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Evolving teacher interests in innovative learning environments: impacts of exposure and implications for professional development

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Abstract

Teachers' practice is increasingly oriented towards designing and working in Innovative Learning Environments (ILE). In-service teachers' professional development is being designed coherently, sometimes allowing them to experience learning situations in such environments. Two surveys were designed, and validated, to answer to two main questions concerning teachers' interests and how they evolve once they know ILEs and have this training experience. To get all the information needed, one survey was filled before taking part in the training experience, and the other one after it. 255 answers were received and analyzed to extract several conclusions. Results indicate that teachers, after the training, became increasingly open to embracing more active, participatory methods, integrating more innovative, immersive and interactive technology. They also showed greater interest in how to zone and plan meaningful learning experiences in such environments. Furthermore, the main topics teachers wish to receive further training on relate to designing appropriate learning experiences and selecting suitable methodologies. These findings suggest that engaging teachers in a training experience within an ILE serves as a catalyst for professional development in these topics. The study has implications for both educational administrations and school leaders promoting ILEs.

KEYWORDS: Learning Environment, Educational Innovation, Teacher Training, Interest, Educational Strategies.

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1. Introduction

Teachers' motivation plays a crucial role in processes of educational transformation. Their willingness to participate in professional development after their daily teaching responsibilities, to diversify their teaching methods and resources and to overcome the fear of failure largely depends on their intrinsic motivation. Educational administrations can support this transformation through different measures, such as establishing supportive policies, providing additional resources and, importantly, offering high-quality professional development that guides teachers through the steps required to implement successful changes in their practice.

In this context, an important question arises: what constitutes high-quality teacher training? What factors effectively influence teachers' motivation to further develop their professional practice? Effective professional development depends on several key elements. First, it requires the guidance of experienced trainers. Second, it should incorporate innovative content, maybe including resources that can be adapted to different educational contexts. Finally, it should take place in an stimulating environment that encourages reflection and pedagogical change.

This study is focused on the latter element: the environment, posing the following question: how does the environment affect teachers' motivation or interests to learn? Does the environment enhance or diminish teachers' motivation towards exploring certain topics in depth? Despite extensive research on teacher education (e.g., Revista Interuniversitaria de Formación del Profesorado; Revista Electrónica Interuniversitaria de Formación del Profesorado), the impact of learning environments on teachers' interests remains

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underexplored. This omission is regrettable given the significant amount of money that government and public institutions invest in professional development, and more recently in creating specific labs to foster specific learning, namely European Schoolnet's Future Classroom Lab. From a theoretical standpoint, whether having a training experience in such a cared environment positively affects teachers' motivation or not will give clues about how this will work. From a practical standpoint, it supports or not the creation or use of such environments to enhance and foster the desired educational transformation.

Addressing these theoretical and practical concerns, this study aimed to analyze whether there were differences in teachers' training interests after having experienced a two-hour session, carefully designed in terms of the methodology used, the resources facilitated, the work developed and the space in which it takes place (for further information see Annex I). The session was developed in a carefully designed space divided in several areas, each of them focused on skills teachers should help students develop, using activities focused on the development on these skills (Annex II).

To be able to know any possible variation, teachers underwent a test before starting the experience and once it was finished. We focus on teachers' interests on topics related to creating an Innovative Learning Environment in their school, as this is one of the main training programs developed lately by different national and international institutions.

We contribute to professional development literature in three ways. First, when gathering teachers' interests on training, we are able to highlight which topics are of great interest and which ones are not. This helps authorities and schools when designing training programs and academics when identifying topics to explore further. Second, we identify the impact that an experience in a training lab, with specific characteristics, has on teachers' motivations. This helps to support the creation of such environments aiming for professional development experiences and to investigate the impact that such realities have on teachers' interests and therefore in their future. Third, we advance Innovative Learning Environment research by assessing these two issues, which is of great interest to researchers and practitioners worldwide.

We decided to focus on what is known as Innovative Learning Environments (ILEs) as we noticed an international tendency on training teachers in this topic and an increasing interest among teachers and schools to implement them. Although there is not a consensus concerning its definition, we have chosen the one given by the group of professors from University of Melbourne who have been studying them for a decade. Professors Blannin, Mahat, Cleveland, Morris and Imms (2020) define these environments as highly flexible spaces equipped with intentional furniture and ubiquitous technology, used in innovative ways to facilitate student-centered learning experiences. Research evidence indicates that such environments promote student-centered pedagogies (Byers et al., 2018b; Cleveland, 2016; Granda-Pinan & Rojo-Bofill, 2024; Jorion et al., 2016), as teachers tend to involve students in more active, collaborative and creative learning activities (Byers et al., 2018a).

