

Current Practices, Trends and Challenges in K-12 Online Learning

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Abstract: *Online learning is one of the fastest growing trends in Technology-Enhanced Learning (TEL). Technology in combination with an instruction that addresses the cognitive and social processes of knowledge construction could offer more diverse and effective online learning opportunities than their face-to-face counterparts. In this review we attempt to summarize different forms and practices in K-12 online and blended learning as they appear in various regional, national and cultural contexts. The article starts with introducing some basic concepts and terminology, sums up the state of K-12 online learning around the world and ends with summarizing some trends and challenges observed in current K-12 online learning practices.*

Keywords: *Online learning, blended learning, distance learning, learning management systems, K-12 education.*

1. Introduction

In the past several years we observe a shift in teaching and learning, which holds the potential to change the traditional education. This shift is caused by the more and more intensive application of *online learning* – a general systemic approach for education that uses a new delivery medium – Internet. In [1] online learning is defined as structured learning activity that utilizes technology with Internet-based

tools and resources as a delivery method for instruction, research, assessment, and communication. Online learning offers opportunities and possibilities that were unknown to educators 10-15 years ago. Many countries and states are implementing online learning environments to offer the world class educational opportunities to all students, no matter of their geographic locations or socio-economic status. In particular, many practitioners and observers of primary and secondary (K-12) education believe that the existing education system is approaching a critical point with respect to the widespread use of online learning. The changes in the ways K-12 students are taught and learn are clearly supported by the significant technological advance, resulting in continued decrease in the price of the computing power, data storage, Internet bandwidth, wireless networks, learning management systems and digital curriculum assets [2]. However, the continuous pace of technological innovation and its associated economics will not be able to transform K-12 education by itself. More likely, the realization of the promise of online learning will require successful integration of new instructional models and capabilities, updated curriculum strategies, enhanced teachers' engagement and expanded technology infrastructure being leveraged against a defined and specific set of students' and teachers' needs.

One reason for the popularity of online learning is that it allows learning to occur under students' control – at any time and any place. Online learning also holds a promise for promoting equity by providing the students with access to courses that otherwise might not be available, such as accelerated courses in remote rural areas. Keeping in mind the variety of learners and the geographic boundaries, online learning can provide schools with professional support to all students. Experienced teachers can teach in an individualized setting and can meet the specific needs of talented students and students who try to learn.

The main motivation for this review was our belief that the educational community needs to become better informed about the current practices and trends in K-12 online learning in order to foster better communication among the wide range of researchers, experts, policy makers and practitioners, who have the potential to contribute to advances in this field. In general, the literature and research sources on online learning have significantly grown in the past decades. Many studies have been published that examine the extent, nature, technological solutions, software tools and support, and other issues associated with online instruction. However, much of this literature focuses specifically on post-secondary education. The same cannot be said about online learning in primary and secondary education where the online instruction is still considered to be in its post nascent stages. Furthermore, the forces that drive online learning in colleges, universities and corporations are not as predominant in K-12. Although the research and practices on K-12 online learning are maturing, the online education at K-12 level has only been studied for about a decade – a short time to generate a significant body of literature and serious analysis [3]. Accordingly, the aim of this review is to summarize the available literature on challenges, successful models and implementations of online learning with a focus on K-12. With this aim in mind, we

discuss typical approaches applied across various countries and sketch the emerging trends.

The article is organized as follows. In the next section we start with some motivational observations and introduce some basic concepts and terminology used in the rest of the paper. Section 3 presents the state of K-12 online learning in the US, while Section 4 highlights the international perspectives of K-12 online learning. Some trends and challenges are presented in Section 5 and we conclude in Section 6.

2. Online learning: terminological framework

Rapid advances in information and communication systems are driving breakthroughs in all scientific fields. In 2009 the Converge Spring [4] reported that according to the World Future Society, the following ten technologies will transform life as we know it: alternative energy, desalination of water, precision farming, biometrics, quantum computers, entertainment on demand, global access, virtual education and distance learning, nanotechnology and smart robots. These breakthrough technologies will revolutionize the way we work, play, communicate and do business in the next 20 to 30 year. Most importantly, since one of them is virtual education, they will change how, where and when we learn.

The presence of online education, or distance learning, in this prediction is not a surprise; while the importance of Internet in the knowledge transferring process is steadily increasing, still only 10 % of the education is conducted online. Improvements in technology and the associated instructional methods are allowing some institutions to thrive with online courses. As a result, 100 million Americans take continuing education. E-training now accounts for about 30 % of the corporate training and is expected to exceed 50 % soon. TechCast forecasts that virtual education will enter the mainstream use in about 2015 [5].

