

SCIENCE, TECHNOLOGY & LITERACY

Fatime BALKAN KIYICI
Gazi University Gazi Education Faculty
Department of Primary School Teaching,
Science Teaching Programme
fbalkan@gazi.edu.tr

Mübin KIYICI
Anadolu University Education Faculty
Computer and Instructional Technology Department
mkiyici@anadolu.edu.tr

ABSTRACT

Scientific information and new developments influence human lives making every human endeavor systematic. These developments in science and technology lead to educating literate individuals in terms of science and technology, or individuals who can think creatively and deliver their ideas freely. More specifically, individuals in today's world should be educated in a way that they are able to differentiate causes and effects, analyze ideas and solve problems efficiently. In order to educate such individuals, the society needs to have a sound grasp of the notions of technology and literacy along with the interrelationship between these notions. Thus, developments in science and technology influence our lives in a gradually increasing way, which leads the society to equip future generations with working knowledge of science and technology issues.

INTRODUCTION

People who are living in today's world are encountering a new scientific and technological advancements everyday. People who will live in a society, in which scientific and technological innovation and advances occur, should communicate with others effectively, should evaluate events occurring around them in a critical manner, should follow up scientific developments and evaluate probable results of these developments.

At the same time we live in a world that is increasingly dependent on technology (Dugger, 2001). People who are unaware about technology or who cannot evaluate technology cannot succeed in today society.

Science defined in various terms but in Websters dictionary science is defined as below;

Science is ability to produce solutions in some problem domains (www.websters-online-dictionary.com)

Dictionary.com define science

A branch of knowledge or study dealing with a body of facts or truths systematically arranged and showing the operation of general laws.

Another definition of science from dictionary.com

systematic knowledge of the physical or material gained through observation an experimentation

As can be understood from the definition science work on / study about phenomena that can be occur in the natural settings or experimental settings. Scientists especially study in natural settings but if there are some difficulties in the nature scientists prefer to simulate natural settings in experimental settings. Scientists observe the nature, record the data an as a consequence of analyzing these data human-kind understand “*What is going on in their habitat?*” The task of science is both to extend our experience and reduce it to order, and this task represents various aspects, inseparably connected with each other. Only by experience itself do we come to recognize those laws which grant us a comprehensive view of the diversity of phenomena (Anderson, 2001)

Our world has changed significantly this past century, and will continue to change because of the ever-continuous development of new technology. At home, at work, at play and in areas such as communication, transportation, medicine, entertainment, structural design and learning, technology has affected us all (Saskatchewan Education, 2001). Technology has changed our life styles, eating and traveling habits, and activities, that doing in our spare times.

Barak (2005) quoted from Encyclopedia Britannica (2005), technology is the “Application of knowledge to the practical aims of human life or to changing and manipulating the human environment. Technology includes the use of materials, tools, techniques, and sources of power to make life easier or more pleasant and work more productive.”. On the other hand Wonacott (2001) state that Technology consists of all the modifications humans have made in the natural environment for their own purposes (Dugger 2001). Inventions, innovations, and changes intended to meet our wants and needs, to live longer, more productive lives. Such a broad definition of technology includes a broad spectrum of artifacts, ranging from the age-old (flint tools, wheels, levers) to the

high-tech (computers, multimedia, biotechnologies). In shortly, if humans thought of it and made it, it is technology. Another short definition of technology is the things which make human life easier is technology. Technology is perceived as high tech devices such as TV, computer and internet by majority of the society. But actions which are considered and realized to facilitate the lives of people are also called technology. Relation between science and technology is continuously and endless. Science generates knowledge for its own sake, proposing and testing explanations. Technology, on the other hand, develops human-made solutions to real-world problems. Of course, science uses technology to generate knowledge and technology uses scientific knowledge to generate solutions, so the two are integrally connected; but they are different fields driven by different concepts and processes (Bybee 2000). Education especially science education prepare our youth for an increasingly scientific and technological world where citizens will need to learn and apply knowledge to solve real-world problems. Unfortunately, our youths are not learning the nature of science or developing deep conceptual understandings of scientific concepts, nor do they find science interesting.

ITEA (2000) defined relationship between science and technology as below;

Science is a study of the natural world and technology extends people's abilities to modify that world. Science and technology are different, yet symbiotic. Technology is much more than applied science and science is quite different from applied technology. When people use technology to alter the natural world, they make an impact on science. Science is dependent upon technology to develop, test, experiment, verify, and apply many of its natural laws, theories, and principles. Likewise, technology is dependent upon science for its understanding of how the natural world is structured and how it functions.

