centers. From an ontological conception and following the Educational Innovation Observatory (2016), the museum can be known as a physical space and can become one in which the dynamics of approaching situations appeals to experiences where students actively participate in open learning experiences. The latter, challenging and experiential, focuses on the fact that experiences of social and cultural innovation, Niessen (2019) points out, begin with the combined action of practices from below, promoted by universities and other public institutions, with the innovation of traditional cooperative networks and attempts to renew spaces. University museums can become these spaces to set up the most suitable interfaces for collaboration and co-creation between university communities with the city and its actors.

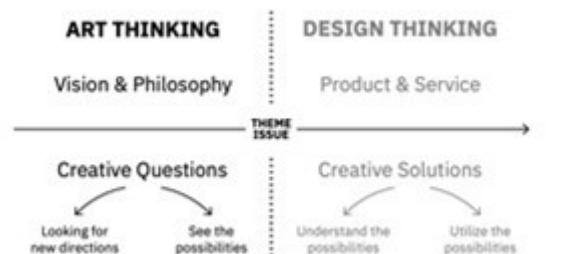
The second area of attention is pointed out from the temporal concurrence of the educational and cultural and it is prosecuted with the development of an increasingly critical current in the work of museums narrated as a new museology (EVE, 2016). In this way, it is possible to understand that approaches such as critical didactic museography and Challenge-Based Learning (ABR), appeal to the design of experiences where students learn when they actively

participate in open experiences (Tecnológico de Monterrey, 2018). such as the development of experiences with visual strategies for exhibitions from didactic museography.

Within the new museography (Aranzazu-López, et. al. 2018), didactic museography constitutes, transversally and disciplinarily, a pedagogical tool that fosters the construction of competencies in visual strategy for the creation of new content. The derivative of this, are the narrative environments designed to generate experiences linked to a response mediated by the contributions of design and engineering, determined from the public and for the public, and that respond to the problem of the quality of immersion in the experience. of the visiting public of today's museums.

Museography, from this perspective (Aranzazu-López, et. al. 2018), is where it is possible to build immersive experiences, essential for the competency-based model, by materializing narratives in complete exhibitions and allowing interaction with them. Under this premise, we understand that the university museum becomes a space for research and creation for knowledge, in which design, arts and engineering converge as drivers of skills, and where academic expression engages in communicative developments.

At this juncture we can remember and reaffirm art as a way of thinking (Amador 2009; Niessen, 2019), of extreme thought, which becomes visible in everyday life, in any individual, which produces innovative languages through innovative forms. and disparate practices and capable of activating processes of cohesion and social inclusion in the territories by turning them into poles of attraction for innovative languages. Art, Minski, 2020 reminds us, is effective at looking at multiple possibilities and issues from a holistic perspective, which, together with design as its direction, creates a solution to shape a service or product (Figure 1).



**Figure 1 Art is a compass by Minski, (2020).**

Through this crucible that we have just explained, museum spaces (ICOM, 2019) are understood as true art and science laboratories, which, enabled by technology, build platforms that allow all their audiences, culturally heterogeneous and hybrid, to co-create, share and interact to solve common complexities. They do so through the development of museography skills in students of disciplines framed within the studies of creative industries (Buitrago and Duque, 2013), and transversally related to artistic thought and communication in new codes; from experiential and challenging situations whose didactics provoke learning and socially significant impacts.

## **Educational innovation in the MUI: art as a way of thinking and a method of learning by competencies.**

The methodological framework of our research is located within the educational innovation project "Learning based on challenges in the Tecnológico de Monterrey Museum", which was developed by the MUI Interactive Urban Museum between the second semester of 2019 and the first in 2021 with students interns and in social service who were studying general education and disciplinary academic programs in the creative studies area of the Tecnológico de Monterrey at its Puebla campus. According to the MUI, this is a university museum located in the center of the city of Puebla in Mexico, managed by the Tecnológico de Monterrey, a private university in Mexico whose educational model, known as Tec21, is based on competency-based training (Technology of Monterrey, 2016).

From a qualitative approach from the experimental design of this educational innovation project, it was structured and delineated from the identification and analysis of previous studies related to education by artistic-creative didactics and competencies (Traverso-Ribón et al., 2016; Fonseca Escudero et al., 2016) concluding in the use of a transdisciplinary approach of intersection of artistic and scientific practices called Art Thinking (Minski, 2020). From this approach it is conceived that art and artistic thought are the optimal way to understand the problems (social, economic, political or technological) and the most complex systems that we have created as humanity. Under this epistemological assumption, "art has the power to scrutinize existing beliefs, cast doubt on common perceptions, and find a way to think outside the box" (Minski, 2020).

