Education in a Technology-Shaped World: Which Learning Model Helps Preparing for the Knowledge-Based Societies?

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Abstract To prepare students to face a technology-shaped world, education must become creative and innovative. In fact, we live in a fast-changing world, where technological advances have been causing a great disruption in our lives, jobs and societies; job automation and knowledge-based economies require our students to get ready for jobs that do not yet exist, for technology that has not yet been invented. This study contributes to the understanding of which learning approach is more likely to provide learners with the skills for the 21st century, to include critical thinking, problem-solving, collaboration and social-emotional skills. Building on existing research on how technology impacts the way we teach and learn, it asks: which learning model optimizes student's preparation for the knowledge-based societies? In this context, the outlined learning methods are traditional learning (learning in the physical classroom); e-learning (learning through online learning programs); and blended learning (a mix of face-to-face and e-learning). This paper is based on a review of literature on different learning approaches and respective advantages and disadvantages, both from the student's and the teacher's perspectives. This analysis shows that education must change, that the change includes using technology and implies challenges for students, teachers and institutions. The results indicate that to provide students with the crucial skills for an uncertain future, instead of the traditional classroom-based or the fully online learning-based model a blended or mixed approach would be preferable, as it takes advantages of the benefits of both.

Keywords Education · Technology · Learning models · 21st century skills

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1 Introduction

"Technology is enabling multi-modal teaching, changing curricula and spawning rich forms of online research and collaboration" (Glenn and D'Agostino 2008).

A few decades ago we would pack some books, notepads, pens and pencils in a heavy briefcase and go to school, where our teachers, pacing between their desk and the blackboard, would lecture us with written and spoken words of wisdom, that we would try to transform into useful notes; today's students might still do some of this, but they are now mostly using much lighter, but nonetheless more powerful tools, that carry unlimited sources of information. Most books and other learning tools of the past are now carried in digital format, in laptops, tablets or smartphones. Furthermore, using the power brought by the Internet, there is really no need to carry those downloaded digital versions, as they are available online, almost anywhere and anytime. Perhaps this was a much-needed moving force, essential to the transformation of conventional education into pedagogy that enables acquisition of the competencies and skills needed to tackle the global challenges of this century's societies. "Current societies and economies are based on a vast and deep knowledge foundation, mainly because of the unlimited access to information brought by constant and unstoppable advances in technology" (Antunes and Almendra 2020).

Technology has been changing our lives, our jobs and inevitably, our ways of teaching and learning; the profound disruption caused by a never-ending technological breakthrough has had mainly a positive effect, although some disadvantages may also be pointed out.

One of the positive sides or advantages of the impact of technology in education is related to whom is the access of learning is granted to; perhaps it is worth going back a few hundred years to remind ourselves that there was a time when education was a privilege of kings, nobles and church members. Such as, back then, that limited access to knowledge was overcome by technological advances—in that case it was the invention of the press—nowadays, the much broader access to all kinds of information is possible mostly because of the appearance and evolution of the Information and Communication Technologies (ICT). This broader access to knowledge paved the way to learning with no borders (anytime, anywhere) and contributed to rethinking the pedagogy that is needed for the complexities and uncertainties of the 21st century.

2 Terminology

ICT has brought a big improvement in what is broadly known as distance learning—in the sense that the student may access learning materials without the need to be present in the physical classroom; since this much easier access has been made possible through technology, an amalgamation of terms have been in use. The most common three are listed below, along with a review of their meanings.

2.1 Traditional Learning

Traditional Learning is assumed to be the conventional learning environment where teachers and students meet every day in the physical classroom, and the former give lectures to the latter, with or without different learning tools. Some authors refer to it as "teacher-centered and static" (Titthasiri 2013) and Rashty, cited in Titthasiri, states that "the instructor conducts the lesson according to the study program and curriculum. […] dictates the structure of the lesson and the division of time" (Titthasiri 2013). While most authors would then define it as face-to-face instruction, Curtis Newbold, an associate professor of communication at Westminster College, in Utah, curiously refers that it includes "either brick-and-mortar instruction or asynchronous online learning" (Newbold 2018).