As mentioned above there is a relationship between science and technology. Scientists work and produce new information and using this new knowledge, technology or tools can be produced. Scientists use new tools or technology for the purpose of science and they generate newer information. This process is endless and newer scientific knowledge facilitate process of technology generating and newer technology facilitate scientist to produce newer information.

SCIENCE LITERACY

As such in past times, at the present time science make easier human life. Science has started from the beginning of the human life on the earth. Even in primitive period of human life, humanbeing use their environment for their profit, and exerted effort for made environment for facilitative for that reason science is a central phenomenon in human beings lives.

Science stimulates and excites pupils' curiosity about phenomena and events in the world around them. It also satisfies this curiosity with knowledge. Because science links direct practical experience with ideas, it can engage learners at many levels (Banks and McCormick, 2005). Science and scientific knowledge will help people to understand the nature which they are living in and also help to live in it friendly.

Scientific literacy entails being able to read with understanding articles about science in the popular press and to engage in social conversation about the validity of the conclusions. Scientific literacy implies that a person can identify scientific issues underlying national and local decisions and express positions that are scientifically and technologically informed (Buxton, 2001). A literate citizen should be able to evaluate the quality of scientific information on the basis of its source and the methods used to generate it. Scientific literacy also implies the capacity to use and evaluate arguments based on evidence and to apply conclusions from such arguments appropriately.

Science literacy is defined differently by different authors. Two accepted definitions are made by Benchmarks of Science Literacy an NRC (National Research Council) (1996) Benchmarks of Science Literacy definition is

A literate person is an educated person, one having certain knowledge or competencies.... In today's world, adult literacy has come to include knowledge and competencies associated with science, mathematics, and technology.... People who are literate in science are not necessarily able to do science, mathematics or engineering in a professional sense, any more than a music-literate person needs to be able to compose music or play an instrument

And NSES definition is

Scientific literacy is the knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic

productivity.... Scientific literacy means that a person can ask, find, or determine answers to questions derived from curiosity and about everyday experiences. It means that a person has the ability to describe, explain and predict natural phenomena

Mayer (1997) defines scientific literacy as the knowledge of substantive content of science that is related specifically to understanding the interrelationships among people and how their activities influence the world around them.

In the direction of these definitions; science literate person is stated by AAAS like that someone who is familiar with the natural world; understands some of the key concepts and principles of science; has a capacity for scientific ways of thinking; is aware of the important ways in which mathematics, technology, and science depend upon one another; knows that science, mathematics, and technology are human enterprises and what that implies about their strengths and weaknesses; is able to use scientific knowledge and ways of thinking for personal and social purposes (Castelão, 2002).

Lederman(1998) state that science literate person can make informed personal and societal decisions by using scientific knowledge. A scientifically literate person might also be expected, on the other hand, to appreciate the elegance and beauty found in studying the natural world or in conducting scientific investigations to explain how the natural world Works (Beeth and Wagler, 1997). To evaluate events occurring around, to live efficiently, to beautify their life and life of society, people should acquire science literacy abilities and be a science literate people.

In recent years education reform of different countries, science literacy was set as the national goal for science education and nations give attention and priority to science literacy (Macaroğlu, 2003; Turpin and Cage, 2004). Ultimately, science education means being able to participate in a democracy in order to pursue the good life. It's not just about being a doctor or a scientist, it's being science literate to the level of being able to participate successfully in the democratic life and to sustain a self-directed educational journey (Hampton an Licon, 2001). Science lesson should be organized not only to teach the fundamental laws and formulas of physics, chemistry, mathematics and biology but also to get acquired knowledge's which will facilitate their lives.

TECHNOLOGY LITERACY

Technology is a product of engineering and science has two parts: a body of knowledge about the natural world and a process of enquiry that generates such knowledge and a process for solving problems (Young and at all, 2002). Science produce scientific knowledge and using this knowledge technology tools and ideas can be produced.

Most people think that technology is only machine and think technology as computer, software, aircraft and microwave products. But knowledge and processes used to design, make and operate these products – engineering know – how manufacturing expertise, various technical skills are also can be named as technology (Young and at all, 2002).

It's a commonplace today that technology, or good or ill, will play an ever larger role in our lives at home, at work, and in the community. There is also some consensus, in an era of educational reform and standards, on the need for technological literacy and the definition of it (Wonacott, 2001). Just as technology involves more than computers and the Internet, technological literacy involves more than hands-on skill in using technology (Bugliarello 2000).

