A Brief View of the Evolution of Technology and Engineering Education

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ABSTRACT
The purpose of this study is to review and investigate the evolutionary course of technological education together with engineering before and after the industrial revolution. A brief history of technology and engineering is provided in this study with regards to Daniel Bell's documents who believed that mankind has so far experienced three technological revolutions. The first one is the invention of heat pumps, the second a result of advancements in chemistry and electricity, and the third revolution, which occurred after world war 2, is when new information technology and communication and thought technology entered the era of post-industrialism. This period was divided into 5 segments including before the industrial revolution, the emergence of the industrial revolution until 1913, from 1913 to the launching of the Sputnik satellite, from 1950-1980, and from 1980 to now. Considering the developments taken place, it can be concluded that educational approaches for engineering have changed following the changes in technological education.

Keywords: history-technological education, engineering education

INTRODUCTION

According to the documents of Baskette and Fantz (2013), Hampshire Technology Education (2012), ITEA/ITEEA (2007), T. Kelley and Kellam (2009), American Society for Engineering Education (2008), Dearing and Daugherty (2004), Cajas (2000), Cheek (1997); Project (1997) with regards to the author, historical periods of technological and engineering education can be divided into 5 periods:

1. Before the industrial revolution
2. Industrial revolution to 1913
3. 1913 to launching of the Sputnik satellite in 1950
4. 1980-recent

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Contribution of this paper to the literature

- The current Engineering Education requires to be updated toward current technology-entrepreneurship-oriented needs.
- In order to improve human capacities including people learning ability and the provision of the required means toward discovering new scientific areas, engineerings are.

HISTORICAL TREND OF TECHNOLOGICAL AND ENGINEERING EDUCATION

Before the Industrial Revolution

Engineering education: historically speaking, the invention of the training system dates back 4000 years before Christ in the lands of Egypt. Even now, Alexandria is considered Egypt's center for engineering, where many aspects of Egyptian technical culture can be seen. When this became the Greek scientists and philosopher's base, this merging lead to a new branch of science called engineering. Archimedes is sometimes called the founder of the science and art of engineering because he was a complete form of science and practice. Heron was the chief and engineer of Alexandria's school of engineers. It's true that throughout history the figure of an engineer was found in individuals such as Heron Alexandria, Archimedes, Artakhaleps, and Imhotep; however, engineering, as a coherent system for human activities, was established in the 19th century. (Hejazi et al., 2011)

Technology education: technology is considered one of mankind's primary activities, which, historically speaking, was performed with a purpose towards advancing and evolving human beings. However, most human beings were forced towards a coalition of common interests in order to satisfy their primary needs and resolve their physical deficiencies. This called for interaction of technical skills through training systems gaining an irrefutable position and for technology education. Scandinavian farmers were in need of a constructive profession to fill out their long winter nights, thus they started working on inlaying furniture and carving tools. This had become a major component of the Sweden and Finnish culture, which became part of the formal system after the industrial revolution and the emergence of machines. Anna Signiss and Oto Salomon from Swedin were the educational leaders of this educational system. In other words, technology education in many countries is the result of arts and crafts and technical skills. Technology education was long considered a component in both public and professional education. In the primary system, it was the master's responsibility to both teach the trainee how to perform the task and how to live a successful life within cultural aspects. With the gradual advancement of formal schools and educational systems, often one professional goal would be combined with academic goals. During early 1700, Bennet Anderson and Postalagy and Herber and Fenelberg Schools were established along with the Scandinavian Movement (Hampshire Technology Education, 2012).