2.1. Terminology

Since the vocabulary related to K-12 online learning is not standardized, in this section we introduce some of the basic terms and concepts used in the paper, most of which are adapted from [12, 13, 14, 22].

Online learning is teacher-led education that utilizes technology with Intranet/Internet-based tools and resources as a delivery method for instruction, research, assessment, and communication. It may be synchronous (in real time) or asynchronous (separated by time) and accessed from multiple settings (in school and/or out of school buildings). Online learning can be fully online, with all instructions taking place through Internet, or online elements can be combined with face-to-face interactions in what is known as blended learning.

Blended learning is a formal education program, in which a student learns at least in part through online delivery of the content and instruction (with some elements of control over time, place, path, and/or pace) and at least in part at a supervised traditional school away from home [15].

Online course refers to any course offered over Internet.

Virtual schools or *cyber-schools* are schools that deliver all curriculum and instructions via Internet and electronic communication, usually with students at home and teachers at a remote location, and with everyone participating at different times. A complete K-12 online learning program is also sometimes referred to as a virtual school.

Full-time programs typically must address the same accountability measures as physical schools in their states.

Supplemental online programs provide a limited number of courses to students who are enrolled in a school separate from the online program.

A *Learning Management System* (LMS) is a software application for the administration, documentation, tracking, reporting and delivery of education courses or training programs. LMSs range from systems for managing training and educational records to software for distributing online or blended courses over Internet with features for online collaboration and monitoring the students' progress.

A *Learning Repository* is an online library for storing, managing, and sharing digital learning resources, such as quizzes, presentations, videos, tests, or any other documents for use in online learning.

2.2. Dimensions of online programs

There are many types of online education programs. In parallel, K-12 online and blended learning have evolved in new directions in the past years. As a result, online programs vary considerably in many of their key elements.

Vanourek proposed ten dimensions that defined an online learning program, published later in the annual Keeping Pace with K-12 Online Learning reports¹. Fig. 1, adapted from [13], shows these dimensions; they describe whether the program is supplemental or full-time; the breadth of its geographic reach; the organizational type and operational control; and location and type of instruction. Some of the attributes may be combined or operate along a continuum (e.g., location and type of instruction).

Comprehensiveness (supplemental vs. full-time): One important distinction is whether the online program provides a complete set of courses for students enrolled full-time or provides a small number of supplemental courses to students enrolled in a physical school.

Reach: Online programs may operate within a school district, across multiple school districts, across a state, nationally or internationally.

Delivery (synchronous vs. asynchronous): most online programs are primarily asynchronous meaning that students and teachers work at different times, not necessarily in real-time interaction with each other. The ones that operate classes in real time may present a somewhat different set of program and policy questions depending on the state policies.

¹ <http://kpk12.com/>

Synchronous communication: Online communication in which the participants interact at the same time.

Asynchronous communication: Communication exchanges which occur in the elapsed time between two or more people. Examples are email, online discussion forums, message boards, blogs, podcasts, etc.

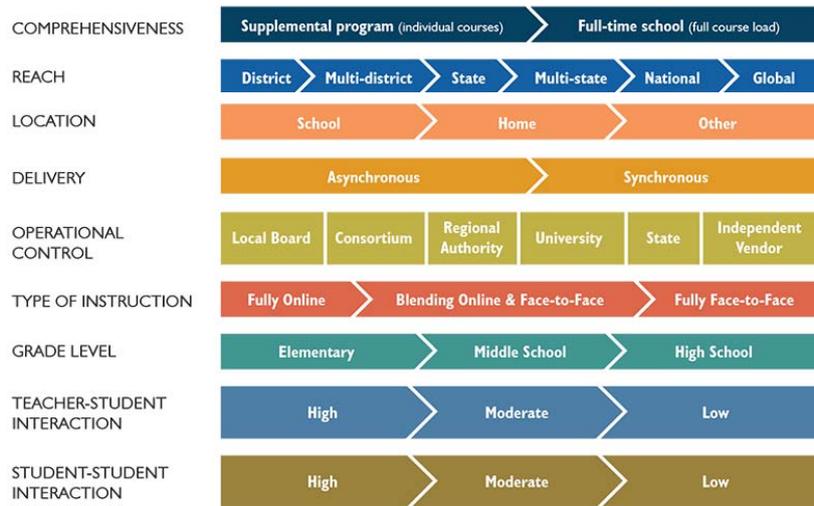


Figure adapted from Gregg Vanourek, A Primer on Virtual Charter Schools: Mapping the Electronic Frontier, Issue Brief for National Association of Charter School Authorizers, August 2006.

