Abstract
The evolution of educational theories in recent years, as well as the emergence of new pedagogical strategies related to learning processes, require attention to research on the configuration and organization of learning spaces (Byers, 2014; Barret, Zhang et al, 2013; Cuban, 2010; 2004; Tyack and Tobin, 1994).

Several reports written by international organizations such as OECD or European Commission (Istance, Salgado and Shadoian-Gersing, 2013) consider that the improvement of education happens, among other factors, by a different organization and less rigid schedule and space in educational institutions. Recent academic research shows how some of the factors related to the change in the organization, operation, use, etc., of the educational space have a positive influence on academic results (Barret, Zhang et al, 2015; Kontturi, 2013; Kangas, 2013). So far, although there is no a single model for the definition of the perfect learning space (Wall, 2016). The theoretical review carried out show three dimensions of key analysis for its conceptual design: the pedagogical, environmental and technological dimension.

This paper shows the results of an investigation that aims to analyze the knowledge, preferences, perceptions and needs of teachers regarding the configuration of the classroom as a learning space that responds to an innovative teaching and learning process with ICT integration. To this end, a quantitative study was carried out using the survey method of a sample of 847 teachers from primary and secondary schools in Catalonia (representative of the population of teachers studied with a margin of error of ± 3.5, for a level 95.5% confidence in infinite populations, where p and q are equal).

The results show that teachers perceive that their classrooms allow them to implement different teaching methodologies, but the possibilities could be much greater to move from teacher-led learning to self-directed learning by the student, reducing masterly exposure times and increasing collaborative work. On the other hand, teachers' awareness of these issues is demonstrated, with women being the most critical and sensitive in aspects related to space and pedagogies. The integration of technology (fixed, mobile, or robotic) has emerged as the least valued.

Finally, those who attribute a greater importance to all the dimensions linked to the creation and design of learning spaces are those of the most initial stages (Pre-school and Primary Education).

Keywords: learning spaces, Teachers' perception, technology, pedagogy, pedagogical innovations, space design.

1 INTRODUCTION
At the present, teaching practice is in the process of change in relation to the conception of learning processes and new strategies and resources. An attempt is being made to break with a didactic background framed by a traditional educational culture, with the intention of adapting to the needs of society and students. They have not only incorporated new uses of digital environments and tools, but they are moving towards new ways of communicating and new models of face-to-face work, collaborative and networking, and look for forms of organization and relationship markedly different from the current ones, more flexible, horizontal and efficient (Marcelo, 2013). That requires learning spaces designed to promote, among others, teamwork, creativity, social, open, flexible and ubiquitous (Mathews and Lippman, 2015).

Different reports written by international organizations such as OECD (2013) and the European Commission (Dumont, Istance and Benavides, 2010) consider that the improvement of education needs different and less rigid organization of time and space in schools- Those are elements that strongly condition the learning dynamics. Other studies show specifically how some of the factors related to the change in the organization, conditions and use of educational space positively influence academic outcomes and the satisfaction of those involved (Barrett, Zhang, Moffat and Kobbacy, 2013;
Besides, these studies also reveal a growing interest of the teaching staff and the management teams to accompany the didactic innovation processes with conceptual and structural changes of the learning spaces.

All this leads to the need to design classrooms and new generation spaces (Bautista and Borges, 2013, Oblinger and Lippincott, 2006, Byers, T., Hartnell-Young, E., & Imms, W., 2018). Educational spaces that allow combining learning activities focused on inquiry and an active vision of the student in a constructive way, while using digital technologies and adapting themselves structurally to the different moments and needs of the learning process.

The implementation of digital technologies in the classroom does not necessarily mean the improvement and advancement of teaching and learning environments. Even so, many authors agree that there are several key factors that drive digital technology as a central component and opportunity for the change of the education system. According to the OECD (2013), in tech-rich spaces, digital technologies can play several key functions in the process of change, including the possibility of adapting learning to the needs and individual rhythms of students, providing tools to be more creative or work collaboratively.

Teachers have at least one double responsibility with digital technology. First, use it didactically to enhance learning: access to information, motivation, immediacy, personalization, communication. Second, that the classroom becomes a place of literacy for the use of these technologies, since these skills are already a reality that strongly affects the development and socialization of people and necessary to thrive in a social context in the that could risk creating a digital divide from school (Groff, 2013).

