

The Adoption of Instructional Techniques and Educational Technologies among Teaching

Salissou Mahaman Halimatou^{1*}, Xiuqing Yang²

¹Institution of Higher Education, Huazhong Agricultural University, Wuhan, China

²School of Public Management, Huazhong Agricultural University, Wuhan, Wuhan

Email: misslimat2002@yahoo.fr

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Abstract

The development of technology in daily life continues to show its effects on the behavior of human beings. Their integration in the field of education is an asset to the effectiveness of learning for both the teacher and the learner. However, some people tend to confuse instructional technics with educational technologies, while these concepts are different and have their roles in the process of learning. This paper first defines the three concepts in education namely instructional technics, educational technologies and learning theories, and highlights their characteristics. It also introduces the influence of educational technologies in instructional techniques, their advantages and inconvenience and ends with suggestions to improve them to be more suitable and profitable.

Keywords

Instructional Technics, ICT, Technologies, Learning

1. Introduction

The development of any country relies entirely on good education. To solve a large number of problems that this sector faces, educators, philosophers, sociologists, psychologists and actors involved in education draw techniques and methods to meet the educational requirements of learning in the time and space. Thus, with the new technologies, which the speed of evolution is beginning to worry experts, who fear that one day, the teacher

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could lose his role as the main mediator between knowledge and learners. Of course, other support full integration of these technologies in education and consider them as motivating ways to make learning much easier, and therefore make them as “partners” in instructional techniques.

Those who support the full integration of these new technologies in the field of education believe that they are created in order to develop this sector and to achieve the teaching goals set by the education policies of each country.

However, those who criticize the integration of these technologies are against because they can lead to financial difficulties by high cost, the equipment and the training of teachers apart other problems. Certainly they have many advantages, but we have to take in account their disadvantages too.

In both cases, we cannot reject the new technologies and we cannot either drop out the old educational techniques. Therefore, it is necessary to combine and complete both (new educational technologies and old educational techniques) at the same time in order to evolve the educational system and the development on this sector.

This paper is a review of articles. It firstly introduces the concepts of instructional techniques, educational technologies and learning theory, the relationship between teaching and the technologies before showing the advantages and disadvantages of these new technologies in the field of education. And finally, it provides suggestions about how to improve these technologies in order to integrate them properly in learning.

2. Definitions

2.1. Definition of Instructional Technique

The word technique means all systematic processes based on scientific knowledge and employed in production (Josianne, 2005). This brief definition let to define educational technology as the implementation of process, in a certain order, to convey messages, knowledge to another person. It is a reasoned action resulting from reflection and choice. It is used by the teacher to awaken in the trainee a set of well-defined learning behaviors. It represents a set of formalized procedures and applies following defined principles to acquire skills consistent with the educational objectives.

Teaching methods can be defined as means of organizing the cognitive activity of students to let them to acquire some knowledge and skills and bring them gradually through the various stages of the learning process (UNESCO, 1966). It consists of rules and procedures to implement a master teaching or student learning, in a theoretical or practical way. It is used to manage, explain, discover and evaluate. They are classified depending on the objectives, contents and targets; and represented in the form of typology.

2.2. The Evolution and Development of Instructional Technique

(Gary, 1991) classified the historical periods of the development of teaching techniques:

- The first step in the evolution of educational technology is mainly based on knowledge and practical knowledge taught to students. It was the birth of an empirical knowledge base for education in 1920. The third decade of the century was marked by the maturation of several ideas that are fundamental to instructional development. Most prominent among these are educational objectives and individualized instruction.

- Behavioral Objectives and Formative Evaluation in 1930. This step insisted on the student’s behavior and refined the procedure for writing instructional objectives. The study confirmed that objectives could be clarified if written in terms of student behavior, to ensure that the alternative curricula were implemented as planned.

- The period 1940-1950 has been marked by instructional media and research and development, and programmed instruction and task analysis. There has been successively to other changes and developments in teaching techniques are characterized by the use of media for educational purposes, research and development in the education sector and the education program.