Since asynchronous online learning is, in its very nature, online, and usually seen as a type of e-learning environment that does not enable immediate feedback, as we will describe next, we do not agree that it is a kind of traditional learning; in fact, we prefer the understanding that traditional learning is exclusively the classical learning, occurring in a formal and classroom-related environment.

2.2 E-Learning or Online Learning

E-Learning or Online Learning commonly refers to an environment where the student uses computers as the educational medium to access learning content, that may be available in multiple formats and either stored locally or somewhere away from the learner's location; its main advantages include allowing the learner to choose his own pace and the amount and formats of available information. It could be simply defined as "the use of digital technologies to deliver complete learning programs." (Liimatainen 2020) or "… a computer based educational tool or system that enables you to learn anywhere and at any time" (Zogg 2017). Sometimes also described as a Learning Management System (LMS), although this term usually refers to specific online learning platforms or applications, such as iSpring Learn, Docebo or Adobe Captivate Prime (Monson 2017), e-learning may be synchronous or asynchronous; when there is real-time interaction between student and teacher, using chat, instant messaging or video conferencing tools to ask and answer questions, it is called synchronous; if there is no such type of interaction or if the existing interaction does not happen in real-time, it is called asynchronous (Mindflash 2020).

A broader concept that may also be found in online learning related literature is distance learning; Kaplan and Haenlein (2016) say that it encompasses not only current computer-based distant education, but also previous formats such as television courses or even printed materials sent by mail. In that sense, distance learning "…first appeared in 1728 when the Boston Gazette featured an advertisement for a distance stenography course through weekly classes sent by mail" (Kaplan and Haenlein 2016). In the same line, Liyanagunawardena et al. (2013) argue that, having started

with correspondence courses using postal services for the exchange of study materials and submission/return of assignments, for every new technology invented (such as radio, TV, video recorders or home computers), an associated development in distance education has appeared.

2.3 Blended Learning (B-Learning) or Hybrid Learning

Blended Learning or Hybrid Learning is, for most of the reviewed authors, an educational model that in essence combines e-learning with face-to-face learning; as such, it implies some physical presence of the student in the classical brick-and-mortar classroom, where he might get involved in group activities, lab work, lectures or simply question and answer sessions. He manages the rest of his study time using web-assisted instruction.

In this paper, we follow the concept of blended learning described above; nonetheless, we must refer that there are authors who have a more restrict view about what is blended learning, as they do not consider the classical classroom to be part of it, but instead the virtual classroom in its place. That is the case of Jared Carman, who refers to blended learning as "a mix of modalities and methods of learning" (Carman 2005) and then describes what he considers to be the five key ingredients of that mix, all of them being actually variations or components of online learning: live events (virtual classroom), online content (independent online study), collaboration (online discussions), assessment (online pre and post evaluations) and reference materials (download study guides and other training materials). Some authors such as Elliot Masie, Allison Rosset, Zemke and Julian & Boone, cited in Carman, (2005) consider all of us as blended learners and that the optimum or adequate blend or mix of these ingredients is situation or context related. As said, we prefer a broader definition of blended learning, that includes the classical classroom and online modalities, but we agree with Carman's idea of a 'situational' instructional design model, in the sense that the adequate blend of traditional and online learning methods depend on each learning situation.

Blended learning has paved the way to another approach to the teaching methodology: while the traditional method is based on the teacher presenting new knowledge or information in the classroom, complemented by homework review, in this new approach there is an inversion of that procedure; the student uses online learning to study new materials at his own pace, saving for the physical classroom the practical aspects such as problem-solving or lab applications of what he has studied at home, or also to discuss and clarify doubts with the teacher. The concept is known as 'flipped classroom' and as described by Ramos (2016), "combines classroom tasks and activities held by the use of digital information and communication technologies. It proposes that the students, before class, should study a specific theme, in order to prepare themselves and come to class with questions and concerns that will be the starting point for discussions in the classroom with peers and teacher".