© Keeping Pace with K-12 Online and Blended Learning, 2012, kpk12.com

Fig. 1. Defining dimensions of online programs

Type of instruction (from fully online to fully face-to-face): many programs are now combining the best aspects of online and classroom instruction to create various forms of blended or hybrid learning experiences.

Among the benefits of online education for school-age youngsters are the increase in enrolment or time in school as the education programs reach underserved regions, broader educational opportunity for students who are unable to attend traditional schools, access to resources and instructors not locally available, and increases in student-teacher communication [16].

3. K-12 online learning over the world

The development of interactive online technology has the potential to drive the development of online learning all over the world. The degree to which this potential has been embraced varies from a country to country based on factors including economics, governmental support, infrastructure, population, and local innovation. However, the noticeable trend is that the majority of the countries in the world are leveraging the new technology and are adopting online teaching and learning across the educational spectrum including K-12.

3.1. The US perspective

The cumulative primary and secondary education process in the United States is known as K-12 education. To improve the educational outcomes, many school districts and states in the US are turning to online learning. With the new millennium, online learning at K-12 level has grown from an experiment to a movement. In the last decade the United States have largely invested in online learning: it is intended that US online education will outgrow traditional education by the end of the current decade. Already today renowned institutes like Stanford and MIT offer massive online courses for free – followed by up to 100 000 students worldwide [6]. According to [13] 50 % of the employers use online learning for training; one in four undergraduate and graduate students enrolls in an online course in higher education; 5.9 million college students take online courses. Although K-12 lags behind post-secondary education in using Internet to teach, many states and school districts are realizing and utilizing the benefits of online education, which provides the students with unique equity and access to high quality education unconstrained by time and place.

Online learning is often suggested as a tool for improving educational outcomes, expanding the access at lower costs than conventional approaches or allowing talented teachers to focus on what they do best by automating or offloading more routine tasks. In his book *Disrupting Class* [7], Clayton Christensen predicts that by 2019, half of all high school classes will be online. This prediction implies that online learning for high school students will grow at an incredible pace over the next decade. In another publication [8] Christensen and co-authors maintain that the widespread adoption of online learning will follow an S-curve that predicts the pace of substitution of fully online-delivered learning versus traditional instruction. They point out that “Using Internet to deliver courses seems to contain great disruptive potential. It could allow a radical transformation to happen in an incremental, rational way.”

Different types of online education programs are being implemented in the US, such as state virtual schools, charter schools², multidistrict programs, single district programs, programs run by universities, blended programs, private schools, and consortium based programs to name some of the most common program types. While now some established sectors of the field, such as state virtual schools and online charter schools have continued to grow, relatively new forms, such as consortium programs and single-district programs are expanding even more rapidly, as the range of private providers competing to work with districts.

Recent estimates report that in 2010 1.5 million elementary and secondary school students participated in some form of online learning [44]. The annual review of online learning policy and practice – *Keeping pace with K-12 online learning* [14] estimates that 275 000 students attended fully online schools in 2011-12. The annual increase in the number of students attending these schools in the

² In the United States, charter schools are primary or secondary schools that receive public money. They are subject to some of the rules, regulations, and statutes that apply to other public schools, but generally have more flexibility than traditional public schools. Charter schools are expected to produce certain results, set forth in each school’s charter.

largest states is typically hovering around 15 %. The same annual review also counts 619 847 course enrolments (one student taking a one-semester-long online course) in 28 state virtual schools in 2011-2012, an increase of 16 % since year 2010-2011. The authors claim that the total number of students taking part in all of these programs is unknown, but is likely to be several millions, or slightly more than 5 % of the total K-12 student population across the United States. While the vast majority of students will continue to take all of their courses in physical classrooms over the next five years, the number of students taking courses online will climb to more than 10 million by 2014, according to data released recently by the research firm Ambient Insight. Fig. 2 (adapted from [54]) illustrates the number of virtual schools and students in 2011-2012.

Many educators are finding that online learning is an efficient way to reach various categories of students: talented students, students who fail one or more courses, or those who seek an alternative to traditional education. Some of the early online programs, originally focusing on high-achieving students, have expanded their offerings and are working now with a much broader range of students.

