Rethinking 21st century schools: the quest for lifelong learning ecosystems

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Abstract

The relevance of current education towards the needs of 21st century society is questioned as most schools, especially in developing countries that offer their students homogenizing learning experiences in the 19th century style. This paper presents the results of a mixed-method study focused on identifying the main features of 21st century education as a concept that should promote lifelong learning experiences. The method combined a systematic literature review, survey application, visits to innovative schools and interviews with international educational experts. Results show the relevance of a soft skills-centered and purpose-oriented curricula, the activation of personal learning paths and the minimization of instruction in favor of research as a teaching approach. It is noteworthy that, although most of the results are widely discussed in the literature, they are currently presented with new possibilities of implementation and with a greater innovation potential, due to the technological evolution of our time.

Keywords: 21st century education. Personal learning paths. Educational research. Lifelong learning. Learning ecosystems.

1 Introduction

Crises in education are recurrent; in fact, during the past two centuries, several waves of educational reforms have cyclically reshaped educational policies both

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in Europe and in America (MCCULLOCH, 2011). Although the current crisis is multi-causal (GREENE; MANNER, 2016; HURSH, 2016; WOOD, 2011), there is a general perception that education is somehow lagging behind the information economy because it relies on a "factory model" of the "industrial era" (EVANS, 2018). This model has been developed based on standardization, where individuals with different talents are received and taught and assessed in the same way, considering that everyone should learn the same, at the same time, and with those who share a poorly relevant characteristic to their learning: their year of birth or the beginning date of their studies (ROBINSON; ARONICA, 2015).

Regarding this, many voices have been raised calling for a model in which the differences of individuals, not standards, become the principles of reference for the educational system (NODDINGS, 2013; REBER; CANNING; HARACKIEWICZ, 2018). In this context, a rapidly evolving and technology-saturated world brings forth the notion that a traditional curriculum is not enough or is not 21st century-relevant (HIGGINS, 2014). In this regard, it is possible to recognize some symptoms of educational change, above all, from the integration of Information and Communication Technologies (ICT), especially from the use of the internet. In this sense, despite the emergence of transformative educational modalities such as e-learning, m-learning, MOOC, among others who offered the promise of personalizing learning (GYNTHER, 2016; HAMILTON, 2011), many of the structural aspects of education remain immovable within the homogenizing paradigm of the current traditional educational system. In fact, many things in today's classrooms are quite similar to classrooms from a couple of centuries ago, in spite of the characteristics of some resources and devices that converge in learning environments. However, structural issues related to curriculum, teaching and evaluation are painfully similar.

Due to the above, 21st century education has become a topic of interest both to scholars and researchers for more than two decades. Figure 1 shows the research related to 21st century education published in peer reviewed journals indexed in Scopus.

Despite the increasing production of literature on this subject, very few concepts or key ideas stand out as representative of the way education should be conducted in a century characterized by uncertainty, constant change, ambiguity, and extensive technological mediation and globalization (SCHLEICHER, 2012). Moreover, very few of these key ideas are clearly materialized in the daily lives of most

Figure 1 - 21st century education research on Scopus
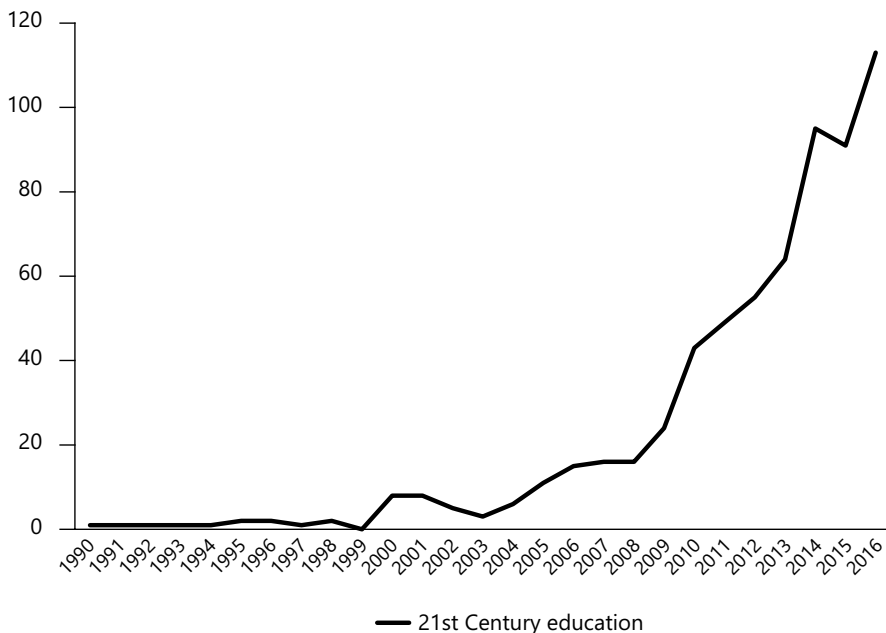
Source: Own elaboration based on Scopus data (2018)

schools around the world. The case of Latin American schools is particularly concerning, as students find themselves constrained by educational institutions that tend to perpetuate not only 18th century educational models buy with very few technological resources (OLIVEIRA, 2018).

