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Implementation of IkasLab in Primary Education: A Mixed-Methods Study of Learning Spaces, Teaching Practice and Metacognition

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Abstract

The present article employs a mixed methodology to evaluate IkasLab's innovative spaces, investigating how the reorganisation of educational spaces contributes to the development of 21st-century skills in the Basque educational context. The sample comprised 13 primary schools (ages 6–12), where quantitative data were collected using a validated instrument (rubric) ($n = 13$ spaces) and qualitative data through semi-structured interviews ($n = 22$ teachers). Reliability analyses (Alpha = 0.909; Omega = 0.907) confirmed the robustness of the assessment instrument. The quantitative findings indicated a high level of project implementation ($\bar{X} = 3.26/4$), with particular emphasis on the development of communication and relational skills. However, the indicators associated with metacognitive work showed less consolidation. Qualitative analysis yielded significant findings pertaining to student autonomy, methodological innovation, and educational inclusivity. Notable gaps were also identified in the integration of metacognitive practices and urgent needs for systematic teacher training and continuous pedagogical support. The results suggest that IkasLab constitutes a solid and promising framework for reimagining learning spaces and promoting educational practices in line with contemporary challenges. However, the full impact of the model depends on ensuring sufficient resources and strengthening professional training that enables teachers to effectively integrate the principles of the model into their teaching activities.

Keywords: Innovative Learning Environment; IkasLab; metacognition; educational innovation; teacher training

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1. Introduction

1.1. Contextualization of Innovative Learning Environments

The increasing presence of AI tools in educational settings has had a profound impact on an already rapidly evolving landscape. UNESCO [1] itself has warned of these changes, emphasising the necessity to advocate for an ethical education grounded in social justice, one that dismantles barriers between individuals while safeguarding the distinctiveness of each context. In addition, it emphasises the necessity of investigating methodologies that underscore critical thinking, metacognition, pedagogies of care, and ethical reasoning, with the aim of counteracting the reductionist logic of memorisation,

standardised evaluation, and cognitive offloading. Consequently, many educational institutions have become interested in moving towards Innovative Learning Environments that take these realities into account and foster those skills.

In fact, these environments have the capacity to facilitate the development of 21st-century skills in students in a safe and comprehensive manner [2]. It should therefore be remembered that the classroom is the environment that must adapt to the educational needs of the moment, just as it has historically done [3].

However, the notion of redesigning current educational spaces is not a novel phenomenon; as early as 1990, MIT initiated the exploration of educational spaces that would facilitate active and collaborative learning through its Technology Enabled Active Learning (TEAL) project. This resulted in the establishment of new educational spaces at various universities, including the Student-Centered Active Learning Environment for Undergraduate Programs (SCALE-UP) at North Carolina State University; Transform, Interact, Learn, Engage (TILE) at the University of Iowa; and the Active Learning Classrooms (ALC) at the University of Minnesota and McGill University [4]. Additionally, new learning environments have been developed in various schools through projects such as the Vittra schools in Sweden [5]; the Future Classroom Lab across Europe [6]; and the Creative Spaces of the Canary Islands [7].

1.2. IkasLab: The Future Classroom Lab in the Basque Country

IkasLab emerged from a series of reflections, research endeavors, and educational innovation projects centered on learning spaces. IkasLab can be conceptualized as the adaptation for the Basque Autonomous Community of the Spanish project “Aula del Futuro” [8] and the European project “Future Classroom Lab” [9]. In essence, IkasLab is conceptualized as a learning laboratory, a space where the integration of ICT, active methodologies, and collaborative learning converges.

In this vein, IkasLab classrooms propose reorganizing the space by creating three physical areas—IKERTU (research), SORTU (create), and KOMUNIKATU (communicate)—in line with the Spanish and European projects. These spaces have been shown to enhance the learning process and develop various cognitive processes in a diverse manner. This enhancement is achieved through inquiry, prototyping, and presentation activities [10].

However, the IkasLab project is being developed as a standalone initiative within the Basque education system. In addition to the spaces previously mentioned, it introduces a new and original component: the PENTSATU (thinking) space. This space is distinguished by its transversal nature, which extends to other zones with the objective of facilitating metacognitive work and student self-regulation [11]. Therefore, the incorporation of the PENTSATU space into the proposal can be attributed to a focus on the visible and explicit cultivation of autonomous, reflective and strategic thinking [12], which enables students to develop the skills of ‘learning to think’ and ‘thinking to learn’ [13]. This is due to the understanding that metacognitive work, which aims to raise awareness of one’s own thinking, contributes to the ability to reflect on one’s own strengths and weaknesses [14,15]. Consequently, PENTSATU would enable students to develop strategies and tools that allow them to monitor their learning process autonomously and effectively [16].

Indeed, from a UDL perspective, IkasLab is an innovative proposal in terms of cognitive accessibility [11,17]. As its theoretical framework is based on the work of thinking and metacognition, it takes into account students’ cognitive diversity and learning styles and develops a technology-enriched environment in such a way that students can access knowledge through multiple forms of representation, action and engagement [18].

