

ICT-based Education: Its Effect on Teaching and Learning

Mohammed Djemoui SABER, *

University of M'sila (Algérie)

mohammeddjemoui.saber@unila.dz.

Abstract ;

Information and Communication Technology (ICT) has reshaped the world we live in. Now, most of people can use ICT in different parts of their life. In education, teaching and learning in 21st century can neither improve nor develop unless they are ICT-based. Nor can ICT-illiterate teachers and learners enhance their 21st-century skills and competencies. Indeed, ICT-based education has many promises that enable learning and teaching to be not only effective but also authentic.

Article info

Received

27/04/2021

Accepted

16/05/2021

- ✓ *Second*
- ✓ *ICT-based education,*
- ✓ *21st-century competencies and skills,*
- ✓ *ICT-illiterate teachers/ learners*
- ✓ *macrostructures,*
- ✓ *semantic*

* *Corresponding author*

Introduction

Attempts to improve education with modern machines —such as the phonograph, lantern slides and television— date from the early 20th

century (Castro, 2004; Cuban, 1986; Earle, 2002; Reiser, 2001; Snider, 1992). For the most part such inventions come and go, yet what happens in the classroom looks pretty much the same (Callister, 1992). Information and communication technologies (ICT) were also introduced in schools to transform teaching and learning processes and to improve strategies for better educational attainment (Culp, Honey, & Mandinach, 2003; Kozma, 2003; Sunkel, 2006).

Attempts to improve education with modern machines —such as the phonograph, lantern slides and television— date from the early 20th

century (Castro, 2004; Cuban, 1986; Earle, 2002; Reiser, 2001; Snider, 1992). For the most part such inventions come and go, yet what happens in the classroom looks pretty much the same (Callister, 1992). Information and communication technologies (ICT) were also introduced in schools to transform teaching and learning processes and to improve strategies for better educational attainment (Culp, Honey, & Mandinach, 2003; Kozma, 2003; Sunkel, 2006).

Attempts to improve education with modern machines —such as the phonograph, lantern slides and television— date from the early 20th

century (Castro, 2004; Cuban, 1986; Earle, 2002; Reiser, 2001; Snider, 1992). For the most part such inventions come and go, yet what happens in the classroom looks pretty much the same (Callister, 1992). Information and communication technologies (ICT) were also introduced in schools to transform teaching and learning processes and to

improve strategies for better educational attainment (Culp, Honey, & Mandinach, 2003; Kozma, 2003; Sunkel, 2006).

The term, information and communication technology (ICT), comprises all forms of technology that are used to transmit, store, create, share or exchange information. ICT-based education refers to teaching and learning with ICT. Researches globally have indicated that ICT can lead to improve students' learning and better teaching methods. Attempts to improve education with modern machines, such as the phonograph, the lantern slides and television, started in the early 20th century (Cuban, 1986; Snider, 1992; Reiser, 2001; Earle, 2002; Castro, 2004). ICT was also implemented in schools to improve teaching and learning processes and to develop strategies for better educational attainment (Kozma, 2003; Sunkel, 2006). This means that ICT is getting more and more important in education as it acts as the keystone of the modern world; thus, understanding this technology and its basic concepts is perceived as a central part of education (UNESCO, 2002). There are two major categories of ICT: ICT for education and ICT in education.

ICT for education: ICT for education refers to the development of information and communication technology for learning and teaching purpose. ICT for education is generally linked with achieving technology literacy rather than information literacy. Informatics, or computer education, tends to be the focus in defining ICT for education, which makes one think of ICT in education as a curricular subject rather than an approach to enhanced educational processes (Richmond, 1997; The Asian Development Bank, 2009).

Moreover, the Asian Development Bank, 2009) stressed that ICT for education can often be narrowly associated with using computer and the internet in the classroom. ICT has the potential for enhancing educational processes in different ways, and therefore educational initiatives do not necessarily need to rely on the use of computers and the internet to develop improved teaching and learning practices.