- 1960-1970 has been for instructional systems development and instructional development (ID) models and maturation. In that period the evolution has started to grow fast and accelerated the years of the Renaissance so after the war. Instructional development acquired the accoutrements of a profession as ID scholars and practitioners sought to define and describe more thoroughly the process they advocated.

- 1980-1995, it was the time for microcomputers and performance technology. Organizations, more flexible, less vertical and more complex modes of management emerge when changing teaching techniques took a different form from those already passed. A new form has changed the process of teaching techniques with the in-

tegration of new technologies in education: The instructional applications of microcomputers have come to dominate much of the literature of instructional design. There is little consensus regarding the meaning of this powerful technology to instructional development.

2.3. Definition of Educational Technologies

The term technology depends on the field in which it is used. Originally, it comes from the Greek word “*tekh-nologia*” meaning treaty or a dissertation on art. Technology is a rational discipline designed to assure the mastery of man over physical nature, through the application of scientifically determined laws. But in empirical meaning, it refers fundamentally to systems of rationalized control over large groups of men, events, and machines by small groups of technically skilled men operating through an organized hierarchy (Gary, 1991).

In the field of education, it is defined as a field of knowledge and activities to design and build objects and systems (Josianne, 2005). The National Academy of Engineering’s Instructional Technology Committee on Education defines educational technology as the body of knowledge resulting and from the implementation of the science of teaching and learning to the real world of the classroom, together with the tools and methodologies developed to assist in thesis applications (Gary, 1991). Specifically, educational technology is a combination of the processes and tools involved in addressing educational needs and problems, with an emphasis on applying the most current tools: Their computers and related technology (Roblyer, 2003).

2.4. Different Kinds of Educational Technologies

New technologies are an extension of existing technologies. As an example, the first instructional videos that looked like filmed courses. Indeed, very often people tend to believe that educational technology is limited only to the Internet; but through what has already been mentioned above, this is not the case. The new educational technology includes several other technologies including cognitive tools that contain the semantic organization tools (building semantic databases), dynamic modeling tools (spreadsheets, micro world, etc.), interpretation tools (information retrieval tools, visualization tools), tools for building the knowledge and conversation tools (synchronous or asynchronous conferencing) (Josianne, 2005). It also includes educational television and radio.

Moreover, these new educational technologies comprise a set of tools, machines and devices all based on digital electronics:

1) Audiovisual features:

-Educational television in closed-circuit within the same institution where educational programs are broadcast on ultra-shortwave or wire. It can also be in opened-circuit where educational programs are broadcast to students in the classroom or at home;

-Broadcasting which plays an important role in literacy, language teaching science, arts, etc.;

-Language laboratories with equipment such as tape recorders, CD players, microphones and headsets;

-Educational films or cartoon;

-Video conferencing.

2) Information technology (IT) are based on computer technology, microelectronics, telecommunications (including networks), logo (nowadays almost disappeared), word processing software, simulation-modeling, computer algebra software, geometric construction and lexicographical analysis of text. But the arrival of the internet, which is today’s greatest innovation, has facilitated access to resources and databases from anywhere on earth and has contributed to develop the distance learning (e-learning) and online libraries.

3) Telematics: Telematics refers to the transmission of information and telecommunications over a distance, include several types of media, interactive kiosks, vehicular technologies and robotics.

Telematics is the use of various combinations of telecommunications, television, multimedia and information technologies (IT) (Hilary Perraton & Charlotte Creed, 2000). In addition, telematics-based products and service can retrieve, store, process and communicate information as voice, sound, text, graphics, images and videos. The possibility of the use of telematics in the field of education has diversified related to, include computer-mediated communication (CMC), computer-supported collaborative work (CSCW) and computer-supported cooperative learning (CSCL). Telematics may be used in conventional, flexible and distance education to support teaching and learning which is one-to-one, one-to-many and many-to-many (Patrick Dillon, 1998).