1.3. Assessment of Educational Spaces

The proliferation of projects and discourses concerning innovation in educational spaces has given rise to a heightened interest in the evaluation of these spaces. The evaluation of educational environments can be approached from various perspectives, ranging from a modern architectural approach to the educational implications that spatial organization may entail. In this regard, the work by Alcaráz-García [19] compiles various certified evaluation systems (BREEAM—Building Research Establishments Assessment Method, LEED—Leadership in Energy and Environmental Design, GBCA—Green Building Council of Australia, VERDE—Valoración de Eficiencia de Referencia de Edificios, etc.) that, from a building design perspective, promote the creation of flexible, sustainable environments that are consistent with the corresponding educational system.

Furthermore, there are various guides and tools similar to the ones previously mentioned that are designed for the purpose of evaluating and designing educational spaces. These tools are utilized in the process of involving educational stakeholders in the design process. For instance, the UK's Department for Education and Skills and the Construction Industry Council developed a tool (DQI—Design Quality Indicator) for assessing educational needs and subsequent construction [20]. This tool is similar to the guide *Mon école, un espace qualité*, which aims to serve as a guide for educational institutions in Brussels. In this guide, the adoption of criteria related to flexibility, sustainability, safety, health, and identity development is promoted when designing educational spaces [21].

In the domain of education, the Aula del Futuro project website provides a variety of guides for the transformation of educational spaces [22–24]. In a similar vein, the project provides a toolkit (*Kit de herramientas*) that encompasses guidelines for the diagnosis, planning, and design of a classroom of the future, as well as its evaluation, among other themes [25].

1.4. Justification of the Study

IkasLab was initiated within the Basque education system as a pilot project in 10 elementary and secondary schools selected by the Basque Government's Department of Education during the 2022–2023 academic year. The number of schools participating in the project increased year by year, and by the 2024–2025 school year, three distinct generations of IkasLab projects had been completed [26].

Despite the recent surge of interest in the transformation of educational spaces, as evidenced by the growing body of literature on the subject, there is a paucity of studies that focus on the practical implementation of contextualized models, such as IkasLab [11]. In this regard, the present research aims to identify the strengths and weaknesses of the concrete application of this framework, providing evidence of its contribution to the re-design of spaces and the development of students' cognitive and metacognitive processes.

In addition, a rubric for evaluating IkasLab spaces was designed and validated using the Delphi method in a previous study [27]. This research takes it a step further by evaluating the rubric's reliability to obtain a scientifically validated and reliable resource. The objective is thus to enhance the methodological robustness of the instruments utilised for the evaluation of educational spaces.

1.5. Objectives and Research Questions

The present study has been designed to assess the level of implementation and teachers' perceptions of the IkasLab project. To this end, a mixed-methods approach has been adopted. The objectives of the study are as follows:

- Objective 1: To examine the level of implementation of the IkasLab model by applying a systematic observation rubric to these settings, with the aim of identifying the levels of development across the model's various dimensions.
- Objective 2: Analyse the reliability of the rubric by calculating Cronbach's Alpha and McDonald's Omega to assess the internal consistency of the instrument used.
- Objective 3: Explore teachers' perceptions regarding the IkasLab model through semi-structured interviews and thematic discourse analysis to deepen the understanding of the framework among educational stakeholders.

Additionally, the following research questions have been formulated on the basis of these objectives:

What is the level of implementation of the IkasLab model in the participating elementary schools? (RQ1)

Does the assessment rubric for IkasLab spaces demonstrate adequate levels of internal reliability? (RQ2)

What are teachers' perceptions of the IkasLab model in the participating schools? (RQ3)

2. Materials and Methods

2.1. Sample

In view of the population of IkasLab classrooms, the initial plan was to select five schools per generation ($n = 15$), all of which were elementary schools, with a view to maximising homogeneity in terms of context and needs. The selection of five schools was determined by the maximum number of schools available in the first generation, which was the most reduced. However, in the second generation, it was only possible to access three schools, reducing the final sample to $n = 13$.

Consequently, the selection of schools was informed by criteria of accessibility and availability, consistent with the exploratory nature of the study and the level of implementation of the IkasLab project within the Basque education system. Notwithstanding, the sample size is regarded as adequate, as it integrates quantitative evaluation with in-depth qualitative analysis, facilitating methodological triangulation and a contextualised comprehension of the model.

However, it should be noted that the results obtained are not intended to be generalizable; nevertheless, the diversity of participants and the consistency of the data provide interpretive value for analysing the implementation of IkasLab and its evolution across the different generations of the project.

2.2. Instrument

The present study employs a mixed-methods approach to analyse the application and implementation of IkasLab in schools, and to assess the reliability of the rubric used to evaluate these spaces.

In order to achieve this objective, a rubric that had been designed and validated in previous studies [27] was employed. The instrument comprised four sets of indicators and descriptors, each with five levels of development (1—Social learning spaces, 2—Student-centred learning spaces, 3—Spaces for reflective thinking, 4—Spaces for maintaining and developing deep thinking). It was developed on the basis of the theoretical foundations of IkasLab [11], the matrices of visible thinking by Ritchhart & Church [12] and Ritchhart et al. [28], and the experiential learning rubric by Evin et al. [29]. Subsequently, as mentioned above, the rubric was validated through a two-round Delphi expert assessment, yielding an expert coefficient of $k = 0.835$.

