Education, Curriculum and Technology Landmarks: The Renewed Concept of the "Classroom of the Future"

L. Cardoso

Abstract: One of the most debated concepts in Education and Technology is the "Classroom of the Future", not only because classrooms changed, but first of all because students, society and teachers have changed. This is a global challenge for Higher Education: to prepare future teachers for these new ages of technology-based classrooms, students who master digital and informational tools and pedagogy that needs to be enhanced in order to follow all these simultaneous mutations.Our main objective is to discuss how Universities need to focus on new pedagogical approaches for the "Classroom of the Future", combining Education, Curricula and Technology, preparing future teachers and drawing the path for teaching and learning success.

Keywords: Education, Curricula, Technology, Classroom of the Future

I. INTRODUCTION

It is often said that we face an uncommon and difficult trilogy in Education, due to the fast social mutations, technological changes, students multitask skills, teachers up to date knowledge about Literacies, and curricula that still maintains a huge heritage of the past and from the traditional way of teaching. According to this Trilogy based Learning (TL) , we are teachers from the 21st century, teaching students of the 21st century in 19th-century classrooms. However, this is a narrow point of view as many changes have occurred and are still in progress, as Mohd & Shahbodin wrote.

Students are now the centre of the teaching and learning process:

In this classroom, the emphasis of learning is different. The goal is no longer to learn by memorizing and retrieving, but to learn how to learn. Now students use the knowledge they have gained in their projects to show their mastery of the subject. Students learn how to ask the right questions, do the right analysis, find answers and use data. The emphasis is on developing life-long learners in this classroom. To order to achieve this, students go beyond the role of the student and learn through experience in the real world. (Philippe, 2015, p. 4).Teachers no longer live and use pedagogy from outdated times and education guidelines and are the main agents for this necessary change. Teachers are no longer isolated teachers. Education for the various types of students can be customized by teachers, schools and texts[6]. Teachers have also been trained to tackle teaching and learning problems and dynamics in the 21st century and how to prepare the current education and training generation more effectively[17].

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Today they co-teach, mentor groups, and collaborate with other members of the organization. Teachers know that they need to participate and provide effective training through a range of teaching methods as well as innovations for their students. Teachers keep up-to-date with what happens on the ground to do so. (Mohd & Shahbodin, 2015, p. 4).

Furthermore, the classroom is no longer a portrait of the 19th century. Space organization, teaching methodologies, ICT based learning, more involvement from the students, a close connection to the "outside" world (now, there are no barriers from inside the classroom to the outdoor world) are some of the characteristics of the modern classroom, but first of all we must highlight the new relations between teachers and students:

In the classroom of the 21st century, educators promote student learning and build effective classrooms where students can improve their skills today or in the future. Through default, an engaging educator is fully aware of a classroom's group dynamics. The effectiveness of classroom learning, as Dörnyei and Murphey[10] explained, depends a great deal on: how students relate and teach: what classroom conditions are; how efficiently students interact and communicate with one another, the role not only played by teachers but also by learners.. (Mohd & Shahbodin, 2015, p. 5).

The curriculum is also changing. Technology and social changes are now present in key issues debated in classrooms and there is a close relationship between curriculum and "the real world", but much is needed:

The program must become more important for the experiences of students in the workforce of the 21st Century. The program needs to go beyond assisting students in the acquisition of knowledge in order to engage studants in knowledge creation in order to meet the challenges faced by a diverse and international society in order to improve their deliberate learners. Various curriculum structures and study modes are related to the various understandings of the inferred participant, which are on the basis of which they base important curricular decisions. The students must build on a wide variety of knowledge bases, incorporate them, analyze them more sophisticatedly, and use their applied knowledge to solve complicated problems. (Mohd & Shahbodin, 2015, p. 5).