4) Robotics: Robotics can be grouped in telematics category. The use of robotics in education is very useful at many purposes such as engineering, science and computer science. Indeed, there are many kinds of use robotics

in the field of education as Jacek Malee (2001) demonstrated the use of LEGO robots, RoboCup. Jeonghye Han (2008) describes also the use of IROBI, a companion robot which recently introduced in Korea educational system. IROBI is both an educational robot and child companion at home and contains many features. A longtime USA has experienced the use of robotics course in school and university of Washington for language program. Even in Britain, the use of Lego-based robotics for teaching language, using Legos Mind storm kits for teaching science and technology, as well as in Sweden, Denmark and other developed countries. The educational use of robotics in Japan is focusing on English language learning with using ROBOVIE program. On the other hand, Canada uses educational robotics for health and hygiene in schools and the use of interactive robot to teach children fitness and healthy living. As in Korea, using the home tutor robot IROBI and the teaching assistant robot TIRO is becoming familiar (Jeonghye, 2008).

5) Another category of telematics in education such as: Blogs, Forums, Communities, Webcast, Podcast, User Groups, Picasa and Flickr, W3 Schools.com, Webopidia, Wikis, Web Conferencing, Videoconference, Chat, E-mail, Instant Messaging, Bulletin, Board, VOIP, Data Conference, Shout Box, Image Board, You Tube, Slide Share, etc., also including TECH types such as calculators, engagement devices, portable ICT devices, virtual learning, multimedia projectors, tablets and e-readers.

3. Characteristic of Instructional Technique and Educational Technologies

3.1. Difference between the Three Concepts: Instructional Technique, Educational Technologies and Learning Theories

The concepts of instructional technology, educational technology and learning theory can create confusion in the meaning whereas they are individually distinct. Technical education is understood as a set of teaching techniques used efficiently and to improve the performance of education systems (Baron, 1998). It is synonymous with teaching method and describes the educational tool adopted by the teacher in the use of educational technologies that are available to facilitate his tasks and achieve his educational goals.

As for the theory of learning, it attempts to answer the question: How people learn? It is a design of what a person has in mind about how learning occurs and that any teacher should have whether conscious or not. This is reflected in his teaching plan, actions and behavior in the classroom and the way he evaluates his students. Finally, this is a design that would promote educational intentions, that is a better match between what the teacher wants the students to learn and the paths taken to reach this goal. Having said that, educational technologies are used in instructional technique, which depends on how teacher conceives, plans and runs his teaching activities (theory of learning).

3.2. Advantages and Inconvenience of Educational Technologies in Education

There is no doubt that new technologies have many advantages over old teaching techniques through the major role they play in the education sector; as they also have disadvantages in this area. Thus we can classify these advantages and disadvantages in the relationships between the three agents of learning:

Advantages:

- In the relationship between learning and knowledge: there is no doubt that educational technologies, both in developed countries than in developing countries, contribute to the development of this sector. These new educational facilities are extremely important because they have a less abstract character than the printed materials that are traditionally used. They put students in direct contact with more experience and combine this experience to the subject studied. As well as the judicious use of modern teaching techniques can make instruction more effective in helping students to better understand the phenomena, stimulating their interest, engaging eyes and ears, more actively, etc. (UNESCO, 1966). It is now established that the audio and video broadcasting can make teaching livelier, more concrete and richer in meaning.

They also allow interactivity. It is through the interactive capabilities of ICT that the user can be more active and that the roles of actors in the process of communication become interchangeable. Computers are commonly believed to change how effectively we do traditional tasks, amplifying or extending our capacities, with the assumption that these tasks stay fundamentally the same. A primary role for computers is changing the tasks we do by reorganizing our mental functioning, not only by amplifying it (Basque, 2005).

It is also important to mention the aspect of motivation that these technologies have made or strengthened.

The computer and software became a mirror of practice, cement of collaborations and leverage to help change the school. It also becomes, with networks, an opened gate to the world and a way to access culture as told in his speech, the King of the Belgians Albert II in 1996 “Computer technologies have unleashed the research opportunities of information and interactive equipment and multimedia provide students an inexhaustible mine of information...” (Duchateau, 1996). Technology might help to address the cognitive, motivational, and social needs of at-risk student (Roblyer, 2005). With the explosion of technology that’s revolutionizing education around the country, many students are now eager to stay after school, competing for access to all the high-tech equipment that’s opening up so many new opportunities to them (Torr, 2003).