Additionally, in order to incorporate qualitative data collection, in-depth interviews were also conducted with the project leaders at each school.

Finally, the quantitative data was extracted and analysed using SPSS (version IBM SPSS Statistics 27.0), while the qualitative data was subjected to thematic analysis [30].

2.3. Procedure

The study was conducted by contacting selected schools to explain the research objectives and procedures. As stated in the section on the sample, fifteen IkasLab schools were contacted, but thirteen ultimately decided to participate.

The data collection process was standardised across all participating schools as follows: (1) Firstly, the fieldwork was conducted through a visit to the IkasLab classroom. The quantitative data required to complete the rubric were collected through direct observation. (2) Subsequently, in-depth interviews were conducted with the IkasLab coordinators at each school in order to gather qualitative information. (3) Thirdly, the quantitative data was analysed by entering all values into an SPSS spreadsheet. This process enabled the assessment of the instrument's reliability and the identification of key findings based on the obtained values. (4) Finally, the analysis of the qualitative data was undertaken by means of a thematic analysis of the transcribed in-depth interviews, in accordance with the criteria established by Braun & Clarke [30]. It was determined that qualitative analysis had achieved data saturation in interview no. 9, a point at which the predominant themes began to recur. It is important to note that to ensure methodological transparency and the quality of the qualitative research, the cross-cultural adaptation by Quemba-Mesa et al. [31] of the COREQ—Consolidated Criteria for Reporting Qualitative Research—guidelines was incorporated (see Appendix A).

3. Results

3.1. Quantitative Data Analysis

In relation to the results obtained from the rubric, it should be noted that no substantial differences were initially observed in the average scores when comparing the three generations. Despite the first generation of schools attaining the highest score of 3.55/4, the subsequent generations exhibited comparable results, with the second generation achieving 3.02/4 and the third generation attaining 3.15/4. The data indicates a high level of project implementation across all generations, suggesting a relatively homogeneous assimilation of the model once it was established.

Given that the overall average obtained on the rubric is $\bar{X} = 3.26$, it could be stated that the IkasLab spaces evaluated are at a high level of development, close to the maximum score provided for by the instrument. Consequently, from an evaluative standpoint, this value indicates that, in addition to incorporating the structural elements of the model, the schools have functionally integrated these aspects into their educational practice.

Meanwhile, three items received the highest average scores: indicator No. 2, "Relational Space," which aims to assess the IkasLab classroom's ability to foster in-person and/or online relationships between students and other educational stakeholders in a straightforward manner; No. 9, related to the use of active methodologies in real-world contexts; and No. 14, linked to the level of implementation of the KOMUNIKATU (communicate) space in the IkasLab classroom. The averages obtained (consecutively $\bar{X} = 3.69$, $\sigma = 0.48$; $\bar{X} = 3.69$, $\sigma = 0.48$, and $\bar{X} = 3.69$, $\sigma = 0.63$) reflect an emphasis on aspects related to interaction, communication, and active learning—dimensions that appear to be more accessible and transferable to schools in the early stages of the model's implementation.

Finally, with regard to the lowest scores, although metacognitive work—an essential component of the IkasLab project—is thoroughly embedded in a number of the schools,

the indicator designed to evaluate the space's capacity to promote metacognitive work received the lowest average score ($\bar{X} = 2$; $\sigma = 1.15$). Subsequently, indicator no. 8 also obtained one of the lowest scores ($\bar{X} = 2.85$; $\sigma = 0.69$), as it is linked to the evaluation of a space that provides students with the autonomy to self-regulate their learning process. The findings indicate that, while the conceptualisation of reflective thinking through the PENTSATU space constitutes a pivotal element within the IkasLab theoretical model, the practical implementation of this approach is characterised by greater complexity and variability across schools. This observation underscores the necessity for enhanced pedagogical and training support (RQ1).

In addition, the dispersion observed in the metacognitive indicator serves to reinforce the hypothesis that these practices have not yet been systematised. This in turn gives rise to questions regarding the degree of operationalisation, explicitation and understanding of this dimension within the assessment instrument itself. This issue will be revisited in the Discussion Section (Section 4).

3.2. Reliability of the Instrument

In the context of data collection and research, it is imperative to employ instruments that are in alignment with the principles of validity and reliability. This ensures that the findings are both relevant and of a high quality, and that they accurately reflect reality [32]. In a similar vein, and as previously mentioned, this study utilised a previously validated rubric to evaluate the IkasLab spaces. The reliability of the instrument was then calculated in order to verify its internal consistency, a process which was based on data obtained through systematic direct observation.

Reliability is defined as the consistency of the results produced by an instrument over time and under comparable conditions [33].