	Schools	Students	Percent of all Enrollment	Average Enrollment Per School
<i>For-profit EMO</i>	95	133,128	66.7%	1,401
<i>Nonprofit EMO</i>	9	2,156	1.1%	240
<i>Independent</i>	207	64,309	32.2%	311
Total	311	199,593	100%	642

Fig. 2. Number of schools and students enrolment in 2011-2012 (from [54])

As online learning moves past the early adopter phase, the growth of online programs has redefined how educational technology can be used to address the needs of all students – from advanced ones searching for advanced placement or dual-credit courses, to at-risk students trying to find the right instructional mix to fit their learning styles. According to the Project Tomorrow Survey, conducted in 2009 [9], the primary reason for students to take online classes is to be in control of their learning. The largest part (51 %) of the surveyed population said it allows them to work at their own pace; 49 % said it was to earn college credit; 44 % said it allows them to take a class not offered on campus; 35 % said it was to get extra help; 19 % said they took online courses to get more attention from teachers.

The Simba 2010 survey [53] confirmed that the typical reasons for students to look for online courses are for credit recovery, access to unavailable course, advancement, remediation or dual credit (Fig. 3).

In the United States online learning alternatives are proliferating rapidly. While distance learning as it is practiced in today's virtual schools uses technology that is about ten years old, the literature shows that student's online education can be as effective as it is in a classroom, provided that a classroom with the appropriate course is accessible to the student [16]. B a k i a et al. [11] discuss five ways in

which online learning could increase educational productivity by improving the learning opportunities: broadening the access to resources and experiences; engaging the students in active learning; individualizing and differentiating instruction; personalizing learning; and maximizing the teacher's and student's time.

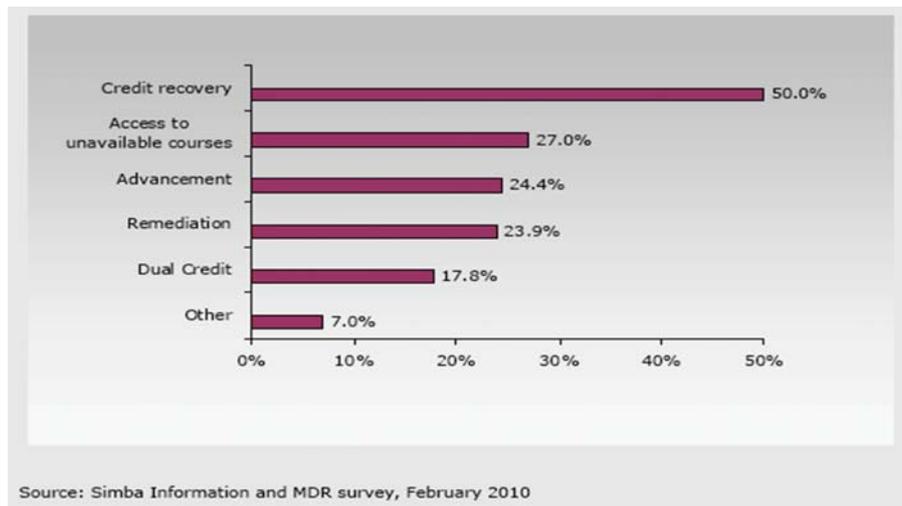


Fig. 3. Defining dimensions of online programs

3.2. Asia, Middle East and Africa

In Asia, credit-based online learning is already reaching many millions of learners. Several countries are putting their entire K-12 curriculum online. This is the region that has the highest growth rate for online learning in the world, at 17.3 %. At a country level, India has the highest growth rate followed by China and Malaysia. India launched a program to scale up high quality K-12 online education in 10 years. The government is subsidizing 12 million tablets, which is opening up online learning to a vast number of Indians (800 million). This decision puts also pressure on Indian higher education institutions, which in general have been highly resistant to e-Learning, to move more quickly, if they are to access additional government funding for tablets [55].

China is increasingly using online learning tools to supplement traditional pedagogical methods. As of 2010, the entire Chinese primary and secondary curriculum was online, however relatively few students have accessed it. The Chinese government's goal is to have their entire K-12 population of over 200 million students online by 2020 [55]. (Note however, that according to [22], the activities that are generally referred to as technology integration in North America are included under the umbrella of online learning in China). By 2015 all provinces of China will have digital education trial regions and all cities and counties will have demonstration schools to be used to lead a large scale education digitalization program. At least 60 % of all schools will have high speed broadband access and all rural schools and kindergartens will be equipped with multi-media classrooms. The

overall student to computer ratio will be 10:1 in primary schools, 8:1 in junior schools and 5:1 in high schools. The teacher to computer ratio will be 3:1 [28].