- In the relationship between the learner and the teacher: the use of technology is a motivating factor for students and teachers: interest of the task, potential wealth of skills to exercise, computer support in realizing (Lebrun, 2000). From this viewpoint, educational technology was seen not just as a medium for communicating instructional information, but as a systematic approach to designing, developing, and delivering instruction matched to carefully identified needs motivating students to learn, to enjoy learning, and to want to learn more has assumed greater importance in recent years (Roblyer, 2005).
- Similarly, these new educational technologies have expanded the old techniques and methods with the emergence of distance education. This has contributed greatly to the expansion of the educational program in the world. It not doubt contributed to the early interest in programmed instruction, often enough without much consideration of its basis in behaviorist learning theory, the use of audiovisual media, computers and technology generally (Osborne, 1982/1983).
- In the relationship between the teacher and the new educational technologies: for teachers, the new educational technologies facilitate the transmission of knowledge to students. They also allow to search, store, process, select, create, classify and to calculate to transmit information (Josianne, 2005). The purpose of instructional technology is to make education more productive and more individual, to give instruction a more scientific base, and to make instruction more powerful, learning more immediate and access more equal (Anglin, 1991). Techniques and teaching methods place the teacher as a mediator between students and the teaching through which he supposed to pass knowledge. This is also the case of network technologies which are first and foremost a tool of mediation. In their educational uses, the new educational devices can be a function not only as a carrier of educational messages, but also symbolic systems, cognitive tool and mediation tool between people, objects and ideas (Basque, 2005).

Educational technology is also intended to improve education for the 21st century learner by:

- Using robotics at home and school which, their simple facial expressions have been proven to make an important impact on children’s learning.
- As well as the use of social networking has helped built greater relationship among students and students/teachers also (Eric, 2009).
- Using games as educational technology is really one potential application of distributed intelligence to the learning process. Games can help children to learn about nation-building and international diplomacy (Henry).
- Other researchers found also that games improve skills in communication and collaboration, problem-solving and various number-related skills (Eric, 2009).

Disadvantages:

- The use of ICT as a vehicle for educational messages may explain, in large part, the fear expressed by some teachers to see the teacher, who should be the main if not the only transmitter of knowledge, replaced by ICT in learning. Much remains to be done before ICT to become for universities teachers, not substitutes but real educational partners (Basque, 2005).
- According to a study conducted by the European Union in July 1996 in the context of the working group “educational software and multimedia”: multimedia has demonstrated its effectiveness in teaching through several pilot experiences. Its integration into practice will not however be realized without innovative teaching approaches being well accepted institutionally and socially. Thus it finds its place in the general context of changing educational systems (Lebrun, 2000). But the passivity of students obviously may be a disadvantage.
- Also among the disadvantages of these technologies, they do not put the learner to be the center of learning as the old techniques did. It is time to put into perspective that promotes the use of educative technologies, which will be an anthropocentric perspective (centered on humans) (Simonian, 2007).

- It is also important to consider that the computer's learning environments emphasize a stable transition of knowledge, constituting the background of the activity to a continuous navigation in a learning environment. Today, knowledge appears as mobile. This mobility leads to instability in the relationship between a learner and content but also and especially in the relationship between the learner and the teacher.
- The distance education is the greatest invention of new educational technologies. It was noted that the main disadvantages of distance education are the lack of human mediation, the isolation of the learner and too encyclopedic content (Simonian, 2007).
- It's clear that interactive telematics teaching is a 21st century response to learner\teacher support. Even advanced communication technologies such as videotext, video disc and computers, being sophisticated and expensive are not frequently used in developing countries.
- The high cost of these technologies and the need for teacher training to learn how to use requires an enormous funding. Indeed the introduction of these techniques in all branches of education depends largely on the ability to recruit teachers able to solve many problems that arise constantly depending on local conditions. The training of such personnel therefore becomes important (UNESCO, 1966). However, technical difficulties and the high cost of production and broadcasts hinder the use of television as a medium of instruction in many areas and it would be particularly useful, especially in developing countries.

