

# Trends and Outcomes of the Innovative Physical Learning Spaces: an International Comparative Approach

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**Abstract:** This paper focuses on the first observations on trends regarding the innovative physical Learning Spaces in EU, North America, Oceania and Asia, and intend to compare the Japanese situation to the other territories. The Learning Spaces phenomenon represents a key transformation factor in Higher Education around the world, on the institution's IT and on the teaching and learning practices. Nevertheless, beside obvious similarities, interesting differences – some of them culturally related – are observed in the Learning Spaces strategy, design and uses from countries to other ones.

**Keywords:** Learning Spaces Design, Active Learning Classrooms, Learning Commons, BYOD, International Comparative Study

## 1. Introduction

During the last decade, the innovative physical Learning Spaces (usually shortened to “Learning Spaces”) have become a continuous increasing hot topic in Higher Education [1].

These spaces consist of formal and informal learning areas, presenting a mix between an innovative spatial organization and ICT equipment, seeking to allow innovative practices in teaching & learning (active learning, flipped classrooms, collaborative work, project based learning).

Although the first attempts of such Learning Spaces mainly consisted to Active Learning Classrooms, the trend then moved to larger and integrated spaces as the Learning Commons (Fig. 1) or the Learning Centers, most of them considered to be a new generation of University Libraries as they usually are located inside them or replacing them.



**Fig. 1 Kyoto University  
Central Library Learning Commons**

A Learning Spaces (Active Learning Classrooms, Learning Commons, Learning Centers) international comparative study has been launched in October 2016 through an international collaboration between several universities. This project aims to

study the Learning Spaces phenomenon through different angles: policies, trends, design principles, outcomes on teaching and learning practices, and more globally on campuses transformation. We have already investigated 40 institutions on four continents, and involved international associations and workgroups such as EDUCAUSE/ELI [2].

This paper presents the study framework, the criteria used, and the first results that have been collected through these 40 institutions in an international comparative approach.

## 2. Framework of the study

### 2.1 Range & Methodology

The study addresses a sample of institutions in four main territories: Europe, North America (USA and Canada), Asia (Japan, Singapore and Hong Kong) and Oceania (Australia and New Zealand).

We aim to make this sample as significant as possible, by including national and private universities, sciences focused and humanities focused ones, aiming diversity in their size, and located in various regions in each country. The selection of universities in the sample was also based on the existence or on the upcoming existence of Learning Spaces, integrated in an institution campus strategy. At the time of this paper's writing, the Japanese sample includes 20 universities already participating.

The methodology consists of collecting quantitative and qualitative materials through visits, interviews of stakeholders, managers, designers, faculties, and students, and observations on site using time lapse video recordings, and photo diaries.

We intend to use these data to identify similarities and differences among spaces designed for similar purposes, across the different territories and institutions. From the study of the spaces themselves and the uses/practices they effectively induce, we aim to conduct a reverse analysis first to highlight the design purposes, and the institution's strategy that was applied to this project. This is supposed to outline the conditions of the Learning Spaces success, and the potential of a large scale generalization.

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## 2.2 Study's criteria

The study itself is based on a list of ten major criteria. Those criteria have been chosen as they address the Learning Spaces not only on their physical point of view, but also on the induced (or not) practices. They also cover their genesis, their governance, their motivations and purposes, and their integration in the campus context.

- Terminology: What types or spaces are precisely defined by the terms Active Learning Classrooms, Learning Commons and Learning Centers? What are their key features and purposes?
- Layout and furnishing: What type of spatial organization and what type of furnishing (fixed, mobile, mixed) are chosen for the spaces?
- Integrated IT/ICT: What kind of IT/ICT equipment are installed in the Learning Spaces (large displays and video sharing systems, online reservation system or distance monitoring for instance)?
- BYOD compliancy: Are the Learning Spaces designed to be used in a BYOD configuration, and if so, are they a part of the institution's BYOD strategy?
- Location on the campus: Are the Active Learning Classrooms gathered in a centralized location? Is the Learning Commons located inside or outside the library?
- Governance of the project: How the Learning Spaces project has been integrated in the context of the campus, and in the institution's strategy? Is it an institution-wide or a local (school/faculty) initiative?
- Design and evaluation tools: Did the project team use design and evaluation tools during the design process, and in the Learnings Spaces operations?
- Community interactions: Are the uses of the Learning Spaces affected by the life style of the students?
- New services: In the case of Learning Commons and Learning Centers, what kind of new services are provided compared, for instance, to the former University Library?
- Teaching and Learning Practices: do the Learning Spaces have an impact on the faculties and students' practices?