ICT in Education: Unlike ICT for education, ICT in education has to do with the adoption of general components of information and

communication technology in practical use in teaching and learning processes (Richmond, 1997; Voogt&Pelgrum, 2005; Watson, 2006). Noss (1991) highlighted that technology can be regarded as a tool that can be used to solve a problem efficiently and easily or to determine educational change. Almost in all situations or tasks, we discover that the integration and the use of technology solves problems. Ajayi (2008) underlined that the world of today is considered as a global village through the use of ICT in different educational, political, economic and social sectors. For technology to be effective in education, teachers must integrate it in their teaching practices in such a way that it aligns with student learning goals. According to Haddad and Draxler (2002), technology in education has got at least five levels: presentation, demonstration, drill and practice, interaction, and collaboration as the table below shows:

Level	Technology				
	Text	Audio	Video	Computer	Internet
Presentation	X	X	X	X	X
Demonstration	X	X	X	X	X
Drill & practice	X	e.g., Language Laboratory		X	X
Collaboration/ communication				networked	X

Table 1: levels of technology use in education

Furthermore, many technologies can typically be used in combination rather than as the sole delivery mechanism. For instance, the UK Open University (UKOU)¹, founded in 1969 as the first educational institution in the world entirely dedicated to open and distance learning, is still based on print-based materials supplemented by radio, television and, in recent years, on the Internet programming.

The Advantages of ICT-based Education

¹United Kingdom Open University.en.wikipedia.org

The introduction of ICT in education has brought many benefits to learning and teaching. According to a report by Becta (2004) (British Educational Communications and Technology Agency), ICT is able to:

1. enhance learning and enrich teaching in different locations and institutions of diverse quality;
2. contribute to the raising of standards of achievement in education;
3. increase communication channels through email, discussion groups and chat rooms;
4. help the characteristics of a culture to be brought into the classroom either through digital resources or direct interaction via video conferencing.

Papert (1997) stated that technology is here to change the educational landscape forever and in ways that will engender a dramatic increase in the performance of learners. Similarly, Jhurree (2005) noted that many research studies have revealed the benefits and gains that can be achieved by students and teachers who use ICT. Hepp, Hinostroza, Laval and Rehbein (2004) stressed that ICT has many roles in the educational system: cultural, social, professional and administrative. Therefore, schools as well as teachers are invited to profoundly revise present teaching practices and resources to create more effective learning environments and improve life-long learning skills and habits in their students.

The Impact of ICT on Learning Theories: According to Balacheff (1993), ICT promotes new approaches to learning, and new ways of interacting. Similarly, Resnik (2002) stressed that new technologies are beneficial if we rethink our approaches to learning and education.

Furthermore, Bruner (1960) believed that man's brain has evolved to its larger size thanks to the use of tools; technological advances lead to the evolution of the thinking process. As the individual matures, he can integrate his knowledge and behaviours cognitively. These then become blueprints for higher order thinking.

From these perspectives, ICT per se has been seen as a cause of change and catalyst for reform to improve the quality of learning and

support new pedagogical practices that provide new learning environments that are more learner-centred, knowledge-centred, and community-centred. Thus, moving from teacher-centred to more learner-centred teaching practices can by no means be attributed solely to constructivism. We have to recognize that change in theories of learning exerts a powerful impact on uses of technologies, but new technologies also make new kinds of interaction possible and hence affect theories of learning.