4. Relationship between Teaching and Educational Technologies

Designations were assigned to technologies in the field of education such as New Technologies in Education (NTE) or Information and Communication Technology for Education (ICTE). But whatever the designation, the new educational technologies establish a connection between the three agents of learning: the teacher, the learner and the content (the curriculum) (**Figure 1**).

For teachers, educational technology, although facilitate his task, are hiding behind complexity. The teacher himself must master these technologies before applying them in learning. Indeed, would be faced with the difficulty of their application, especially if he was using traditional teaching techniques, characterized by specificity, stability and transparency. However, the latest digital technologies in education, such as computers, software and other applications, are protean and can be used in many different ways, unstable as they evolve rapidly and opaque. In addition, what complicates the teaching with these technologies is that they are neither neutral nor impartial. Similarly, social and contextual factors also complicate the relationship between learning and technology (Koehler & Mishra, 2009). Consequently, learning can change when certain technologies are used in a particular way. Technology has revolutionized the way we work and is now set to transform education (Watson, 2001). Add to that the need to properly train teachers for effective use of technology in learning.

About the content or curriculum, technology is a catalyst in creating change in the content, because the computerized systems are artificial universe, complex and without a stable rule (Duchateau, 1996). Hence need to change the curriculum of education in order to integrate these new technologies. There is no one best way to integrate technology into curriculum. Honoring the idea that teaching with technology is a complex, ill-structured task; we propose that understanding approaches to successful technology integration requires educators to develop new ways of comprehending and accommodating this complexity (Koehler & Mishra, 2009). (Wat-

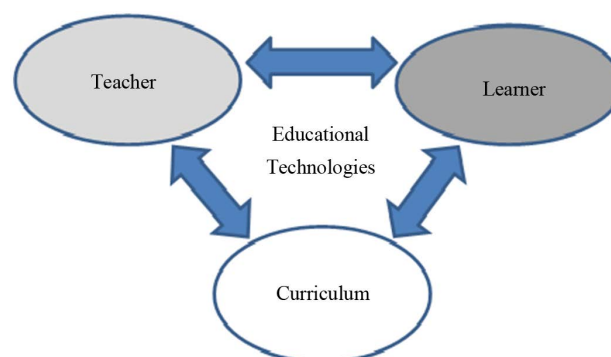


Figure 1. Relationship between learning agents and the educational technologies.

son, 2001) places the teacher at the heart of the success or failure of education changes. But he also asserts that if change is to happen, it requires teachers to understand themselves and to be understood by others. Curriculum change theories have generally asserted that once small cohorts of innovators emerge, their adoption of the innovation cascades through their peer group of subject teachers.

And finally this change and complexity will affect students negatively and positively. On the one hand, educational technologies motivate students through their effective use, but also make them lazy. For example, today for a simple algebraic calculation, the student prefers to use his calculator. Also, the speed in which they operate, causing a delay to some students especially those in less developed countries. Through the use of the ITs in the curriculum, schools will also be helping pupils become knowledgeable about the nature of information, comfortable with the new technology and able to exploit its potential. To enrich and extend learning throughout the curriculum, and to help young people acquire confidence and pleasure using IT, become familiar with some everyday applications.

5. Integrating Educational Technology into Teaching

The development of new teaching techniques in the improvement of teaching constantly worries in the world, experts in the fields of education, psychology, specialists in mass media, scholars, etc. However, to overcome all the problems and difficulties caused by the new educational technologies and facilitate their integration, several solutions have been proposed including:

1) The role changing of the school:

(Duchateau, 1996) proposes to “change schools” if we want teachers work in school and do not go there just to teach and if we want students to come to school to learn and not just to sit in classrooms. We need architects to make school, a place where teachers work and students learn. It needs offices for teachers, large-scale space with variable functions such as multimedia rooms for student. Local networks can help to develop access to new technologies, provide information resources and boost information research.

