

# **Trends of Emerging Technology in Online Learning**

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## **Abstract**

Online distance learning (ODL) has empowered traditional and non-traditional students to the point that there is a total transformation, from the makeup of student bodies to the way education is delivered. Higher education is rapidly changing, and technology is the catalyst of this change. The impact of emerging technologies and the affordances of these technologies improve access and therefore democratization of education and cost issues for students. While allowing higher education institutions to reach traditional and non-traditional students on their terms; in their own time and at their convenience. To elucidate the idea of the impact of technology in education with regards to the democratization of education, trends of emerging technologies in online learning in the next 5 years and beyond are examined. This paper reports on examining technologies that are and could be catalysts of social transformation in the next five years and beyond. A preliminary investigation based on a qualitative research approach suggests a constant evolution of emerging technologies and an apparent contribution to the democratization of education. This report will present the impact of changes in an online paradigm and the support afforded through fostering a sense of community in a potentially cold social environment.

## **Keywords**

Democratization; Social Environment; Transformation; Emerging Technology; Technology Affordances.

## **1. Introduction**

Gartner Hype Cycle of emerging technologies presents an evolution of technologies over a period of 10 years and more in a way that highlight the emergence, adoption, maturity and the impact on application of specific technologies (Gubbi et al., 2013), see an illustration below in Figure 1.

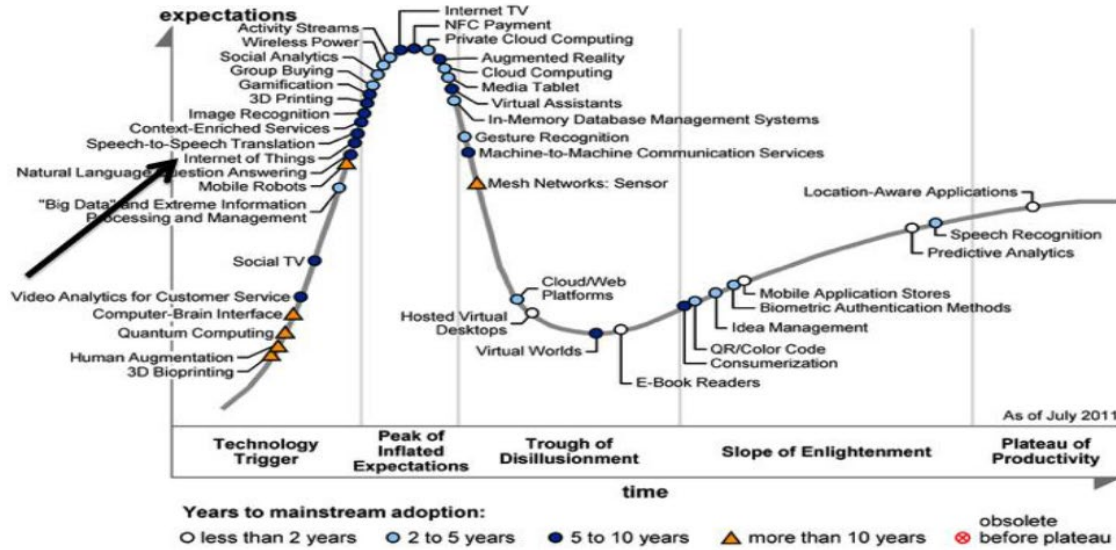


Figure 1. Gartner 2011 Hype Cycle of Emerging Technologies (Source: Gartner Inc.)

There are numerous platforms on which online learning takes place, these include Learning management Systems (LMS), e.g. WebCT, Blackboard, Moodle, etc.; Blended method, e.g. Blogs, Wikis, Skype, etc.; Synchronous platforms, e.g. online lectures, videoconferencing, etc.; and Asynchronous platforms, e.g. Podcast, video lectures, etc. Emerging technologies can be grouped according to their affordances (Siemens & Tittenberger, 2009) and each technology above possesses multiple affordances, see an illustration below for an elaborate example.

For the purpose of this essay, emerging technologies will be presented based on their contribution to the changes in the online learning paradigm and five of the emerging technologies that are critical and will continue to play a transformational role in the next 5 years and beyond, are discussed (Figure 2).