According to David (2015) and Osborne (2017), never have job prospects for the future been so uncertain and changing. This implies that people must face lives where they will very likely have to redefine themselves professionally several times (FREY, 2014; REDECKER *et al.*, 2011) which places lifelong learning as an extremely important concept for 21st century education.

For educational researchers, especially in the Latin American context, this situation has brought about the need for a study to identify the concrete elements 21st century schools should have, so that policy makers, teachers, and other stakeholders may undertake the transformations required to make 21st century schools capable of providing truly lifelong learning experiences for current and future generations.

2   Method

With the previous considerations in mind, this study focused on identifying those key ideas that characterize 21st century education; that is, the structural elements of a school able to cope coherently with the educational requirements of this century. For this purpose, a mixed-method approach was conducted, combining a literature review with surveys, visits, and interviews with various educational stakeholders including educational experts (teachers, school managers and researchers), students, and parents.

Dalziel and Dobozy (2016) present the term "educational expert" and refer to it as the ability of a researcher or a practitioner to adequately manage information related to Learning Design processes and indicate that "an educational expert is more able to infer the background pedagogy of Learning Design than a novice, because novice educators may need additional descriptive information to accompany Learning Design before they fully understand its goals". Due to the experience of the experts consulted, their answers have a special relevance in terms of what a 21st-century school should be.

According to the perspective of Moraes and Kalnin (2018), Yin (2006) states that "Using mixed methods within the confines of a single study can simultaneously broaden and strengthen the study" (p. 41). Johnson and Onwuegbuzie (2004) contend that mixed-methods research makes use of the pragmatic method, uses induction, deduction, and abduction, legitimizes the use of multiple approaches, is expansive, creative, inclusive, and complementary, and suggests researchers take an eclectic approach. These researchers define the approach as "the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study" (p. 17) Thus, the current study seeks to use different approaches, methods, and instruments, to explore the characteristics of a relevant 21st century education using a sequential design as Hanson *et al.* (2005) propose, in which:

> quantitative and qualitative data are collected and analyzed at the same time. Priority is usually equal and given to both forms of data. Data analysis is usually separate, and integration usually occurs at the data interpretation stage. Interpretation typically involves discussing the extent to which the data triangulate or converge. These designs are useful for attempting to confirm, cross-validate, and corroborate study findings (p. 229).

The methodological development of this study was conducted through three processes of inquiry that were advanced in parallel, as shown in Figure 2.

Figure 2 - Research data workflow
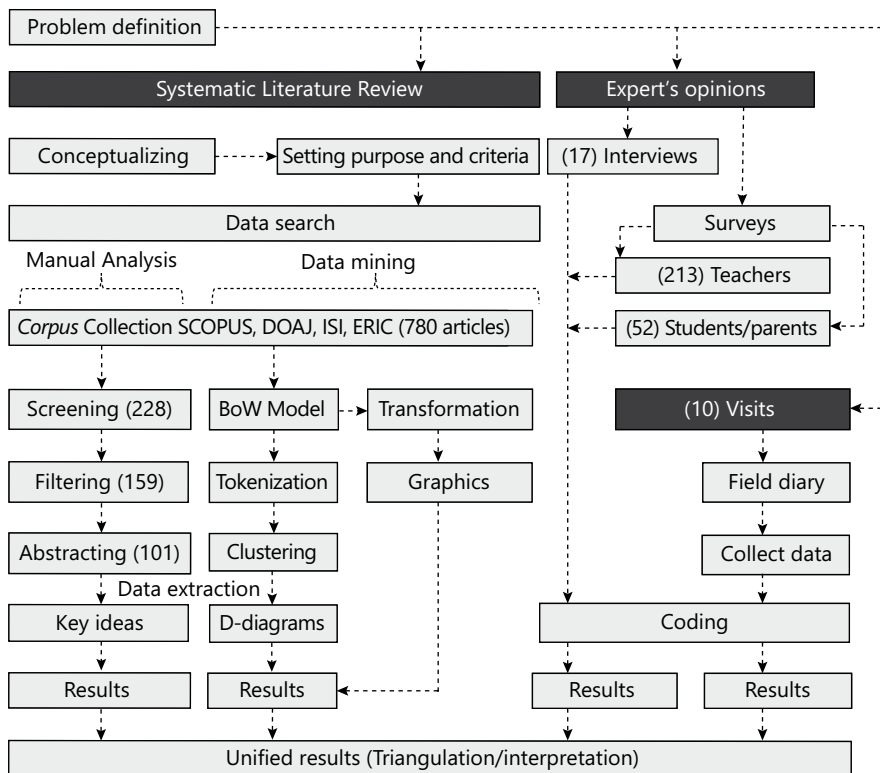
Source: Own elaboration (2018)