In this educational innovation project, Art Thinking is approached as experimentation in and for the design of exhibitions with new museography. In this way, methodologically, experimentation was built with challenging and experiential situations whose pedagogical objective was to determine the impact on the level of skills and abilities in museography for the design of immersive experiences of students enrolled in courses related to visual strategy and who participated in the creation of content for the design of the exhibitions Collaborative People, COVID Residence and The World in the Cloud scheduled for the 2020 and 2021 exhibition cycle (MUI, 2021). The output variable that the design of the didactic situations of the experimentation sought to measure was the change in the level of skills and abilities of the participating students. In particular, the level of four disciplinary competencies in new museography and two transversal ones, defined in 10 and 2 subcompetencies, respectively (Table 1) for the same project from the documentary research carried out and those declared by the Tec21 model (Tecnológico de Monterrey, 2019).

It is important to highlight the methodological basis of the experimental procedure carried out. Which given the change in formats of interaction with students that was caused by the global health contingency and the prevailing need to evolve towards digital exhibition experiences, the design of learning activities that should obtain products / ideas or plans for format of digital exhibition took into consideration the experiences systematized in *The Routledge Handbook of Museums, Media and Communication*. by Kirsten Drotner, Vince Dziekan, Ross Parry, & Kim Christian Schröder. (2019).

Competences		Subcompetences
Disciplinary in Museography	Visual Strategy	Formulates design strategies through tactical plans and considering the necessary resources available.
		Implements action plans on the general design strategy, covering the complementary projects that are extracted from it.
		Designs exhibition products that generate static, dynamic, interactive and immersive visual experiences using analog and digital resources.
		Develops visual narratives based on principles of semiotics and fundamentals of design.
		Uses the technological resources of digital design in the development of the visual design proposal.
	New Content Creation	Analyzes the socio-historical, cultural and arts context, identifying their interrelationships in the creation of creative proposals.
		Analyzes content and narrative using textual theories and methodologies.
		Creates content and narratives in different formats using relevant languages and technologies, and managing resources efficiently and sustainably.
		Interprets the conceptual, virtual and physical environment as a basis for his representation proposals.
		Identifies appropriate analog and digital technologies in the design of creative projects.
Transversal	Understanding other codes	Generates communicative discourses in which it uses various codes (visual, sound, architectural, spatial, graphic, etc.) that take into account geopolitical and sociocultural contexts
	Systemic thinking	Analyzes problems with an integrated vision from inter and transdisciplinarity, conceiving reality as a set of interconnected systems.

**Chart 1 Disciplinary and transversal competences measured. Own elaboration based on documentary research and declared by the Tec21 Model (2019)**

For each of the disciplinary sub-competences, mastery levels and success criteria were built at the discretion of each exhibition project based on approaches on critical museography and new museography, as well as from the Tec21 competency-based education model. of success based on the reflections and conceptual definitions of Aranzazu-López, et al. (2018) on interactive museographic narratives, experimental art, and museology and experimental museography by Aranzazu-López, et. to the. (2018), Minsky (2020); Forero Parra (2014) and Achiam, Haldrup, & Drotner (2021); in dialogue with the analytical plans designed by the Tecnológico de Monterrey for its entry of creative studies (Tecnológico de Monterrey, 2020). Similarly, for the measurement of the transversal ones, the evaluation criteria tables (Tecnológico de Monterrey, 2019) were used for said competencies in relation to systemic thinking and the understanding of other codes. Finally, for the validation of the comparison proposed in the measurement of the level of competences, the degree of mediation<sup>1</sup> that the museum exhibition produces is considered as a success criterion.

The didactic situations of the experimentation were designed throughout three moments corresponding to the planning of the scheduled exhibitions and in the practical-theoretical framework of Art thinking (inspiration, envision and prototype), and the MUI artistic residency model. At first, within six courses declared in the entry of creative studies (Appendix A) of general education, exploration of area, discipline and disciplinary block of the professional training of the Tecnológico de Monterrey campus Puebla, and three Tec weeks of student training (LiFe), 155 registered students are immersed in a museological

<sup>1</sup> Museum mediation understood as the resulting experience of teaching produced by museographic narratives and is measured in relation to its [1] possibility of reciprocal communication, [2] the expansion of content and [3] the inclusion of various audiences (Aranzazu-López, C.U. et al., 2018).

program that consists of inspiring tours, talks, workshops, prototypes and actions by resident artists and expert-academics invited by the museum within the exhibition program.