In this instance, the decision was taken to calculate Cronbach's Alpha (α) due to its popularity and effectiveness within the scientific community for calculating the reliability coefficient [34]. However, it was also decided to calculate McDonald's Omega (ω) as well, given that this allows for quantifying the instrument's reliability while accounting for its multidimensionality, and is capable of yielding more stable results [33,35]. Moreover, in view of the limited sample size on which the research was based, it was considered that calculating two coefficients might contribute to a greater depth of analysis in the study.

Finally, it must be acknowledged that the calculation of both coefficients was stratified. This decision was made on the basis that the different aspects and dimensions of the IkasLab classrooms were to be addressed when using the rubric. Table 1 presents the results for each coefficient in their totality, as well as for each of the dimensions.

Table 1. Cronbach's alpha and McDonald's omega coefficients (overall and stratified).

	Cronbach's Alpha Coefficient (α)	McDonald's Omega Coefficient (ω)
Full instrument	0.909	0.907
Section 1 of the rubric: Social Learning Space	0.829	0.854
Section 2 of the rubric: Learner-centered Learning Space	0.805	0.803
Section 3 of the rubric: Space for Reflective Thinking	0.507	0.508
Section 4 of the rubric: Space to Develop and Maintain Deep Thinking	The fourth dimension of the rubric consists of a single item, so it is not possible to estimate its internal reliability using Cronbach's α or McDonald's ω	

As demonstrated in Table 1, both Cronbach's alpha and McDonald's omega coefficients yield excellent results, with values greater than 0.9 [35,36]. In addition, it can be seen that the first two blocks provide substantially elevated coefficients; however, in the third block, the reliability achieved falls below the 0.7 acceptable threshold. However, in the case of the latter, this may be subject to several factors. It is evident that the minimal number of items contained within Block 3, in conjunction with the restricted sample size ($n = 13$), has the potential to compromise the stability of the stratification. Secondly, the section exhibits inadequate internal consistency, yet it does maintain consistency with the overarching construct. In the final analysis, it was not possible to perform both tests in the fourth block, since this block contained only one item.

In summary, the segmented rubric demonstrates satisfactory reliability in the initial two blocks, with the potential for enhancement in the third. Notwithstanding, with regard to the overall structure, the data obtained indicate a very high degree of reliability of the instrument.

3.3. Qualitative Data Analysis

The subsequent section presents a summary of the qualitative findings, which have been categorized into three overarching classifications that address the topics most frequently mentioned by teachers. Each category is further subdivided into subtopics. To provide greater clarity for the research, Table 2 includes a graphical summary of the results from this section.

Table 2. Graphical summary of the thematic analysis.

Main Topic	Subtopic	Main Findings
Space, Structure and Resources	Project currently under development	Teachers see IkasLab as an initiative that is constantly evolving, which means that its long-term educational impact cannot yet be fully assessed.
	Impact of IkasLab on the school and its functioning	IkasLab encourages reflection on how schools operate, even in the traditional classroom.
	Time and human resources	Teachers report a clear need for staff and time to carry out the project.
	Methodology and active learning	Teachers reported that IkasLab facilitated the implementation of active methodologies in schools where such approaches were not previously consolidated, while its impact appeared less transformative in already innovative settings.
	Digitalization	The increased use of ICT in the learning environment facilitates the teaching of subjects such as computational thinking and programming.
Curriculum and learning	Autonomy level	A greater degree of autonomy is evident due to the way the class is organised (work in learning zones) and the use of sensitive equipment such as ICT.
	Teaching implementation	Initially, there are fears and prejudices regarding the project, although collaboration amongst teachers is cited as a means of overcoming these and making the educational process more effective.
	Inclusivity	Flexible learning zones and versatile technological tools were perceived as facilitating participation and accessibility for students with diverse educational needs and linguistic backgrounds.
	Teaching needs	There is a sense of loneliness and helplessness in the teaching body. Teaching staff are calling for training and guidelines to help them operate IkasLab. The current resources are not perceived as sufficient or up to date.

Thinking Skills and Metacognition	Lack of knowledge regarding the implementation of metacognitive practices	Some members of the teaching staff, who have no prior training in the thinking work, do not understand how practical implementation of the PENTSATU space works.
	Positive assessment and impact of IkasLab's original PENTSATU proposal results thanks to IkasLab.	Teachers with experience of thinking routines have observed that pupils find it easier to engage in thinking activities and achieve better results thanks to IkasLab.

3.3.1. Topic 1: Space, Structure and Resources

IkasLab is a project currently in the implementation phase, as by the 2024–2025 school year, only three generations of schools had begun to roll out the project. “Changes have been made. At first, we had 6 zones, and then it went down to 4” [Teacher 3]; “the zones aren’t clear yet; we have to keep refining them” [Teacher 1].

However, even though this project still has great potential for development, these initial experiences have had an impact on the structure and functioning of the spaces and the school as a whole. Likewise:

“We consider IkasLab to be more of a concept than a physical space. After all, we are a very big school, and we cannot guarantee that every student will have the opportunity to come here. That is why we see IkasLab as making a conceptual contribution that must also be brought into the regular classroom—by incorporating the functions of IKERTU, SORTU, KOMUNIKATU, and PENTSATU. So, sometimes the work begins in the classroom and ends in the IkasLab space, and vice versa. In short, we see IkasLab as a concept that must be brought to the entire school” [Teacher 19].