To train teachers on this topic, several institutions have created labs in which they built a space as an example of an ILE. Some examples are the Future Classroom Lab in Brussels (European Schoolnet, 2024) or Aula del Futuro in Spain (INTEF, 2024). These training labs have been designed to promote reflection but not to serve as fixed models to replicate in schools. Research states that teachers in contact with one of such spaces, both in a lab or in a school, feel compelled to modify their teaching approaches (Byers et al., 2014), feel more motivated to work in a more innovative way. This leads us to pose the research questions: 1) How does teachers' interest evolve when they get in contact for the first time with this training environment? 2) What are the topics that become more interesting for teachers once they delve into Innovative Learning Environments?

When designing training related to this topic, three main aspects are considered. First, the most important topic is related to student-centered teaching methodologies. There is not one approach or methodology more important than others, but all of them can fit in it, depending on teachers' and students' needs and interests. Some of these methodologies are identified by Blázquez (2016): Service Learning, Project-based learning, Problem-based learning or Cooperative Learning.

Second, training is designed concerning digital competence and use of digital devices. In such learning environments, digital space extends and complements the physical space (Gonzalez-Mohino et al., 2023; Granda-Pinan et al., 2024; Rivera-Vargas et al., 2024). Therefore, training on digital use is basic. Once more, there is no basic technology to be implemented in it, although some international institutions (Educause, 2023; ODITE, 2022) have identified some which are or will be essential in education, such as Robots, Computational thinking, Programming, Virtual Reality, Artificial Intelligence or 3D printing.

Third, literature emphasizes the importance of training teachers in how to exploit the space itself (French et al., 2022). The space that it is posed in doesn't have some fixed physical characteristics, but some essential definitory ones. Innovative learning spaces are designed under the values and principles of flexibility, openness, interconnectivity and activity (García-Mongue et al., 2023; King et al., 2015; Mahat et al., 2018; Radcliffe, 2009), fostering interaction among students, teachers, knowledge and resources (Mahat et al., 2018). From this perspective and in line with studies such as the one developed by Nelson et al. (2023), we

identified as possible training themes the impact of aspects such as colors, furniture or sound in learning, or the design and use of different learning zones.

These three big topics have been considered to develop the tool to gather teachers' interests in training, but we decided there was a lack of didactics. Teachers not only need to know the existence, characteristics and operation of these resources, but also require knowledge about how to integrate them into the curriculum and, finally, how to use them in their teaching and learning process (Suárez et al., 2010). It is then suggested that there may be an interest in understanding how to design learning situations, how to temporize them, how to tutor and mediate in them or how to apply evaluation methods appropriate for this pedagogy. Therefore, this is the fourth aspect considered in our study.

This study is part of a broader line of research on teachers' professional development in Innovative Learning Environments (ILEs). Some contextual and preliminary aspects of this research were previously presented by the authors in a related publication (Lozano et al., 2024). However, the present paper extends that work by specifically analysing how teachers' training interests evolve after participating in a training experience within an ILE, based on pre- and post-survey data.

2. Materials and Methods

This study adopted a quantitative, non-experimental, descriptive, comparative, and correlational research design, using a questionnaire as the main data collection instrument (McMillan & Schumacher, 2001). This approach was considered appropriate because the research was conducted in a natural, real-world context (Losada López & López-Feal Ramil, 2003).

2.1. Process of development and validation of the instrument

Two questionnaires were specifically designed for this study and administered before and after the training session, as no existing instruments met the research objectives. Participants were informed of the study's purpose and provided informed consent.

The content validation process followed the specifications of Lawshe (1975), with the modifications introduced by Tristán-López (2008). Thirteen experts in the field (secondary school teachers, university teachers in Education and Educational Sciences, inspectors, and professional development advisors) evaluated each item in terms of clarity, relevance and importance. Both questionnaires were structured in four dimensions, including multiple-choice items or Likert-scale items (1 - no interest, 5 - A lot of interest). These dimensions include: A) Demographic variables: ten items (four included in the post-questionnaire) were used to collect information of the participants' personal profile and their prior experience with ILEs; B) Methodologies and strategies, where respondents chose how interested they are on twelve different approaches; C) Digital Technology, gathering interest on ten items; D) Educative Spaces, made of three items, and E) Implementation on ILEs, in which respondents reflect on their interest on seven different aspects related to didactics.

2.2. Sample

The sample comprised 225 teachers from different educational stages (see Table 1). A non-probabilistic convenience sampling strategy was employed. The questionnaire was administered in paper format to teachers who requested a visit to the Aula del Futuro, a teacher training laboratory located in Valencia (Spain), between April and July 2023. These visits were advertised on the official professional development institution's website and were intended for teaching staff from non-university educational institutions. All active teaching staff were eligible to complete the survey under the sole condition that they had requested a visit to the mentioned Aula del Futuro. The randomness was, therefore, semi-restricted to the teaching staff requesting the activity (full visit).

Table 1 - Distribution of respondents' background characteristics (N=225).