Industrial Revolution – 1913

Engineering education: 19th century and first half of the 20th century - Since engineering is considered a specific and different profession, fundamental programmers for engineering education have focused on preparing students by means of practical training. However, the role of science and mathematical models were rarely accepted and didn't have a chance to improve much (Motoahari Nezhad, 2011). Russian engineers from the Tamperial School of Moscow were the first to replace traditional internship methods with a simple educational programming consisting of easy to hard practical classes separate from workshops. Traditionally, imitation was considered one of the main methods for gaining skills and information for a limited number of individuals all taught by a master. (Hampshire Technology Education, 2012)

Technology education

The need Viktor Dalavus and his coaches felt for an educational program that could shorten the time needed for learning industrial arts in Russia, 1876, led to the launching of an exhibition for industrial arts including products made by students for honoring the hundredth anniversary of the establishment of Philadelphia

Exhibition. This exhibition had great influence on the American Manual Training System. Calvin Woodward from Washington University in St. Louis and John Ranklin from the Massachusetts Institute of Technology determined that engineers from the corresponding institutes lacked educational preparedness, which was a result of lack of experience for working with machines and materials. They announced that most graduates needed to pass a long-term internship course before becoming formally known as engineers. Many ideas and inspirations were given at the industrial arts exhibition in Russia ultimately leading to a relatively novel system for manual training in higher education.

The establishment of St. Louis and Boston School of Arts and Crafts was a result of their endeavors. In 1890, John Raskin and William Morris started the Arts and Crafts movement in response to the anti-humanitarian aspects of the industrial revolution. The Arts and Crafts movement made its way to the United States where Charles Benet had established modern aspects in industry and arts. This included graphical arts such as geometrical shaping and visualization of industrial marketing of wood and metal as well as the arts of clay fabrics, spinning & weaving, wickerwork and binding, cooking, and printing. Benet's philosophy was concerned with preparing students for life. He believed that all learning experiences should be focused on this purpose. (Hampshire Technology Education, 2012)

From 1913 to Launching the First Sputnik Satellite in 1950

Engineering Education: during this period, engineering education entered into scientific and statistical fields in order to improve engineering and industry, which, for example, can be seen in the works of Henry Ford and Dr. Shuart for controlling the Six Sigma process. However, the major leap in quality of engineering occurred after the World War. (Akbarpoor Shirazi, 2005)

Technology education

In 1913, Fredric Bouncer and Louis Mosmen established an individual framework for industrial arts in Columbia University. Their main work was concerned with elementary teachers. They believed that before becoming mature consumers, students had to think productively, which led to a new fundamental definition for educational programs. Industrial arts applied new changes in the form of materials used by humans to satisfy their needs including 7 fields of carpentry, industrial design, metalworking, graphical arts, handicrafts, mechanics, and power (electricity) (Board of Technology Education, New Hampshire Engineering, 2012). In the course of time, changes were made in modern large-scale literacy focusing on cognitive and executive qualification in vocational training for some educational programs. (Ernst & Haynie, 2010)

From 1950 to 1980

Engineering education

The "Engineering Science Approach" starting in Europe was later developed and empowered in the United States after World War II. The main reason that this approach was proposed is that previously, scientists were more prepared in facing new and modern technology than were engineers.

Thus, the scientific and mathematical context of education engineering programs increased, whereas the amount of time spent by students in workshops and for technical and professional engineering activities decreased. (Grimson, 2002) After World War II (1945), General Electric Company realized that it's expenditures during the war had increased; thus, Lawrence Miles, the senior engineer at General Electric Company was sent to investigate this issue. After necessary investigations, he found that during the war, due to pressures and difficulties of war as well as operational and time requirements, some materials and projects had been replaced coincidentally with better performance and lower costs. Considering this, he established the fundamentals and principles of Value Engineering in 1947 taking major steps in decreasing General Electric Company's expenditures and costs.

After Miles had recognized the innovative ways of Value Engineering, in 1950, the U.S Navy considered employing Value Engineering in its contracts for building warships. In 1962, Mack Namara, the former Secretary of Defense of America, gave the order to include Value Engineering in the ministry's activities. Later, in the 1980s, the application of Value Engineering in reducing government expenditures had become quite common throughout America. American Ministries were able to avoid millions of dollars in their costs and expenditures.