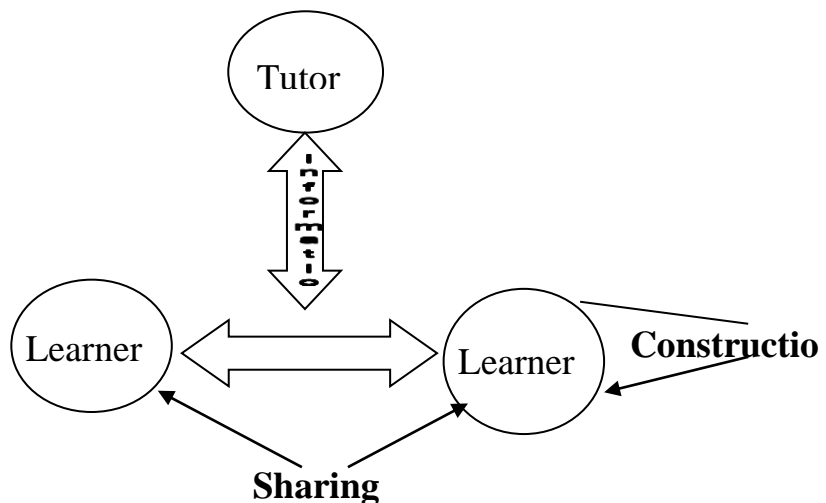


Figure3: Learner-centred approach to teaching(Stefani, et

The importance of ICT in the Curriculum

For many years, course has been written around textbooks because traditional teaching focuses on content. All knowledge is taken from the textbook and is imparted to the students by the teacher. Thus, students have been taught through lectures and presentations combined with tutorials and learning activities intended to consolidate and rehearse the content. As Pakerson (2008:158) puts it, “students are expected to master facts and concepts”. Nunan (1998:24) argues that this approach sees learning a language as “essentially the mastering of a body of knowledge”.

Critics of this subject/ authoritarian/ teacher-centred approach, which is the most traditional form of the curriculum, argue that each subject is taught in fragmented, isolated way and that there is no attempt to integrate subject matter.

The changes in curriculum due to changes in tools or the introduction of new tools may be subtle. For example, Language teachers rarely pay attention to their students' spelling mistakes or mispronunciations because most of them are equipped with electronic spelling and pronunciation checkers.

The use of technology in classrooms has created new settings which are now in favour of learner-centred curricula that promote competency and performance. In addition to this, the learner-centred curriculum tends to perceive language acquisition as a process of acquiring skills rather than a body of knowledge. Now, curricula begin to emphasize capabilities and to be concerned more with how the information will be used than with what the information is. On this vein, Nunan (2013) emphasizes that the learner-centred curricula encourage the learners to gain the communicative and linguistic skills they have to carry out real world tasks rather than acquiring the totality of language.

On this basis, Flanagan and Jacobsen (2003) state that ICT integration has to be cross-curricular and must not be a separate course or topic in itself. Hence, every teacher is expected to use ICT to enhance student learning in every subject. Grabe and Grabe (2001) argued that ICT must engage the thinking, decision making, problem solving and reasoning behaviors of students. Thus, what learners need to learn in an information age is these cognitive behaviours.

Impact of ICT on Learning and the learner: Many field researchers and experts (Tapscott, 1998, 1999; Kozma, 1994; Jonassen, Campbell, and Davidson 1994; Prensky, 2001, 2006) admit that ICT has revolutionized the way we live, work, and play. It is not surprising that it affects the way we learn. Many of them assert that ICT has promoted many forms of learning such as active, collaborative, creative, autonomous, integrative, and inductive, lifelong learning. ICT is rapidly changing the ways in which information is distributed in society.

Information sources are within reach all over the world, and the new technologies and telecommunications make it easy to collaborate across physical distances, and thus provide new ways of teaching and learning (Bates 1997, Farrington 1999, Light & Light 1999, Säljö 1999).

Tapscott (1999), president of New Paradigm Learning Corporation in Toronto, has outlined some important shifts in focus in learning:

1. A shift from linear to hypermedia learning - access to information is more interactive and non-sequential
2. A shift from instruction to construction and discovery,
3. A shift from teacher-centred to learner-centred education,
4. A shift from absorbing material to learning how to navigate
5. A shift from schooling to lifelong learning,
6. A shift from one-size-fits-all to customized learning,
7. A shift from learning as torture to learning as fun
8. A shift from the teacher as transmitter to the teacher as facilitator

Furthermore, Kozma (1994) stressed that ICT is able to promote the implementation of the constructivist model which is a much more complex process than just a series of stimulus-response connections. In his view, learning is no more than “an active, constructive, cognitive and social process by which the learner strategically manages available cognitive, physical and social resources to build new knowledge by interacting with information in the environment and incorporating it with information already stored in memory” (p.8). Furthermore, Resnik (2002) goes as far as to say that computers encourage people to transmit, access, represent, and manipulate information in many new ways. Because education is linked with information and computers are associated with information, the two seem to make a perfect marriage

It should be noted that computers have no impact on learning and the learner if they are not utilized. Field researches have shown that exposure to technology can positively impact student performance in all content areas (Huang & Russell, 2006; Page, 2002; Resnik, 2002; Tally & Goldenberg, 2005). Research by Light (2007) suggests that simply

putting students in front of a computer will not ensure learning. If students are not encouraged to work actively together or the software/hardware is not constructed for collaborative usage, they tend to take turns to make moves, or one of the groups dominates the whole task. Jonassen & Land (2000:15) point out that technology is used to “facilitate understanding that would be difficult, if not impossible, to otherwise support. It also enables learners to represent their thinking in concrete ways and visualize and test the consequences of their reasoning”.