The following chapters presents the main specificities and similarities observed across the different territories for some of those Learning Spaces features.

## 3. Layout & Services

### 3.1 Flexible/fixed furnishing

In almost all types of Learning Spaces, flexibility and collaboration appear to be the most basic features. Many authors and papers mentioned this flexibility as a key to the switch to an Active Learning configuration [3], and/or to promote collaborative work. The choice of furniture type and the layout design reflect those features, through two main types.

The first type of layout and furnishing is based on highly moveable furniture, providing a real flexibility in the organization of space, offering a lot of possible configurations.

Those furniture don't integrate any specific technology (power supply and video connection). Despite this flexibility, it appears in several examples from all territories that the users spontaneously don't change the configuration of the space. That's the reason why some institution provide maps to the users to show some examples of layout they can compose in the space.

The second type of layout and furnishing is based on fixed tables, usually designed to promote collaboration by proposing a design that allows all the participants of a group to see each other, and by providing specific features such as wired networking for specific purposes, power supply, and shareable displays (Fig. 2).



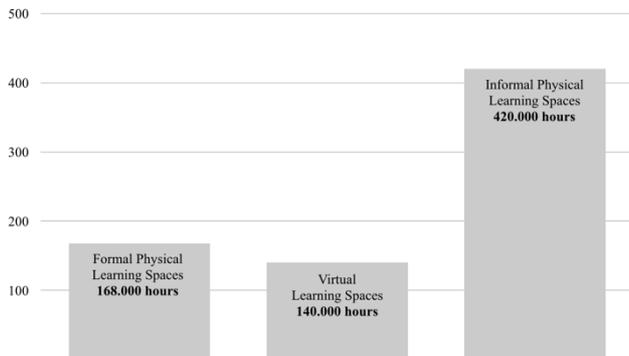
**Fig. 2 Paris Ile-de-France Digital University  
BYOD Faculty Development Active Learning Classroom  
In Paris 8 University library**

Both of those configurations (flexible and fixed) are almost systematically compliant with the BYOD (section 4.4) in all territories. In the case of a single stand-alone Active Learning Classroom design process, a choice had to be made between the flexible and the fixed configuration. Even if the flexible configuration is often representing the typical Active Learning Classroom, a significant number of the fixed configuration also exists, sometimes differently named. This second type of configuration keeps a significant popularity among students seeking for group work facilities in all territories. Overall, the mix between those two types of layout and furnishing is a reality in all territories. However, we notice a trend on the European and Japanese side to use a slightly bigger proportion of flexible configuration than North American and Australian side.

### 3.2 Informal spaces

The study has also shown very early a significant increasing of the informal physical Learning Spaces importance in all territories, especially when they are embedded in Learning Commons. The design of those informal spaces, due to their specific typology of use, is based on specific furnishing, reflecting the less formal interactions and the socialization they are supposed to promote (for example low height sofas or bar style counters). Usually located in a very accessible way (entry halls, central areas), totally open on the rest of the floor, they can also integrate displays and/or vending machines.

Illustrating their growing popularity, an Australian study shown that on a yearly base, a cohort of students spent three times more time in informal physical Learning Spaces than in the formal physical Learning Spaces and in virtual Learning Spaces [4] (Fig. 3).



**Fig. 3 Survey of time spent during one year by a cohort of student at University of Sydney in the different kinds of spaces**

Those informal areas are especially compliant with the BYOD. That's the reason why the type of furniture chosen for such areas are not only comfortable, but also integrate power plugs for many of them (Fig. 4)



**Fig. 4 University of Washington Informal Spaces in Odegaard Library 1F**

### 3.3 Zoning

In a larger integrated Learning Space such as a Learning Commons, the different types of spaces described above can and usually co-exist. Introducing the notion of zoning, in which different under categories of Learning Spaces, presenting different features for different kinds of practices, are existing in a single integrated structure, as functional units. In all territories, the zoning appears to be a key factor of the efficiency of a Learning Commons design, regardless of its size (Fig. 5).