In 2010 Hong Kong enacted a policy recommendation for digital learning that “de-bundled” textbooks and teaching materials to make them more affordable and accessible to schools, and accelerated the development of an online repository of curriculum-based learning and teaching resources. A pilot scheme later resulted in a program made available to all 410 000 primary and secondary school students in 300 000 low-income families – especially the 8 percent without Internet access at home – to gain access to Internet for the purpose of learning [22].

In South Korea, there has been a nation-wide effort to incorporate online learning into primary and secondary public education, including the development of the educational content. All primary and secondary schools must be entirely “digital” by 2015, and every child should have a personal learning device. According to [28] 77 % of K-12 students are enrolled in some form of education opportunity outside of the traditional school. Moreover, 53 % of the South Korean children of age three years and above have used online learning services in 2012 and 30 % have been using e-Learning services through mobile devices.

Singapore provides local schools with the ability to develop online and blended learning programs for all subjects with the intent of improving students’ ability to research, analyze, and publish information using a variety of media. All schools use online learning, where it is also used to build life skills for students to become successful in the global information economy. In Singapore every teacher is prepared to teach online. An online learning week is scheduled yearly when school buildings are closed and school is taught online [22].

In 2012 the Malaysian Prime Minister announced that they would provide one tablet per every 10 students by 2015 with the goal to equip all 5.4 million school children in the country with a tablet in ten years as part of the National Education Blueprint 2013-2025. Also as part of the blueprint, the government intends to connect over 10 000 schools with 4G connectivity and to connect all the schools in the country to a national virtual learning platform [23].

Although Turkey has a remarkable history in distance education in the higher-education level, not much can be found for online practices at the lower levels. Turkey has recently developed a project, which aims to equip schools with infrastructure, develop and manage e-content, and offer training to teachers. While there are some longstanding K-12 online education programs, the use of K-12 online learning is still limited due to access and infrastructure issues. The K-12 online programs that are currently operating are focused on underserved populations, particularly students in rural areas. Some 15 million K-12 students in Turkey learn online [22].

The Middle East and Africa, to some extent, have begun contracting online content worldwide so that their students can have access to good quality online courses. In Saudi Arabia the government-operated Technical and Vocational Training Corporation (TVTC) network of over 50 instructors has over 100 000 students and was an early adopter of online learning. TVTC’s goal is to reach 400 000 students by 2014 with over 1200 online courses. There are a number of

public and private schools turning to online learning through the development of infrastructure within their schools to provide closer working relations between parents, students and teachers via school nets and the use of online learning resources and learning management systems [23].

Egypt provides online learning options to some students, typically those attending larger schools. The use of online learning options in Egypt is also available to students with special needs and to students who travel, as well as students taking college-level or advanced courses.

In Africa online learning is developing fast. However, there are certain conditions needed for online learning to succeed [45]:

- Since education is socially and culturally based, online learning developments need to be planned, developed, and managed locally (i.e., nationally or regionally). Only local people understand the local contexts in which online learning will have to work.

- Adequate electricity, Internet access, and teachers' training are necessary prerequisites for online learning, thus online learning may not be the immediate priority for national or international funding.

- Learners need low-cost, convenient access to computers (or mobile phones) and Internet in safe and secure environment that facilitates study. That condition cannot be still met by billions of people, but is rapidly improving.

- The content and even the technology are usually the smallest cost components. Learners' support (i.e., teachers or facilitators) is often necessary for successful learning.

3.3. Canada, Australia and New Zealand

In Canada online learning is a feature of the education systems in all 13 territories and provinces. In 2011 it was estimated that over 200 000 students were enrolled in online courses and/or programs. Given the vast land area and regional autonomy, there is an extremely broad spectrum of distance learning provisions varying by districts, provinces and territories [24]. More than one million computers were available to 5.3 million students in elementary and secondary schools across Canada almost ten years ago. British Columbia has the highest percentage of students' participation in online education. Ontario Ministry of Education funds and oversees the development of online learning courses and provides Learning Management Systems for all 72 districts. Online learning/teaching content is uploaded into Ontario Educational Resource Bank, which is accessible to all Ontario teachers, students and parents.

As it might be expected for a very large country with many isolated communities, there is a significant number of virtual schools in Australia. The largest numbers are in New South Wales and Queensland, with three in Victoria, two in Northern Territory and one each in South and Western Australia. From the published enrolment numbers, it appears that the School of Isolated and Distance Education in Western Australia is the largest, with several thousands of enrolments. The new national curriculum for all prep-to-year-10 schools mandated to be

available by 2012 through electronic delivery (including resources and materials) for those who wish to attend school online.