3 Which Model Is Better to Improve Education?

"Education must be a priority in order to prepare our future generations to not only succeed, but to survive" (Grabar-Kitarović 2019).

Speaking about education in the 2019 Estoril Conference on 'Global Challenges, Local Answers', at the Nova School of Business in Portugal, Grabar-Kitarović, the President of Croatia (Grabar-Kitarović 2019) was worried about our future generations capability to succeed and survive. This fear is legitimate as although we cannot predict the future, recent MGI reports (McKinsey Global Institute 2017a, b, c) show how automation and Artificial Intelligence (AI) are disrupting our lives and our jobs; they also indicate trends on what kind of jobs we may expect in the next decade; in order to adapt people to the effects of this disruption, education needs to change, and that change must be a priority, as stressed by Grabar-Kitarović. To prepare today's students for the challenges of a complex and uncertain future, we then need to choose the learning model that is more likely to provide them with the adequate skills.

Every approach or learning model has advantages and disadvantages, both from the students and from the teachers or facilitators perspective.

Traditional learning privileges real face-to-face interaction, not only between teachers and students, but also peer-to-peer collaboration among students themselves. According to Tayebinik and Puteh (2013), "face-to-face interaction communicates a lot of facial expressions, body language, tone of voice, and eye contact. […] the brain needs and expects these more significant channels of information". It also fosters a sense of community, described by Mc-Millan & Chavis, cited in Tayebinik & Puteh, as "a feeling that members matter to one another and to the group, meaning a feeling of mutual commitment and belonging, and 'a shared faith that members' needs will be met through their commitment to be together" (Tayebinik and Puteh 2013).

However, in order to promote that kind of interaction, it implies the physical presence of teachers and students in the so called brick-and-mortar classroom, as well as it requires all of them to follow a preset schedule, a common learning pace and basically limits students to only receive the knowledge that the teacher has to offer. Furthermore, and not less important, as stressed by Scott (2015), "traditional approaches emphasizing memorization or the application of simple procedures will not advance learners' critical thinking skills or autonomy".

A pure e-learning environment will, of course, make available an incredible amount of information, in several formats, on almost everything, and this may be accessible nearly anytime and anywhere, with incredible speed; the learner is able to choose what, when and where he wants to access, as far as he has a connected device, that may be a simple smartphone. If it is a synchronous e-learning environment, as described, he may even interact in real-time, with other learners and teachers, regardless of their location, provided they are also connected and available.

But, at least with current technology, even using social networks, chat and video conferencing tools, he won't be able to interact in the same way as in the above described face-to-face contact, especially in what concerns the sense of community:

"…learning takes place while the teacher and learner are separated […] engagement in e-learning and virtual classes hinders e-learners from community interaction" (Tayebinik and Puteh 2013). These authors also mention that the lack of real interaction might cause feelings of frustration and isolation, while Laurillard and Kennedy (2017) alert for another important consequence: a partial loss of the social and emotional value of the face-to-face: "The lack of classroom presence means that 'wholly online' courses loose some of the social and emotional value of the face-to-face…".

A blended learning environment represents, in our opinion, a successful attempt to take advantage of the best characteristics of both the classical classroom and online learning, in a harmonious equilibrium that should be context related: short-term learning experiences, such as business training sessions to improve company productivity, will probably require a mix of learning models different than a leadership program or a long-lasting university course.

"…blended learning is significant, because it uses digital activities to supplement teacher-supported classroom work. The blend is optimal because it combines the value of face-to-face interaction with teacher and peers, which is constrained in time and place, with the online environment, which is self-paced and less time-constrained" (Laurillard and Kennedy 2017). In fact, empowered by the ability to quickly access limitless and varied amounts of information, interact with other learners and teachers, and even collaborate with other unknown people with similar interests, the blended approach takes advantage of the faster and cheaper education, that are characteristics of e-learning; simultaneously, by maintaining an adequate level of the traditional face-to-face interaction, it will promote motivation, foster self-discipline, and prevent the described lack of sense of community and feelings of isolation and frustration. It will, indeed, require the time and travelling arrangements for some physical presence, in scheduled occasions, that may vary in number and duration, depending on each situation, thus posing some difficulties for those who work and/or are at a distant location.