A second phase consisted of the participation in the curatorial research process, and museographic design and production of 85 students from the courses of the first phase and currently enrolled in professional internships and social service at the MUI for a semester. In this second phase, an initial evaluation was made through participant observation records, project portfolios and focus groups, according to the competencies that should be evaluated or the activity in which the student was involved in the creation process. and design of exhibitions and products derived from them. This made it possible to determine the level of competences in museography and the transversal ones related to the design of narrative environments with immersive experiences for those beginning in August 2020 and concluding in June 2021.

The measurement instruments used (checklists and rubrics) were designed from the reflexive intersection of the new museography (Niessen, 2019; Aranzazu-López, et. al. 2018), the approach of artistic and creative thinking (Minski, K., 2020) and the map of training in skills in creative studies (Tecnológico de Monterrey, 2019; 2020). The instruments measure and evaluate performance in open learning activities that seek to trigger creative and design thinking to build experiences with visual exhibition strategies (Appendix B).

The data collection for the measurement after the experimentation is carried out several times throughout the two semesters. The data collection happens during the formative experience of the learning activities designed within the five phases that are generally considered in the process of creation and exhibition design (Kamaruddin, 2019): initial, conceptual, design, production, launch.

In a last third moment, the exhibition project developed by the museum is evaluated in its museographic component, through content analysis and because of collective intelligence with the participating students. Together with unstructured interviews, the level reached in them of the disciplinary and transversal competences declared in the experimental design is determined. The contrast between the first evaluation and the last one made it possible to identify the change in the level of competencies studied. Similarly, the content analysis of the museographic scripts designed for each exhibition allows validating the results of the comparison.

The informed consent of the students participating in the experimentation is obtained by signing the letters of social service and professional practices. As well as the recording of the sessions from the Zoom streaming platform, derived from the change in the class format due to the COVID 19 health contingency.

Finally, the development of the project and its experimentation were involved in approximately 90% of the context caused by the health crisis caused by the COVID-19 pandemic. Thus, it was developed in a digital context, being only the pilot test in face-to-face format during the month of November 2019. Despite this radical change, the learning became more interesting, reflecting these in the summary of results.

## **Conclusions**

### **Summary of results**

The experimentation of the innovation proposed from the project developed at the MUI was implemented with Professional level students in 9 groups and impacted 215 students. The proposed educational innovation sought, in the words of teachers and collaborators (interpersonal communication, 2021):

Build new forms of content creation for the design of exhibitions in the museum from challenging situations. [Thus] students can develop disciplinary and transversal skills in non-formal education spaces, causing impacts in the work with the community; they explore and participate in museological work reviewing disciplinary content through various formats to design visual and learning experiences in the exhibitions.

The implementation of this educational innovation was accompanied by an experiment that measured its impact on a battery of 12 conceptualized variables, operationally, in relation to the performance levels defined for the Tecnológico de Monterrey. For the measurement of the experimentation of each of them, it was carried out with a control group and the data obtained reached an Inferential level of analysis. Thus, according to the shared evidence, it is possible to conclude that all the variables showed a significant positive impact.

The measurement and its analysis made in the experimentation of the educational innovation of this project allows us to conclude how the museum approached as a space for experimentation and research based on artistic thought, is a space catalyst for the formation of professional skills of students who enter the creative studies area of the Tecnológico de Monterrey on the Puebla campus, without significantly differentiating the semester they are studying. The results of the initial and final evaluations carried out on the 85 participating students enrolled in the MUI professional internship and social service program reflect that, in general, approximately 80% of the students show a change in the level of mastery of the disciplinary and transversal competences. An improvement and change in the level of mastery (level A, B or C) of the two transversal competences and their sub competencies in 85% of the students are highlighted, while this change in the level of mastery of the disciplinary ones is observed in 75% of the participating students (Appendix C).

In the same way, the content analysis carried out on the exhibitions designed and produced as part of this educational innovation project reflects a high degree of medication of the three exhibitions integrated into the experimentation, thus highlighting that the experience resulting from the teaching produced Due to the design of the museographic narratives, it allows reciprocal communication between the audiences and the exhibition, expands the contents of said narratives to other forms of reality, digital for example, and finally causes the inclusion of a greater diversity of audiences. As a validation strategy, the comparison between the initial and final mastery level within a ratio of participating students from 10 to 8.