Many authors think that curriculum is absolutely vital for these new thoughts, like Suto: An alternative view on the optimal development of 21st Century skills is that curricula should be developed to cover them explicitly. Over the past decade, critical thinking, for example, has become a subject in its own right for

many sixth-form students in England. (Suto, 2013, p. 9)

As far as the trilogy is concerned, we think much water has already passed under the bridge of pedagogical innovation and Universities, teachers, future teachers, students and technology are now all mixed together to create a new vision for this problem. And one of the main strategies is to constantly up to date the definition of the "Classroom of the Future". Or to use Marc Prensky words, we must take a huge leap for the classroom: true Peer-to-Peer Learning (PPL), enhanced by technology and gave us a piece of advice:

Classroom technology should support and enhance the pedagogies that work in today's environment and context (such as students connecting with the world, and teaching themselves with coaching rather than being told.) Unfortunately, even our younger "Digital Native" teachers do not automatically know how to best use these pedagogies, which they didn't experience in their own educations; we must teach them. (…) I recommend that you seriously consider bringing this true pedagogical innovation—either via the technology-enhanced commercial system or via its free "conceptual" version—to your own institution. (Prensky, 2011, p. 2)

II. ENHANCING AND (RE)DEFINING THE "CLASSROOM OF THE FUTURE"

We need new classrooms because we have new students. And we need the future of the "Classroom of the Future" because our students are changing: their needs, tools, technological platforms, information surplus, multiple gadgets, modes of socialization, interaction ways, thinking and working, creating and transforming, creativity, problem solving, decision-making, communication, collaboration, citizenship, and personal and social responsibility.
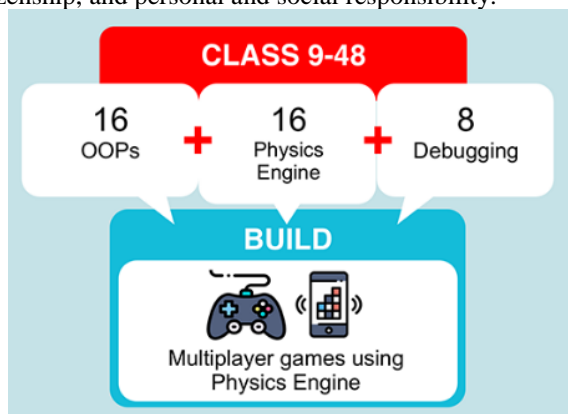

Figure 1. Future Centre of the teaching and learning process

Figure 1 shows the Future Centre of the teaching and learning process. On the other hand, we also need "Classrooms of the Future" because the Future is always changing and we can't really predict what major skills will be needed or what new professions will be created. With this scenario, many studies have been pointing out the need to further renew our thoughts about key skills and literacies for our future students. As Suto argues:

ATC21S researchers have concluded that the skills of 21st Century can be grouped into 4 broad areas: I way of thinking, ii) way of working, iii) working, and iv) world-wide abilities (Binkley, Erstad, Herman, Raizen, Ripley, and

Rumble, 2010). The authors of this study are also the main research companies currently in the process of evaluating and teachings of 21st Centsury ability (ATC21S). In these categories 10 skills are defined to encapsulate all others and to take all approaches into account. (Choice, 2013, p. 5)
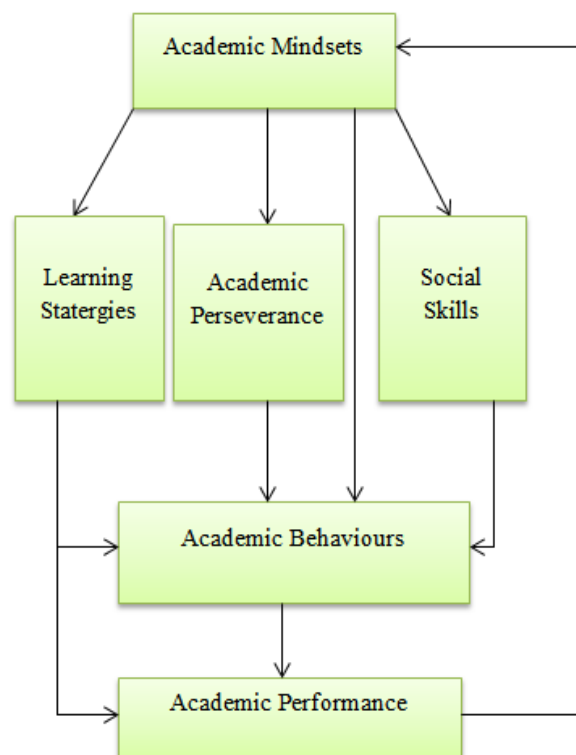

Figure 2. 21ᵗʰ Century Framework of proposed model

Figure 2 shows the 21ᵗʰ Century Framework of proposed model. As key skills are on a constant move, the classroom but also follow the new trends in education and society. If we talked before of a "Classroom of the Future", now we can only talk about the evolution of this concept and incorporation of different ideas, concepts and technologies in alliance with new pedagogical approaches.