Characteristics	Frequency (n)	Percentage (%)
Gender		
• Female	177	78.7
• Male	43	19.1
• Lost	5	2.2
Stage		
• Infant and Primary Education	166	73.80
• Secondary Education	51	22.7
• Lost	8	3.6
Age		
• 20-30	26	11.6
• 31-40	83	36.9
• 41-50	70	31.1
• 51-60	44	19.6
• Lost	2	0.9
Years of teaching experience		
• 0-10	91	40.4
• 11-20	77	34.2
• More than 20	57	25.3

Only participants with no prior contact with innovative learning spaces were included. The visit was guided by

specialized staff from the professional development network under the jurisdiction of the Generalitat Valenciana, always following the same structure, prepared beforehand by a group of experts on ILEs with the aim of providing teachers with a rich and active experience on what it means to learn in such scenario (Annex I).

2.3. Data analysis

The statistical package IBM SPSS 28 was used to analyse the obtained data. Both questions are answered describing the data found. After verifying the assumptions of normality and homogeneity of variances, several non-parametric tests were applied to the independent variables, including the Mann-Whitney U test and the Kruskal-Wallis H test, as well as Pearson's bivariate correlations. These analyses made it possible to examine the relationships between general variables in Dimension A (educational stage, age, etc.) and the research variables included in Dimensions B, C, D and E.

3. Results

We have organized the results found according to the two research questions posed in the introduction.

3.1 Research question 1: How does teachers' interest evolve when they get in contact for the first time with this training environment?

The answer to this question depends on the dimension studied.

Dimension B: Methodologies and strategies

Table 2 compiles the number, frequencies (in parentheses) and mean of responses of teachers' interests in the methodologies and strategies consulted, pre and post training experience.

Answers given pre and post training experience were compared using Wilcoxon test. Results are gathered in Table 3.

Dimension C: Digital technology

The second dimension gathered information about 10 digital tools or strategies that can be implemented in schools. Table 4 shows the results, pre and post training experience, for each item.

We can observe that teachers' interest increases in some of these aspects after having the learning experience in the lab, and others decrease (Table 4). However, we only found significance through the Wilcoxon test for the variation found on items 6, 7 and 8.

Dimension D: Educative Spaces

Three aspects are studied in this dimension, encountering the following frequencies (table 6).

Although we can observe that there is a tendency of an increase of interest on the three aspects, Wilcoxon test (table 7) supports that there are differences statistically speaking on dimension three.

Dimension E: Implementation on ILEs

The last dimension studied focused on didactics. Table 8 shows the interest expressed by teachers pre and post visit.

In Table 8 we observe that, in general, teachers feel more motivated towards learning these aspects after having a learning experience in an Innovative Learning Environment. The only aspect towards which interest decreased was the one related to scheduling a learning process (c3), although there are no differences statistically significant, so it could have been a matter of chance. There were differences for items 2, 4 and 5, which means that teachers' interest in learning how to design and program learning experiences in ILEs, how to manage coexistence and participation and how to select and organize the appropriate methodology or strategy to be developed in an ILE to achieve learning increases.

3.2 Research question 2: What are the topics that become more interesting for teachers once they delve into Innovative Learning Environments?

To answer this question, we have used the information found on tables 2, 4, 6 and 8 to create table 10, which compiles the means, number of positive answers and percentage of them for every item after the visit. With it, we can describe that teachers feel more interested in Dimension E, being the items with higher means the ones referring to "Design and programming of learning experiences in environments other than the traditional classroom (e2)" (x=3,68), "Selection and organization of the appropriate methodology or strategy to promote learning (e5)" (x=3,66) and "Design, programming, and creation of projects or experiences that promote learning (e1)" (x=3,64).

Focusing on Dimension B, teachers are more interested in "Cooperative learning (b4)" (x=3,62) and "Project-based learning (b1)" (x=3,61). In fact, this last one is the one who got the highest percentage of positive answers.

Teachers expressed having a high interest in Dimension D, being the last item the most interesting, the one referring to "Zoning of useful learning environment (d3)" (x=3,55).

Last, we can observe that interest on Dimension C is lower than the other ones. The most interesting item for teachers in this dimension has been "Virtual reality (c6)" with a mean x=3,28.

Table 2 - Interest in Dimension B items (Frequencies), pre and post training experience (N=225).