Technological literacy is much more than just knowing about and using computers. Certainly students have to be capable users of technology, but they also have to be able to seek, analyze and evaluate information, problem solve and make decisions, and be informed, responsible and contributing citizens (Saskatchewan Education, 2001).

The ultimate goal of a school program that involves the study of technology is to provide technological literacy to all students. Technological literacy is the ability of a person to use, manage, assess, and understand technology. A person who is technologically literate understands, in increasingly sophisticated ways that evolve over time, what technology is, how it is created, and how it shapes and is shaped by society (Dugger, 2001). Not only using technological tools ensure being technological literate. At the same time one must know how is technology produced, which purposes serve, which conditions should be operated and solutions to possible problems.

A person that understands with increasing sophistication what technology is, how it is created, how it shapes society, and in turn is shaped by society is technologically literate. He or she can hear a story about technology on television or read it in the newspaper and evaluate its information intelligently, put that information in context, and form an opinion based on it. A technologically literate person is comfortable with and objective about the use of technology neither scared of it nor infatuated with it (ITEA, 2000).

CONCLUSION

A society that lives independent of technology, working with technological devices and decide about technology is the duty of technologists only, but as technology gains importance these decisions should be taken by each individuals. The increasingly powerful role of technology in late 20th-century society and the related global concern to establish technology as a component of general, rather than vocational, education has led to an emphasis on the promotion of technological literacy (Jenkins, 1997). With the increasing complexity of technology, it is important for each citizen to be able to make informed decisions about the technology that he or she uses (Weber, 2005).

As mentioned above there is an infinite relations between science and technology, technological and scientific concepts, facts and events are affecting each other mutually. Scientific concepts and processes are best developed in the context of technological problem solving (Beven and Raudebaugh, 2004). The scientifically literate citizen has the potential and ability to influence public life and contribute to the social good. This citizen is empowered through her/his understanding of the world and ability to explore and address problems and issues (Hampton and Licona, 2001).

It is widely accepted that one of the major goals of education is to develop pupils' intellectual competencies such as analytical thinking, creativity, problem solving abilities and teamwork (Barak, 2005). This objective is not just rhetoric or a matter of educators' intentions, but rather the main desire of the pupils themselves. To achieve this goal, the following guidelines are suggested for education in the coming years:

- ✓ Involve pupils in the design and construction of advanced technological systems, emphasizing state-of-the-art technologies such as communications, robotics and biotechnology.
- ✓ Link technology studies to the advanced industries, academia and the community.
- ✓ Encourage teamwork of pupils, teachers and experts both inside and outside the schools.
- ✓ Strengthen ties between the study of technology, computers and the natural sciences.
- ✓ Technology should be introduced in the context of science content.
- ✓ Technology should address worthwhile science with appropriate pedagogy.
- ✓ Technology instruction in science should take advantage of the unique features of technology.
- ✓ Technology should make scientific views more accessible.
- ✓ Technology instruction should develop students' understanding of the relationship between technology and science (Barak, 2005; Flick & Bell, 2000).

Most of the people in society think literacy as separate from science and technology. But in our times literacy skills are not sufficient for surviving in a society which is technology based. And one should be evaluate phenomena which emergent in their habit, and should be produce solutions to environmental problems. People who will assist their personal advancement and societal advancement should learn science subject and they will live in the light of these subjects. On the other hand people come to live in technology dense society day by day. It is come to a necessity one should use technology faced, using these technologies they should bring their live to a efficient form, and when they use technology tools they should think effects on environment, individual and society health issue. In shortly, person should live in a peaceful manner to environment and society which they live. The most short way of providing this is combining literacy, science and technology concept and teach these abilities to person from beginning of primary school.

REFERENCES

- Anderson, Andy. Designing Systems to Support Learning Science with Understanding for All: Developing Dialogues among Researchers, Reformers, and Developers. 2001. Online: www.project2061.org/meetings/textbook/science/anderson.htm
- Banks, Frank and Prof. Bob McCormick A case study of the inter-relationship between Science and Technology: England 1984-2004. PATT -15 Technology Education And Research: Twenty Years In Retrospect. Haarlem 2005. Online: <https://www.iteaconnect.org/Conference/PATT/PATT15/Banks.pdf>
- Barak, Moshe. Engineering and Excellence: An Old-New Agenda for Technology Education in Israeli High Schools. PATT -15 Technology Education And Research: Twenty Years In Retrospect. Haarlem 2005. Online: <https://www.iteaconnect.org/Conference/PATT/PATT15/Barak.pdf>