**Fig. 5 Osaka International University Zoning in Learning Commons**

### 3.4 New services

Learning Commons and Learning Centers are often defined by the following fundamentals: facilities, contents, practices. Their design philosophy is systematically translated to new services compared to the eventual prior situation, for instance of a library. The most usual new services that are observed are listed below:

#### 3.4.1 Laptop & Tablet lending system / Charging stations

The BYOD trend can be completed by some devices lending service, usually installed in the library located Learning Commons. For those devices, as well as the users' owns, power remains as a very basic yet fundamental issue when having an intensive use in mobility. One day long autonomy is clearly not a reality for number of devices, making necessary to provide battery charging solutions, especially in the Learning Spaces where their use is potentially intensive. As mobile furniture typically use in flexible spaces don't allow to integrate power supply, such equipped Learning Spaces can have charging areas along a wall, or simply electrical racks lying on the ground. Fixed furniture, on their side, almost systematically integrate power plugs for the users.

#### 3.4.2 Specialized Workstations

An obvious consequence of the BYOD trend is the on-going removing of the fixed PCs. In almost all the Learning Spaces that have been visited in all territories, fixed PCs tend to disappear, also because of the furniture specificities (section 3.1). Nevertheless, in the Learning Commons and the Learning Centers, if large PCs areas free to use for the students are tending to be removed, some fixed PCs areas still remain on precise purposes. The installed machines installed in such areas present specific features, such as A/V producing workstations [5].

#### 3.4.3 Tech Support & Workshops

The conjunction between the BYOD and the Learning Spaces also introduces new modalities in terms of technical support and user assistance. Within the new types of services provided for

example in the Learning Commons, 1<sup>st</sup> level technical assistance desks or counters (previously provided at the IT department) appear to be one of the most popular and useful ones [6].

### 3.4.4 Teaching Assistance

In a huge majority of the visited Learning Commons and Learning Centers, a pedagogical support / teaching assistance counter is proposed on a daily or weekly basis [7]. Such service allows for example undergraduate students to get topical mentoring from graduate students, on site and face-to-face. Nevertheless, within a same territory, such kind of service can show very variable results, some of them by cultural specificities.

### 3.4.5 Group Work Areas

As collaboration is a core component of any Learning Spaces design, Group Work areas constitute a key feature, especially in the Learning Commons. In all territories, bookable (though a classical human counter or through an online tool) spaces are very popular among students. They are usually equipped with collaborative tables, shareable screens and writable surfaces. Physically, they can be closed (usually by glass walls) or separated by specific furniture (Fig. 6)



**Fig. 6 University of Melbourne  
Group work areas in School of Design Learning Commons**

### 3.4.6 Printing Labs & Fab Labs

As a supporting service for the academic and research activities, some Printing Labs can be observed in Learning Commons, allowing researchers for example to print scientific posters. In some cases, and especially in Learning Commons installed in specific schools, some genuine Fab Labs can be integrated, proposing for example 3D printing services.

### 3.4.7 Visualization Areas

Some Learning Commons and Learning Centers include specific features focused on large scale displays. Technically speaking, those areas are usually built around a grid of LCD displays or tiles. Those visualization areas open interesting pedagogic perspective, for example in data analyzing or large scale image processing [8], offering to the Learning Commons a

unique feature on the campus.

### 3.4.8 Presentation Areas

Several Learning Commons integrate areas focused on presentation and lectures, smaller than the classical lecture halls, and with different purposes. They are usually open on the rest of the Learning Commons to incite people to freely attend the lecture or presentation that are organized. These presentation areas are less formal than a usual academic lecture, and open to a wider audience. In Japan especially, those presentations areas can be permanent, then using a mini lecture hall style of furnishing (Fig. 7).