Regardless of the learning experience type or situation, we must keep in mind that we need pedagogies that enable us to acquire skills and competencies needed in a complex and uncertain future. As Cynthia Scott states "…formal education must be transformed to enable new forms of learning that are needed to tackle complex global changes" (Scott 2015). The Organization for Economic Cooperation and Development (OECD) (2018), has launched 'The Future of Education and Skills 2030' project in 2018, with the aim of designing an instructional system to help countries in facing the social, economic and environmental challenges driven by globalization. That project alerts for the need for broader education goals, namely the individual and collective well-being and states that "Education has a vital role to play in developing the knowledge, skills, attitudes and values that enable people to contribute to and to benefit from an inclusive and sustainable future" (OECD 2018).

The United Nations (UN), through its cultural and educational branch – UNESCO (UN Educational, Scientific and Cultural Organization)—have also been stating the importance of broadening and improving education, as the 'Sustainable Development Goal 4' (SDG 4) clearly pledges to reach universal primary and secondary education

Table 1 Advantages of different learning models

	Traditional learning	E-learning (online)	B-learning (hybrid)
Advantages	Permits face-to-face communication	Learning is student-centric (student sets the learning pace, path and schedule), personalized and focused on the individual learner	Supports different learning styles and preferences; allows for deeper understanding of topics by using web resources and class interaction
	Promotes socialization, in-person peer-to-peer collaboration	Learning may take place at literally any time and any where	Combines the versatility of e-learning with the advantages of face-to-face experience and peer-to-peer collaboration
	The setup and rules of the system have been in place and working for a long time, the path of least resistance is easier to follow	Almost unlimited sources of information are available, providing an endless variety and diversity of topics	Provides dynamics and dialogic learning spaces that reframe the roles of students, teachers and learning process
	Strong student commitment	Access to learning (a simple smartphone is needed) is possible to everyone (including people with disabilities)	Brings back some of the student commitment lost in pure online learning
	Strong competition feeling	Faster learning at a reduced cost (for students)	Brings back the competition feeling
	Retains social and emotional value of face-to-face interaction	Interaction (collaboration) between people geo-graphically separated	Retains some social and emotional value of face-to-face interaction

by 2030, demanding a "seismic shift in the provision and quality of education and teachers" (UNESCO 2016).

Blended or hybrid learning seems to point to the appropriate path; Davies, Fidler and Gorbis, cited in Scott (2015), referred that "technology alone cannot ensure a successful learning experience" probably meaning that traditional methods have their value and must not be discarded. But technology cannot be ignored either, not only because it has improved the way we learn, but also because the technology itself must be learnt: "In the era of digital transformation and with the advent of big data, digital literacy and data literacy are becoming increasingly essential, as are physical health and mental well-being" (OECD 2018).

Pursuing the quest of finding the adequate approach to fulfill the needs of today's and tomorrow's education systems, we present the following comparison table, where we try to summarize both the negative and positive aspects of each learning model;

Table 2 Disadvantages of different learning models

	Traditional learning	E-learning (online)	B-learning (hybrid)
Disadvantages	Teacher-centric (the teacher or the school has full control)	Lack of face-to-face communication	Requires institutions and teachers to adapt to their new roles, functions and instructional methods
	All students need to adapt to the same learning pace, dictated by the teacher	Technology-dependent, needs fully working equipment	Totally different interaction between teachers and students require a great deal of adaptation from teachers
	Limited to take place in the physical classroom (place-constrained)	Inhibits real socialization	Part of it needs to take place in the physical classroom (relatively place-constrained)
	Limited to a schedule set up by the institution/teacher (time-constrained)	May separate students from reality, causing lack of context	Some of it is limited to a schedule set up by the institution/teacher (relatively time-constrained)
	Learning only what is offered	High cost investment on technology (for learning institutions)	
		Requires a considerable amount of motivation and self-discipline	

one must have in mind though, that some advantages or disadvantages may apply differently, depending on the perspective (teacher's or student's): Tables 1 and 2.