Item		SCALE 1-4 (1=No interest, 4=A lot of interest, NC = no answer)					Mean
		1	2	3	4	NC	
b1 Project-based learning	Pre	4 (1,8)	17 (7,6)	79 (35,1)	112 (49,8)	13 (5,8)	3,41
	Post	2 (0,9)	7 (3,1)	54 (24,0)	126 (56,0)	36 (16,0)	3,61
b2 Problem-based learning	Pre	5 (2,2)	37 (16,4)	67 (29,8)	78 (34,7)	38 (16,9)	3,17
	Post	4 (1,8)	19 (8,4)	74 (32,9)	85 (37 8)	43 (19,1)	3,32
b3 Inquiry-based learning	Pre	5 (2,2)	30 (13,3)	77 (34,2)	68 (30,2)	45 (20,0)	3,16
	Post	4 (2,8)	17 (7,6)	74 (32,9)	85 (37,8)	45 (20,0)	3,33
b4 Cooperative learning	Pre	4 (1,8)	13 (5,8)	57 (25,3)	133 (59,1)	18 (8,0)	3,54
	Post	2 (0,9)	7 (3,1)	51 (22,7)	128 (56,9)	37 (16,4)	3,62
b5 Flipped classroom	Pre	12 (5,3)	39 (17,3)	59 (26,2)	70 (31,1)	45 (20,0)	3,04
	Post	10 (4,4)	31 (13,8)	67 (29,8)	71 (31,6)	46 (20,4)	3,11
b6 Design Thinking	Pre	10 (4,4)	35 (15,6)	58 (25,8)	70 (31,1)	52 (23,1)	3,09
	Post	11 (4,9)	33 (14,7)	68 (30,2)	69 (30,7)	44 (19,6)	3,08
b7 Visual Thinking	Pre	10 (4,4)	33 (14,7)	56 (24,9)	77 (34,2)	49 (21,8)	3,14
	Post	9 (4,0)	29 (12,9)	71 (31,6)	72 (32,0)	44 (19,6)	3,14
b8 Personalised learning	Pre	4 (1,8)	21 (9,3)	51 (22,7)	99 (44,0)	50 (22,2)	3,40
	Post	3 (1,3)	25 (11,1)	65 (28,9)	87 (38,7)	45 (20,0)	3,31
b9 Service learning	Pre	9 (4,0)	32 (14,2)	50 (22,2)	83 (36,9)	51 (22,7)	3,19
	Post	7 (3,1)	30 (13,3)	60 (26,7)	81 (36,0)	47 (20,9)	3,21
b10 Gamification	Pre	5 (2,2)	26 (11,6)	57 (25,3)	105 (46,7)	32 (14,2)	3,36
	Post	5 (2,2)	16 (7,1)	59 (26,2)	102 (45 3)	43 (19,1)	3,42
b11 - Corners or ambiences learning	Pre	4 (1,8)	20 (8,9)	56 (24,9)	110 (48,9)	35 (15,6)	3,43
	Post	2 (0,9)	18 (8,0)	53 (23,6)	111 (49,3)	41 (18,2)	3,48
b12 - Universal Design of Learning	Pre	8 (3,6)	14 (6,2)	51 (22,7)	116 (51,6)	36 (16,0)	3,46
	Post	2 (0,9)	16 (7,1)	53 (23,6)	111 (49,3)	43 (19,1)	3,50

Table 3 - Wilcoxon test comparing answers given pre and post training experience.

Items	N	Neg Ranges	Pos Ranges	Draws	Z	p
b1	180	8	42	130	-4,588	<,001
b2	156	18	38	100	-2,743	,006
b3	148	12	36	100	-3,617	<,001
b4	174	15	30	129	-2,383	,017
b5	150	17	36	97	-2,143	,032
b6	145	29	35	81	-,616	,538
b7	147	30	33	84	-,314	,753
b8	145	30	23	92	-,922	,356
b9	146	28	33	85	-,980	,327
b10	164	21	30	113	-1,079	,280
b11	158	16	31	111	-1,711	,087
b12	161	17	28	116	-1,736	,083

Table 4 - Interest in Dimension C items (Frequencies), pre and post training experience (N=225).