That's why we can find different definitions or ideas about this concept and the whole process of this evolution that never ends. Eggers & Macmillan defy us to meet this classroom:

Take a class in 2020 and watch heavy forces at play. A global lack of talent encourages career-oriented education. Our ancient concepts of classroom have become obsolete through digital education, digitization and increased reality. Evolving learning needs to redefine the purpose, the implementation and how of education. Students are educators, learn from each other through project-organized learning contexts. The financing for learning works towards pedagogical methods illustrated by real-world assessments. The new normal is unbundled, personalized and adaptive learning. (Eggers & Macmillan, 2015, p. 29)

Moreover, they underline 2020 Education trends: digitized classrooms, digital technologies pervade almost every aspect of the classroom, 3D printing, robotics and real-time collaboration with community startups, virtual laboratories, schoolwork is game-based, education technology mash-ups, augmented reality (AR) applications become a

common feature, a new teacher-student relationship, robot teaching assistants, rise of the hybrid teacher, advanced neural headsets will allow teachers to actually "read" students' minds, personalized learning for everyone, self-organized learning environments (SOLE), cognitive calibration in the classroom, the student becomes the master: peer-to-peer learning, marketplaces for learning, breakup of the composite structures comprising schooling today, next-generation apprenticeships, school-business collaboration, digital "flexbooks.", children are introduced to coding for computers early, museums become learning hubs, rethinking career pathways, a shift from credit hours to competencies, alternative pathways for upgrading skills and advancing careers, and stackable educational credentials (Eggers & Macmillan, 2015, p. 29 – 32). With this multiple classroom and multiple trends, comes along new definitions of literacy as:

New dimensions of literacy were created by the rapid acceleration of technology. Because new technologies engage the senses of learners and provide a more engaging way of learning, literacy is characterized by critical thinking, creative thinking, calculation, and "compassion"—computer-based computational skills required to access knowledge. Emotional and social intelligence are also taught in schools in 2020. Therefore, students can understand themselves and others quickly and pursue career paths best suited for their intellectual abilities. They also need a better understanding of themselves and others. (Eggers & Macmillan, 2015, p. 32).

The mutation of the concept of "The Classroom of the Future" led us to (re)think the concept and its characteristics, the role of the teacher and the nature of the student, the spatial definition of the classroom, for instance, as noticed by many authors like Kember, D., & Leung, D. Y. P. (2005), Sawyer, R. K. (2006), Mäkitalo-Siegl, Zottmann, Kaplan and Frank Fischer (2010), Crişan, A. & Enache, R. (2013), Xenos M. (2018) or DeCoito, I., & Richardson, T. (2018) who, once again, warn us for the main focus, the teachers:

Teachers need an emerging understanding of which technologies exist and what their functionalities (technological knowledge or TK) are to incorporate digital technology into their learning. Baturay, Gökçearslan, and Sahin (2017) have described TK as the largest in practice technology-inclusion predictor in their analysis of the use by teachers of computer-aided learning and their gender relationship. In addition to TK, Köhler and Mishra (2009) have demonstrated that teachers need imagination and versatility when they are using classroom technologies and understand how integrated technology transforms the pedagogical environments in the classroom (TPK). Teachers also need a thorough understanding of the effect of technology on the areas of learning (technology or TCK). (DeCoito, I., & Richardson, T., 2018, p. 364).

Around 2010 and 2014, the European Schoolnet partnered with the school's educational departments, innovation suppliers and research organizations in iTEC (Innovative Technologies for Engagement Classrooms). Over 2,500 schools in 20 EU countries with a total of 26 project partners, 14 education ministers and € 9,45 million in funding from the European Commission FP7 initiative are evaluated for tools and resources. The findings of this very critical research have been identified in three main areas of the final assessment report and teachers are again key actors:

Impact on learners and education: students improved their know-how in the 21st century, particularly independent learning, and thought they were better able to do exams; they took on new roles in their classes and became peer evaluators, peer-tutors and co-designers of their learning, even professors ' trainers;

Impact on teachers and teaching: The creation and teaching methods for educators and teachers have been clearly seen as innovative; technological skills and pedagogy have been strengthened; teachers have been made more enthusiastic about their pedagogical practices; technology has been increasingly utilized, incorporated in the learning process instead of for study and presentation.