**Fig. 7 Soka University  
Presentation Area in SPACe**

### 3.4.9 A/V Production Studios

The MOOC trend, as well as the generalization of online rich contents, supported the emergence of A/V Production Studios, located for some of them in the Learning Commons and the Learning Centers. In Japan and in the US, especially, different types of video recording facilities can be observed in the Learning Commons, from simple “one button operation” ones allowing faculties to produce a commented video of a slideshow, to higher end ones, involving specific HR but providing sophisticated recording, editing and post production.

### 3.4.10 Relaxing Areas

In their usual zoning, the Learning Commons and the Learning Centers systematically integrate relaxing areas. Those versatile areas are very popular among the students as they usually are the only ones of this style on the campus. Important variations can be observed between the different territories, clearly culture-related, such areas being much more systematic in the US and Australia,

## 4. IT/ICT

The integrated IT/ICT presents huge variations. From high-tech to less technologically equipped ones, almost all the specter of Active Learning Classrooms and Learning Commons can be observed in all territories.

#### 4.1 Basic but fundamental needs

The BYOD (section 4.4). has very direct consequences on the Learning Spaces design, and on the top of them, the very basic, yet fundamental, question of the WiFi connectivity. Indeed, the BYOD type of devices (smartphones, tablets, laptops) makes an intensive use of wireless connectivity, and even more due to the generalization of cloud based software on the campuses. In several user surveys, very basic features such as an reliable and fast WiFi connectivity, as well as power plugs, systematically figure on the top of the wish list. The answer that the institution give to those needs clearly impacts the frequentation of the different spaces.

#### 4.2 Video sharing features

Beside the WiFi connectivity, the Learning Spaces ICT most popular feature consist to wired and/or wireless video sharing capabilities. That's especially true in the Active Learning Classrooms, where they offer interesting possibilities in terms of pedagogic dynamic. On the technical point of view, and due to the heterogeneity of systems and platforms inherent to the BYOD, these video sharing features often make necessary to use multiple systems in parallel. Wired and wireless connections have to comply with multiple types of video outputs and protocols on the devices, potentially requesting to multiply the types of receptors and connectors to be compliant with all of them.

In some examples, this challenge is addressed by the universities central IT by providing a list of features (including the type of wired/wireless connection system) suggested to the users before they buy their device.

#### 4.3 Low-tech trend & Analog/Digital mix

Usually, all types of Learning Spaces include a larger part (often the largest one on the campus) of embedded technology than the classical classrooms, lecture halls and libraries (section 4.2). However, in Japan and Europe, a trend of “low tech on purpose” may be observed in few spaces. Not only motivated by a cost cutting logic, this trend seeks to support a fully human collaboration, not especially enabled by a specific hardware and software technology. The term “humanware” has been introduced to illustrate this trend, which is however rarely observed in North America. Regarding this low-tech trend, it's necessary to mentioned that it doesn't present any correlation with the outcomes on the uses and on the practices. Some very interesting ones has been observed in facilities in which the technological equipment wasn't a priority.

More globally, the Learning Spaces all around the world tend to validate an Analog/Digital mix to best the best way to promote uses and practices. Analog writable surfaces, for instance, are an especially popular feature in almost all Learning Spaces, and often more than Digital SmartBoards. A zoning mixing high tech and low tech spaces can also be a very suitable answer.

#### 4.4 BYOD

The BYOD appears to be one of the most potentially impacting criteria in the Learning Spaces strategy and design, with numerous connections to the other ones. Integrating the BYOD concept in a Learning Space design process, whatever could be its kind, has very direct consequences on layout and furnishing (especially because of mobile device compliant furnishing an spatial organization), on the integrated IT/ICT level (regarding wired and wireless network and video connectivity, and above that a BYOD compliant IT infrastructure), on the governance of the project (if the BYOD and Learning Spaces are jointly included in the institution strategy), on the new services (especially established to comply and complete the users devices: for instance technical help desk) and of course on the Teaching and Learning Practices (by involving more interactions between the teacher and the students through digital tools and contents).

This first step of the study confirmed a fundamental assertion: Learning Spaces AND BYOD are – together - more than a temporary trend. In all territories, they clearly move in synergy, promoting (and sometimes justifying) each other.