One of the main elements that must be guaranteed in the infrastructure of the learning space in relation to technology is the connectivity through the different existing options: Bluetooth, wi-fi, wireless. This connectivity should allow students and teachers to perform different tasks in digital format and support comfortably, such as searching, sharing and creating information and knowledge in an agile and constant way (Long and Ehrmann, 2005).

On the other hand, even if the space is tech-rich, this technology should be only a means for the teacher and the student. Therefore the design of the classroom should seek a non-preeminent presence. It is an error to associate the idea of a new generation space or innovative classroom with a visible and intensive presence of technology in space. Precisely, today digital devices are portable, with different measures and highly integrated, etc., to facilitate this discrete, ergonomic presence and subject to the methodology. As defends Gros (2010), technologies must be introduced in the classroom in an invisible way, so that they are available to students and teachers permanently, as an instrument of intellectual work and as a tool for shared knowledge construction.

In this way, most of the changes have been superficial, with the incorporation of some type of digital device (Bigum & Rowan, 2008). And the incorporation of this digital technology has not caused pedagogical changes; in many cases it has reinforced existing behaviors and pedagogies (Selwyn, 2010). These superficial changes result from the lack of understanding of the integration of digital technology. This affects the physical and social conditions of the classroom environment (Lippman, 2010). An example of this is how the projectors and interactive whiteboards have been installed. In general, they have been placed in the front of the classrooms and have reinforced pedagogical strategies focused on the master’s exposition (Reynard, 2009).

This multidimensional approach allows us to orient the discussion on the importance of incorporating and systematizing the different elements that we propose so that they are considered in the conformation and design of the new learning spaces in the schools.

2 METHODOLOGY

An explanatory research has been carried out with a quantitative study whose general objective is to analyse the perceptions and needs of the teachers regarding the configuration of the classroom as a learning space, specifically in relation to the digital dimension.

The methodology used is a quantitative study and survey method to a representative sample of Catalan primary and secondary schools. It aim is ascertaining the knowledge, predilections, perceptions and needs of teachers regarding the configuration of the classroom as a learning space, specifically in relation to the digital dimension.
The analysed population is the total of teaching staff of the Catalan educational centers (62,733 teachers of preschool and primary, and 43,322 teachers of secondary) during the academic year 2017-2018. The final sample of participating teachers was 136 teachers of preschool, 355 of primary and 333 teachers of secondary education, representative of the population of teachers studied with a margin of error of ± 3.5, for a level of confidence of 95.5% in infinite populations, where p and q are equal. For the selection of participants, an accidental sampling was used (Hernández Sampieri, 2006), characterized by the selection of easily accessible cases.

The data collection instrument was a questionnaire formed by a Likert scale of five degrees (strongly disagree -1-, disagree -2-, neither agree nor disagree -3-, agree -4-, very agreement -5-). To create the scale, a set of indicators for the technological dimension was previously identified, which subsequently became 9 judgments:

- The classrooms where digital technologies are integrated must have a different configuration of traditional classroom space
- It is necessary to integrate mobile screens (mobile phones, tablets, etc.) in the classroom
- It is necessary that the Internet connection of the center allows students to access the Internet at any time and place
- A computer classroom is not necessary because technology must be available in the classroom when necessary
- I agree with the bring own device to the classroom (BYOD - Bring Your Own Device)
- I agree with the tendency to "make students become creators" with ICT (3D printers, Kit Arduino, etc.)
- Integrating robotics and / or programming favors the creation of classroom scenarios in which students are the protagonists of their learning
- A fixed computer connected to a projector is essential in the classroom
- Digital whiteboards are needed in the classrooms

The reliability of the scale was calculated using Crombach's Alpha internal consistency index yielding a score of 0.70. For the content validity the judgment of experts was used, which showed a broad agreement with the relevance and importance of the judgments proposed in each of the scales. For construct validity, a factorial analysis was applied using the Varimax Main Components method, the KMO test showed significance and the adequacy of this analysis (p = .000 and KMO > 0.5).

In addition, other variables were requested that describe demographic and contextual aspects of the studied population: age, sex, years of teaching experience, educational level in which he teaches, ownership of the educational center to which he belongs, interest in teaching innovation (measured through the participation in innovation projects); ability to decide to change the distribution of the classes in which he teaches and availability of economic resources by the educational center to make changes in the configuration of the space.