Scalability: Since the iTEC methodology evolved over the five periods, widespread adoption was more apparent, and the scenario-led design process was able to promote the implementation of technology. The Scenarios, Learning Stories and Learning library; iTEC's activities are regarded as a valuable contribution to promote systemwide innovation; the iTEC approach may be implemented and influence future solutions in countries in which the iTEC is compatible with national policies and strategies.(Ayre, J. et alii, 2014, p. 6)

Pedro, N., Baeta, P., Paio, A., Pedro, A. & Matos, J. F. recently studied the "Classroom of the Future", gathering inputs from students, teachers and designers, These authors interviewed and analysed the key issues and trends about this classroom from these three groups and achieved some accurate and interesting guidelines for this pedagogical project:

It was possible to see that collaborative work is at the core of future classroom environments. Either in small or large groups, the central core of learning should be collaboration and teamwork. Students ought to have a strong and active role in their own learning experiences and the classroom layout needs to successfully accommodate it. (…) The classroom space, along with other elements such as furniture and technologies should promote more student-to-student interactions. (…) Mobile technologies, wearable gadgets and multiple touch-screen surfaces were also seen as relevant in the learning environment and the high relevancy of wireless internet access was clearly pointed out. Therefore, an effective inclusion of digital technologies as assistive teaching and learning tools might be seen as a priority. (…) (Pedro, N., Baeta, P., Paio, A., Pedro, A. & Matos, J. F., 2017, pp. 7908-7917)

Another side of the "Classroom of the Future" is that nowadays we no longer have the traditional concept of classroom with walls and windows. Today, learning can occur anytime and at any place. There are more learning spaces than the usual school classroom and the education system is currently recognizing with more strength the relevance of learning outside the system, therefore "outside the walls", creating a new approach to the classroom: a classroom with no physical barriers, that includes different types of learning experiences and that can offer them to students as Taddei (2009) argues. Furthermore, i is important to attract the students' attention, skills and interests into this new classroom, bringing their knowledge, their insights, their ways of thinking and reacting, so that a new classroom dynamics can be created. This idea and the relevance of technology, namely mobile devices, is

emphasised by UNESCO, as Scott clearly states:

In the settings in which students choose their own ways of learning and put personal devices into education, future learning processes will inevitably take place. Mobile devices make education simpler by increasing the boundaries between formal and informal learning. Using a mobile device, students can view additional material individually and conveniently for clarity and sharing ideas with others (UNESCO 2013a, p. 21). UNESCO (2012) claims that mobile devices ' portability and broad use will make them ideal instruments for influencing teaching and learning to exceed personal computer use. However, in response to new technology and new user needs, the World Wide Web continues to develop. Teachers should turn their positions from' content conveyors' to' content curators' inside 21st century learning environments (Institute for the future, 2013). The ability to recognize and find data and learning tools is important and educators can help students identify the resources they need. Resources and forums for engaging and directing students to learn relevant opportunities are becoming increasingly important. (Scott, 2015, p. 9)

These are some of the frontiers for the new "Classroom of the Future". It will always be a work in progress, an incomplete pedagogical design and technological vertigo of innovation.

Many things will be brought to this concept in the next years, but some will remain key pillars: the teacher, the student, curriculum, pedagogy and most of all, we have a new world to build that begins with a question and quite a long answer:

In the near future what changes can be made for education? Teachers remain, but their positions as teachers, mediators and guides, facilitators, training coordinators, evaluators and developers and compilers of learning resources will be enhanced. The research undoubtedly continues, but the assessment is tailored and formative. The curriculum is customized and tailored to represent the needs and interests of individual students, and informal learning opportunities are known as alternatives to conventional formal education. Practice in the real world can permeate learning activity. Schools are most likely to stay, but schools are more available to different learning opportunities and training would eventually reach the culture. Education services will still provide face-to-face training, but informal and digital resources are added to this. Autonomous learning is important and learners should expect to decide how their learning profile looks. New learning technologies are being developed. Technology facilitates customized learning processes and encourages alignment and equality. If lifelong learning becomes the future norm, it is reasonable to expect that learning methods and pedagogical techniques are dramatically changed and new opportunities are built for students of all ages and abilities. (Scott, 2015, p. 16).

III. RESULTS AND DISCUSSIONS

3.1 Efficiency

Teachers are no longer isolated teachers. Education for the various types of students can be customized by teachers, schools and texts. Teachers have also been trained to tackle teaching and learning problems and dynamics in the 21st century and how to prepare the current education and training generation more effectively. The proposed "classroom of future" method have better efficiency. The

figure 3 and Table 1shows the efficiency of the proposed approach.