Item		SCALE 1-4 (1=No interest, 4=A lot of interest, NC = no answer)					Mean
		1	2	3	4	NC	
c1 Robotics	Pre	13 (5,8)	46 (20,4)	55 (24,4)	64 (28,4)	47 (20,9)	2,96
	Post	15 (6,7)	47 (20,9)	51 (22,7)	66 (29,3)	46 (20,4)	2,94
c2 Programming	Pre	9 (4,0)	52 (23,1)	57 (25,3)	70 (31,1)	37 (16,4)	3,00
	Post	16 (7,1)	42 (18,7)	58 (25,8)	65 (28,9)	44 (19,6)	2,95
c3 Computational thinking	Pre	11 (4,9)	59 (26,2)	56 (24,9)	52 (23,1)	47 (20,9)	2,84
	Post	16 (7,1)	52 (23,1)	61 (27,1)	50 (22,2)	46 (20,4)	2,81
c4 Audiovisual technology	Pre	8 (3,6)	23 (10,2)	82 (36,4)	77 (34,2)	35 (15,6)	3,20
	Post	7 (3,1)	21 (9,3)	77 (34,2)	79 (35,1)	41 (18,2)	3,24
c5 - Document/ Presentation/Infographics	Pre	13 (5,8)	28 (12,4)	67 (29,8)	79 (35,1)	38 (16,9)	3,13
	Post	7 (3,1)	28 (12,8)	59 (26,2)	85 (37,8)	46 (20,4)	3,24
c6 Virtual Reality	Pre	7 (3,1)	37 (16,4)	68 (30,2)	69 (30,7)	44 (19,6)	3,10
	Post	7 (3,1)	27 (12,0)	57 (25,3)	92 (40,9)	42 (18,7)	3,28
c7 Augmented Reality	Pre	10 (4,4)	39 (17,3)	61 (27,1)	73 (32,4)	42 (18,7)	3,08
	Post	9 (4,0)	31 (13,8)	56 (24,9)	83 (36,9)	46 (20,4)	3,19
c8 3D Printing	Pre	17 (87,6)	44 (19,6)	55 (24,4)	62 (27,6)	47 (20,9)	2,91
	Post	14 (6,2)	35 (15,6)	62 (27,6)	69 (30,7)	45 (20,0)	3,03
c9 Scanning	Pre	25 (11,1)	48 (21,3)	53 (23,6)	47 (20,9)	52 (23,1)	2,71
	Post	15 (6,7)	51 (22,7)	65 (28,9)	43 (19,1)	51 (22,7)	2,78
c10 Artificial Intelligence	Pre	12 (5,3)	34 (15,1)	51 (22,7)	76 (33,8)	52 (23,1)	3,10
	Post	11 (4,9)	31 (19,8)	53 (23,6)	74 (32,9)	56 (24,9)	3,12

Table 5 - Wilcoxon test comparing answers given pre and post training experience.

Items	N	Neg Ranges	Pos Ranges	Draws	Z	p
c1	179	28	25	96	-,555	,579
c2	181	28	32	97	-,157	,875
c3	179	32	34	82	-,317	,751
c4	184	30	38	90	-,316	,752
c5	179	29	40	86	-1,007	,314
c6	183	23	45	84	-2,997	,003
c7	179	20	40	93	-2,192	,028
c8	180	23	39	87	-2,011	,044
c9	174	30	36	77	-,587	,557
c10	169	24	36	84	-1,637	,102

Table 6 - Interest in Dimension D items (Frequencies), pre and post training experience.

Item		SCALE 1-4 (1=No interest, 4=A lot of interest, NC = no answer)					Mean
		1	2	3	4	NC	
d1 - Characteristics of learning spaces (colours, light, sound…)	Pre	4 (1,8)	22 (9,8)	65 (28,9)	104 (46,2)	30 (13,3)	3,38
	Post	1 (0,4)	17 (7,6)	62 (27,6)	108 (48,0)	37 (16,4)	3,47
d2 - Furniture in useful learning spaces	Pre	4 (1,8)	15 (6,7)	62 (27,6)	110 (48,9)	34 (15,1)	3,46
	Post	1(0,4)	16 (7,1)	58 (25,8)	110 (48,9)	40 (17,8)	3,50
d3 - Zoning of useful learning environment	Pre	3 (1,3)	22 (9,8)	52 (23,1)	114 (50,7)	34 (15,1)	3,45
	Post	1 (0,4)	14 (6,2)	52 (23,1)	119 (52,9)	39 (17,3)	3,55

Table 7 - Wilcoxon test comparing answers given pre and post training experience.

Items	N	Neg Ranges	Pos Ranges	Draws	Z	p
d1	188	20	35	106	-1,327	,184
d2	185	24	38	93	-1,322	,186
d3	186	22	40	94	-2,107	,035

Table 8 - Interest in Dimension D items (Frequencies), pre and post training experience.

Item		SCALE 1-4 (1=No interest, 4=A lot of interest, NC = no answer)					Mean
		1	2	3	4	NC	
e1 - Design, programming, and creation of projects or experiences that promote learning	Pre	1 (0,4)	8 (3,6)	59 (26,2)	133 (59,1)	24 (10,7)	3,61
	Post	1 (0,4)	9 (4,0)	47 (20,9)	131 (58,2)	37 (16,4)	3,64
e2 - Design and programming of learning experiences in environments other than the traditional classroom	Pre	2 (0,9)	8 (3,6)	61 (27,1)	125 (55,6)	29 (12,9)	3,58
	Post	0 (0,0)	9 (4,0)	42 (18,7)	137 (60,9)	37 (16,4)	3,68
e3 - Scheduling of a learning process	Pre	2 (0,9)	22 (9,8)	67 (29,8)	106 (47,1)	28 (12,4)	3,41
	Post	3 (1,3)	22 (9,8)	60 (26,7)	100 (44,4)	40 (17,8)	3,39
e4 - Management of coexistence and participation in innovative learning environments	Pre	1 (0,4)	16 (7,1)	65 (28,9)	114 (50,7)	29 (12,9)	3,49
	Post	2 (0,9)	11 (4,9)	51 (22,7)	124 (55,1)	37 (16,4)	3,58
e5 - Selection and organization of the appropriate methodology or strategy to promote learning	Pre	1 (0,4)	12 (5,3)	64 (28,4)	122 (54,2)	26 (11,6)	3,54
	Post	0 (0,0)	8 (3,6)	47 (20,9)	130 (57,8)	40 (17,8)	3,66
e6 - Design, organization, and development of co-teaching	Pre	2 (0,9)	18 (8,0)	55 (24,4)	121 (53,8)	29 (12,9)	3,51
	Post	4 (1,8)	14 (6,2)	43 (19,1)	124 (55,1)	40 (17,8)	3,55
e7 - Design of learning assessment: what, how, and when to evaluate	Pre	1 (0,4)	17 (7,6)	64 (28,4)	122 (54,2)	21 (9,3)	3,50
	Post	3 (1,3)	11 (4,9)	53 (23,6)	119 (52,9)	39 (17,3)	3,55