3 RESULTS

First, in relation to the demographic and contextual aspects of the population studied, the average age of the participating teachers is 43.63 years; 80% are women and 20% are men. The vast majority has more than 10 years of teaching experience (74.7%), 12% have between 6 and 10 years of experience and 13% have less than 6 years of experience. Regarding the educational level in which they teach, 16.4% belong to children's education, 42.6% to primary education and 41% to secondary education. With regard to the ownership of the educational center in which they work, 83.4% do so in public centers, 14% are from subsidized centers, and only 1.2% come from private centers.

The digital scale presents a two-dimensional structure, with two factors that explain 50.6% of the variance. The load of the factors is higher than 0.4 in all the items, except for the 1 (The classrooms where digital technologies are integrated must have a different configuration of traditional classroom space). The two interpretable factors are the fixed technology (items 8 and 9) and the most innovative technology, such as robotics and mobile technology (items 1, 2, 3, 4, 5, 6 and 7).
Table 1. Digital scale Factorial analysis. Total variance explained

<table>
<thead>
<tr>
<th></th>
<th>Initial eigenvalues</th>
<th>Sums of saturations to the square of the extraction</th>
<th>Sum of the saturations to the square of the rotation</th>
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<tbody>
<tr>
<td></td>
<td>Total</td>
<td>% of the variance</td>
<td>% of the variance</td>
</tr>
<tr>
<td>1</td>
<td>3.05</td>
<td>33.931</td>
<td>33.931</td>
</tr>
<tr>
<td>2</td>
<td>1.50</td>
<td>16.675</td>
<td>50.606</td>
</tr>
<tr>
<td>3</td>
<td>.951</td>
<td>10.517</td>
<td>61.178</td>
</tr>
<tr>
<td>4</td>
<td>.900</td>
<td>10.333</td>
<td>71.510</td>
</tr>
<tr>
<td>5</td>
<td>.700</td>
<td>7.777</td>
<td>79.283</td>
</tr>
<tr>
<td>6</td>
<td>.610</td>
<td>6.777</td>
<td>86.060</td>
</tr>
<tr>
<td>7</td>
<td>.513</td>
<td>5.703</td>
<td>91.764</td>
</tr>
<tr>
<td>8</td>
<td>.392</td>
<td>4.355</td>
<td>96.119</td>
</tr>
<tr>
<td>9</td>
<td>.349</td>
<td>3.881</td>
<td>100.000</td>
</tr>
</tbody>
</table>

Table 2. Factorial analysis of the digital scale. Matrix of rotated components

<table>
<thead>
<tr>
<th>Component</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The classrooms where digital technologies are integrated must have a different configuration of traditional classroom space</td>
<td>.314</td>
<td>-.211</td>
</tr>
<tr>
<td>2. It is necessary to integrate mobile screens (mobile phones, tablets, etc.) in the classroom</td>
<td>.736</td>
<td>-.311</td>
</tr>
<tr>
<td>3. It is necessary that the Internet connection of the center allows students to access the Internet at any time and place</td>
<td>.608</td>
<td>-.286</td>
</tr>
<tr>
<td>4. A computer classroom is not necessary because technology must be available in the classroom when necessary</td>
<td>.529</td>
<td>.073</td>
</tr>
<tr>
<td>5. I agree with the bring own device to the classroom (BYOD - Bring Your Own Device)</td>
<td>.743</td>
<td>.006</td>
</tr>
<tr>
<td>6. I agree with the tendency to &quot;make students become creators&quot; with ICT (3D printers, Kit Arduino, etc.)</td>
<td>.774</td>
<td>-.023</td>
</tr>
<tr>
<td>7. Integrating robotics and / or programming favors the creation of classroom scenarios in which students are the protagonists of their learning</td>
<td>.676</td>
<td>-.132</td>
</tr>
<tr>
<td>8. A fixed computer connected to a projector is essential in the classroom</td>
<td>.047</td>
<td>.845</td>
</tr>
<tr>
<td>9. Digital whiteboards are needed in the classrooms</td>
<td>-.044</td>
<td>.840</td>
</tr>
</tbody>
</table>

The data show that for teachers the integration of digital technology requires a layout and configuration of the space different from traditional classrooms (3.9 on average over 5, with a standard deviation of 1.07). In this way, most have the need to modify the traditional organization (tables and chairs oriented to the blackboard) by another configuration of the space.