On the other hand, in terms of negative aspects, there is a perceived need for resources. While teachers emphasize the need for resources, stating, “We need time. More time to develop the project and, above all, to implement it in a large and diverse school like this one” [Teacher 19]; others highlight the lack of human resources and the need to hire teachers trained in this area:

“As teachers, we’re expected to train ourselves in computational thinking, the use of radios, speaking skills... But all of that should have been covered beforehand. We should enter the workforce prepared in that regard. You may not have practiced it, but you should at least have heard about it. It would help us a lot if young teachers came in with the knowledge needed to handle the realities of the classroom” [Teacher 8].

3.3.2. Topic 2: Curriculum and Learning

The implementation of IkasLab has had other pedagogical and educational impacts. First, in relation to methodology, several teachers emphasize the value of IkasLab in significantly expanding learning opportunities: “Their classroom, despite being organized into groups, is limited in terms of space—it’s small. Here (in IkasLab) you have the option to move from one place to another, to work differently” [Teacher 3].

It should be noted that for those few schools where active teaching methods were already in place and part of the teachers’ daily routine, IkasLab has not resulted in a structural change in methodology, but rather has proven to be a useful tool. “For us, it’s just another resource. It hasn’t come to change anything, but rather to reinforce the change we had already begun” [Teacher 12].

Nevertheless, improvements in learning processes have been identified, such as in the digitisation and use of educational technology: “I believe that when students enter a space like this, they become somewhat self-regulated (in the conscious and responsible use of ICT)” [Teacher 4] or “we saw that computational thinking, programming, and robotics could also be introduced in IkasLab” [Teacher 5]. These improvements have also been observed in terms of the development of student autonomy:

“As you have seen, you have walked into IkaLab and the students have kept working. They have seen different people come in before, and they take it in stride. Since these aren’t traditional lectures, they work in learning zones, and each student has their own tasks and autonomy—we really emphasize that” [Teacher 5].

On the other hand, one of the most frequently mentioned subtopics in this section has been teacher involvement. In this regard, while all interviews revealed feelings of fear or apprehension among teachers toward IkaLab when it was first introduced at the school, factors that helped alleviate those emotions were also identified. To this end, collaboration between teachers and innovative figures has been indispensable: “on top of that, having a mentor alongside to help them makes teachers feel much more at ease” [Teacher 10] or “teachers have felt reassured by having a dedicated figure specifically tasked with helping them navigate IkaLab” [Teacher 21].

“It has been very difficult to introduce this at school. People find it very hard to step outside their comfort zone and face something new. Although it’s true that this third year we have had a new teacher—who is very positive and has a great attitude—and she uses these kinds of teaching methods. So for her, this classroom has been an opportunity; she has trained the rest of the teaching staff, and we could say that thanks to her, the home-room teachers are using the IkaLab classroom more and more” [Teacher 14].

Moreover, the unrealistic expectations that have been identified among a significant number of teaching staff have been addressed through collaborative efforts among professionals.

“There has been some apprehension. Over the past three years, we have observed the process, and it has evolved. At first, people felt nervous about going to IkaLab because they thought it would involve a different set of demands. But eventually, attending became routine. Later, we decided that teachers would need the support of a colleague or to co-teach with other instructors. And, as of today, most groups come with more than one teacher” [Teacher 6].

In addition, it is worth noting the ideas regarding IkaLab’s inclusive nature and its focus on diversity. It is observed that these types of classrooms allow for a learning experience distinct from that of a traditional classroom, providing more relaxed and flexible spaces where all students can engage with learning situations through multiple forms of participation, interaction, and knowledge construction: “Since it is an open space with less pressure, it has been beneficial. They don’t have to face forward. And it offers the chance to work with more tools, technological resources to make progress in a different, more practical way” [Teachers 6 and 7].

“It’s true that we haven’t measured it in a concrete way, but I do see that this classroom motivates students and that they experience it in a way that’s, let’s say, informal. But not informal in the sense that we stop working. I mean that it’s a workspace that’s perceived as more flexible and relaxed. And in that sense, better. And I’ll tell you, when they come to this space, they work in small groups, which is positive for them. I’d even say that working in a big group in a classroom like this one can be even more complex” [Teacher 19].

Similarly, IkaLab’s potential to ensure linguistic inclusivity is highlighted: “Students can use the technological tools in their native languages” [Teacher 13]. It also provides teachers with resources to ensure cognitive accessibility:

“It’s clear that students with special educational needs are more engaged because they have a wider variety of opportunities to work. We have students whom you would never see speak in a regular classroom. But here, through interactive presentations and other materials, they try. So this is another opportunity offered to them, something unthinkable in a regular classroom” [Teacher 17].

Finally, regarding the negative aspects of this section—which are related to those mentioned earlier—one of the most frequently cited concerns throughout all the interviews is the need for training. In this regard, the most frequently mentioned idea reflects a need for support for teachers so they can develop and harness the potential of IkasLab.