2.1 Sampling

Because the methodological design combined several complementary processes, each of them had a different type of sampling adapted to their nature. In relation to the systematic literature review, the final set of documents analyzed (n = 101) was formed based on a first search of documents (n = 780) in the selected peer-reviewed journal databases. From there, three processes of screening, filtering and abstracting were conducted, which, according to Gough, Oliver and Thomas (2012), constitutes a sampling of documents that follows a method of filtering by application of inclusion/exclusion criteria.

On the other hand, the collection of expert opinions and visits was conducted in an intentional non-probabilistic sampling (ONWUEGBUZIE; COLLINS, 2007) and included semi-structured interviews (n = 17), application of online

surveys to teachers of different educational levels (n = 213) and to a group of parents and newly graduated students (n = 52). Finally, 10 visits were made to educational institutions at both preschool, primary and higher education levels, as well as to some units involved in governmental educational management and educational research.

2.2   Systematic literature review and categories of analysis

The literature review was conducted with the purpose of identifying the main ideas associated with 21st century education to relate those key ideas to current school conceptions and reality. An initial search was carried out in four major peer reviewed journal databases (Scopus, ISI, Doaj, and Eric) producing a corpus of 780 research documents. A first screening process for relevance and topic correspondence left a corpus of 228 articles. Then, re-filtering by date of publication and excluding those published before 2,010 reduced them to 159 articles. Finally, an abstract revision process based on previously established inclusion and exclusion criteria produced a final set of 101 articles for in-depth reading, data extraction, and text mining.

The general characteristics of each study and the main key ideas associated to "21st century education" were established through an in-depth reading process. Once the reading process was completed, the key ideas were compared, standardized, unified, and categorized for a subsequent process of analysis and interpretation.

A thorough analysis of frequencies and co-occurrences revealed the most prominent concepts within the global set of results. The interpretation of the results was generated in accordance with the guiding questions of the review and a more qualitative process was carried out based on the comparison of text segments extracted from the selected articles.

As a first process, the literature review served to establish the central categories on which the object of the investigation would be analyzed later: skills, curriculum, emotions, technology, spiritual dimension, teaching, school management and institutional culture.

2.3   Collecting Expert opinions

To complement the systematic literature review, a process was carried out to identify expert opinions of the main educational stakeholders, which was achieved through the application of surveys, interviews, and visits to innovative educational institutions.

2.3.1 Teachers, students, and parents' surveys

A survey was carried out to obtain text data from educational experts. A freely shared Google Forms® questionnaire was published with a single open-ended question: *In your opinion, what should a 21st-century school be like?*

According to Turner III (2010), the use of open-ended questions is very useful and pertinent for educational research, especially for exploratory studies, since they provide answers from different angles by requiring a greater imaginative effort on the part of those who answer the questionnaires.

A total of 213 answers from teachers was collected mostly from practitioners and educational researchers belonging to academic networks with an internet presence, from a wide variety of educational levels as follows: preschool (n = 7; 3.29%), primary (n = 31; 14.55%), secondary (n = 97; 45.54%), undergraduate (n = 32; 15.02%), graduate (n = 18; 8.45%), and others (n = 28; 13.15%), mainly integrated by corporate, vocational, and informal educators. In addition, 52 responses were collected from students and parents. The surveys were kept open for a period of 8 weeks to delimit the amount of responses from both educational experts and parents and students linked to academic networks.

A thematic analysis was carried out, in which all the answers were initially coded by one researcher according to the central categories previously established; later, two other team members separately reviewed the results by tagging agreement and disagreement. Their reviews were used to measure inter-coder agreement via Cohen's Kappa coefficient, which results on K = 0.671 on 535 items, which according to McHugh (2012) provides an acceptable reliability level on data extraction and categorization.

As with all the other textual data retrieved, a text mining process was carried out to triangulate human and computational results. Preprocessing of text data started by cleaning the undesired elements out and analyzing the remaining data using Natural Language Processing techniques. Any such technique requires using basic language units or tokens for analysis: those could be characters, words, or groups of words (FELDMAN; SANGER, 2008); for this case, this process was 1-gram tokenization. Experts' survey responses were tokenized using an iterative approach that systematically replaced the various inflexions of a word with its basic form – lemmatization – using Wheaton College's Lexos software (DROUT *et al.*, 2016). For such a short *corpus* – 4,539 terms that yielded 303 distinct terms –, iterative lemmatization provided an advantage over an initial stemming performed using R's {tm} and {SnowballC} packages.