It should also make teaching a common work for teachers to collaborate between them: for some activities not it better three teachers for teaching sixty students rather than three classes, each with one teacher and his group of twenty students? This collaboration and teamwork are encouraged during periods or teachers accompany the students, but also for the rest of their time working in the school (Poyet, 2009). It mentioned that the creative integration of ICT in schools is likely to fundamentally change the way schools work. It is a culture of cooperation to promote learning. It is also essential to give teachers a mastery of time; so that he could use small available time and these technologies in practice.

In addition, it is necessary that the public service in relation to education and cares deeply about improving everything about the ongoing teacher training, dissemination of the work of teachers, available to teams, essential information resources etc.

Finally, the teaching profession must cease to be leisurely without progress. It is necessary that prospects are offered to teachers. Currently, the good promotions can usually be obtained by leaving the world of education. It needs to promote teaching and encourage teachers, expected to use these technologies, not let technologies teach themselves.

2) The role changing of the teachers:

It is necessary to change the role of the teacher or assign him other roles more than a scholar whose expertise and knowledge come only from him. Students are accustomed to search information through ICTs so that they do not work as it should take to learn effectively. But ICTs are an admirable indication of the need for this extension of the expected roles of the teacher: guide, accomplice, facilitator and co-explorer. The software tool allows the development of teaching strategies based on the development and autonomy in the construction of knowledge, interactions between students and metacognitive activities. The teacher can fully play his role as a mediator and adopt a reflexive posture to deal with the difficulties of teaching (Poyet, 2009).

It is also important for teachers to know how to change, combine, and try to apply old techniques accompanied with the new ones. This system of integrated use of various teaching aids has been recommended in March 1962 during an international meeting of experts on the development and use of new methods and techniques of education, and approved by the General Conference of UNESCO at its twelfth session: the need to combine new technologies with traditional ones. The effectiveness of each new teaching aid, so great it may be, is greatly enhanced when we use several at once. It is therefore essential to produce them simultaneously in the context of an

overall plan that must have a specific objective defined in operational terms whenever possible (UNESCO, 1966).

3) The arrangement changing of the curriculum:

Naturally we have to enter in school spaces of freedom, beyond the partitioning of disciplines and the fragmentation in tight times. It's also needed to introduce in the overall training program for new activities around research and information processing. It should also provide opportunities for learners to define and lead team projects and give meaning to what is proposed. The continual introduction of techniques and tools will be able to transform the educational context and refine the relationships within the classroom and outside school.

6. Conclusion

Our dependence on new technology has reached a level where we can qualify them as the winners on our behavior and our daily life. In the field of education, we can only seek to well incorporate them to not let them taking the role of the teacher, but to be his technical partners. In addition, a number of measures remain to be done so that the school becomes a part of learning where teacher works well and focuses on students and not even him seek to understand new educational tools. Finally, these technologies must be combined with old techniques of education to be qualified as educational means and not goals or targets of learning.

But we cannot globalize these new technologies that the developing countries did not even ensure access to a quality education, the lack of infrastructure and pedagogical materials, lack of qualified teachers has stronger reason to purchase these technologies.

By the way, our goal is to improve the educational system as a whole, adopt educational policies that take into account the reality of each country, the cultural aspect and the population needs. Certainly these new technologies can help us to achieve this goal if the International Organizations will deploy efforts in the improvement of these technologies and alleviate their very high cost. It will be also necessary to change the way we manage our schools to succeed in introducing and integrate them into our schools.