“What teachers struggle with most is assessment; they don’t know how to assess. Designing learning situations—well, more or less. But no one has helped us with that either. Everyone creates learning situations as best they can or by using the ones that are already made” [Teacher 7].

“What I know is because I’ve done my own research. If I had received the necessary training, I wouldn’t waste so much time. On top of that, imagine if I’m not here next year [as the coordinator of the school’s IkasLab], how would someone else do it? Start from scratch? We need training tailored to our actual needs. The training we receive is useless; it needs to be updated. Often, those workshops between schools with IkasLab boil down to therapy sessions for teachers” [Teacher 17].

3.3.3. Topic 3: Thinking Skills and Metacognition

Third, one of the topics most frequently discussed by the teachers interviewed is metacognitive work and the development of deep thinking, which is central to the IkasLab initiative.

In this regard, two main themes have been identified: first, a sense of unfamiliarity with educational practices that foster students’ metacognitive thinking and the inclusion of the PENTSATU space. Teacher 1, for example, commented on the PENTSATU space: “I just don’t know what to say about this topic” or “even though PENTSATU is present throughout the entire process, we wanted to create an area with encyclopedias.” Other comments included: “After all, thinking is something that happens in all our daily activities” [Teacher 17] or “I mean, PENTSATU is something we do all the time, isn’t it?” [Teacher 20].

However, the second set of opinions demonstrates a good understanding of the IkasLab framework regarding reflective work, thinking, and self-regulation. Thus, the inclusion of such practices is viewed positively: “You can see it in the students who know, who have more autonomy when, for example, they carry out those thinking routines” (Teacher 5). “I do observe that through this classroom they are getting to know their limits better, and that is something that doesn’t happen in the traditional classroom—that self-reflection” [Teacher 15].

“I think the key was to structure the initial learning situations correctly, because that’s when and where they began to engage in that kind of reflection. And now, reflection is part of every learning situation; metacognitive work is built right in” [Teacher 4].

“Some students engage in metacognition and others don’t. It’s true that students find it difficult. I mean, they struggle to stop and think about themselves. I have had students who were straight-A students in the traditional classroom, but when they entered IkasLab and started doing those metacognitive tasks, they had a mental block. Sometimes, out of habit, they struggle to work freely or in a less guided way” [Teacher 15].

4. Discussion

The outcomes of the study suggest that IkasLab remains a project in its early stages, showing great potential as well as areas for improvement. Both the quantitative study, which showed higher scores on items related to relational aspects and the use of active methodologies for real-life situations, and the qualitative study, with testimonials regarding IkasLab’s potential to complement or introduce active learning, reflect IkasLab’s capacity to introduce methodological changes in new educational contexts in line with the needs of the 21st century. This finding is consistent with the results obtained in previous

studies on analogous projects, including Aula del Futuro [27], Future Classroom Lab [37], and the Portuguese adaptation EduFor Innovative Classroom Lab [38].

Conversely, both quantitative and qualitative data indicate a necessity for greater emphasis, comprehension, and pedagogical guidance in the implementation of the PENTSATU space, with a view to integrating metacognitive practices into teaching-learning processes. Nevertheless, some teachers with more extensive training in this domain hold a favourable view of the prospects afforded by explicit metacognition instruction for students' autonomy, strategic thinking, and self-regulation. This finding is concordant with other studies, including Teng and Mizumoto [39].

In this regard, the study makes an original contribution by presenting, for the first time, both quantitative and qualitative data on the impact of the IkasLab project's implementation. The programme has been developed to identify both the strengths of the participants and the areas in which they can improve, with a view to the more effective implementation of future IkasLab classrooms.

However, it should be noted that while the sample was appropriate according to IkasLab's availability criteria, it remains a fairly small panel. Consequently, the results of the study should be treated with caution, in view of the exploratory nature of the research. In a similar vein, subsequent studies should seek to expand this sample as new IkasLab spaces are developed, with a view to assessing the persistence of these trends and whether accumulated knowledge across multiple generations contributes to the facilitation of the aspects that present the greatest challenges.

Furthermore, the aspects related to metacognitive work and the PENTSATU framework demonstrated the greatest variation, suggesting a lack of consistency in how these dimensions are understood and applied across schools. This finding is largely consistent with other studies, such as that by McKendree and Washburn [40], which sought to assess how teachers fostered metacognition among their students. The study concluded that there was a discrepancy between the understanding and the operationalisation of metacognitive aspects, with teachers finding it challenging to teach them in an intentional and sustained manner. This is reflected in the implementation of PENTSATU. Consequently, the implementation of pre-test and post-test research studies to evaluate teacher training in these practices within the Basque education system would be a valuable endeavour. This would be complemented by the establishment of teacher training programmes, which would proliferate in response to the training needs identified in the qualitative analysis. For instance, studies could emerge on the implementation, support, and evaluation of more structured teaching guidelines that allow for the identification of specific existing gaps.

Finally, the present article also contributes to the rubric used in the research process by conducting a reliability analysis of the instrument. Therefore, while the instrument had been validated in previous studies [27], its reliability has now also been verified. However, it should be noted that, given the limited sample size, the statistical results for Cronbach's alpha and McDonald's omega may demonstrate limited stability. Hence, it would be worthwhile to assess the instrument's capacity to sustain this stability over time in subsequent studies evaluating active and holistic learning spaces, such as IkasLab.