	ACCESS	PRESENCE	EXPRESSION	CREATION	INTERACTION	AGGREGATION
Blogs						
Skype						
Wikis						
Second Life						
Facebook						
Google Reader						

Figure 2. Affordances of emerging technologies

## 2. An overview of emerging technologies and their potential roles Web 2.0

Web 2.0 applications are characterized by seven principles as defined by O'Reilly (2005a, p.1). These principles differentiate Web 2.0 from Web 1.0 technologies. There are a number of applications that demonstrate the foundations of Web 2.0 concept and they are currently in use and display attributes that confirm that they will be used in the next five year and beyond. For example Web 2.0 is called a 'social web', because its content can be easily generated and

published by users and the collective intelligence of users encourages more democratic use web' (Boulos, & Wheelert, 2007). Web 2.0 applications include Wikis, Blogs, content tagging serves, etc. Many of these applications are not technologies as such but services built using building blocks of the technologies and open standards that underpin the internet and the web. The online social interaction of Web 2.0 has been enriched using wikis, RSS and blogs, encourages a more human approach to interactivity on the Web, better supports group interaction, and fosters a great sense of community in a potentially cold social environment (Boulos, & Wheelert, 2007). The collaborative concept underpinning web 2.0 applications and the shareable and distribute electronic nature of web 2.0 applications is key to this emerging technology dominance of the next five years.

Educators can use blogs to update learners on course activities, post reflections on online conversations. Wikis are used, among other things, for collaborative writing and group work and social bookmarking is used to organize personal information and sharing information, articles and learning resources.

There are undeniably problems for systems that allow such level of openness and blogs and wikis have suffered from problems of malicious editing and vandalism (Anderson, 2007). Also, social networking attracts a full spectrum of users, making them susceptible to offensive activities (Boulos, & Wheelert, 2007).

## **2.1 Gesture-based computing**

The New Media Consortium predicts that there will be more gesture-based computing (GBC) and lots of inter-connected objects packed with useful information (Barseghian, 2012), this is a phenomenon of post tangible robotics era and an era of gesture-based computing. This emerging technology eliminates hand held controllers of video games and uses player's gesture to control applications (Barseghian, 2012).

Gesture based computing is promotes access and openness for those with special needs, gesture control devices offer the prospect of independence and freedom, which critical enabling elements of social justice. These elements underpin the key factors for gesture-based computing to dominate online education in the next five years and beyond. Current uses include changing the amount of light in the room, virtual autopsy and facilitating multi-classroom interactions. Therefore, this technology is one of the most exciting technologies to enable recruitment of all students, irrespective of special needs.

Gesture-based learning making Digital Game-based learning (DGBL) cutting edge territory, since from the perspective of traditional universities DGBL is still a few years from becoming a regular classroom practice (Barseghian, 2012). The benefit of DGBL comes from the appeal of games with learning, the ability of games to capture student interest, motivate them to progress to higher, more difficult levels of learning (Barseghian, 2012). Games are used to leverage the best game theory in education, that is, teamwork, leadership and discovery and scientists are beginning to use crowd source games to carry out experiments in protein percentages in participating players (Barseghian, 2012). Alternative games are used to teach students to create solutions for real-world problems, such as infrastructure and economics.

The challenge in application of DBGL and GBC is how to use traditional education content in a game setting and a lot of time is spend researching information that will help to figure out how to move along in a game. This challenge keeps researchers and educators interested in DGBL practices, which creates a long term in the technology.

## **2.2 Learning Analytics**

Institutions providing online education are starting to develop data mining techniques to improve student's online learning performance and, Big Data will drive decisions on the part of students, faculty and the foundations and companies in the education sphere (Barseghian, 2012). The rise of big data education is one of the biggest game-changers in the education sphere and has drawn the attention and financial support of big guns (Barseghian, 2012). Data mining id not a new emerging phenomenon, however the process of using data to develop solutions for student's problems, is an emerging trend.

The benefit derived from using analytics is that educators can help students with their struggles and needs and customize what they teach based on hard data. In the application of learner analytics reports are generated on student's performance, identifying the risk level and solutions for struggling students and students get feedback and assessments from educators while they complete the exercise (Barseghian, 2012). Also, the ability to identify patterns in data and

provide solutions personalized to students' learning experience, since learning analytics can pinpoint students at risk and enable educators to customize solutions to their specific needs (Barseghian, 2012).