Moreover, ICT enables learning to take place in various places, both physical and virtual. Learners now can choose when and where they study and learn. Learning occurs more efficiently and enthusiastically in ICT-rich environments where teacher and learners can interact with each other exchange information and experiences in a friendly way. ICT, in this way, improves learning environments, and promotes lifelong learning that takes place in many modes and places.

On the other hand, there is a widespread belief that ICT is crucial for learning and learners; teaching and teachers. In business, for example, it has been developed to solve problems, improve living standards and increase productivity. Therefore, it is reasonable that we should expect ICT to achieve similar objectives.

ICT, such as weblogs, face-book discussion groups, can promote collaborative learning, including role playing, group problem solving activities and articulated projects (Forcheri and Molfino, 2000). Branson (1991) emphasizes that technology enables students to learn not only by the teacher but they also with the teacher and by interacting with one another. Indeed, now students are much more active than the teacher in conventional learning environments. For productive teaching-learning process, teachers and students ought to use information technologies according to their requirements and availability. West (2000, as cited in Eadie 2001) sees the future student as,

“ ... the student who is expected to spend a few hours in a neighbourhood learning centre, primarily to take social, sporting and cultural skills but possibly for some

teaching and tutoring in certain subjects. This input tends to be followed by online tuition, possibly from home, with tutors drawn from all over the country or the world. The student could then log on to research his or her latest project, drawing on the latest information from the world's leading libraries and research institutes. The staff in this scenario tends to be more diverse, with a greater emphasis on specialisation.” (p.39)

Additionally, an extensive review of the literature on ICT revealed that where ICT is a regular part of the classroom experience, there is evidence of its positive impact on learning and learners performance. Cox et al. (2003) found evidence of positive effects on learner attainment. Pittard et al. (2003) note that evidence from large-scale studies, most notably ImpaCT2. Harrison et al., (2002) show that the use of ICT can motivate learners and result in a positive effect on attainment amongst those learners who make relatively high use of ICT in their subject learning. Using information technologies help students to decide about their studies, learning time, place and resources in a better way. Students tend to learn in more supportive environments, ask for help from teachers and fellows, and exchange their learning experiences and ideas in romantic and productive fashion.

Various studies have also found evidence that some technologies such as digital video improved learner engagement and enhanced conceptual understanding (see, for example, the findings of Dede, 1998, Pittard et al., 2003; Livingston and Condie, 2003; Becta, 2003; and Passey et al., 2004). Other studies (Valentine et al., 2005) showed that ICT improved motivation and confidence, made school work more enjoyable and improved achievement generally deepen understanding. Implementing Information and Communication Technology in the right way personalizes pupil learning, promotes pupil-centred and collaborative approaches to learning and provides new ways of supporting and enhancing pupils' conceptual learning (Pittard et al., 2003).

It must be remembered that ICT is important in the development of the learner's multiple intelligences. Gardner (1983), Professor of Harvard University and author of *Frames of Mind*, stated that there are seven or more multiple intelligences that are of equal importance in human beings and grow at different times and in different ways in different individuals. Multi-media are able to address these intelligences, much more than traditional teaching methods.

We should admit, therefore, that ICT has a positive impact on the student since it has promoted his learner-centredness, triggered his motivation, lowered his anxiety, increased his engagement, raised his attainment, enhanced his conceptual understanding, improved his confidence and his self-reliance, and developed a variety of his competencies not usually measured. Needless to say, Information and Communication Technology has encouraged student to work in collaborative and interactive learning environments effectively, communicating, sharing information and exchanging ideas and learning experiences with all in the environment. "Where Information and Communication Technology learning opportunities were good, there was a higher likelihood that the learning was good or very good" (Pittard et al., 2003:8). Therefore, it is not out of place to say that ICT has the potential to deliver new forms of learning in schools and to revolutionize pupils' approaches to learning.