In 1969, along with enhancements in Value Engineering in America, the Society of American Value Engineering (SAVE) formally began operating making value engineering known to other countries. Currently, the society has become known on a global level as an international value engineering society (SAVE International) with a purpose to improve and develop value engineering by publishing articles, training evaluators, VE teachers, recruiting real and legal individuals and value engineering societies of other countries, and providing them with academic support.

In spite of the fact that with the help of advanced methods, many countries have been able to optimize their activities, the importance of value engineering in re-optimization is very clear such that it ensures a 20-dollar return on investment for every 1 dollar of investment. It is worth noting that for more than 50 years, value engineering has been employed on global level to promote productivity and reduce worldwide costs, even in Arab countries of the Persian Gulf. However, value engineering was not that common in Iran except for a few recent cases (Saghafi, Ameli, & Mohammadsadeghi, 2004)

Technology Education: coincidently, at the same time that the Sputnik Satellite was launched (1950), the era of technological experiments and modern fields of transportation, plastics, and electronics began expanding (Board of Technology Education, New Hampshire Engineering, 2012). In other words, the latest educational programs come from these practical training methods which first began developing in the 18th and 19th centuries. The John Dewey Experimental School used similar educational activities with a focus on practicality. The three important factors in creating technology educational programs included the "industrial arts" movement in the U.S in 1950; combination of public and professional education in leading programs; and merging industrial and aesthetics components (arts and handicrafts). Two of the most effective projects for stabilizing technology educational programs included the industrial arts program and the Maryland project.

Generally speaking, these cases were based on research and introduced new subjects in the educational program which changed the frequent method of "teaching through practice" and were even applied widely by all schools or states. In addition, both of these projects still effect modern technology education of the 21st century. The industrial arts project was one of the biggest professional education programs funded by the United States departments of Education, Health, and Welfare. The first project officials were Donald G. Lux, Willis A. Ray, and Edward Towers.

This project led to the advancement of two new courses related to industrial arts programs for elementary levels, namely the World of Construction (Lux and Ray, 1970) and World of Manufacturing (Ray and Lux, 1971). Advancements in these courses were mainly inspired by the project leaders. Subjects were theoretically organized on the works of Warner (1948) and Olson (1963) limiting the element's names, different processes, and the curricula to two organizers: Construction and Manufacturing. Back then, this was considered an important step in the curricula.(Ernst & Haynie, 2010) The late Donald Molly, a professor at the Maryland University, was also a great influence on the technology education programs of today. His work reached its peak in the "Maryland Project" (Maryland, 1973). The Percy Jackson industrial arts educational program summit was held for planning a single route for ordering the clear definition of themes, qualifications, and comprehensive results. This summit led to a foundation for "reconstruction of industrial arts as a building block for technological literacy" (Cinder and Hals 1981 quoted from Hejazi (2016).

From 1980 to Recently

Engineering education

Technological advancements of the 21st century including successful containment of nuclear energy and also geo-political realities such as satellites led to mastering engineers in science and mathematics and consistency of engineering education programs with the changed requirements. This structural change continued to a great extent until recent times, although the design context gradually increased. During early 90s, it was found that something more than science is needed, and many engineering colleges emphasized on non-technical skills such as group work and communication. Engineering is in fact somewhere between science and society and is concerned with systematic principles of science and mathematics in order to conclude scientific results for improving real life (Grismon J, 2002).

Therefore, in engineering education, we must emphasize on both science and practice (John V, 2002) so that students majoring in engineering fields could achieve the necessary qualifications for working in the industry and working environments of the 21st century. During the last few decades, engineering education has been criticized in some countries.