### **New insights to future**

The results obtained prove the functionality and strategic role that university museums can have as new cultural centers in competency-based education, where disruptive, hybrid methods and promoters of transdisciplinary thinking between art and science produced from approaches such as the new museography They represent a comprehensive training based on



collaboration as collective intelligence capable of producing innovative solutions to highly complex challenges.

A significant discovery for the understanding of the factors in the construction and development of students' competences consisted in understanding that the model of the 3Cs (collaboration, coordination, and cooperation) of the experimental art of Minski has a direct relationship in the scope at the domain level undifferentiated by the semester the student is studying. It is assumed because of this observation that the collective intelligence generated because of the synergy of the same didactic situation can allow the early development of disciplinary competences in those students of the first years of the area of creative studies.

## Appendices

### A. Courses enrolled at MUI Project

Semester	Course's Name	Course	Key	Enrolled Students	Campus
Agosto - Diciembre 2019	Cultura de la imagen	Materia	29075	28	Puebla
Agosto - Diciembre 2019	Cultura de la imagen	Materia	29074	24	Puebla
Agosto - Diciembre 2019	Diseño centrado en el usuario	Materia	18831	25	Puebla
Agosto - Diciembre 2019	Diseño de experiencias II	Materia	18833	7	Puebla
Febrero - Junio 2020	Ergonomía para el diseño	Materia	38122	32	Puebla
Agosto - Diciembre 2020	Estética	Materia	35274	9	Puebla
Agosto - Diciembre 2020	Arte de Emocionarte	Semana Tec	8793	30	Puebla
Agosto - Diciembre 2020	Arte de Emocionarte	Semana Tec	8799	30	Puebla
Agosto - Diciembre 2020	Arte de Emocionarte	Semana Tec	8800	30	Puebla

**Chart 2. Enrolled courses at MUI project**

## **B. Measurement instruments**

1. **Checklists for evaluating the disciplinary competence in interactive museography**, which refers to the domain, mainly of skills and attitudes to create immersive spaces in narrative environments, considering the aesthetic and usability foundations, through multimedia technologies and the study of its correct functioning to compose exhibition objects in environments that encourage experiences.

They Built from the approaches on critical museography and new museography, and the Tec21 competency-based education model. Also, they were validated, tested and modified during the piloting carried out in week i 2019 [PUE-NTALLSV-21537] LuminiEscence: designing the light of the future.

The competencies that support the domain in interactive museography are in Visual Strategy (formulates design strategies through tactical plans and considering the necessary resources available. Designs exhibition products that generate static, dynamic, interactive, and immersive visual experiences using analog and digital resources, based on principles of semiotics and fundamentals of design); and in Creation of new content: (analyzes the socio-historical, cultural and arts context, as well as analyzes and creates content and narratives using textual theories and methodologies in different formats using relevant languages and technologies).

2. **Rubric and checklist for evaluation of transversal communication sub competencies** in other systemic thinking codes. In relation to the measurement of transversal competences, these two instruments are designed based on the Guidance Document for higher education teachers on transversal competences in the Tec21 model.

To define the criteria, the theoretical, conceptual, and procedural constructs were considered from the didactic and critical museography on the creative and design process in the production of the narrative environments that provoke and induce a level of immersion in the narratives of the exhibition that manages to generate the process of interpretation subject-object.

3. **Checklist for evaluation of museological script proposals with criteria** built from the approaches on critical museography and new museography of: Aranzazu-López, C.U.; Bahamón-Cardona, C. A. and Beltrán Cardona, D. F. (2018). Minski, Kristefan. (2020). Forero Parra, M.A. (2014) and Marianne Achiam, Michael Haldrup, & Kirsten Drotner. (2021).