The Role of the Learner in an ICT-rich Environment: The new concept of learner-centredness has emerged as a reaction against the traditional teacher-centred approach to education which has been authoritative in nature. A shift in focus has occurred on behalf of the learner. This shift is an attempt to explore ways of making teaching responsive to learner needs and interests and allowing learners to play a fuller, more active and participatory role in the day-to-day teaching/learning processes. Therefore, it is believed that ICT can promote the implementation of the learner-centred model which leads to learner autonomy (Prensky, 2001, 2006; Oblinger & Oblinger, 2005). In an ICT-rich environment, the learner is supposed to act as follows:

1. Spot and work out problems using critical and creative thinking;
2. Work effectively as a member of a team, group, organization and community;
3. Arrange and manage themselves and their activities responsibly and effectively;
4. Collect, analyze, organize and critically evaluate information;
5. Communicate effectively using visual, and/or language skills in the modes of oral or written presentation;
6. Make use of science and technology effectively and critically, showing responsibility towards the environment and the health of others; and
7. Understand that the world is no more than a set of related systems and that problem-solving contexts do not exist in isolation.

Similarly, a study conducted by Tony Wagner², an American education expert at the Harvard Graduate School of Education, has indicated that there are seven skills that are necessary for the students of today to develop in order to survive the challenges of 21st century:

- Critical Thinking and Problem-Solving
- Collaboration across Networks and Leading by Influence
- Agility and Adaptability
- Initiative and Entrepreneurialism
- Effective Oral and Written Communication
- Accessing and Analyzing Information
- Curiosity and Imagination

We know now - based on findings of hundreds of research studies (Becta, 2002; Becta, 2004; Becta, 2006) - that, properly used, ICT continues to have a substantial effect on what the learner does in school

²Prakash, A. (2009), Effective Integration of ICT in Education: 21St Century Skills Based Sustained Professional Development for Teachers. Available at: www.unescobkk.org

just as the advent of the pen and paper did in the past. Unfortunately, some learners still show resistance to ICT-enhanced learning.

Learner's Resistance to ICT-enhanced Learning

Learners and teachers felt under pressure to change many of them reported different attitudes to the use of ICT, ranging from acceptance to refusal. However, there is an acceptance that must not be ignored. According to Chambers et al. (2004), ICT maximizes the shift to a learner-centred environment and puts a part of the teacher's responsibility on the learner's shoulder so that s/he can develop her/his autonomy and self-confidence. Unfortunately, there are some learners who favour neither ICT-enhanced learning nor learner-centred education simply because they believe that ICT-enhanced learning and learner-centred education break the conventions, the prevailing norms of the pre-existing pedagogical contract that establish the teaching-learning relationship between students and teachers. Davis and Steiger (1993) make the point that "any time a teacher decides to break the conventions of the pre-existing pedagogic contract, s/he must expect student resistance and must be prepared to justify why such a break is occurring" (p.736).

Similarly, Felder & Brent (1996) states that "the students, whose teachers have been giving them everything they wanted to know from the first grade on, do not necessarily appreciate having support suddenly withdrawn" (p.43). Besides, students resist ICT-enhanced learning for the following reasons as stated by Weimer (2002:151):

1. they are not ready to take more responsibility for their own learning,
2. ICT-enhanced learning increases the amount of work. This resistance is an objection to the pain associated with the hard work of learning.
3. the fear becomes a major anxiety for students who face learning tasks without confidence in themselves as learners
4. Good lecturers may feel awkward when they start using ICT-enhanced learning methods.

ICT-enhanced learning/ teaching may impose steep learning curves on both teachers and students. We must admit that the initial teacher awkwardness and student resistance are both common and

natural. Therefore, what is important is that the teacher should work towards removing these inadequacies so as to develop learner self-confidence which inevitably leads to self-reliance and autonomy.

Conclusion

In this paper, we looked at the importance of ICT in education. It seems that technology continues to be viewed as a catalyst for change and a powerful tool that enhances learning and enriches teaching. The use of ICT in teaching and learning requires a modification of the teacher's and learner's roles. It is believed that to bring about real change we must first change ourselves at the very core of our being. Therefore, if the learners want their learning to be effective and efficient, they have no option but to adapt themselves to change and keep pace with new methods and technologies. Possibly, the area of the most rapid change is that of Information and Communication Technologies (ICT).