4 Successful Initiatives

If nothing else, broadening the access to knowledge would be a very strong reason to say the influence of technology in education has been positive; the possibility of attending a variety of courses through online learning, sometimes even a college degree, is real and most of the times for a very reduced cost; Massive Open Online Courses (MOOC) and Small Private Online Courses (SPOC) exist in many digital platforms (such as Coursera or edX) since as early as the 2000s and have been a great success.

Liyanagunawardena, Adams & Williams refer to a course first offered in 2008 by the University of Manitoba, Canada, called 'Connectivism and Connective Knowledge', as being the first MOOC (Liyanagunawardena et al. 2013). Kaplan and Haenlein (2016) have the same opinion but go further, indicating that although "The term MOOC was coined in 2008 by Dave Cormier from the University of Prince

Edward Island in Canada with regard to a course called Connectivism and Connective Knowledge…", the University of Phoenix, USA, launched its online campus in 1989, offering both bachelor's and master's degrees online. Twenty years before that, in 1969, the Open University had made its appearance in the UK, using television and mail to provide distance learning (Kaplan and Haenlein 2016).

This type of online education, which has started initially in Europe and in the Americas, where was offered by almost 150 high education institutions in 2015, and is now spread in Africa and Asia; the number of African college students was around 200 million in 2015 and forecasted to be about 400 million in 2045, because of the easy access provided by online learning; for example, most of the 23 universities of South Africa provide this learning model (Kaplan and Haenlein 2016; University of Oxford 2015). "…the supply of digital educational offerings is growing at an exponential rate. In Africa, for example, sales of cloud-based e-learning products are increasing at nearly 40% a year, albeit from a low base. Worldwide, the growth rate is 7.6%…" says Pfeffermann (2013), founder and CEO of the Global Business School Network (GBSN), in a 2013 article on Technology, Education and the Developing World. Pfeffermann (2013) also states the demand for online offerings will keep growing as the access to technology spreads, and that more than 80% of the GBSN member schools believe technology is changing the way they educate, according to a recent survey. Technology has brought an important characteristic to online learning, which is an extraordinary flexibility, especially because it frees the occurrence of the learning process from the bound to a specific time or place; in an analysis of the implementation aspects of MOOCs in Sweden, Ulf Olsson, from the Stockholm University, states: "The flexible format [of MOOCs], without its bounds to a classroom, makes it possible to be anywhere in the world as long as the teacher keep track of time" (Olsson 2020).

A specific success case of the blended learning model is the masters of strategic communication (MSC) that the Salt Lake City Westminster college started in 2013: associate professor of communication Newbold (2018), who is co-chairing the course, comments in a 2018 article: "without question, it's one of the most distinctive and innovative educational structures I've observed, and I've felt fortunate to have fallen into its development process." Newbold describes the program[1] as having a hybrid format (students need to be in campus a full day per semester, interacting with each other, with teachers and with the clients of their projects—business, non-profit, or government organizations, a curriculum with five broad subject areas, no grade evaluation, and a flexible schedule. "Creativity, adaptability, critical awareness, project management and writing skills are reviewed from semester to semester, and a clear indication of significant improvement has been observed through 'competency' assessment and rubrics over five semesters", says professor Newbold (2018), as he refers to the undeniable success of the learning outcomes.

[1]For a detailed description of the MSC, consult the reference.

5 Transitioning from Physical to Virtual Classrooms

Studies show trends that indicate the learning institutions want to transition from the traditional environment to an online educational format, as a strategy to stay competitive; one example is a white paper by the Center for Educational Innovation of the University of Buffalo (n.d.), USA, that also refers that "Various external and internal forces have brought about the expansion and growth of online learning… […] External forces such as decreased state funding, tuition increases, technology costs and depressed economies have led to internal pressures to reduce costs and increase revenue…".