Table 1. Efficiency

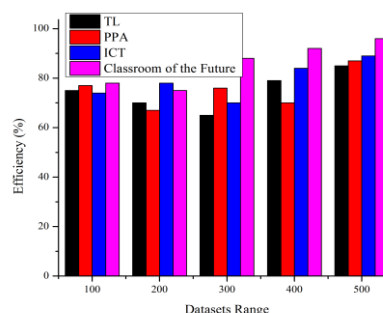| Datasets Range	TL	PPA	ICT	Classroom of the Future
20	67.6	68.5	69.8	69.8
40	72.5	63.5	75.67	65.6
60	65.6	75.6	84.6	76.78
80	75.7	82.4	86.7	88.7
100	80.3	86.9	89.6	96.5

Figure 3. Efficiency

3.2 Classroom Learning

In the classroom of the 21st century, educators promote student learning and build effective classrooms where students can improve their skills today or in the future. Through default, an engaging educator is fully aware of a classroom's group dynamics. The effectiveness of classroom learning, as Dörnyei and Murphey explained, depends a great deal on: how students relate and teach: what classroom conditions are; how efficiently students interact and communicate with one another, the role not only played by teachers but also by learners. Table 2 and Figure 4 shows the performance of classroom learning.

Table 2. Performance of Classroom Learning.

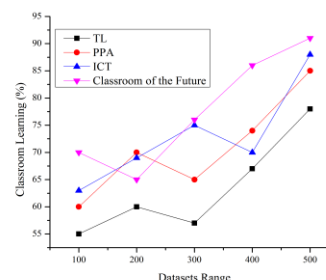| Datasets Range	TL	PPA	ICT	Classroom of the Future
20	55.4	60.4	63.4	72.3
40	65.5	70.3	70.8	65.4
60	75.6	65.4	77.8	78.7
80	70.3	77.6	72.3	85.4
100	77.6	84.3	77.8	94.3

Figure 4. Classroom Learning

IV. CONCLUSION

The "Classroom of the Future" continues an active constantly changing concept. It is no longer equivalent of modern technology in the classroom by its own. This involves Education - the whole Education system -, new ways of designing Curriculum, and more student-centred processes always in close connection with teachers, the 21st-century teachers. Moreover, the classroom is no longer a physical space but a multiplatform basis for teaching and learning.

Several authors have been giving us more studies about the evolution of this pedagogical concept. Recently, Pedro, N., Baeta, P., Paio, A., Pedro, A. & Matos, J. F. summarized the most important features of the "Classroom of the Future":

Taking in account the main ideas that emerge from this study, the following guidelines are presented for the design of future classrooms (meaning every classrooms that aims to promote learning experiences that fully address 21st-century skills): i) all the architectural characteristics of the classroom (space, windows, walls, floor, etc.) must enable students' collaboration and active learning, it should energise students, encourage them to move, think, act and communicate; the space or the different spaces must be design for allowing multiple types of activities, the classroom layout should be flexible and reinterpretable; iii) furniture must be movable, multifunctional and reconfigurable in order for adjust to students and teacher' needs; iv) internet access and interactive technologies should be embedded in the classroom and used for educational purposes; v) an ambience of comfort, pleasure and engagement must be built. Classrooms as any human living space must be seen as a dynamic environment, an evolving habitat that adapts to its user. And as Basye stated, users-teachers and students- claim for a classroom where space fits the learning process instead of a space to which the learning process must fit. (Pedro, N., Baeta, P., Paio, A., Pedro, A. & Matos, J. F., 2017, pp. 7908-7917).

However, these characteristics will soon be overrun by technology or society evolution and new ideas shall be debated in the process of renewal of this concept.

Nevertheless, we can conclude that the trilogy Education, Curricula and Technology are the basis for the constant renewal of the "Classroom of the Future", but one protagonist is absolutely vital, as the OECD tells us:

Teachers are the most important factor in student learning. Teachers should contribute to the level of the profession and give all their students opportunities for success. We will encourage students to innovate; to learn, think and collaborate with others. Good teachers can also encourage and direct the growth of students to meet their own standards. Therefore, it is important to understand why teachers do this in the classroom. (OECD, 2018, p. 3)

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