Table 9 - Wilcoxon test comparing answers given pre and post training experience.

Items	N	Neg Ranges	Pos Ranges	Draws	Z	p
e1	188	15	24	129	-,837	,403
e2	188	12	35	117	-3,242	,001
e3	185	20	27	115	-,306	,759
e4	188	13	34	117	-2,709	,007
e5	185	11	32	119	-2,514	,012
e6	185	17	28	117	-1,353	,176
e7	186	21	22	124	-,039	,969

Table 10 - Compilation of means, number of positive answers (Num) and percentage of them (%) post training experience.

Dimension B			Dimension C			Dimension D			Dimension E		
Item	**Mean**	**Num (%)**	**Item**	**Mean**	**Num (%)**	**Item**	**Mean**	**Num (%)**	**Item**	**Mean**	**Num (%)**
b1	3,61	180 (80,0)	c1	2,94	117 (52,0)	d1	3,47	170 (75,6)	e1	3,64	178 (79,1)
b2	3,32	159 (70,7)	c2	2,95	123 (54,7)	d2	3,50	168 (74,7)	e2	3,68	179 (79,6)
b3	3,33	159 (70,7)	c3	2,81	111 (49,3)	d3	3,55	171 (76,0)	e3	3,39	160 (71,1)
b4	3,62	179 (79,6)	c4	3,24	156 (69,3)				e4	3,58	175 (77,8)
b5	3,11	138 (61,4)	c5	3,24	144 (64,0)				e5	3,66	177 (78,7)
b6	3,08	137 (60,9)	c6	3,28	149 (66,2)				e6	3,55	167 (74,2)
b7	3,14	143 (63,6)	c7	3,19	139 (61,8)				e7	3,55	172 (76,5)
b8	3,31	152 (67,6)	c8	3,03	131 (58,3)						
b9	3,21	141 (62,7)	c9	2,78	108 (48,0)						
b10	3,42	161 (71,5)	c10	3,12	127 (56,5)						
b11	3,48	164 (72,9)									
b12	3,50	164 (72,9)									

4. Discussion and Conclusions

Throughout this study, the two research questions posed in the Introduction were addressed. The first question sought to explore how teachers' interests evolve when engagement with an Innovative Learning Environment (ILE) occurs for the first time. Specifically, the aim was to examine how exposure to such environments, through a visit to a lab designed with ILE characteristics and a hands-on learning experience, impacts teachers' perceptions and enthusiasm for adopting new educational practices. This immersive experience was carefully crafted to not only familiarize teachers with ILEs but also to challenge their traditional views on pedagogy and space, offering them an opportunity to reflect on how learning environments shape educational outcomes. It should be noted that the training provided was relatively brief (two hours in duration), which may influence the results. In addition, the study aimed to measure short-term interest rather than actual behavioral change. Further research could further explore the potential effects of this type of training over a longer period.

Regarding teaching methodologies and strategies (Dimension B), the results of the Wilcoxon test indicate a significant increase in teachers' interest in innovative, student-centered approaches, such as Project-based learning, Problem-based learning, Inquiry-based learning, Cooperative Learning and Flipped Classroom. These findings suggests that teachers become more receptive to adopting active, participatory methodologies or strategies that promote students' critical thinking and problem-solving skills.

In Dimension C, which focuses on digital technology, the results reveal a heightened interest in training related to Virtual Reality, Augmented Reality and 3D printing. These technologies, which can be considered as peripheral to the core of educational practice, seem to be seen by educators as powerful enablers of more innovative, immersive and interactive learning experiences. This finding is consistent with global trends in education, where the integration of technology is increasingly considered essential for preparing students to navigate a rapidly evolving digital landscape (Educause, 2023; ODITE, 2022).

In relation to training in spatial design and organization (Dimension D), a notable increase in interest in the zoning of learning spaces was observed. Teachers became more engaged with the idea of configuring learning environments to maximize comfort, flexibility and adaptability. This reflects a growing awareness that physical space is not a neutral backdrop to learning but can be strategically designed to enhance collaboration, creativity and student involvement.