In New Zealand, Digital Strategy 2.0 [52] was designed to provide the infrastructure that will allow New Zealand to join the leading countries in online learning. While there are several very active online learning organizations in New Zealand – e.g., Virtual Education Networks, the New Zealand Virtual Learning Network and LEARNZ, there appear currently to be only three virtual schools.

3.4. South America

In South America the growth rate of K-12 online learning is a healthy 19.3 %. To date, South America tends to import the majority of content and technology from outside the region [23]. In Mexico, high school will be mandatory in the near future. However, there are not enough face to face schools to meet the needs of the growing teenage population that will require this educational level. Mexico's ministry of education created a program in Mexico City to test the social acceptance of fully online high (school programs among low income teenagers and their academic performance [30]). In Mexico every new teacher is trained to use digital curricula [29]. There are also virtual courses offered in single subjects. Telecentre.org, which is based in Mexico, offers online mathematics education to primary and secondary school students in Mexico, Bolivia and Peru [24].

The blended learning is also gaining momentum in South America. This learning model, which costs 30-70 % less than the on-campus education, combines classroom discussions with online studies. In Argentina, a program was launched to place three million netbooks in schools throughout the country by 2012. In Uruguay, "One Laptop Per Child" program has been applied to primary school students since 2007. Distribution of laptops to secondary school students has been initiated in 2012. The Uruguayan government has funded computers for students to be used in a blended learning environment. While a very good initiative, it stays rather isolated from other policy decisions. In Peru, online learning is only available at 1.4 % of all public schools. In Bolivia, scarce resources have prohibited public funding of online learning program development at the primary and secondary levels. As to Brazil, there is a federal law prohibiting online learning at the primary and secondary levels [22]. Teachers' unions believe that this type of system is bound to dehumanize the process of learning and is likely to create antisocial, over-individualistic students.

3.5. European Union

Following the developments in the United States, the availability and popularity of online education in Europe are on the rise [6]. At the beginning of the first decade of this century the online learning was characterized by:

- Limited offering of online and blended learning, mainly in regular upper secondary schools and upper secondary schools for adults, and occasionally in some vocational schools.

- Limited amount of digital repositories for school resources, including collections of modules on relevant subjects from existing training programs.

The e-Learning Action Plan, adopted by the European Commission in 2001, gives the new communication technologies a greater role in education [35]. The Action Plan was intended to support the implementation of the online learning initiative by:

- Setting out the principles, objectives and lines of action of e-Learning, defined as “the use of new multimedia technologies and Internet to improve the quality of learning by facilitating the access to resources and services, as well as remote exchanges and collaboration”.

- Placing emphasis on creating appropriate conditions for the development of the content, services and learning environments which are sufficiently advanced and relevant to education.

In 2010 the EU member states and the European Commission agreed to include education and training as a key element in “Europe 2020” – the EU’s strategy for smart, sustainable and inclusive growth over the coming decade. Separately, the European Commission funds the research and implementation projects on online (distance) learning in the European Union including Eastern Europe. The growth rate of e-Learning products and services in Eastern Europe is around 21 % [33]. Eurydice is an executive agency of the European Commission that provides data on education systems and educational policies in Europe. The European SchoolNet (EUN) is a network of 30 Ministries of Education across Europe and provides country-specific detailed reports on the use of learning technology and digital content in Europe.

As reported by the International Research on K-12 online learning [24], in 2012 there were 68 European virtual schools and colleges distributed across 18 countries (although the total number of European virtual schools was likely to be well in excess of 60 and perhaps approaching 100). The average size of the schools was 475 students. On the basis of the available evidence, Bacsich and Bristow [24] estimated that the virtual schools are split evenly among those established by public and private providers. A considerable proportion of these schools is offering a full or broad curriculum. Moreover, a significant proportion of the virtual schools (extrapolated to be between 30-50 %) were initially established to address issues of student exclusion. Characteristics of student exclusion addressed by European virtual schools include:

- Students who are long-term sick and/or hospitalized;
- Students with disabilities;
- Young parents or pregnant young women;
- Travellers;
- Students who have been bullied or are school-phobic;
- Students who left school with no or few qualifications;
- Students who are imprisoned;
- Geographically isolated students;
- Students with specific language needs (immigrants with poor host-nation language skills).

At least ten European virtual schools were initially established to support expatriates and/or the children of military personnel serving overseas. In several European countries there appears to be growing interest towards virtual schools providing supplementary, specialist and/or revision courses and lessons. The virtual schools offer a broad pedagogical spectrum – from 100 % online to significant face-to-face interaction – and a variety of communication tools. In many cases the virtual schools reflect local/national circumstances – either in support of local/national policy priorities or to meet demands not sufficiently catered for in their host region/nation [24, 46].