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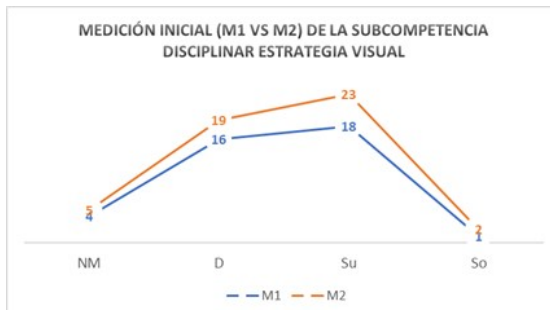
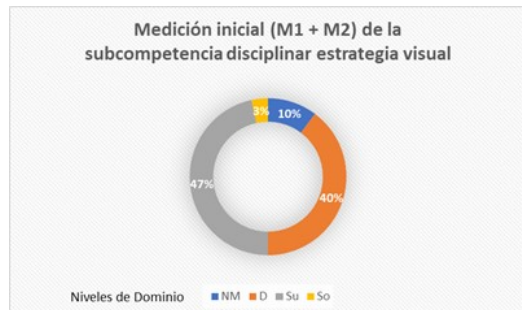
### Chart 3. Checklist for evaluation of museological script proposals with criteria

## C. Educational impact results (sub competencies analysis synthesized).

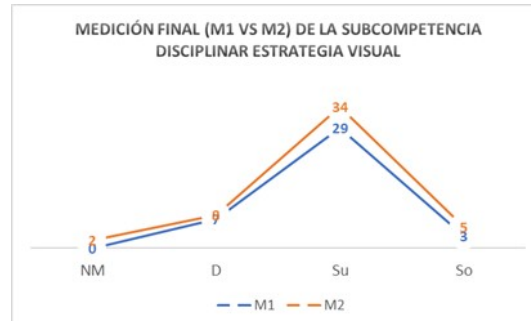
For more detailed information, contact the author.

### Visual strategy [Disciplinary competence in Museography]

#### 0. Initial measure

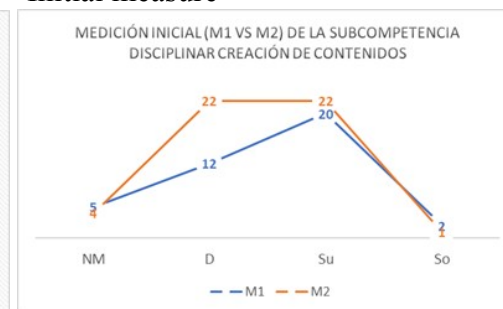


#### 1. Final measure

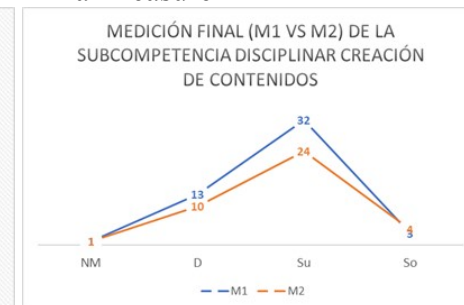


### Creation of new content [Disciplinary competence in Museography]

#### 0. Initial measure



#### 1. Final measure

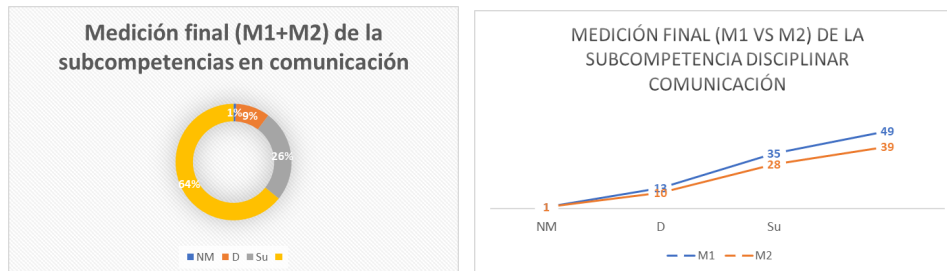


## Understanding of other codes [Transversal competence]

### 0. Initial measure



### 1. Final measure



## Systemic thinking [Transversal competence]

### Niveles de dominio

Básico Intermedio Avanzado

<36 pts 37-60 pts 61-80 pts

#### 0. Initial measure

Resumen medición inicial			
Nivel de desempeño	M1	M2	To
Básico	15	27	42
Intermedio	12	15	27
Avanzado	8	11	19
	39	49	88

#### 1. Final measure

Resumen fin.			
Nivel de desempeño	M1	M2	To
Básico	20	24	34
Intermedio	12	12	30
Avanzado	8	10	24
	39	49	88

## Acknowledgements

The author wishes to thank the financial support granted by the NOVUS fund (Grant: 29) and the Writing Lab, Institute for the Future of Education, Tecnológico de Monterrey, Mexico, for the realization and production of this work.

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