In France, during the 90s, industry owners complained about the engineer's practical disabilities while in Britain, these similar complaints were raised a decade earlier. During the 90s, in the United States, members of academic boards of many engineering colleges discussed the best method for engineering education reform for undergraduates. The main discussion of many colleges was about corresponding engineering education with the requirements of the industry. Other colleges were seriously focused on low design skills of engineering students. In all cases, the critics complained about the fact that engineering education has taken some distance from practical orientations, and real requirements have become even more unbalanced (Harwood, 2006; Motahhari, Hossein, & Davami, 2011)

During the 21st century, rapid changes occurred throughout the world, which along with the changes made in engineering education in 1990s, led to the expansion of engineering education. Despite the fact that the new structure was based on high scientific and mathematical preparedness, there will probably be a great emphasis on the professional role of engineers, and then, new qualifications will be mentioned regarding new world order. National investments for producing wealth are increasingly dependent on empowering the "Triangle of Knowledge" comprising of education, research, and innovation (Ambrose, Bridges, DiPietro, Lovett, & Norman, 2010; Motahhari, et al., 2011)

This approach is based on training "soft" skills of individuals through practical innovations in engineering education in order to ensure that the first year of undergraduate education becomes an entertaining and fun period, instead of a dull and boring one. This approach provides an overview of engineering education, introduces its supporting skills and creates interesting ways for attracting talent for STEM-based professions. It configures the curricula in way that different fields of learning are ensured. (Apelian, 2013)

It seems that engineering education of today requires a rebirth based on entrepreneurship and technology meeting recent requirements. In addition to technical knowledge, an engineer must be equipped with group, problem solving, and human power promotion skills such as improving learning capability of people and providing necessary tools for researching modern scientific fields. Physical power along with intellectual power are considered by engineers in economics fundamental global knowledge. Motahhari's classification, quoted from Apelian (2013) includes complementary engineering education courses. On the other hand, analysis of engineering education quality made by numerous national institutes and international councils have shown a great increase of changes in engineering education emphasizing the importance of engineering education during the last decades as well as the consistency with the surrounding world. Technology education during this period also faced great changes. It seems that different approaches for technology education and changes in engineering have become synchronized.

Technology education

The 1978 Standards Project was initiated with another major investigation based on determining the state and design for change. After this investigation, a team of professional gathered in order to improve standards related to educational, equivalency, and special needs organization. A collection of workshops were built for obtaining more occupational data including representatives from all 50 states. This project reached its peak in 1981 when it reached a collection of publications such as standards for industrial arts programs, American Society for Industrial Arts Education, Guideline for industrial arts programs, gender equality guideline for industrial arts programs, and the special needs guideline for industrial arts programs. (Reed & LaPorte, 2015)

Amongst other projects is the "human created world" project conducted by Josep Pell et al., in New York State University located in Stoney Brooke. This was the first high risk activity in the 19th century with a goal of merging science with technology (Dennis W Cheek, 1997).

The American Association for Industrial Arts changed its name to the International Technology Education Association in 1984, and guidelines were updated in order to formally include "technology". Traditional programs were taught in "workshops"; however, it did not involve modern computer technology and cognitive concepts of technology and its effects not operating well under standard reviews.

The technology project for all Americans was initiated in 1994 by the International Technology Education Association (ITEA) in order to provide educational program standards for supporting students in a technology research (ITEA, 2008). In 1996, the International Association for Technology Education and Training published a document containing reasons and structures for studying technology later used for standardizing technology literacy in 2000. The evolution of technology education led trainers towards teaching technology in the engineering design process, and engineers were provided with trainings for inventing test models for evaluation and building and were also provided with easy to hard solutions. In this engineering course, the individuals were exposed to different professions (Board of Technology Education, New Hampshire Engineering, 2012).