2.3.2 Interviews and visits to innovative schools

In addition to the surveys, unstructured interviews were conducted (n = 17) with educational experts by applying the same open-ended question, to identify the practical and conceptual elements that these experts had with respect to the 21st century school. In addition, 11 visits to innovative school institutions of various educational levels were carried out. The interviews with experts and visits were selected considering their recognition in the national and international educational field and their mention in the reviewed literature[1]. The origin of this sampling was Latin America (Colombia-Mexico) (64.29%), US (7.14%) and Europe (Finland) (28.57%).

The general information from both the visits and interviewed experts is shown in Table 1.

Table 1 - Characterization of interviewed experts

Expert's position	%
Principal	25.0%
Founder	7.1%
Head of department	7.1%
Director	21.4%
Former head/director	10.7%
Professor-researcher	14.3%
Consultant	3.6%
President	3.6%
Tutor	3.6%
Program coordinator	3.6%
Level expert works at	**%**
Kindergarten	3.8%
Primary-Secondary	26.9%
Higher Education	50.0%
Government	11.5%
Other	7.7%
Countries visited	**%**
Colombia	60.7%
USA	7.1%
Finland	28.6%
Mexico	3.6%

Source: Own elaboration (2018)

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[1] Due to the commitment of data protection and privacy of the identity of the participants, it is not possible to indicate the names of the experts interviewed or the educational institutions visited. This information may be shared after the article is published by direct request to the researchers.

3   Results

The compared results of the literature review and the expert surveys were grouped into the central categories as shown in Table 2. Also, comparison of key ideas between parents and students are shown in Table 3.

Table 2 - Relative frequency comparison for categories in literature and surveys

Categories	Literature	Surveys
Skills	38.0%	14.5%
Curriculum	23.6%	30.1%
Emotions	10.6%	8.9%
Technology	16.8%	19.9%
Teaching/pedagogy	16.3%	16.7%
School management	4.8%	3.4%
Spiritual dimension	3.8%	5.8%
Institutional culture	30.3%	55.4%

Source: Own elaboration (2018)

Table 3 - Relative frequency comparison for key ideas between parents and students

Key Idea	Category	Frequency - parents	Frequency - students
Personal learning paths	Curriculum	41.20%	58.80%
Education in values	Spiritual dimension	64.30%	35.70%
Use of ICT	Technology	23.10%	76.90%
Integral formation	Teaching/pedagogy	81.80%	18.20%
Teaching excellence	Institutional culture	57.10%	42,90%
Student autonomy	Skills	20.00%	80.00%
Social awareness	Emotions	40.00%	60.00%
Multilingualism	Skills	60.00%	40.00%
4Cs skills	Skills	60.00%	40.00%
School-family integration	Institutional culture	100.00%	0.00%

Source: Own elaboration (2018)

The results are presented below for each central category of the study. The data in brackets correspond first to those extracted from the literature review and then to those from the surveys.

3.1   Results related to skills

Mahoney *et al.* (2012) highlight the importance of skill development and state that these skills and talents are quite different from what they were in previous generations.

In the literature review and in the surveys, the ideas with high frequencies related to the "Skills" category were: "4C" skills – Communication, Creativity, Critical thinking and Collaboration (Romero *et al.*, 2015) – (n = 105; 50.6% - n = 138; 34.0%), digital information literacy (n = 53; 25.3% - n = 10; 1.9%), autonomy (n = 19; 8.9% - n = 88; 16.0%), problem solving (n = 13; 6.3% - n = 6; 1.0%), metacognitive skills (n = 11; 5.1% - n = 0; 0.0%), Design thinking (n = 5; 2.5% - n = 0; 0.0%), traditional literacies (n = 3; 1.3% - n = 0; 0.0%) and thinking development (n = 0; 0.0% - n = 38; 6.8%).

The development of skills that allows a student to perform adequately in a changing, uncertain, highly globalized and interconnected context is one of those issues that stand out from others when reference is made to 21st century education.

An adequate ecosystem in which lifelong learning is encouraged should allow students to learn what they need right when they need it, and for this they will need to develop skills focused mainly on autonomy, collaboration and creativity. The traditional educational system does not facilitate the development of such skills since its dynamics is based on achieving predetermined learning, equal for all, strictly following the recommendations of the system: what to learn, when to learn it and where to do it.