5. Conclusions

The present study constitutes an investigation into the implementation of the IkasLab project in primary schools within the Basque Autonomous Community. The findings of the present mixed-methods study have indicated the potential of the Innovative Learning Environment model to promote active learning, autonomy and collaboration within the educational setting.

However, it has also been observed that the work on thinking and metacognition, which underpins the project's theoretical framework, has not been fully operationalised. This poses a challenge for many teachers. In this regard, the in-depth interviews conducted with teachers involved in the project have highlighted the need for teacher training and pedagogical support.

This exploratory study makes a contribution to the evaluation of this type of space. The present study is pioneering in its use of empirical evidence to assess the implementation of IkasLab in Basque schools, incorporating both quantitative and qualitative data. However, it is imperative to acknowledge the exploratory nature of the study. As IkasLab represents a pioneering project currently in the implementation phase, the sample analysed was relatively small, which poses challenges in obtaining generalisable data.

Consequently, subsequent studies could make contributions in this respect by conducting longitudinal research that might corroborate the exploratory data obtained in this study and observe the evolution of both the positive and negative findings observed. Furthermore, as the project progresses and becomes established within the Basque education system, it would be interesting to gather teachers' perceptions, so that future studies can report on the involvement of teachers in improving educational contexts.

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Institutional Review Board Statement: Ethical review and approval were waived for this study because the research involved non-invasive educational observations and semi-structured interviews conducted in professional educational settings, without the collection of sensitive personal data or any intervention involving participants. The study was conducted in accordance with the principles of the Declaration of Helsinki. All participants were informed about the aims and procedures of the research, their voluntary participation, the anonymous treatment of the data, and their right to withdraw at any time.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study. Prior to participation, all participants were informed about the objectives and procedures of the research, the voluntary nature of their participation, and the anonymous and confidential treatment of the information collected. Participation in the interviews and observations was considered as consent to participate in the study.

Data Availability Statement: The data supporting the findings of this study are available within the article. No additional datasets were generated.

Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A

Table A1. COREQ (Consolidated Criteria for Reporting Qualitative Research).

No.	Item	Questions/Description
1	Interviewer	Which author(s) conducted the interview or focus group? The first author conducted the in-depth interviews.
2	Credentials	What was the researcher(s)' academic background? E.g., PhD, MD The first author is a doctoral student at the University of the Basque Country. The other two authors are PhDs and faculty members at the same university.
3	Occupation	What was/were the researcher(s)' occupation(s) at the time of the study? The first author is a PhD student at the University of the Basque Country. The other two authors are PhD holders and lecturers at the same university.
4	Gender	What was the researcher's gender? Male/Female/Other The author who conducted the research was male.
5	Experience and training	What experience or training did the researcher have? The author had conducted various research projects, both quantitative and qualitative, throughout his academic career, either as part of his master's degree or during his doctoral program.
6	Established relation	Was contact made with the participants before the study began? It had been agreed with some of the teachers to hold training sessions related to the IkasLab project. However, there was no direct relationship between them. Prior to meeting in person, the schools were contacted via email and phone to explain the research and invite them to participate.
7	Participant's familiarity with the interviewer	What did the participants know about the researcher? E.g., personal goals, reasons for conducting the research The invitation sent to the schools included a brief introduction to the research and provided basic information about the researcher (Ph.D. program, affiliation with a research team, and research objectives). In addition, before the start of each interview, this information was reviewed and elaborated upon in order to clarify the objectives, methodology, data analysis, and any other issues that might raise questions.
8	Interviewer Qualifications	What personal characteristics were reported about the interviewer/facilitator? E.g., biases, assumptions, motivations, and interests regarding the research topic In terms of research interests and objectives, this study was conducted as part of a doctoral dissertation currently in progress. Likewise, the potential gap between the theoretical perspective from which the research is approached and the empirical reality of educational institutions was identified as a possible source of bias. It was acknowledged that academic work, by focusing on conceptual frameworks, can at times stray from the complexity and practical dynamics that characterize school contexts.
9	Methodological guidelines	What methodological approach was adopted to support the study? E.g., grounded theory, discourse analysis, ethnography, phenomenology, content analysis A methodological approach based on thematic analysis was adopted, following the framework proposed by Braun and Clarke. This approach made it possible to identify significant patterns within the data obtained through in-depth interviews.
10	Sample	How were the participants selected? E.g., purposive, convenience, consecutive, snowball A non-probabilistic convenience sample was selected from schools with available IkasLab projects.
11	Approach method	How were the participants contacted? E.g., in person, by phone, by email Initial contact was made via email. However, in cases where no response was received, a second attempt was made to contact them by phone.
12	Sample size	How many people participated in the study? Thirteen schools participated in the study. The IkasLab project coordinators from each school took part in the interviews. A total of 22 teachers participated, of whom 17 were women and 5 were men.