Whether education institutions want to transition to e-learning or blended environments or not, the change is actually inevitable; back in 2011, a report of the Pew Research Center (Parker et al. 2011), USA, was already indicating a solid growth in student preference for online courses: "Over the past decade, enrollment in online courses at colleges and universities around the country has grown at a greater rate than overall higher education enrollment" (Parker et al. 2011); a late 2017 study by the EDUCAUSE Center for Analysis and Research (ECAR) (CAE Team 2019), also concludes that the student's preference for blended learning has been increasing, when comparing the number of those that choose that learning model over face-to-face. According to the study, the reasons are related to the flexibility of the online access to learning (to include variety of resources and ability to control their own schedules), and the relationship with technology that new generations possesses; from the previously included comparison of advantages and disadvantages of each learning model, we could add other reasons, such as the lower cost or the possibility of interaction/collaboration between students (or between students and teachers) geographically displaced.

Many authors and sources support the idea that the transition will occur sooner or later in every institution, some even stating that "Technology is not an educational option—The blackboard is dead, replaced by an online whiteboard that students and teachers write on [with] mice and track balls" (Hogan and Kedrayate n.d.). We wouldn't be so radical, as we value the importance of 'real' face-to-face interaction, although we agree that nowadays, even in the physical classroom, the blackboard itself is nearly not used. Anyway, "…eLearning is here to stay…" (Hogan and Kedrayate n.d) and we also agree that this transition is not only good, but also certain. Another indication of the increasing tendency in using online learning is the creation of mobile versions of some of the digital study platforms (meaning versions that are optimized for mobile devices such as smartphones): "It's clear that an impressive number or organizations, mostly nonprofits, are already developing educational programs via mobile phones" (Pfeffermann 2013).

We also believe the transition will gradually occur, eventually leading to a learning model strongly supported by technology, thus, more online-based than supported by physical classroom; but although the trend is to use more and more connected devices, we still believe that the role of teachers, either in the physical classroom environment

or designing and supporting online learning, remains essential, as stated by UNESCO (2016): "Every education system is only as good as the teachers who provide the hands-on schooling".

6 Transitioning Challenges for Students, Educators and Institutions

The new generations of learners seem to have a natural appetite to absorb technology, perhaps because they are surrounded by it since the day they were born; using connected mobile devices and interacting through connected applications is part of their daily lives.

They are actually the main reason for the increasing need for transformation and adaptation that both the classical educators and traditional learning institutions have been facing; studies show that students prefer the blended or online approaches to education, as they take control of their learning, learn faster and cheaper while managing their time better (CAE Team 2019; Parker et al. 2011). Nonetheless, pure online learning seems to have the danger of not fostering enough motivation, and if not properly guided, young students might not have the adequate level of self-discipline to remain focused in the learning objectives.

Educators, on the other hand, need to break out with their traditional teaching habits, mainly with the habit of being in control. While this is gradually happening, it's not an easy adaptation: "The greatest obstacle, it seems, is adapting to instructional methods far different from the way we were both trained and educated ourselves", says professor Newbold (2018), when relating the difficulties felt by himself and other faculty in the initial years of implementation of the MSC; "Most college educators, myself included, were not trained to understand formalized education as an environment where students take the reins, where deadlines are flexible, where projects and assignments are highly customized and diverse, where they assess in collaboration with coaches, and where grades are not the epitome of assessment" (Newbold 2018).

Besides the educators 'pedagogical culture' adaptation referred by Newbold, they also need to understand their new roles and the technological tools they will be using when guiding and interacting with students. The ideal path might be having future online and blended learning educators going through a training program before starting their jobs, and also spend some time of on-job training (mentored by fully trained colleagues) after that program. This is the method used by the School of Education of University of South Australia (Best and MacGregor 2015), where a previously classroom-based pre-service teacher Design and Technology Education course has successfully transitioned to an online learning environment.