Lichtman (2014) states that "Great education *is* an ecosystem" (p. 224). He points out how natural ecosystems evolve in response to natural environments and relates that to the way schools must prepare students for a rapidly changing world. In this scenario, schools and students should regenerate "around the paradigm of self-evolution" (p. 223) in order to develop strategies for adaptation. This idea of "self-evolution" is closely associated to lifelong learning. Heinrich, Battacharya, & Rayuda (2007) state that the challenges of contemporary society such as the increased use of technology, globalization, and changing roles in the work place, require "lifelong learning skills, meaning the ability to solve problems, work both independently and in a team, communicate effectively in all formats and on all levels, and self-direct one's learning and professional development needs" (p. 653).

3.2   Results related to curriculum

Considering the multiple definitions and components of the concept "curriculum", it seems reasonable to expect that there were many references in the reviewed articles that were related to the term. As can be seen in the following discussion, those found in the literature refer to a conception of curriculum aligned with the definition posited by Moye (2019) as "a multidimensional, dynamic, and causal component of the instructional system" and "the collection of learning experiences in a prescribed instructional unit of study, leading to a defined outcome". Rather than a specific outline of courses, the literature referred to a richer, broader, more flexible, and diverse notion of curriculum.

In this category, the highest-frequency ideas both in the literature review and the surveys were: STEM (n = 42; 20.4% - n = 22; 3.9%) for Sciences, Technology, Engineering and Mathematics (Drew, 2015), social responsiveness (n = 30; 14.3% - n = 67; 12.1%), multiculturality and inclusion (n = 25; 12.2% - n = 59; 10.7%), transdisciplinary curriculum (n = 21; 10.2% - n = 6; 1.0%), personalized learning experiences (n = 13; 6.1% - n = 102; 18.4%), multilingualism (n = 13; 6.1% - n = 27; 4.9%) and transmedia storytelling, international quality standards and student-oriented curriculum (n = 9; 4.1% - n = 3; 0.5%). With less than 2%, we found: formative assessment, link to university, high performance on standardized exams, curricular flexibility, no homework and reducing the number of courses.

The development of the aforementioned skills would not be possible if the school persists in deploying a unified and predetermined curriculum for all students, who are forced to address it at the same time, often without recognizing its importance or relevance to their own development. In that sense, and according to what Guettat and Farhat (2013) mention, lifelong learning requires access to content and experts at the time they are needed and with topics oriented to the needs of the personal learning process.

One of the most relevant curricular characteristics of an ecosystem for lifelong learning is undoubtedly the construction of personal learning paths. To do this, it is necessary to get rid of the paradigm of the *unified curriculum* and recognize that not all students should learn the same, at the same time, and in the same way. Therefore, not everyone should be assessed in the same way, with the same scales and indicators. In that sense, establishing personal learning objectives articulated to the learning objectives for a whole cohort of students is one of the great challenges of an ecosystem for lifelong learning.

3.3   Results related to emotions

According to Zins *et al.* (2004, p. 3), Social and Emotional Learning (SEL) plays "a critical role in improving children's academic performance" […] and "includes characteristics that need to be developed for success not only in school, but also in life, such as learning to recognize and manage emotions, care about others, make decisions, behave ethically and responsibly, develop positive behaviors, and avoid negative behaviors".

The key ideas associated with the "Emotions" category in both the literature review and the surveys were, by frequency: global awareness (n = 57; 27.3% - n = 54; 9.7%), digital citizenship (n = 57; 27.3% - n = 3; 0.5%), resilience (n = 9; 4.5% - n = 0; 0.0%), high productivity (n = 9; 4.5% - n = 0; 0.0%), health promotion (n = 9; 4.5% - n = 0; 0.0%) and emotions development (n = 0; 0.0% - n = 8; 1.5%).

A 21st century student must be a citizen of the world (TOMEI, 2013). The flexibility of lifelong learning should be taken beyond the topics of learning or the management of time and space to learn. A 21st century learner should be able to cross the boundaries that formal and traditional educational offer, and find and participate in global learning spaces in which they can interact with people of different backgrounds, levels of expertise and knowledge. A lifelong learner should be able to move with freedom and confidence in digital and open learning environments, which go beyond the borders of a particular country and enable the development of a broad perspective of the world and its possibilities. In this regard, interview 12 mentions that:

> I think it is important to go deeply into issues instead of having generalized information and decidedly starting with questions and not answers to problems that are often not even identified well. […] Curiosity, astonishment, fascination for all things must prevail. The authentic question empowers and brings people together to find convincing solutions. Automatically, knowledge becomes more rigorous, precise and, curiously, kind [extract int-12].