##### 4.4.1 Types of BYOD

The Japanese part of the study immediately shown a quite unique situation, by making a difference between a PC based BYOD, introducing the BYOPC concept, and a generic BYOD. Indeed, the smartphone – and not the laptop or the tablet – is clearly identified as the primary device for Japanese students. And even if the laptop or tablet equipment rate is equal to the European and North American ones, the Japanese students habits consist to bring only the smartphone on the campus. That's why some Japanese universities, which initiated western BYOD-like policies, introduced the BYOPC concept [9] as their challenge is to create a physical and digital learning environment that would motivate the students to finally bring not only their smartphone, but also their laptop or tablet on the campus instead of using the institution's fixed PCs.

In Europe and in North America, the use of the acronym BYOD is clearly connected to laptops and tablets, and not to smartphones. Meaning that a BYOD compliant Learning Space design is focused on the use of user's laptops and tablets in the space, through the features previously described (sections 3 & 4).

##### 4.4.2 Institutional context of the BYOD

In Japan, and regarding the cultural practices of the students described in the chapter 4.1, the switching from the current smartphone-based BYOD to BYOPC appears to be an institution initiative, rather than a spontaneous user trend. Practically speaking, and in significant examples [10], those institutions initiatives are cloud based applications servers allowing users to access a selection of software regardless the type of their device (laptop, tablet), most of the cases through a Virtual Desktop Infrastructure (VDI).

In Europe, the situation is quite opposite, as the move has been initiated by the end users. The BYOD was indeed a reality before such applications/software delivery infrastructures. One of the major European specificities was the French government leded

“Student Laptop Program” [11] run from 2005 to 2009 by the French Ministry of Higher Education and Research. This program consisted of specific hardware/software/services offers directly and nationally negotiated with the laptop manufacturers, software editors and services providers. These offers were combined with call for proposals and financial incentives towards universities to support this upcoming BYOD. At a time when the average price of a laptop was significantly higher than today, this program helped to rise the equipment rate to 90% before the 2010’s. Culturally speaking, it appears that the European students strongly intend to make profits of their investment into a laptop by systematically bringing it on the campus for their daily learning (and not) activities. Regarding a BYOD supporting cloud based initiative, a wide range Proof of Concept of a regional and mutualized Higher Education cloud infrastructure has been run by the Paris Ile-de-France Digital University from 2012 to 2015 [12].

US universities also integrated the BYOD quite early, as the students’ equipment is supported by an almost systematic presence of a university store/coop on the campus, proposing negotiated hardware and software offers. As the typical way of life of the students in the US is to live on the campus itself, the BYOD is virtually a non-question: the personal equipment is already on the campus with its owner. There isn’t any issue related to transportation from home to the campus. Visiting the US universities clearly confirm this: almost all the students spent their entire day with their own laptop, in the lecture halls, the classrooms, the libraries, in the informal spaces and outside.

Consequently, in Europe as in USA, PC lending service in the Learning Commons aren’t as much important as in Japan, except for the tablets and for digital accessories for specific purposes.

## 5. Governance & location on the campus

### 5.1 Institutional opportunity

The motivations that lead an institution to launch Learning Spaces projects, whatever could be their perimeter and their ambitions, present significant differences between the territories. Those differences appear to be connected to the national Higher Education context and policy. For instance, a large majority of the Japanese Learning Spaces establishment has clearly followed two major nationwide policies from the MEXT: a recommendation to promote Active Learning in 2009, and the universities’ buildings structure anti-seismic strengthening operations that have been funded from 2011 right after the Tohoku earthquake. Beside, highly competitive Higher Education systems such as the Japanese and US ones tend to use the existing or upcoming Learning Spaces as an attracting feature to enroll students.

### 5.2 Governance

The matter of the governance related to Learning Spaces is obviously connected to their locations on the campus.

A centralized configuration usually reflects an institution-wide strategy, that can show different motivations: visibility in a competitive Higher Education environment, will to promote innovation in the students experience, or more basically taking

the opportunity of a renovation to move from a traditional layout to a Learning Spaces configuration. This is particularly the case for libraries partially or completely moving to a Learning Commons, involving or course important changes in terms of organization and HR due to the new services that can be integrated in it (section 3.4). Few very large scale initiatives are observed as campus wide project, involving most of the campus facilities, and led as the highest strategic level of the institution [13]. They logically reflect high ambitions regarding the students experience and the institution’s visibility.