References

- (2013). Ecole Eloignée en Réseau. Conceptions de l'apprentissage—Qu'est-ce qu'une théorie de l'apprentissage Behaviorisme Traitement de l'information, Constructivisme.
http://www.telelearning-pds.org/doc_eer/demarrage_classe/outillage1.html
- American Teachers (2008). *Access, Adequacy and Equity in Educational Technology*.
- Baron, G. L. (1998). *Des technologies "nouvelles" en éducation?* (pp. 1-7) INRP.
- Basque, J. (2005). *Une Réflexion sur les fonctions attribuées aux TIC en enseignement universitaire* (pp. 30-34, 36-38).
- Beverly, K. M., & Gene, D. M. (1987). *Teaching Technology to Children* (pp. 91-95). Massachusetts: Davis Publications, Inc.
- Chapman, D. W., & Mahlck, L. O. (2004). *Adapting Technology for School Improvement: A Global Perspective*. UNESCO International for Education Planning.
- Duchateau, C. (1996). *Pourquoi l'école ne peut intégrer les nouvelles technologies* (pp. 1-14). CeFIS.
- Eric, K., Osterweil, S., Groff, J., & Haas, J. (2009). *Using the Technology of Today, in the Classroom Today*. The Education Arcade Massachusetts Institute of Technology.
- Fadel, C., & Lemke, C. (2014). *Technology in School: What the Research Says*.
<http://www.cisco.com/web/strategy/docs/education/TechnologyinSchoolsReport.pdf>
- Gary, J. A. (1991). *Instructional Technology Past, Present and Future* (pp. 1-17). Colorado: University of Kentucky, Libraries Unlimited, Inc.
- Jacek, M. (2001). *Some Thoughts on Robotics for Education*.
http://fileadmin.cs.lth.se/cs/Personal/Jacek_Malec/psfiles/aaai01rae.pdf
- Jeonghye, H., Jo, M., Jones, V., & Jo, H. H. (2008). Comparative Study on the Educational Use of Home Robots for Children. *Journal of Information Processing Systems*, 4, 159-162.
- Keswani, B., Banerjee, C., & Patni, P. (2008). *Role of Tecnology in Education: A 21st Approach*.
- Koehler, M. J., & Mishra, P. (2005). What Happens When Teachers Design Educational Technology? The Development of Technological Pedagogical Content Knowledge. *Journal of Educational Computing Research*, 32, 131-152.
- Koehler, M. J., & Mishra, P. (2009). What Is Technological Pedagogical Content Knowledge? *Contemporary Issues in Tech-*

- nology and Teacher Education*, 9, 61-66.
- Lebrun, M. (2000). Pédagogie et technologie: En marche vers "l'autrement". *Pédagogie Médicale*, 1, 45-53.
- McGraw, T. (2008). Designing and Maintaining Instructional Technology Systems.
http://www.doe.virginia.gov/support/technology/edtech_plan/guidelines_resources/edtech_guidelines.pdf
- Meirieu, P. (1985). *L'école, mode d'emploi: Des méthodes actives à la pédagogie différenciée* (pp. 3-4).
- Molebash, P. Technology and Education: Current and Future Trends.
<http://www.itari.in/categories/futuretrendsineducation/FutureofEdu-Tech.pdf>
- Osborne, C. W. (1982/1983). *International Yearbook of Educational and Instructional Technology* (pp. 63-94). Reading: Bulmershe College.
- Poyet, F. (2009). *Impact des TIC dans l'enseignement: Une alternative pour l'individualisation?* (pp. 1-10). Veille scientifique et technology, Institut national de recherche pédagogique INRP, VST.
- Prensky, M. (2008). The Role of Technology in Teaching and Classroom.
http://www.marcprensky.com/writing/Prensky-The_Role_of_Technology-ET-11-12-08.pdf
- Riley, D. (2007). Educational Technology and Practice: Types and Timescales of Change. *Educational Technology and Society*, 10, 85-93.
- Ross, S. M., Morrison, G. R., & Lowther, D. L. (2010). Educational Technology Research Past and Present: Balancing Rigor and Relevance to Impact School Learning. *Contemporary Educational Technology*, 1, 17-35.
- Torr, J. D. (2003). *Computers and Education* (pp. 49-101). San Diego: Greenhaven Press.
- Watson, D. M. (2001). Pedagogy before Technology: Re-Thinking the Relationship between ICT and Teaching. *Education and Information Technologies*, 6, 251-266.
- Winthrop, R., & Smith, M. S. (2012). A New Face of Education Bringing Technology into the Classroom in the Developing World.
http://www.brookings.edu/~media/research/files/papers/2012/1/education%20technology%20winthrop/01_education_technology_shearer.pdf