Bibliography

- Becta (2003)** 'What research says about ICT and whole school improvement'. UK: [Becta](http://www.becta.org.uk/page_documents/research/wtrs_ws_improvement.pdf).
http://www.becta.org.uk/page_documents/research/wtrs_ws_improvement.pdf.
- Becta (2004)** 'A review of the research literature on barriers to the uptake of ICT by teachers' UK: [Becta](http://www.becta.org.uk/page_documents/research/barriers.pdf). Accessed at: http://www.becta.org.uk/page_documents/research/barriers.pdf.
- Becta (2006)** 'The Becta Review 2006: Evidence on the progress of ICT in education', UK: [Becta](http://www.becta.org.uk/corporate/publications/documents/The_Becta_Review_2006.pdf).
http://www.becta.org.uk/corporate/publications/documents/The_Becta_Review_2006.pdf
- Branson, R. K. (1991).** *The School Year 2000 Concept*. At Northwestern March 7.
- Chambers, A., Conacher, J. E., Littlemore, J. (2004).** *ICT and Language Learning: Integrating Pedagogy and Practice*. University of Birmingham.
- Cox, M. et. Al. (2003)** 'ICT and pedagogy, a review of the research literature'. A report to the DfES, UK: [Becta](http://www.becta.org.uk/page_documents/research/ict_pedagogy_summary.pdf#search=%22ICT%20and%20pedagogy%20%22).
http://www.becta.org.uk/page_documents/research/ict_pedagogy_summary.pdf#search=%22ICT%20and%20pedagogy%20%22.
- Cuban, L. (2013).** *Oversold and Underused: Computers in the Classroom*. Harvard College.
- Cuban, L. (1986).** *Teachers and Machines: The Classroom of Technology Since 1920*. New York: Teachers College Press.
- Davis, F &Steiger, A (1993).** Feminist Pedagogy in the Physical Sciences. In Sharon Haggerty & Ann Holmes (Eds.), *Transforming Science and Technology: Our Future*

Depends on it. Contributions to the seventh international gender and science and technology conference. Waterloo, Ontario: The University of Waterloo.

Dede, C. (1998) *Learning about teaching and vice versa*. Paper presented at Conference of Society for Information Technology in Education. Washington D.C., USA.

Eadie, G. M. (2001). *The Impact of ICT on Schools: Classroom Design and Curriculum Delivery. A Study of Schools in Australia, USA, England and Hong Kong*, 2000. Available at: www.tki.org.nz/r/ict/pedagogy/churchillreport.pdf

Earle, R. S. (1998). Instructional design and teacher planning: Reflections and perspectives. In R. M. Branch & M. A. Fitzgerald (Eds.), *Educational Media and Technology Yearbook* (Volume 23, pp. 29–41). Englewood, CO: Libraries Unlimited.

Earle, R. (2002). The integration of instructional technology into public education: Promises and challenges. *Educational Technology*, 42, 5-13.

Felder, R.M., & Brent, R. (1996). *Navigating the bumpy road to student-centered instruction*. *College Teaching*, 44(2), 43-47.

Forcheri, P. and Molfino, M. T. (2000). ICT as a tool for learning to learn. In Watson, D. M. and Downes, T. (Eds.) *Communications and Networking in Education*. Boston, MA: Kluwer Academic. pp 175-184.

Gardner, H. (1983). *Frames of Mind: The theory of multiple intelligences*, New York: Basic Books

Gunton, T. (1993). *Dictionary of information technology*. Penguin, London.

Haddad, W. D. & Drexler, A. (2002). "The Dynamics of Technologies for Education", in Haddad, W. & Drexler, A. (eds.) *Technologies for Education: Potentials, Parameters, and Prospects* (Washington DC: Academy for Educational Development and Paris: UNESCO), p. 9.

Hepp, K. P., Hinostroza, S.E., Laval, M.E., Rehbein, L. F. (2004). *Technology in Schools: Education, ICT and the Knowledge Society*".

www1.worldbank.org/education/pdf/ICT_report_oct04a.pdf

Huang, J., & Russell, S. (2006). The digital divide and academic achievement. *The Electronic Library*, 24, 160-173.

Jhurreev, V. (2005) "Technology Integration in Education in Developing Countries: Guidelines to Policy Makers". *International Education Journal* [Electronic], 6(4): 467-483.