The challenge is that most captured data cannot identify intangible, unquantifiable qualities like creativity; leadership and innovation, which are equally important to student achievement (Barseghian, 2012). Issues of privacy, profiling and information sharing are highlighted as disadvantages of learner analytics (Gubbi et al., 2013). Extracting useful information from a complex sensing environment at different spatial and temporal resolutions is a challenging research problem in more complex situations, such as in artificial intelligence paradigms, there making learner analytics complexity a challenge (Gubbi et al., 2013).

### **2.3 Internet of Things**

In the application of Internet of Things (IoT) technology, everything is connected, smart objects connect users to information and information back to users (Barseghian, 2012). IoT is fairly new and applications are sparse, the technology is mostly used for tracking people, objects, and spaces (Barseghian, 2012). In Universities student IDs are used to track their class attendance and, in some case, to track lab equipment and resources. The institutions will have an instant window into the condition of the objects, with internet being the mechanism for real-time monitoring of current location, environment, and movement of an object in their care (Barseghian, 2012). IoT can be realized in three paradigms, that is, middleware, sensors and semantic orientation, although this type of delineation is required due to the interdisciplinary nature of IoT, the usefulness of the technology can be unleashed only in an application domain where the three paradigms intersect (Gubbi et al., 2013).

It apparent that since IoT has come to existence, search volume is consistently increasing with the falling trend for Wireless Sensors Networks. This trend is likely to continue for the next decade as other enabling technologies converge to form a genuine IoT (Gubbi et al., 2013). As consumers look for more data about various topics, IoT gains popularity and social acceptability.

Benefits of IoT include the availability of enabling technologies such as RFID, which enables design of microchip for wireless data communication and secure data aggregation required for extending the life of the network and ensuring reliable data is collected.

There are several benefits of the application of IoT and these are realized in the four domains, which are Home for individuals who own the network; Enterprise, for applications within a work environment; Utilities for service optimization and consumer consumption; and Mobile for smart transportation and smart logistics (Gubbi et al., 2013). Challenges associated with IoT range from appropriate interpretation and visualization of the vast amounts data to the privacy, security and data management issues that must underpin such a platform for it to be available (Gubbi et al., 2013).

The social impact of emerging technology on ODL

Developments in emerging technologies, in particular web 2.0 tools such as blogs, wikis and social media, and mobile devices such as smartphones and tablets, have given the learners more control over access to education and the creation and sharing of knowledge. These tools have enabled an environment in which learners are empowered and afforded faculty a means to leverage this learner control to increase collaboration and various similar social activities in education.

### **3. Literature Review**

The dawn of the 21st century came with the realization that we have largely overcome the stigma that games are for playing, which is the opposite of working. Majority of role players in education believe that games are engaging, they can be effective in T&L, and they have earned a place in T&L (Van Eck, 2006). Therefore, it is easily accepted that predictions of university life in the next 10 to 20 years reflect an era of a lot of inter-connected and internet-connected objects packed with information, applied in T&L (Barseghian, 2012).

The new horizon report on higher education predicts that there will be more gesture-based computing and that video games will become common place in lecture rooms (Barseghian, 2012). The report crystalizes a lot of what is being witnessed in T&L today, for example, how open education resources are disrupting higher education, the proliferation of free online courses and the evolution that led to the certification of free online courses (Barseghian, 2012).

It is apparent in the literature survey that the predicted future is already here since students already expect to be able to work, learn, and study whenever and wherever they want to. The technologies used are increasingly cloud-based and driving the world of work to become more collaborative, therefore changing the way student projects are structured. Online learning is of strategic importance for many academic institutions, and more are moving to hybrid learning and collaborative T&L models. There is more emphasis on challenge-based experiential learning with more active learning experiences, both inside and outside the lecture rooms.