At the same time, the initial design for the national science education movement resulting from the AAAS movement and the scientific society of academic teachers was mentioned in 1996. Several significant discussions were made regarding how to face technology in the form of the mentioned standards and by considering it as an independent field of science and as an element in teaching sciences and independent technology education. Ultimately, the actual position of technology regarding social concerns of the modern world and sciences were mentioned. (Cheek, 1997)

Central issues regarding the literature of researching the history of technology are resulted from the efforts of individuals working in the field of society and technology published in technology journals. Historically speaking, technology education has accepted numerous options for training learners regarding technology. In the course of history, technology education has focused on educational programs including arts and crafts, handicrafts education, industrial arts, industrial technologies, preparing technology, and projects resulting in solutions, though it is worth noting that focus on skill-based and industrial-based approaches has changed towards design- and problem solving-based approaches. Additionally, the range of technology education expands very widely. For example, it includes construction, communication, transportation, biotechnology, etc. (T. R. Kelley, 2008) Results of a study conducted by Newberry (2000-2001) also indicate a huge movement in the course of introducing technology to educational programs in American schools. National surveys conducted in 1991 also indicated a transitional trend from industrial arts to technology education. Oaks et al. (1991) conducted a national survey in 1991 indicating a transition from industrial arts to technology education. They also performed a national census in Canada.

It is worth noting that during the course of history some have tried to stop the trend of changes in technology such as the 18th century Britain luddites who wanted to stop the significant technological advancements in knitting and leather industry by building knitting machines.

The luddites impact was; however, insignificant, and the knitting machines greatly helped the industrial revolution in England. On the other hand, the kind of thinking that anything can be solved using technology must also be reconsidered (New Jersey Curricula Framework, 1998). A study conducted by Sanders, which compared common technology education programs with the results of studies conducted by Pelley & Schmitt using research tools applied in the studies of Sanders and Dugger, Miller , Bame, Pinder, Gales, Yong, and Dixon, indicated that changes in the thinking process regarding technology education goals have started since 1980. Results of this study indicated high response rates for developing problem solving skills as a major goal in technology education. (Baskette & Fantz, 2013; Sanders, 2009). Amongst global efforts regarding technology education are: revival of technical skills, manufacturing handicrafts, engineering and change, expanding science and technology, modeling, and problem solving. Block provides a summary of recent advancements and approaches in many countries.

In Finland, technical skills are measured apart from their traditional concept, in which students study and use the skills for systems and materials. Visual elements, redesign, and performance in research and program are combined. Many approaches to industrial arts in Sweden involve a combination of manual skills, aesthetic sensibility, and traditional design. In Eastern Europe, technical productions are applied with an emphasis on skills along with concurrent machine production, its control, and organization. The global engineering internship method prepares technicians and engineers through a complex educational system. A complex method which complements modern technologies focused on information technology and is applied in France. Denmark and other countries are dependent on the science and techniques of technology, highlighting a close correlation between different regions. In Britain, the main emphasis is on design as an essential concept of technology research and application. The increasing impact of designed-based approaches in Britain has greatly helped in balancing the pressures of engineering for educational programs. Problem solving approaches in the United States defines and answers questions regarding social requirements and makes use of a mutual order approach. Social and technical approaches employ students to study technological innovations along with social changes. Engineering clusters, design, research, and advancements were clearly organized in previous educational programs. (Reed, 2010)After educational reforms, the importance of understanding technology and technical skills identified as an important goal for all students.

Important examples include the scientific project, project 2061, American Association for the Advancement of Science (AAAS) (1993) and standard of Technology Literacy, International Technology Education Association (ITEA) (2000), United Nations Educational, Scientific, and Cultural Organization (UNESCO). (Cajas, 2000)

After industrial educations were driven towards technology education and technology education approaches changed from skill-based approaches to problem-solving approaches, since 2000, when ITEA published its Technology Literacy standards, engineering concepts found their way into technology education programs and different fields were created including the ProBase project, principles of engineering, engineering design, and addressing technological literacy standards.(Daugherty, 2005; Denson, Kelley, & Wicklein, 2009; Lewis, 2006)

Later, the National Center for Engineering and Technology Education made an emphasis on the importance of studying the current state of technology education. The center also stated in its report (2006) that the best way for technology to make its way into technical and engineering classes is to make production its main goal.(Householder & Hailey, 2012; Seymour, 2002)

After historical changes in the concept of technology, technology-related processes were transformed into elements for technology education programs or technology literacy. Engineering is related to the concepts taught in technology education. Many educated people talk about the need for practice in educational programs and the importance of renaming professions as well as the fact that technology education leans towards a deeper reflection of processes and the concept of engineering.(Ritz, 2011)

At the same time, different types of curricula were developed with a combination of technology and engineering, including the following programs.