On the other side, more local initiatives, by definition decentralized, of course less ambitious on the size matter, are still observed, most of the times under the form of Active Learning Classrooms. They sometimes constitute an experimentation that can inspire wider institution-wide projects, even if their limited visibility requests specific communication to make aware a wider audience than the natural local users.

On all territories, both institution-wide and local initiatives can still be observed, even though the institution-wide configuration part is clearly and logically increasing since several years, showing how important the Learning Spaces became in the institution campus strategies.

### 5.3 Location on the campus

The location of the different types of innovative physical Learning Spaces appears to reflect the existing – or not – campus strategy of the institution, as well as the eventual evolution process the libraries could be involved in.

#### 5.3.1 Active Learning Classrooms

The Active Learning Classrooms locations are various, and can be divided in two categories, whatever the observed territories.

First, the decentralized Active Learning Classrooms, installed in schools, and usually dedicated to the one they belong to. In that case, and beside the generic ones, some specialized Active Learning Classrooms (geology, chemistry [14]) are appearing in few recent initiatives. They mix a usual Learning Spaces based layout, with specific furniture adapted to the purposes of the discipline.

On the other side, the centralized Active Learning Classrooms, usually installed inside integrated spaces such as Learning Centers and Learning Commons, themselves located in a central position in the campus (section 5.3.2), usually in libraries. Such centralized configuration usually reflects diverse motivations: to promote innovation in the libraries, to take advantage of their usual central locations and – often mentioned –, to take advantage of their neutrality in the campus.

No significant differences regarding the repartition between those two categories are observed between the different territories. Beside, a mixed situation can be observed: generic and centralized Active Learning Classrooms located in the Learning Commons, and specialized decentralized ones in the different schools.

### 5.3.2 Learning Commons

The matter of the Learning Commons location on the campus, can be divided in two similar categories as well.

The decentralized Learning Commons, also installed within the schools, are usually smaller, and mainly designed around collaborative purposes only. They usually reflect a school based strategy rather than a campus-wide one (section 5.2)

The centralized Learning Commons are mainly installed inside the libraries. It has to be noticed that a library located Learning Commons can present different configurations: the Learning Commons entirely replaced the former library, or the Learning Commons is hosted inside the library (which keep its former layout beside). In Japan, the overall proportion of such configurations inside libraries compare to a location outside the libraries is usually measured at approximately 80% [15], similar as other territories

### 5.4 Number of facilities and capacity

The Active Learning Classrooms' number on a campus clearly appears to be a key factor to move from an experimental situation to a generalization. Regardless of the territories, multiple examples of well designed Active Learning Classrooms can be observed, that can't reach the step of a generalization as they can't host regular weekly classes. This generalization challenge is not only connected to the practices (see 7.1), but clearly also to their capacity to face a huge number of classes and students. As Active Learning basic principles tend to avoid to large number of students in a same classrooms, the Active Learning Classrooms need to be multiplied.

## 6. Design and Evaluation Tools

Becoming a strategic, financial and operational matter, the Learning Spaces and their trend highlighted the necessity of design and evaluation tools, able not only to provide good practices and guidelines for the upcoming projects, but also to assess the efficiency and the quality of the existing ones.

Measuring the efficiency and/or the quality of an object as a Learning Space brings the natural question of what defines this efficiency and/or this quality: the furnishing ? the embedded ICT ? the integration in a campus strategy ? the transformations induced on the teaching & learning practices ?

### 6.1 EDUCAUSE Learning Spaces Rating System (LSRS)

The first, and still major initiative up today is the Learning Spaces Rating System [16], initiated and developed by the EDUCAUSE Learning Spaces Constituent Group. The LSRS V1 has been published in 2014 in its original English version (French translation/adaptation in 2017, Japanese translation in 2017).