The literature survey depicts clearly that ongoing research, for the past two decades has led to widespread public interest in games as learning tools (Van Eck, 2006) & (Beavis, 2012) and (Beavis,2015). Throughout the decade proponents of technology education (TE) have published essays, articles, and books on the power of TE (Beavis, 2015), e.g. Beavis (2015): Computer games can get your brain working and Erstad (2013): New literacies and digital epistemologies. Belshaw (2012): Essential elements of digital literacies and Gee: Language and Learning in the digital age.

Then, Hague & Payton (2010): Digital literacies across the curriculum and Routledge (2009): Game-based learning in the classroom. Kuhlthau et al. (2012): Guided inquiry learning in the 21<sup>st</sup> century and Johnson (2005): Everything bad is good for you, Gee (2003): What video games have to teach us about learning and literacy, were amongst the most prolific researchers that publish work in support of technology education in T&L.

This body of knowledge resulted in researchers publishing technical and critical work on TE (e.g. DGBL), as was postulated by Kuhlthau et al. (2012), about awareness of the knowledge gap for participating in digital games. Routledge (2009) deliberated on digital games being tools designed to transfer knowledge to the player through interaction with the information object and characters or the environment. McLoughlin(2011) postulated that it can be inferred that the use of graphics, movement and sound assist the learner to navigate through the game, therefore enhance the process of learning.

Kuhlthau et al. (2007) enhanced support for the use of digital games when they put forward the argument that within digital games there are problems to be solved and decisions to be made and therefore participants begin the game by seeking information by immersing themselves in various sources of information to gain the learning they need. Thereafter decisions must be made on the best information sources available and applicable to find solutions, thus establishing the best information creation tools to communicate learning.

In the same context, Erstad (2013) defined lifelong learning as the ability to continuously reinvent your knowledge and expertise to manage changing problem situations, which is essentially what a learner does within the context of a game, Prensky (2005). Turkey et al. (2015) closed the argument in support of the use of digital games in T&L when they put forward that TE levels up the information behaviors, just as guided inquiry enhances the development of information behaviors, and consequently learning becomes a learner-centered activity Phillip & Garcia (2013).

It is crucial to recognize that DGBL lecture rooms and paradigms that view digital literacy practices as embedded within TE, do not recognize the use of digital games as a replacement for the instructor or lecturer. TE is aligned with constructivist and socio-constructivist learning theories, the role of a lecturer becomes not one of an expert but of a facilitator and guide (Routledge, 2009). Thus, the facilitator needs to be familiar with the elements and infrastructure of the game, such as rules, goals, levels, and settings, Pivec & Pivec (2011).

Introduced in the early 1970s, is the theory of transactional distance by Michael Moore. Moore recognized the limitation of the structure of the independent learning package by including dialogue as a second variable. Moore's theory of transactional distance is intuitively appealing and moves the field toward the realization of a pedagogical theory. According to Moore (1991), transactional distance is pedagogical, not geographic, and necessitates "special organizations and teaching procedures" (p. 3) composed of two variables (clusters, dimensions?), i.e. structure and dialogue (Moore, 1990; Moore and Kearsley, 1996). The structure reflects the course's design and is largely a function of the teaching organization and communications media employed.

On the other hand, dialogue is also associated with the medium of communication and may include either real two-way communication or Holmberg's internal didactic conversation. In Moore's theory, the most distant program has low dialogue and low structure while the least distant has high dialogue and high structure (Moore, 1993). The innovation applied to improve student performance deals with Moore's pedagogical variables of transactional

distance. The innovation works on structure as it relates to course design and communication media employed. It also deals with dialogue, for the engagement between student and instructor is bound to increase.

#### **4. Methodology**

The study is focused on first-year engineering students, who have taken engineering statistics for the semester. Analysis is done on the results of the first assignment to measure the impact of the innovation on student performance. Adequate support is provided for students with different learning styles. Ally and Fahy (2002) found that students with different learning styles have different preferences for support. The difficulty level of the material is set to match the cognitive level of the learner so that the learner can both attend to and relate to the material.

The cognitive description is applied on the result and student are grouped according to their performance. Poor-performing students are placed on a pacing and an instructional scaffolding teaching program and excelling students are placed on an adaptive learning and gradual release of responsibility program. The unit of analysis (the case) is an intervention program that is instructionally designed to develop a personalized and differentiated learning process that breaks down lessons into lower and basic components, for struggling learners, and improves lessons to a complex high level and challenging activities for excelling students.