- Beeth, Michael E. and Mark Wagler. The Heron Network -- Changing the Ways Students Learn Science. *Electronic Journal of Science Education*. Vol. 2 No.2 December 1997. Online: <http://unr.edu/homepage/jcannon/ejse/beethwagler.html>, 2002
- Benchmarks of Science Literacy. Project 2061. Online: <http://www.project2061.org/tools/benchol/bchin.htm>
- Beven, Roy Q. and Robert A. Raudebaugh. A Model for Unified Science and Technology. *The Journal of Technology Studies*. Vol:30 Issue: 1. 2004 Online <http://scholar.lib.vt.edu/ejournals/JOTS/v30/v30n1/pdf/beven.pdf>
- Bugliarello, G. .Reflections on Technological Literacy.. *Bulletin of Science, Technology & Society* 2 pp: 83-89. 2000
- Bugliarello, G. Reflections on Technological Literacy. *Bulletin of Science, Technology & Society* volume: 2 pp: 83-89. 2000
- Buxton, Cory A. Exploring Science-Literacy-in Practice: Implications for Scientific Literacy from an Anthropological Perspective *Electronic Journal of Literacy Through Science* Volume: 1 Issue: 1 2001 (Accessed: http://sweeneyhall.sjsu.edu/ejlt/archives/scientific_literacy/buxton.htm 16.08.2006)
- Bybee, R. W. Achieving Technological Literacy: A National Imperative. *Technology Teacher* Volume: 60, Issue. 1 pp: 23-28. 2000
- Castelão, Teresa. Epistemology of Science, Science Literacy, and the Demarcation Criterion: The Nature of Science (NOS) and Informing Science (IS) in Context . *Informing Science InSITE - “Where Parallels Intersect”* pp: 251 – 260. 2002
- Dugger, William E. New Media and Standards for Technological Literacy. *New Media in Technology Education Proceedings PATT-11 Conference* March 8-13, 2001
- Flick, L., & Bell, R. Preparing tomorrow's science teachers to use technology: Guidelines for Science educators. *Contemporary Issues in Technology and Teacher Education*, 1(1), 39-60. 2000
- Hampton, Elaine and Miguel Licona. An Emerging Understanding of Science Literacy: Moving Toward a Curriculum of Inclusion. *Electronic Journal of Literacy Through Science*. Volume:1 Issue: 1. 2001. Online: <http://sweeneyhall.sjsu.edu/ejlt/archives/diversity/hampton.htm>
- ITEA (The International Technology Education Association).Standards for Technological Literacy: Content for the Study of Technology. Virginia. USA 2000
- Jenkins, Edgar W. Technological Literacy: Concepts And Constructs. *Journal of technology Studies*. Vol: 23 Issue: 1. 1997 Online: <http://scholar.lib.vt.edu/ejournals/JOTS/Winter-Spring-1997/PDF/2-Jenkins-article.pdf>
- Lederman, Norman G. The State of Science Education: Subject Matter Without Context *The Electronic Journal of Science Education* Volume 3, No. 2.December 1, 1998. Online: <http://unr.edu/homepage/jcannon/ejse/lederman.html>
- Macaroglu, Esra. Using Internet On The Way Of Scientific Literacy. *International Educational Technologies Symposium and Fair Proceedings* Book Vol II. pp: 1109 – 115 2003
- Mayer, V. J. Global science literacy: An earth system view. *Journal of Research in Science Teaching*, 34, 101-105. 1997
- NRC (National Research Council. National Science Education Standarts. National Academy Press. 1996.
- Saskatchewan Education. 1999 Provincial Learning Assessment In Technological Literacy. May 2001.
- Turpin, Tammye and Bob N. Cage. The Effects of an Integrated, Activity-Based Science Curriculum on Student Achievement, Science Process Skills, and Science Attitudes. *Electronic Journal of Literacy through Science*, Volume 3, 2004. Online: http://sweeneyhall.sjsu.edu/ejlt/current_issue/articles/turpin_doc.pdf
- Weber, Katherine . A Proactive Approach To Technological Literacy. *The Technology Teacher*. *The Technology Teacher*, Volume: 64. Issue:7,pp: 28-30. 2005
- Wonacott, Michael E. Technological Literacy Clearinghouse on Adult, Career, and Vocational Education ERIC Digest No: 233 . 2001
- Young A. Thomas. Jonathan R Cole Denice Denton. Improving Technological Literacy. *Issues Science And Technology*. VOlume: 18 Issue: 4 ss:73 – 79. 2002