3.4   Results related to ICT

According to Dede (2011, p. 1) "Emerging technologies are enabling ubiquitous learning. This can empower a structural change away from classrooms as the primary place of learning, the school day as the primary educational time, and the teacher as the primary source of information". Regarding the "Technology" category, the ideas with higher frequencies, both for the literature review and

the surveys, were: use of ICT (n = 101; 48.6% - n = 295; 53.4%), multimodal learning (n = 59; 28.6% - n = 0; 0.0%), m-learning (n = 30; 14.3% - n = 0; 0.0%) and videogames (n = 18; 8.6% - n = 0; 0.0%).

A lifelong learning ecosystem cannot be developed without the proper support of ICT, which may seem quite obvious. However, in the interviews there is an aspect of the use of ICT that does not appear in the results of the surveys but that acquires a special relevance in the specialized literature: learning analytics. Although the use of mobile devices is shown as one of the most relevant results in terms of support for lifelong learning, the analysis of large amounts of educational data at the service of teaching and continuous learning seems to be one of the topics with the greatest projection in the near future in this matter. In this regard, interviews 2 and 8 indicate:

> The use of mobile phones or tablets is very common in the classrooms of 21st century schools. However, it is not always well known how to use them and this has negative consequences in terms of problems of distraction and discipline in class. But on the other hand, continuous learning is strengthened by the use of this type of technological devices enabling students to learn outside the boundaries of the classroom [extract int-2].

> The use of ICT is necessary to implement learning analytics processes, which is increasingly linked to education in the 21st century. Making educational decisions at all levels without adequate and sufficient information almost always results in inefficient results or very little innovation [extract int-8].

3.5 Results related to teaching

Teaching and pedagogy have evolved significantly since the beginning of the last century. Many approaches share similar characteristics in terms of being student-centered, active, creating cognitive dissonance to promote understanding, engaging students in problem solving, requiring higher-order thinking skills, and fostering interactions. Slavich and Zimbardo (2012) have named these types of teaching as transformational teaching, that is "the expressed or unexpressed goal to increase students' mastery of key course concepts while transforming their learning-related attitudes, values, beliefs, and skills".

For the category of "Teaching/Pedagogy", the key ideas with higher frequencies, both for literature review and surveys, were: research-based learning (n = 49;

23.5% - n = 97; 17.5%), transdisciplinary teaching (n = 31; 14.7% - n = 6; 1.0%), teaching using mobile devices (n = 31; 14,7% - n = 0; 0.0%), transformative teaching (n = 31; 14.7% - n = 0; 0.0%), teaching for personalized learning (n = 18; 8.8% - n = 104; 18.9%) and social learning (n = 18; 8.8% - n = 0; 0.0%). With less than 6.0%, we found: design thinking, lifelong learning, new pedagogies, learning outside the classroom and flipped classroom.

As mentioned above, lifelong learning is intimately associated with the development of the ability to learn autonomously. In that sense, the issues related to teaching that are most highlighted within the lifelong learning-related results focused on the strengthening of research-based teaching methods and the minimization of the instruction, which is a great challenge for lifelong learning ecosystems given the weight of tradition in the current school of teacher-centered didactics.

3.6   Results related to school management

The quality of school leadership is key in shaping the transformation of schools and should, according to Fullan (2014, p. 6), become "a force for improving the whole school and the results it brings". Peter Senge goes on to say in his preface to (FULLAN, 2010, p. vii) "Where a whole system approach has been taken seriously over the past decade, there have been significant improvements in student achievement".

The "School management" category listed the following key ideas by frequency, both for the literature review and the surveys: knowledge society (n = 62; 30.0% - n = 0; 0.0%), teacher training (n = 62; 30.0% - n = 3; 0.5%), international quality standards (n = 42; 20.0% - n = 13; 2.4%), upgrading to university (n = 42; 20.0% - n = 0; 0.0%) and sustainable development (n = 21; 10.0% - n = 0; 0.0%). With less than 5.0%, we found: small groups, no fixed and specialized classrooms, international teachers, maker spaces and school with no *campus*.

Regarding this particular topic, the interviews showed very different results from the surveys and the specialized literature, especially about the importance of paying attention to the configuration and language of the learning spaces. It is interesting that in a large part of the interviews with school principals, it is mentioned that the current configuration of the classrooms, formed by rows and columns of tables, with a blackboard in the front, does not help to transform teaching towards something different from traditional instruction. In this regard, interview # 9 indicated that:

> I agree that teaching must be transformed. However, that will be
> very difficult if the classroom is not transformed. Just look at these
> classrooms and compare them with others 100 years ago... they
> are basically the same but with better toys, right? [...] In order to
> implement more flexible didactics we need more flexible classrooms
> that allow for languages and interactions that are different from what
> we have now [extract int-9].