The LSRS V1 provides a set of 48 criteria for pre-occupation evaluation, organized in 6 sections and covering all the matters involved in a Learning Spaces project. Meaning not only the material aspects (layout and furnishing, ICT) but also the strategical (integration in the campus strategy) and operational (support, training) ones. Overall, the LSRS definitely shows an increasing popularity, that has however to be confirmed beyond

the North American borders. Nevertheless, it clearly represents today the reference for evaluation and assessment of the Learning Spaces.

### 6.2 Flexible Learning Environments eXchange (FLEXspace)

Beside the LSRS described above, FLEXspace [17] is a second and complementary tool, more focused on the post-occupation assessment. Initiated in 2012, FLEXspace is an online open access repository of various types of various and existing Learning Spaces, gathering almost 700 records, accessed by 2000 users from 35 countries. FLEXspace provides technical, spatial, technological, organizational, financial data, high definition photos, and examples of practices that can occur in the described space. Even though its popularity is continuously growing, FLEXspace – as the LSRS described above – needs to gain visibility beyond Canadian and USA borders.

## 7. Teaching & Learning Practices

### 7.1 Faculty Development

The main challenge of the Learning Spaces remains of course the evolution for the students' experiences, and especially of the Teaching & Learning Practices. Especially in the Active Learning Classrooms, that present a strong pedagogic focus, which also requests the teachers to modify their practice to have a real translation from material features to a pedagogic reality. Meaning that in the most successful experiences that have been observed, a genuine Faculty Development initiative exists in synergy with the Learning Space itself. This type of proceedings finds especially its relevancy in centralized institution-wide Learning Spaces strategy. US Universities, in particular, present interesting initiatives in this matter [18]. But this evolution of the Teaching and Learning Practices also highlights again the issue of the evaluation, whose modality regarding this precise topic remains necessary to precise in a qualitative approach (for instance in complementarity with the quantitative approach applied to study an Active Learning Classroom use).

### 7.2 New Generation Digital Learning Environment (NGDLE)

The Learning Spaces and the BYOD trends constitutes by essence a kind of physical counterpart to the Virtual Learning Environments, totally able to work in synergy with them thanks to their collaboration features. In that sense, New Generation Digital Learning Environment (NGDLE), for instance, could get a significant benefice of those evolutions. In all territories, practices involving Physical Learning Spaces associated to NGDLE for universities which implemented some are showing very interesting results in terms of innovation in the Teaching and Learning practices, thanks to the features and the opportunities that such a synergy can provide. A generalization of such innovative practices is obviously a key to the adoption of the Learning Spaces, to a real impact on the students experience and to a measurable transformation on the campuses.

## 8. Concluding Remarks

### 8.1 Cultural impact & globalized trends

Looking back to the Learning Spaces design principles, it appears that the physical aspects (embedded technology, layout and furnishing) don't really tend to homogenize, still reflecting some of their respective territories' cultural aspects. For instance, Japanese Learning Spaces, in their core design, apply the same space optimization process than usually applied in any other construction. North American Learning Spaces, on their side, involve more systematically an important amount of embedded technology. Globally, the same types of purposes can be translated in quite different material realities, without a genuine universal recipe.

Nevertheless, and despite those territories differences, Learning Spaces' basics in design remain the same. Also because the material aspects don't make a significant difference in terms of uses and practices from a country to another. The evolution of the battery capacity, for example, will identically impact the necessity – or not – to provide power slots in all territories' Learning Spaces. As well as the evolution of the furnishing, that is globalized.

### 8.2 Strategic challenges

Strategically speaking, the decision process, the involvement of stakeholders and faculties, and the integration in a global campus strategy definitely appear to be the keys to move from a local – yet interesting – project for example run by a team of faculties, to a real game changer for the institution. Likely, a real evolution of the practices in such new spaces in deeply connected to a strategic pedagogical vision and to a Faculty Development initiative that is obviously necessary in such a context. And so, at least as much as any material feature or specificity. The next steps of this study will especially try to identify those success factors, and their potential of transposition between countries.

The interpretation of those similarities and those differences also invites to go beyond the border of our campuses. The uses of the Learning Spaces are feed not only by the cultural aspects of each territories, but also by the trends of their respective societies facing the digital evolutions.

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