##### **4.1 Data Collection Tools**

Yin (1994) and Patton (2002) stipulate that a hallmark of case study research is the use of multiple data sources, which is a strategy that enhances data credibility (Patton, 2002) and Yin, 2003). This case study will apply the following triangulation of data sources i) document analysis and archival records; ii) Research notes of previous lecturers; and iii) Exam results statistics. It is rational to apply document analysis in this research since it is often used in combination with other qualitative research methods as a means of triangulation.

The combination of methods in the study of the same phenomenon enables a researcher to draw upon multiple sources of evidence and, to seek convergence and corroboration through the use of different data sources credibility (Patton, 2002) and Yin, 2003). Sogunro (1997) provided exemplary clarity concerning the use of document analysis, he reported that the use of document analysis provided information on history, goals, objectives and substantive content of the phenomenon under study.

The decision to gather and analyse archived records is linked to the research propositions developed in the conceptual framework of this study. The use of archival data is supported by Robson (2011) and the claim that archival data is an increasingly viable resource because of an ever-greater amount of archival verbal and visual material that has become universally available with the information proliferation attributes of the internet (Baxter and Jack, 2008). Archival data comprises of wide array of empirical data created by researchers for their personal use or on behalf of an organization.

#### **5. Results**

It apparent that emerging technology trends can seem both elusive and ephemeral, but some are integral to business and education strategies, and form the backbone of tomorrow's technology innovation. The future of technology is based on the current innovation efforts, and with an eye towards innovation and growth and, a spotlight on emerging trends that may well offer new avenues for pursuing strategic ambitions.

##### **5.1 Discussion and Recommendation**

The challenge that emerging technologies bring to online learning new paradigms can be summarized better by the seven principles, along with specific needs of the online learning paradigm, that helps to determine the purpose and rationale of integrating the particular technology, and how it benefits the learner (Beldarrain, 2006). Designers must understand how the technology tools selected will aid interaction and which types of interaction it will promote (Gubbi et al., 2013). Time is of the essence for both learners and instructors, activities and content must be relevant and up-to-date. The integration of emerging into new models of teaching must also take into consideration cultural differences and learning tendencies, respecting the individual (Gubbi et al., 2013).

It is necessary to consider the barriers to the adoption of new technology at this stage and in summary, these barriers include familiarization levels of the user; the ease or difficulty of utilizing the technology; the level of integration

achievable; reorientation and continuous evolution (Staley & Trinkle, 2011). These barriers are summarized as attitude and perception (Internal) and availability and accessibility (external) by (Senaidi et al., 2009).

Technology leadership of an organization must seek to drive synergy in the organization and therefore implement the following changes:

- Integrate all relevant departments, when adopting technology, and ensure all faculty is trained to understand, evaluate and be capable of deploying the technology chosen.
- Assess the impact of emerging technologies on the pedagogy strategy and experiment with the technology based on the paradigm created by the pedagogy strategy, in the classroom.
- Exploit the benefits of emerging technologies implemented and develop a retrospective plan of strengths and opportunities to eliminate the effects of weaknesses and threats.
- Adopt a system view in the implementation of emerging technologies and integrate all relevant processes and systems in order that the value chain is identified.
- Identify and recognize patterns of emerging technology trends based on analytics and Big data leverages and develop solutions that are personalized, individualized and concomitant to specific student's difficulties.

## **6. Conclusion**

Web 2.0; Gesture-Based Learning; Game-Based Learning; Learner Analytics and the Internet of Things are emerging technologies that have an impact on online learning, currently and in the next five years. All emerging technologies, including the above mentioned are prolific with potential pedagogical benefits that can improve online learning paradigms. Although there are disadvantages and challenges to application and adoption, the strengths and opportunities presented by the technologies, surpass the drawbacks. When implementing emerging technologies, faculty in institutions will realize the potential latent in these technologies, when adopted in online learning environments. The reality is that when emerging technologies are adopted, institutions will exploit the benefits, eliminate the disadvantages and incapacitate the challenges commensurate with adopting emerging technologies in an online learning paradigm.

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