A success example of high school online learning is the IB Diploma Online Program [38]. It is an academically challenging and balanced program of education with final examinations that prepares students, aged 16 to 19, for success at university and life beyond. The program has developed gold-standard online courses and trained master teachers to teach online. It is offered to students in 125 countries. The growing community of the IB Diploma Program was covering 280 schools, 1000 students and over 60 teachers located around the world in 2012.

3.5.1. United Kingdom

Online learning is taking off in the UK Higher education. According to the report in [39], there are around 2600 online or distance learning courses available. Of those, over 1500 courses are delivered by 113 UK higher and further education institutions, while the Open University offers 952 courses. However, progress in K-12 online education lags behind that in higher education [35, 36]. As reported in [24], there is no government organization that oversees quality standards for K-12 online teaching or online courses. Furthermore, there is no governmental master strategic plan for online learning on a national scale. The Ministry of Education along with the Infocomm Development Authority shapes the direction of online learning. The government provides funds to local authorities so that they allocate funds for online curriculum, hardware, and software based on their local needs. They usually purchase services and products from private vendors.

The majority of students have access to online resources, and there is a fairly high ratio of students to computers at the schools. Most of the efforts to use technology for learning occur at the secondary level. There is, however, a good support for assistive technologies in schools. Online learning is most often used to support courses for medically homebound students, students with special scheduling considerations, students for whom work is a priority, and students with special needs. There are no government licensing requirements for teachers who teach online, except that they must be qualified to teach. Furthermore, there is no extra training provided to teachers for teaching online and approximately 10 % of the teachers had never received any ICT training of any sort. Yet, teachers typically create the content for online courses and a learning management system is used typically to deliver courses [24].

3.5.2. Finland

In 1997 the National Board of Education and the Finnish Broadcasting Company started, together with 12 educational institutes, a development project funded by the European Union for Upper Secondary Distance Education. The project covers regular upper secondary schools, upper secondary schools for adults, and some vocational schools. In 2007 there were about 120 upper secondary distance learning institutes with approximately 4000 distant students. Upper secondary online education is usually blended. Majority of the studies is completed in the form of online learning under the supervision of teachers. The age of online/distance learning students varies from 18 to 70.

In Finland, online learning at K-12 level is included in the government's national plan for developing educational technology, but its implementation is mainly at a local level and with teachers. There are no governmental licensing requirements or special credentials required to teach online. It is considered a teaching method and source of content that is the same as any other, with no special standing in evaluation, quality assurance, procurement, or otherwise. In 2011 Finland had a single national virtual school.

The online learning content comes from commercial providers and public initiatives but is created mostly by the teachers themselves. All teachers in Finland have at least a master's degree, giving them a good foundation to create and develop their own course material independently. The large educational publishers have their own online content materials, but they are mainly focused on supporting the existing book sales [24].

In higher education the Finnish Virtual University (FVU) is a partnership of all 21 Finnish universities. It develops and supports collaboration among universities in the utilization of educational technology. As a consortium, it develops information, network-based training, and educational services for shared use of its member universities. The government funded the project and it has generated tangible results, such as developing 460 online courses, according to the Ministry of Education. The FVU partnership ended in 2010 however, all 21 universities continue to do business individually.

3.5.3. Bulgaria

According to the report provided in [22] the use of online learning in the public education in Bulgaria is underdeveloped. The ICT in National Education Strategy initiative of the Bulgarian Ministry of Education and Science (2005-2007) provided 3000 Bulgarian schools with computers, broadband connections, laptops and projectors for use in the classrooms, as well as with a national educational portal, containing some e-lessons across the curriculum and allowing resources sharing [56]. However, the initiative targeted at supporting the traditional education taking place in physical classrooms, not from distance. The intended role of the scarce e-Learning resources is also something additional to traditional education.

The idea of online learning is a relatively new concept for a significant proportion of the Bulgarian educational community and administration. The nascent online programs are not tested in practice and the teachers are not ready.