Available from: <http://ehlt.flinders.edu.au/education/iej/articles/v6n4/jhurree/paper.pdf>

Jonassen D. H & Land S. M. (2000). *Theoretical Foundations of Learning Environments*. Lawrence Erlbaum Inc., Mahwah, New Jersey

Kozma, R. (1994). Will media influence learning? Reframing the debate. *Educational Technology Research and Development*, 42(2), 7-19.

- Light, D. & Manson, M. (2007).** *An educational revolution to support change in the classroom: Colombia and the educational challenges of the twenty-first century.* Washington, DC: Education Development Center, Inc.
- Naicker, V. (2011).** *Educators' theories and beliefs and the use of computers in secondary schools.* Educational Research and Reviews Vol. 6(10), pp. 688-694, 12 September, 2011 Available online at <http://www.academicjournals.org/ERR>
- Nunan, David. (2013).** *The Learner-Centered English Language Education: The Selected Works of David Nunan.* London: Routledge.
- Nunan, David. (1998).** *The Learner-Centered Curriculum: A study in Language Teaching.* Cambridge: Cambridge University Press.
- Oblinger D. and Oblinger J. (2005).** Is it age or IT? First steps towards understanding the net generation, in Oblinger D. and Oblinger J. (eds), *Educating the Net Generation*, Educause. Available online at www.educause.edu/educatingthenetgen/
- Page, M. S. (2002).** Technology-enriched classrooms: Effects on students of low socioeconomic status. *Journal of Research on Technology in Education*, 34, 389-409.
- Papert, S. (1997).** *The Connected Family, Bridging the Digital Generation Gap*" (UK, Long Street Press).
- Passey, D., Rogers, C., Machell, J., and McHugh, G., (2004).** The Motivational Effect of ICT on Pupils. Report No: RR523. *DfES*. <http://www.dfes.gov.uk/research/data/uploadfiles/RR523new.pdf>
- Pittard, V., Bannister, P. & Dunn, J. (2003),** *The Big pICTURE: The Impact of ICT on Attainment, Motivation and Learning*, UK: DfES Publications, <http://www.dfes.gov.uk/research/data/uploadfiles/ThebigpICTURE.pdf>
- Prensky, M. (2012).** From Digital Natives to Digital Wisdom: Hopeful Essays for 21st Century Learning. London: Sage Publications
- Prensky, M. (October, 2001).** *Digital Natives, Digital Immigrants.* MCB University Press, Vol. 9 No. 5. Retrieved from <http://www.marcprensky.com/writing/Prensky%20-%20Digital%20Natives,%20Digital%20Immigrants%20-%20Part1.pdf>
- Reiser, R. A. (2001).** A history of instructional design and technology – Part I: A history of instructional media. Educational Technology Research & Development, 49(1), 53-64.
- Resnick, M. (2002),** "Rethinking Learning in the Digital Age," Chapter 3 in *The Global Information Technology Report 2001-2002: Readiness for the Networked World* http://www.cid.harvard.edu/cr/pdf/gitrr2002_ch03.pdf
- Snider, R. C. (1992).** The machine in the classroom. Phi Delta Kappan, 74(4), 316–323.

Sunkel, G. (2006). Las tecnologías de la información y la comunicación (tic) en la educación en América Latina: unaexploración de indicadores. Santiago de Chile: Naciones Unidas. Recuperado de <https://www.cepal.org/socinfo/noticias/documentosdetrabajo/9/27849/Serie126final.pdf>

Tally, B., & Goldenberg, L. B. (2005). Fostering historical thinking with digitized primary sources. *Journal of Research on Technology in Education*, 38, 1-21.

Tapscott, D., (2009). *Grown Up Digital: How the Net Generation is Changing Your World.* Mcgrow- Hill Book Company

Tapscott, D., (1999). *Educational Leadership.* Published by the Association for Supervision and Curriculum Development. ISSN 0013-1784. [http:// www.ascd.org](http://www.ascd.org)

Valentine et al., (2005). *Children and young people's home use of ICT for educational purposes:* The impact of attainment at Key Stages 1-4. Research Report No. 672, University of Leeds.

Weimer, M. (2002). *Learner-centered Teaching.* San Francisco: Jossey-Bass.