Many of the teachers use digital technology in the classrooms, and most of them choose an integration of mobile technology, although not so much for elements related to robotics. Specifically in relation to the item "It is necessary to integrate mobile screens (mobile phones, tablets, etc.) in the classroom" has resulted in an average of 3.75 in relation to 5 (with a standard deviation of 1.09).

In addition, many teachers are aligned with the "bring your own device to the classroom" (BYOD Bring Your Own Device) movement, with an average of 3.25 (and a typical deviation of 1.3). They believe that it is necessary to have mobile devices in the classrooms, and that these are the property of the students.

The item with the greatest agreement on the part of the faculty is Internet connectivity. Teachers need that the connection can be accessible at any time and place.
### Table 3: Internet Connection

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Min.</th>
<th>Max.</th>
<th>Average</th>
<th>Typical deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is necessary that the Internet connection of the center allows students to access the Internet at any time and place</td>
<td>843</td>
<td>1</td>
<td>5</td>
<td>4.35</td>
<td>1.077</td>
</tr>
</tbody>
</table>

The average lowers to 2.03 (and a typical deviation of 1.2) when a fixed computer connected to a projector is asked about the need. In this way, part of the teachers, still needing mobile technology in the classroom, also need a fixed computer and a projector. In addition, with an average of 2.37 (and a typical deviation of 1.2) the need for teachers to integrate a digital board is presented.

In relation to the classic computer rooms, the teachers express (with an average of 4.1 and a typical deviation of 1.1) that they do not require this type of classrooms since the technology must be available in the classroom when necessary.

On the other hand, in relation to devices related to the movement maker (3d printers, laser cutters ..) and robotics (arduino kits, bee bot, lego ...) teachers in general also agree, with an average of 3.9 and 3.92 respectively.

### 4 CONCLUSIONS

From seeing the perception that teachers have about how space should be when learning with technology, one of the most important conclusions is that the actions and policies that have been developed during the last 3 decades to improve learning from the integration of ICT has barely considered the environmental dimension and the organization of the school space. For example, the interactive whiteboard (PDI) was integrated as a substitute or complement to the traditional blackboard, without reflecting on the consequences of this decision. Programs such as one laptop x child were also proposed, without a reflection based on scientific evidence that this was the most appropriate model to improve learning and how the space was prepared to accommodate integrated technology.

Another conclusion derived from the results of the survey is that any process of technology integration must be coordinated with the environmental dimension, but also subject to the pedagogical didactic project in which these technologies will be used.

The teachers consider that it is necessary to reconfigure the classrooms and break with the traditional organization of the learning space. This result is aligned with the vision of some authors (Bautista and Borges, 2013, Oblinger and Lippincott, 2006, Byers, Hartnell-Young & Imms, 2018) that raise the need to design classrooms and new generation spaces that allow the combination of learning activities centered on inquiry and on an active vision of the student.

In addition, the results show that the classic computer classroom is not very necessary because the technology must be available in the classroom when necessary. In this sense, what teachers believe is necessary is that the Internet connection of the center allows students to access the Internet at any time and place. This need is highlighted by research such as Long and Ehrmann (2005), which point out that connectivity is one of the main elements that must guarantee the infrastructure of the learning space.

This finding reinforces the idea of some authors (Gros, 2010) that technology should be integrated into the environment and learning activities in an invisible way, without involving the protagonist element or conditioning the space. This also results in thinking that the most flexible technology is the most appropriate. It is probably not necessary to have a device for each student in the classroom (such as a tablet or computer for each child), if not simply a sufficient number to propose flexible learning activities and have an environment that can respond to any need and a varied approach to learning activities during the same session.

The availability of devices in the classrooms and the good connection can replace, according to most teachers, the classical computer classroom. Even so, the teachers surveyed do not have a clearly defined opinion about how the classrooms should be configured to integrate digital technologies. This is also shown by research such as that of Bautista and Borges (2013); Wall (2016) that express that there is no single model for the definition of a good learning space.
ACKNOWLEDGEMENTS

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REFERENCES