The local education system is conservative and slowly changing. The current focus is on long delayed changes and reforms at a more general level (e.g., organizational improvements, restructuring priorities in funding, etc.) [22]. These are some of the primary obstacles to the growth of online learning in Bulgaria. Currently, very few Bulgarian schools are using any digital content to supplement the face-to-face classroom experience, while most of the schools feel there is not enough research and evidence to demonstrate that online education is an efficient practice. However, several organizations are starting to provide learning content and services; they need though public and administrative support in order this initial effort to grow and make it more than an isolated experience. There were also some pilot projects on online learning, though the effect was not significant and the focus was on peripheral issues. At present, it seems that the use of technology is first advancing inside the schools – the physical presence of technology and its utilization is an essential precondition. The regular use of computers in class will obviate the need for online learning. As stated by [22], some forms of online learning may surface in the next 2-3 years.

4. Trends and challenges

Online K-12 education is becoming a worldwide phenomenon and is marking a global tendency in education. The following trends and challenges have been identified based on the surveyed materials. The majority of the trends and challenges listed below are modified versions from [21] and [22], extended with relevant facts from [41, 42, 43, 45, 47, 48].

4.1. Trends

The rise of online education is expected to continue and will play a big role in how the perception about e-Learning is changing in society. The following trends have been identified as key drivers in K-12 education:

- Blended learning: there is tremendous growth potential for online learning in blended learning opportunities. Many schools and districts are choosing blended learning as a stepping stone to gain experience before moving to a full online program.
- Competency-based learning: mastery is being recognized by educators and policy makers as more important than “seat time”. Technology, and in particular blended and online learning, is providing the means for students to receive individualized instruction and is empowering students to learn at their own pace.
- Continuity of e-Learning: online and blended learning are solutions for ensuring that learning continues during a school closure. Online learning and continuity of learning is more than just providing curriculum in an online format. It involves the planning, training, and management of delivery of an instruction over a new technologically enabled delivery model.

- Mobile learning: mobile learning is truly extending the classroom to anytime and anywhere. Netbooks, smartphones, connectivity and software are driving mobile learning forward.

- Instructional content: the content is a key ingredient to a successful online program. Economic factors, coupled with the need for portability of learning are driving forces for disaggregation and openness of the instructional content, especially as it relates to online and blended learning programs.

- Monitoring the student's progress: the increasing pressure on schools and districts to provide and analyze the student's and teacher's performance is driving the development and adoption of Learning Management Systems. The LMS are turning into all-encompassing portals that not only deliver learning, but also integrate other systems crucial to students' progress.

- Cloud computing: cloud computing provides access to a wide range of educational materials without teachers/students actually having to be on-site. They can access any resources they need from anywhere by an Internet connection. It also requires less equipment for both students and schools.

- Higher progress in developed countries: blended and online choices are most available to students in urban areas from developed countries.

Blended learning is occurring much more frequently than online learning.

Online learning is more prevalent for students with special needs or circumstances (such that prevent them from attending the traditional classroom).

Professional development: specialized teacher training is not required but is encouraged and available.

Educational social media: social media is becoming educational and the educational social networks are becoming popular within the educational system.

The most valuable and often scarcest resource in education is good teachers. In this context, the key question that needs to be addressed is: What supports are required to redefine teacher's education for preparing all new teachers for online teaching and virtual learning professional opportunities [20].

4.2. Challenges

Among the most significant challenges and barriers are:

Limited knowledge about online learning and as a result limited interest in it.

Limited economic resources in many countries that do not allow investing in the technology infrastructure, content development and teacher training needed for implementing online learning.

Lack of governmental vision and leadership to develop policies for implementing and providing online learning.

Lack of governmental funding and encouragement of investments for implementing online learning programs.

Need for teacher's training and professional development in online education.

Lack of equitable access to Internet tools or resources to make online learning possible in many areas.

5. Conclusion

Online learning is one of the fastest growing trends in educational uses of technology. A limited amount of research exists that addresses the current practices of online learning and virtual schools in K-12 context. Most of the publications studying various educational approaches, standards and best practices are based on online post-secondary or face-to-face teaching. Technology by itself does not have the power to improve learning, but when utilized in online learning in combination with instruction that addresses the cognitive and social processes of knowledge construction, could offer more diverse and effective learning opportunities than their face-to-face counterparts [46, 51]. In this review we have attempted to summarize different variations in K-12 online and blended learning, in various regional, national and cultural contexts. It may leave an impression that the practice in the realm of K–12 online education is following the footsteps of post-secondary online education. To some extent this is true, but K-12 online learning addresses specific needs and thus specific challenges and requirements. The results of this survey could be useful in that they provide a frame of references from which to view the emerging and rapidly evolving field of K-12 online education. It was intended to provide a broad picture of K-12 online education that can be helpful in supporting the implementation of new online programs, teachers' professional development and the development of policies that promote virtual schools and online education in general.

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