- 13 Non-participation How many people refused to participate or dropped out of the study? Why? Fifteen schools were contacted, of which two decided not to take part in the study. The reason given was a lack of time and other day-to-day priorities that prevented them from getting involved in the research. The remaining schools took an active part in all aspects of the study as initially outlined to them.
- 14 Data collection setting Where was the data collected? E.g., home, clinic, workplace All interviews were conducted at the schools. In most cases, they took place in the IkasLab classroom itself. However, due to availability issues, in some cases, empty classrooms or administrative offices were used instead.
- 15 Presence of non-participants Were there any other people present during the study besides the researchers and participants? No.
- 16 Sample description What are the key characteristics of the sample? (e.g., demographic data, dates) The interviews began in October 2024. During the first two quarters of the school year—that is, from October through February—only the first two generations of IkasLab were contacted. Since the third generation had just started that same year, the goal was to ensure they had a little more time to develop the project and, consequently, to answer questions about its implementation. During the remainder of the school year, from March to June, the pending interviews were completed, and those with the third generation were initiated. The selection of interviewees was based on criteria of expertise, with schools being asked to include teachers who had participated in the design of IkasLab, who were responsible for the project, or who were very familiar with it. Based on this, the sample consisted of 22 teachers, 17 women and 5 men.
- 17 Guide to the Interview and Pilot Test Did the authors develop questions or guidelines? Was a pilot test conducted? An initial questionnaire was designed, based on the rubric, in order to collect data on all the elements identified in the assessment tool.
- 18 Repeated interviews If repeat interviews were conducted, how many were carried out? No
- 19 Audio-visual recording Were audio or video recordings used to collect the data? The interviews were audio-recorded, with participants being informed that the study was anonymous and that its sole purpose was to extract data from the audio files; once the data had been collected, the recordings were deleted in accordance with data protection regulations.
- 20 Field notes Were field notes taken during or after the interview or focus group? The field notebook was one of the tools used in the research. However, it did not contain any information beyond what was recorded in the audio files. Therefore, it played no significant role in the research.
- 21 Duration How long did the interviews or focus groups last? The average duration of each interview was around 30 min, with the shortest interview lasting 17 min and the longest 55 min.
- 22 Data saturation Was data saturation described? Data saturation was achieved during the analysis of interview no. 9 (Teachers 16 and 17), when no new themes emerged from the thematic analysis.
- 23 Return of transcripts Were the transcripts shared with the participants for comments or corrections? It was not necessary
- 24 Number of data encoders How many people coded the data? The coding was carried out by the first author and reviewed by the other authors.
- 25 Description of the encoding tree Was a description of the coding tree or network provided? Yes. A description of the coding structure was provided, detailing the themes and subthemes identified through the thematic analysis, as well as the relationships between them. Although no graphical diagram was included, a textual explanation equivalent to a coding tree was provided.
- 26 Derivation of themes Were the themes identified in advance, or were they derived from the data? Although the initial interview guide identified some of the key topics to be covered (such as the thinking-based work or the inclusive nature of IkasLab), it was not until the thematic analysis of the transcribed interviews that the most significant and recurring themes were identified.

27	Software	What software was used to manage the data?
No specialized qualitative analysis software was used for data management and analysis. The process was carried out manually, using text editing and organization tools, specifically Google Docs.		
28	Feedback from the participants	Did the participants provide feedback on the findings?
No.		
29	Quotes included	Were quotes from participants included to illustrate the findings? Was each quote identified?
Yes. In the Results Section (Section 3), the identified themes and subthemes were presented in a categorized and written format, with each one illustrated using direct quotations. The quotes were anonymized, with each teacher identified by a number from 1 to 22. Additionally, Table 2 was included in the paper, providing a graphical summary of all the quotes under each of the main themes and subthemes.		
20	Consistency between data and findings	Is there consistency between the data presented and the findings?
Yes.		
31	Main topics	Were the main themes presented clearly?
Yes. All the elements to be included in the study were classified into three main categories or themes, which were presented in the Results Section (Section 3). In addition, within each category, the subtopics were described in detail.		
Topic 1. Space, Structure, and Resources		
Topic 2. Curriculum and Learning		
Topic 3. Thinking Skills and Metacognition		
32	Subtopics	Were the different cases or subtopics described?
Yes.		
Topic 1. Space, Structure, and Resources		
Subtopic 1: IkasLab as an ongoing project.		
Subtopic 2: IkasLab's impact on the school and its operations		
Subtopic 3: Needs and Resources—Time and Human Resources.		
Topic 2. Curriculum and Learning		
Subtopic 4: Methodology—Impact of IkasLab on schools engaged in active learning.		
Subtopic 5: Digitalization.		
Subtopic 6: Level of autonomy.		
Subtopic 7: Teacher activity and perception.		
Subtopic 8: Inclusivity (participation, language management, and cognitive accessibility).		
Subtopic 9: Pedagogical Needs—Lack of Training and Feeling of Neglect.		
Topic 3. Thinking Skills and Metacognition		
Subtopic 10: Lack of Knowledge Regarding the Implementation of Metacognitive Practices.		
Subtopic 11: Positive Assessment and Impact of IkasLab's Original PENTSATU Proposal.		

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