Considering the above, it should be mentioned that the way in which learning spaces are organized and distributed affects the construction of lifelong learning ecosystems in a severe way, although it may not seem so. Spaces have their own languages and determine the interactions and relationships that arise between those who learn and those who teach and as a consequence, if the classrooms are configured in an inflexible way, few will be the possibilities of deploying flexible teaching methods that break with the relationships of vertical power that govern traditional classrooms. In that sense, a 21st century lifelong learner needs to relate to his/her peers and with knowledge in a more empowered, interconnected and flexible way and this will be easier to find in a digital learning environment than in a traditional face to face classroom.

3.7   Results related to spiritual dimension

Souza (2016) has conducted extensive research regarding the relationship between spirituality and education. She concludes that if "we are to develop a sustainable education system which will prepare students for the world in which they are growing into, it is important to identify and address the spiritual dimension" (p. 127). Concerning the category called "Spiritual dimension", the ideas with higher frequencies both for literature review and surveys were: spiritual and noble values (n = 17; 8.0% - n = 51; 9.3%), spirit of service (n = 0; 0.0% - n = 6; 1.0%), humanism (n = 0; 0.0% - n = 3; 0.5%), respect for life (n = 0; 0.0% - n = 3; 0.5%) and environmental awareness (n = 0; 0.0% - n = 27; 4.9%).

In this regard, interview # 1 addresses the importance of spiritual formation or the ethical development of values and indicates that:

> [...] we train professionals and many times we say: how is this
> professional doing? How is he dealing with the problems of his
> society? And what we find there are serious problems, for example in
> ethical behavior. [...] We must bear in mind that a good professional
> is made in school, but an ethical professional is built at home [...] it
> is a great challenge for the school to support the education of people

in their ethical dimensions and values, since many times at home families do not work enough on that [extract int-1].

It is worth mentioning that whether they occur in processes of lifelong learning or more traditional school learning, the dynamics of overproduction and ease of access to any type of information, as well as the impact of the daily use of ICT, it is necessary to work on the construction – from an early age – of ethical criteria about the use of these technologies and the formation of values and virtues, which can be strengthened continuously and steadily over the years.

4   Discussion

From the interpretation of the results of the study, which include the consolidation of what was found in the three sources of information (literature, experts and visits), the following reflections are presented as an invitation to educational change.

If any school were to take the results herein as a strategic guide, it would rapidly find out that they aren't universally applicable; their pertinence is clearly a function of the social context in which they are reviewed. As the prevalence and pervasiveness of concepts like Stem education and the 4Cs is brought to light, some questions emerge: is it the skill-centered framework an immediate, mostly empirical, and instrumental solution to the perceived problem of outdated schools? Should it be part of any lifelong learning ecosystem? In which way are those ecosystems key players in 21st Century Education?

Research is concerned with these questions because any unidimensional approach to current education could be an attempt to appease the mind by setting forth a refurbished paradigm.

Considering the above, some elements emerge that might help explain various salient results of the study. The first one is the practical reappearance of educational change ideas that had been posited before in the literature. "Leading edge" educational theories and practices now seek to guarantee school relevance and pertinence in a rapidly changing world; however, the reviewed models closely resemble educational plans from the past like Wirt's for Gary, Indiana, or C. W. Washburne's for Winnetka, Illinois (DEDE, 2011, p. 1). Their key educational tenets endured, albeit not their application. The "New Pedagogies" appearing in 37.0% of the interviews, is a clear indication that a renovation is perceived as required, even if it comes from the past. As we said before, even if those "New Pedagogies" are not really considered new, they are appearing with a fresh

potential as awakening "sleeping beauties" (VAN RAAN, 2004), which have found their 'prince charming' in the technological evolution of the 21st century.

However, since 'solutions' to the currently perceived educational outdatedness are drawn from the century-old Progressive Education movement, the question remains: how are schools *actually* outdated? From the research results, two dichotomies offer a broad explanation, and a third dimension therefore emerges.

In the first place, there's a pedagogical approach to the problem of outmoded schools that marks "instruction" and "investigation" as dichotomic poles. In this metaphor, the pole of instruction represents the concentration of social vectors trying to move the educational processes towards heteronomous determinations of knowledge and culture. On this side of the dichotomy, teachers guide their students in the "sage at the stage" mode (HUBA; FREED, 2000), transmitting culture and knowledge to them. This mode is associated with a generational imperative in which elders teach the young by controlling them through practices aimed at reproducing the system. On the other end of Huba and Freed´s metaphor, the pole of investigation represents forces aimed at strengthening an autonomous acquisition of culture; teachers help students to navigate uncertainty by discovery and in their own terms, learning along with them – and from them – in a 'guide at the side' mode, which is more compatible with lifelong learning ecosystems.

The results show that the investigation pole is currently considered as the way schools should go in the future, whereas instruction is perceived as a drag from the past. Most likely, the true "good way" lies in a balance of forces adequate for each educational context at each time.