In Dimension E, which relates to didactics in ILEs, our findings indicate a strong increase in teachers' interest in learning how to design and program learning experiences in ILEs, how to manage coexistence and participation and how to select and organize the appropriate methodology or strategy to be developed in an ILE to achieve learning. This suggests that teachers are eager to gain practical knowledge that can help them implement innovative teaching strategies in these new environments.

These findings allow us to conclude that engaging teachers in a training experience within an ILE serves as a catalyst for further professional development, and provide clear indications of the content that should be prioritized in future training initiatives. The exposure to innovative environments stimulates a curiosity and motivation to delve deeper into specific pedagogical approaches, particularly those that align with the characteristics of ILEs, characteristics that are already in some of the laws structuring education in different countries. Educational authorities or professional development institutions can use this information to design targeted training programs that meet teachers' evolving needs, ensuring that such experiences are not isolated, but rather integrated into broader, continuous professional learning pathways.

Our second research question sought to uncover which specific topics become more interesting for teachers once they delve into Innovative Learning Environments. Results showed that the three topics of greatest interest are in Dimension E: "Design and programming of learning experiences in environments other than the traditional classroom (e2)" (x=3,68), "Selection and organization of the appropriate methodology or strategy to promote learning (e5)" (x=3,66) and "Design, programming, and creation of projects or experiences that promote learning (e1)" (x=3,64). Thus, teachers feel the need to receive training on how to implement an ILE. This is consistent with previous research indicating that teachers often struggle to identify the pedagogical strategies needed to create effective innovative learning environments (Cleveland, 2016) and do not readily transition to more active pedagogical approaches (Beery et al., 2013), pointing to the need for professional development that helps translate innovative pedagogical principles into classroom practice. Our findings reaffirm the importance of structured, targeted professional development in supporting teachers as they navigate this transition from more traditional settings.

In addition to these key findings, the most relevant topics in each dimension were identified, providing clear guidance on the content to be addressed in future professional development programs. For Dimension B, "Cooperative learning (b4)" (x=3,62) and "Project-based learning (b1)" (x=3,61) emerged as the most important. In Dimension D, "Zoning of useful learning environment (d3)" (x=3,55) attracted the highest level of interest, while in Dimension C, "Virtual reality (c6)" (x=3,28) stood out.

In general terms, greater interest was observed in didactic issues. However, it should be noted that the most frequently selected item, both in frequency (80%) and in total amount of positive answers, is "Project based learning", with interest shown by 180 out of 225 teachers. It is interesting to observe this, as it is a topic that has been widely promoted and covered in professional development over the past decade. The sustained interest in this methodology may reflect its versatility and relevance across various subjects and educational contexts. It should also be noted that some other aspects received almost the same number of positive responses (Cooperative learning and the three items in dimension E previously commented, e2, e5 and e1).

It is also worth highlighting that all aspects showing statistically significant differences are related to an increase in interest, suggesting that teachers' engagement with ILEs generally fosters a positive response towards further professional development. However, some areas saw a slight decrease in interest when comparing pre- and post-visit results. Specifically, Robotics, Programming and Computational Thinking in Dimension C; Design Thinking and Personalized learning in Dimension B, and Scheduling of a learning process in Dimension E all saw a decline. Although these declines were not statistically significant, they warrant further investigation to understand whether they represent temporary fluctuations or reflect deeper concerns about the practicality or relevance of these topics in ILEs.

Finally, an interesting disconnect regarding Artificial Intelligence (AI) was observed. Despite the growing public and educational interest in AI, it did not emerge as a major area of focus for teachers. This could be due to the fact that our training experience did not explicitly address AI, meaning that teachers may not have been prompted to consider its implications within the context of ILEs. Nevertheless, given the increasing role of AI in shaping future learning technologies, it would be of interest to consider developing further studies on the topic.

This study has several limitations that may affect the generalizability and interpretation of the findings. The sample size and limited geographic scope may restrict the representativeness of the teaching population, and the use of self-reported data may introduce biases such as social desirability. Additionally, the study measures only short-term shifts in interest, leaving the long-term impact of ILE exposure unclear. It also does not account for the practical challenges teachers may face in implementing innovative practices in real-world settings. Finally, the controlled nature of the ILE training lab may not fully capture the diversity of ILE experiences in various educational contexts, limiting the applicability of the results.

Despite these limitations, our study also shows several strengths, including its ability to highlight significant shifts in teachers' interests after exposure to an Innovative Learning Environment, the use of rigorous statistical methods to analyze changes across multiple pedagogical dimensions and its contribution to the growing body of research on how educational spaces and technologies influence teaching practices. Additionally, the study provides actionable insights for designing more targeted professional development programs and underscores the importance of aligning professional development with the evolving demands of 21st-century education.