Smith College curriculum in engineering education:

In Smith College, engineering has been defined as a liberal and professional art at the service of humankind. According to this definition the engineering education curriculum focuses on three aspects of knowledge unity, technological literacy, and entrepreneurship fostering.(Rose, Shumway, Carter, & Brown, 2015) This college supports research and activities that develop an exciting and learner-centered curriculum and challenge the students, develop a combinative curriculum that encourages mastering over engineering foundations in a social and human context, encourage social responsibility and sustainability-based thinking, and support and develop the language of technology. (Nejad, 2015)

Binaural approach to the design of technology education curriculum:

Keirl (2015) emphasizes combining different cases in technology education, such as human and technology, natural and artificial, and visible and invisible, in order to extract basic concepts in technology education curriculum. One of the binaries in the studies of Keirl is whether the universities and technology education seek to make changes or maintain the status quo and whether technology education is just about using tools and technical skills or technological behaviors (Keirl, 2015).

Apelian and Tryggvason model in the curriculum of engineering schools:

The curriculum of engineering schools also underwent changes to emphasize the creative nature of engineering. This model shows the dimensions of the four broad areas including humanities, arts, science, and engineering. Humanities is described through culture (such as literature, art, and history), art activists deal with culture-building, science involves the study of the physical world, and engineering is to make thing in this physical world. This curriculum has been developed to promote technology and information literacy and also critical thinking, problem solving, and decision-making skills required for economic competition in this ever-changing world. (Behzadi, Razavi, & Hosseini, 2015)This curriculum, which requires strengthening the multidisciplinary understanding of scientific and practical knowledge and skills, increases the conceptual understanding of students and procedural knowledge skills and helps to solve social problems using technology. In this approach, students actively participate in the learning process and learn how to efficiently take part in getting access to discoveries and combining the information in the future.(Sharkawy, Barlex, Welch, McDuff, & Craig, 2009 quoted from Petroski, H,2015)

Massachusetts Science andTechnology/Engineering Curriculum Framework:

All students must have an appreciation for the wonder of science, possess sufficient knowledge of science and engineering to engage in public discussions on related issues, and be careful consumers of scientific and technological information and products in their everyday lives. Students' STE experience should encourage and facilitate engagement in STE to prepare them for the reality that most careers require some scientific or technical preparation, and to increase their interest in and consideration of careers in science, technology, engineering, and mathematics (STEM). All students, regardless of their future education plan and career path, must have an engaging, relevant, rigorous, and coherent pre-K–12 STE education to be prepared for citizenship, continuing education, and careers. (Mitchell D. Chester) afterwards Philip Reed and James LaPorte (2015) state that an interesting approach for many in the process of technology education is three-dimensional development of activities for students. There are many examples for this approach such as design-construction-assessment (according to Australian Education Committee, 1994) and determination-design-construction-assessment and stating the problem-hypothesis-model-test (in the US, according to the International Technology Education Association, 1998). Problems of unlimited design have been improved through repeated challenges in the technology curriculum. In this method, students use the divergent thinking practices to identify the classification of potential results and then choose one of them for investigation and subsequent developments. However, challenges of unlimited design do not thoroughly reflect the expected nature of design. (Reed & LaPorte, 2015)

CDIO approach:

The authors write primarily to engineering educators, administrators, and curriculum developers to discuss the Conceive-Design-Implement-Operate (CDIO) approach as it has now been implemented in classrooms across the globe. In looking at the gap between engineering education expectations and form, Crawley et al. (2014) "identified an underlying critical need — to educate students who are able to Conceive-Design-Implement-Operate complex, value added engineering products, processes and systems in a modern, team-based environment" (p. 1). Their message seems to be aimed at a wider audience that includes all engineering and technology educators. "It is not a matter of fixing something that is broken, but of improving something that is vital to our future, namely technological education" (p. 183). Education that is focused on preparing students with elements of practical knowledge must employ applied instruction. This theme is consistent throughout the text and the authors provide valuable insight on how to bring the applied element to classroom instruction. Crawley et al. (2014) make the case for their method by describing the role of engineers as conceiving devices and systems, designing "products, processes and systems that incorporate technology," (Chuchalin, Malmqvist, & Tayurskaya, 2016)

The most important question here is whether the approach of engineering science alone can respond to the challenges of engineering education in the 21st century. Just as engineering education was previously changed to comply with social needs, this evolution and change is also necessary to represent the requirements of the 21st century. Social challenges of the 21st century are quite vast and deep. Essential needs like energy, food and water, housing, transportation, and health are even more critical considering the world population is exceeding 9 billion. The demand for stable improvement requires leadership, innovative engineering talent, and a new definition. Along these changes and challenges, engineering education has performed major changes with an impact as high as the invention of engineering in the 19th century and establishing scientific knowledge as the principle of engineering in the mid-20th century. These changes are formed with the appearance of global entrepreneurship, competition, and continuous economies, in which successful engineers are more than ever in need of technical skills different from what was previously considered beneficial. This period is considered a renaissance and evolution of engineering education. (NAE, 2013)

Education that is focused on preparing students with elements of practical knowledge must employ applied instruction. This theme is consistent throughout the text and the authors provide valuable insight on how to bring the applied element to classroom instruction. (Motahhari Nejad, 2015)

Many organizations comprising of universities and international experts have pursued standardization of the engineering curricula including the CDIO engineering education, American Accreditation Board of Engineering and Technology (ABET), European Network for Accreditation of Engineering Education (ENAEE), Engineers Australia, and Institute of Engineering Education Taiwan (IEET).

CONCLUSION

Results show that meaning of Engineering and Technology has undergone change over the course of history. In the first period of teaching engineering and technology, much attention was paid to apprenticeship. However, after the advent of the industrial revolution, engineering became a different career, the role of science and modeling increased in it, and diverse fields of engineering emerged. Therefore, in addition to practical measures, engineering with a problem-solving approach entered the cultural and educational fields in countries; for instance, universities trained primary teachers with a production approach. In the following years, engineering education sought reduction of costs in societies and new technologies in this field could pave the way for those activities, which were gradually directed toward technological knowledge. The difference was that in the first historical period, technological approach was flexible to apprenticeship and practical work. However, technology has a different meaning today. It makes an effort to solve problems, create science, remove needs, and reduce needs. Soft skills like teamwork and management are on the agenda of future engineers. In sum, having examined the history of technology and engineering education, we conclude that engineering has always been affected by technology. In addition, the meaning of technology has undergone significant changes. These changes have altered

engineering approach in different periods. However, technology is not specific to engineering fields; rather, it encompasses all human fields. Example, history Architectural schools in Iran after passing two courses; one convergent Bowhos) and the other divergent period (postmodernism and pluralism) are now suspended to And the release of this situation requires an overhaul of the previous methods and adopting new approaches to Pay attention to the requirements of the present age. The weakness of educational systems is often the pre-university education. It turns out that instead of the amazing use of the power of mind to store information in an unbelievable way Calling. This undesirable condition of our educational system is inevitable. It is on the road of creativity and utilization of the potential capabilities of the human brain, and as this ability for individuals is prone to being taught; consequently, the importance of creative thinking in learning becomes evident. (Akbari, Selebenei, Hoshmandzadeh, & Tahmasebi, 2017)

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