Secondly, there's the technology issue. Even for its critics, there seems to be a consensus that digital technology should be at the base of 21st century education (SELWYN, 2016; WARSCHAUER, 2007) and that it is necessary for any lifelong learning ecosystem; however, a polarization regarding tech utopias and dystopias has clearly emerged (ROSS; COLLIER, 2016). On one side, education should be determined by the technological capacity of society, to the extent that not only classrooms but even knowledge is deemed "obsolete" by notorious influencers like Sugata Mitra (MISHRA; MEHTA, 2017); on the other side, there is fear that a digital education may disrupt society as we know it. Despite such extreme polarization, the results herein show a generalized acceptance of the convenience of school as the place where formal learning takes place, contrary to ed-tech utopians' beliefs. Not so surprisingly, the use of ICT in schools appears as a

key idea in 76.9% of students' answers to the survey, in 35.0% of the expert interviews, and it covers 48.6% of the technology category.

Regarding technology, our tenet is that schools are relatively stable structures that, from an evolutionary point of view, are focused more on persistence than on variation, even more when school self-preservation is at the stake. As evolution of digital learning ecosystems is currently in a phase of rapid change, the mentioned polarization is an expected result of the differential velocities and, perhaps, divergent directions between those two evolutionary processes. A digital learning ecosystem – and lifelong learning ones – should be more than a mere learning support substrate; it should be a space where all the categories mentioned in the results are organized and may develop, and that can articulate complex interactions between educational actors based on sociotechnical synergy. All this, of course, merits further research.

Last, but not least, our results clearly reveal a need for humanization and familiarization of schools. This is the third dimension that emerges: education as an essential human process requires a space for emotions, family, ecology, and spiritual development. As social and human values and issues are involved, these aspects are at the border between the State and Family spheres. In this sense, self-determination of educational communities appears as a main criterion for seeking application of these results and each one of them is responsible for pushing school evolution forward towards a better future for humanity.

Repensando as escolas do século XXI: a busca por ecossistemas de aprendizagem ao longo da vida

Resumo

A relevância da Educação atual para as necessidades da sociedade do século XXI é questionada, já que a maioria das escolas, especialmente nos países em desenvolvimento, oferece aos alunos experiências de aprendizagem homogeneizadoras no estilo do século XIX. Este artigo apresenta os resultados de um estudo de método misto, focado na identificação das principais características da educação do século XXI, como um conceito que deve promover experiências de aprendizagem ao longo da vida. O método combinou uma revisão sistemática da literatura, aplicação da pesquisa, visitas a escolas inovadoras e entrevistas com especialistas internacionais em educação. Os resultados mostram a relevância de um currículo voltado para habilidades sociais e currículos orientados a objetivos, a ativação de caminhos de aprendizagem pessoais e a minimização da instrução em favor da pesquisa como uma abordagem de ensino. Vale ressaltar que, embora a maioria dos resultados seja amplamente discutidos na literatura, atualmente são apresentadas novas possibilidades de implementação e com maior potencial de inovação, devido à evolução tecnológica do nosso tempo.

Palavras-chave: *Educação do século XXI. Caminhos de aprendizagem pessoais. Pesquisa educacional. Aprendizagem ao longo da vida. Ecossistemas de aprendizagem.*

Repensando las escuelas del siglo XXI: la búsqueda de ecosistemas de aprendizaje a lo largo de la vida

Resumen

La relevancia de la educación actual está siendo cuestionada de cara a las necesidades de la sociedad del siglo XXI, en donde la mayoría de las escuelas, especialmente en los países en desarrollo, ofrecen a sus estudiantes experiencias de aprendizaje homogeneizadoras al estilo del siglo XIX. Este artículo presenta los resultados de un estudio de método mixto centrado en la identificación de las características principales de la educación del siglo XXI como un concepto que debería promover experiencias de aprendizaje a lo largo de la vida. El método combinó una revisión sistemática de literatura, aplicación de encuestas, visitas a escuelas innovadoras y entrevistas con expertos internacionales en educación. Los resultados muestran la relevancia de un currículum orientado a las habilidades blandas y por propósitos, la activación de rutas personales de aprendizaje y la minimización de la instrucción a favor de la investigación como enfoque de enseñanza. Cabe destacar que, si bien la mayoría de los resultados son ampliamente discutidos en la literatura, actualmente se presentan con nuevas posibilidades de implementación y con un mayor potencial de innovación, debido a la evolución tecnológica de nuestro tiempo.

Palabras clave: *Educación del siglo XXI. Rutas personales de aprendizaje. Investigación educativa. Aprendizaje a lo largo de la vida. Ecosistemas de aprendizaje.*

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