In conclusion, our study highlights the transformative and motivational potential of ILEs in reshaping teachers' professional interests and guiding them towards more innovative, student-centered educational practices. While certain topics, such as Project-Based Learning and Cooperative Learning, continue to dominate teacher interest, the growing emphasis on technology and spatial design underscores the evolving nature of pedagogy in the 21st century. The findings also stress the importance of targeted professional development in equipping teachers with the tools and strategies necessary to navigate these new educational landscapes effectively.

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Annex I

Description of the activity developed during the visit to the Innovative Learning Environment

	BACKGROUND
The Future Classroom Lab model promotes the use of active methodologies for skills development supported by digital technologies in flexible spaces. We propose adopting this participatory approach in the design of this guided tour of the Future Classroom Lab (FCL), Aula del Futuro (AdF) in Spanish, creating a route through the six zones that also considers accessibility in the teaching and learning process.	
	GOAL
Understanding the FCL as a flexible space where active methodologies supported by digital technology can be used in the teaching-learning processes, taking into account the principles of accessibility.	
	LENGTH
90'-120'	

0	**BEFORE ENTERING THE CLASSROOM**		
- Welcome. Explanation of the objective of the visit: to understand the FCL as an ILE. *- Creating groups of 4 visitors (heterogeneous)* ***5'***			
1	**EXPLORE -** Search | Investigate | Discover		
Focus	***Resources***	***Purpose of the space***	***Activity***
Space for computational thinking experimentation	Virtual reality glasses, mobile devices, robotics kits...	Support exploration and experimentation with analysis and understanding of environments.	*The visiting teaching group is invited to tour the classroom and try to discover its principles, resources and possibilities.* *Reflection sheet for the entire tour.* ***5'***
2	**INTERACT -** Ask | Collaborate | Debate		
Focus	***Resources***	***Purpose of the space***	***Activity***
Space for exchange and collaborative work.	Mobile tables and chairs. Interactive whiteboard, OER for teaching and research staff...	Support interactivity, collaboration and the development of debates together with formative assessment.	*Each group is asked to think of 4 words that they identify with the* AdF. *Each person will focus on one of the words agreed upon in the group.* *They hand out tablets (material control) or use their mobile phone to create a collaborative word cloud that they will see access to on the whiteboard.* ***10'***
3	**RESEARCH -** Examine | Question | Analyze | Find out		
Focus	***Resources***	***Purpose of the space***	***Activity***
Space for observation and resolution of problems or challenges.	Flexible furniture. Laptops and *Flip pannel*.	To support the development of active research and cross-cutting projects with the promotion of critical thinking.	*Multilevel activity:* *The groups carry out a small research on the Internet to find out what the Classroom of the Future is, what the project and the model consist of.* *- Basic level: Research the AdF INTEF site (or AT site if published) and watch the videos.* *- Medium level: Investigate the INTEF and FCL and AdF sites, watching the videos.* *- Advanced Level: No guide provided* *- Extension: Recognize Fake News about the FCL that appears on social networks or in the press and correct this media misinformation.* ***10'***

4	**DEVELOP-** Plan | Design | Invent		
Focus	***Resources***	***Purpose of the space***	***Activity***
Space dedicated to informal learning and reflection.	Soft furniture, study corners, etc.	Support self-expression and self-directed, personalized learning.	*The groups develop a base script for their final product: a video or podcast of approximately two minutes in length that explains what the FCL is.* *Materials provided: Script template for video and script template for podcast in print and digital.* ***15'***
5	**CREATE -** Imagine | Manipulate | Edit		
Focus	***Resources***	***Purpose of the space***	***Activity***
Space for creation and production.	Chroma, cameras, computers, 3D printers, SW video and audio editing...	Support initiative and creativity and develop social skills through PBL in collaborative groups.	*Creation of the final product (video or podcast) to explain what the Future Classroom Lab is.* ***15'***
6	**PRESENT -** Show | Share | Listen | Inform		
Focus	***Resources***	***Purpose of the space***	***Activity***
Space for initial or final presentations.	Reconfigurable furniture Interactive displays.	Support the sharing of results by encouraging active listening and co-evaluation.	*The groups present their final products. At the end, the dynamization team shows its presentation and explanation of the FCL.* *You can answer some questions briefly or start a colloquium.* *Now, they are asked to recreate a word cloud to contrast the initial vision with the final one.* ***15'***
	DEVELOP- Plan | Design | Invent		
Focus	***Resources***	***Purpose of the space***	***Activity***
Space dedicated to informal learning and reflection.	Soft furniture, study corners, etc.	Support self-expression and self-directed, personalized learning.	*Each participant returns to the reflection space to fill in the* AdF *visit sheet and write a short text about what they now know the* AdF *is. Give the sheet to the dynamic team and save your concluding text in a virtual repository or pen drive.* ***10'***

Annex II

The Aula del Futuro Teacher Training Lab (Valencia, Spain).