For learning institutions, the main challenges include the difficulty to leave the path of least resistance (maintain the established traditional model) and face the need to find a new approach to hire, prepare and support teachers; "Improving education quality requires far more than just having enough teachers in the education system;

teachers need to be trained, supported through professional development, motivated and willing to continually improve their teaching practices" (UNESCO 2016); administrators must not fear the costs caused by the workload and occupational dynamics that come with the change and must understand that the benefits will not arrive immediately. Understanding how online pedagogy works may provide high quality interactive learning, if supported by faculty equipped with new roles and professional attitudes.

7 The Importance of the New Roles of Teachers and Other Educators

The 2018 Global Teacher Prize winner Andria Zafirakou stated, in the World Economic Forum, that "We need children to be the problem-solving generation, and unless we teach them problem-solving skills, which come from the creative subjects, it won't happen" (Gray 2019).

Although she was commenting on the lack of understanding for the creative arts, she mentioned one of the skills for the 21st century, along with critical-thinking, digital skills, collaboration and social-emotional skills (World Economic Forum 2016). As outlined in a 2018 Microsoft, McKinsey and Company's Education Practice joint report (Microsoft, McKinsey Global Institute (MGI), Company's Education Practice (CEP) 2018), "Unprecedented opportunities for collaboration, the progressive automation of lower-skilled jobs, employer's demands for workers with more well-rounded skills, and students' desire and expectations to operate with autonomy and choice all indicate that our education system needs to prepare students for the future in a very different way than it has in the past".

In order to help students acquiring such set of skills, educators need to understand the new roles they have to play in this 'very different way' of teaching: in fact, they will be mentors and coaches instead of teachers, and as such, their role should be to leave the reins and encourage students to take control of their learning, engage them and motivate them, foster collaboration and communication with their peers, guide them into work together with respect, negotiate, make decisions and resolve conflict; furthermore, as they have to play these roles in a technology-based environment, they must also learn how to use technology, and continually update their technology-based knowledge. Being constantly updated allows them to correctly "use their expertise to embed their support in a digital method that supports independent learning" (Laurillard and Kennedy 2017).

To provide this help, both on campus and online, educators must promote teamwork, and discussion groups; learning should be personalized and based on experiences, projects and challenges. "Twenty-first century education will require more personalized learning with an emphasis on supporting rather than stifling creativity" (Scott 2015). As referred by Picciano, cited in Laurillard and Kennedy (2017) "blended approaches to learning have been making a resurgence". Also cited in

Laurillard and Kennedy (2017), Bruff, Fisher, McEwen & Smith further reinforce the value of blended learning: "A blended learning approach to 'wrapping' face-to-face support around the MOOC content may be the most effective and sustainable model" (Laurillard and Kennedy 2017).

8 Conclusions and Future Steps

The impact of technology in our daily lives in our jobs, and in societies and economies as well, caused a need for a profound change in education, in order to prepare students to a world of complexity and uncertainties; the traditional learning model, based on conventional classroom face-to-face seems to be, by itself, inadequate or insufficient to empower students with the skills for modern knowledge-based societies and economies, such as critical thinking, collaboration, problem-solving and social-emotional skills.

Technological advances have also impacted education, and caused the emergence of other learning models, either based on pure online learning or on a blend of that and traditional methods. Which one is better suited to help preparing students for a fast-changing world? This paper reviews and compares the traditional, the online (e-learning) and the blended models, summarizing advantages and disadvantages of each one. It concludes that the blended approach takes advantage of the best characteristics of the traditional and pure online models, being the method that is more likely to help proving learners with the skills they need now and in the near future. The new roles of educators, and also the challenges implied by a transition to a different learning environment are also reviewed.

This study is part of a broader PhD research, focused on improving Design Education, where other related matters are also approached; nonetheless, on this particular field, further investigation is necessary, especially focused on the efficiency and feasibility of applying the blended model in a sustainable education environment.

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