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Received on: 15/11/2018
Accepted on: 10/01/2019
Published online: 25/12/2019

The Concept of Engineering Drawing and its Impact on Engineering Education

Abstract- Engineering drawing is one of the most significant lessons of sensory perception, which possesses unique characteristics change engineering drawing to technical by transforming ideas into drawn lines that are easily conceptualized, and then turning them into buildings, equipment and projects, These comprehensible to everyone and are easy to carry, transport and line deliver to anyone who is paying attention in this scientific are field. Engineering Drawing is built on simple scientific rules and principles. Its concepts have been discussed in this research to be defined as a global language called the Language of the Engineer. It has been demonstrated that increasing the training hours in engineering drawing can lead to an increase in the student's skill in understanding and applying the concepts of the subject of engineering drawing for the majority of the students who were surveyed in this study. In this study, the relationship between engineering drawing and engineering education is discussed in depth. In which freshman students who are currently studying engineering drawing in the department of chemical engineering have be taken as tools for this study and their scores have been studied and compared with other lessons that are included the drawing in their constituents. The results showed the extent of the close correlation between the students' marks obtained in the engineering drawing and their impact on the marks in the other engineering subjects they study.

How to cite this article: F.H. Faraje and K.M. Sadiq," The Concept of Engineering Drawing and its Impact on Engineering Education," *Engineering and Technology Journal*, Vol. 37, Part C, No. 4, pp. 454-459, 2019.

1. Introduction

Engineering design is one of the most important tools of the engineer to design and implement a successful integrated engineering work. As it is considered the language of engineers and basically any project or engineering work requires to this accomplished. The knowledge of the principles and fundamentals of engineering drawings are essential for building an efficient engineer capable of accomplishing his tasks at the fastest possible time, cost and highest level of accuracy. One of the first steps in any engineering work is to prepare designs and sketches for each engineering detail. The preparation of engineering drawings is one of the most important steps of the comprehensive review of modern engineering work. Which refers to errors that can be obtained in the stage of preparing designs and correcting them easily. With the development of the computer and the availability of specialized programs in engineering drawing and in

the field of design preparation, which assigns a large part of its priorities to the establishment of complete and accurate designs for engineering works, the engineer is fully aware of the principles of engineering drawing, which allows him to succeed, to integrate his understanding, and to have a smooth implementation of his engineering work. A person needs to express his ideas and communicate them to others in different ways, including speech, writing, drawings, and drawings are one of the oldest methods used to express ideas. In ancient history used images, People portrayed image in the form of picture writing, but this need was complicated by the progress of life and development, The complex shapes were described only by speech, so man sought to express them by drawing because of the need of precise details. In addition, the engineering drawing is a common global language concerned with shapes and figures and is handled by engineers and manufacturers. The

engineering design develops the metaphors of human imagination and provides the effort and time, even if we refer to the definition of geometry. It is the use of mathematics, experiments, scientific, economic, social and practical evidence for the invention, science, economy, construction, and improvement of structures, machines, tools, systems, components. It is used in various processes where the engineer is always dealing with the design, such as the design of buildings, equipment, roads, bridges, drawing of electrical circuits, drawing formulas for different vehicles, developing plans for factories and production processes. To be able to draw must be given great attention in his education.

Despite the development of the means of drawing electronically using the computer through several programs, including AutoCAD, which is taught as a curriculum in the Iraqi universities, the graphic engineering manual remains the source and starting to keep pace with this development and without understanding the basics cannot an engineer draw and express his creativity in the field of engineering design.

It has been noticed recently in most Iraqi universities engineering complacency in this jurisdiction is considered a secondary lesson and there is more emphasis on drawing using the computer, which will create a generation of geometrically weak graduates that cannot draw a planned Lao, which leads to the development of engineering education at stake, and through this important conference We put this side on the discussion table and work to adhere to the development of this science from hand drawing to using computer programs and find the best solutions for the advancement of this science through our experience in the teaching engineering drawing we found in to a number of graduates to ask questions. Learn drawing and why Its useful in the various fields of work. (1) (2) (5)

The purpose of research is to establish a correlation and to study the effect of engineering drawing on increasing the student's scientific skill and to study the impact of this science on the rest of the engineering studies by studying this effect on four lessons; Therefore contributing to raising the efficiency of engineering education.

2. The origin and development of engineering drawings

Archimedes, in 212 BC, used painting to prepare and produce modern machines and equipment to

organize the defence of the city of Zaragoza in front of the Roman armies. His drawings were in the form of an approximate perspective of his machines and equipment, His last words to the Romanian soldier who killed him: "Do not touch my drawing". He used the idea of engineering drawing to design a machine. A Roman man in 30 BC name Vervius worked in the field of mechanics, designed a bronze pump for the miners.

Also The Arab and Islamic civilization has had a great impact on the development of manufacturing technologies. Heritage books are rich in the drawings of complex mechanical and hydraulic machines left by Arab engineers. Arab and Islamic civilization produced a number of inventors and engineers who laid the foundation for industrial development witnessed by Europe in the Renaissance, Scientific references and manuscripts. Scientific applied books, It is one of the most famous Arabic books, which is concerned with design, mechanical engineering and hydraulics, and its ideas and drawings are still used as inspiration for modern machine designs

Leonardo DA Vinci is a pioneer in the improvement of modern and building painting with his illustrations and structures. The improvement of geometric painting and the utilization of geometrical lines are best credited to the Italian architects all in all, outstandingly Leon Batista Alberti (L. B. Alberti) (1472-1404).

The real beginning of modern geometric drawing came in the eighteenth century, especially in 1727, when rules, terms and general international conditions were agreed upon to standardize the works of geometric drawing and practice in the production of artistic designs. Acting according to his experience and his mind to produce designs and drawings and implementation.

Since then precision in production has taken its course, quantitative production and the use of precision machines have begun, and the idea of producing switch parts has emerged. High-rise buildings and their designs have begun to take effect.

However, the idea of drawing and arranging the projections remained without evolution until the 20th century, until the French mathematical scientist Caspar Mung explained the method of representation of the objects at two orthogonal levels, which gave the painting its integration and opened wide horizons. It is still used and studied to this day. (The third projection) in this way, and objects can be shown and represented in full partial

detail. Since then, the specialization has entered the field of engineering and industrial drawing, and the presence of the Office of Engineering Drawing is an urgent necessity in all industrial establishments and is followed by other departments such as the printing department, the planning department, and the painters' section [1].

Graphic engineering is the science have foundations, rules and origins. Which is the practical application of the rules of flat and geometric geometry. It uses various simple and complex tools called engineering drawing tools. It is a fine drawing that depends on determining the dimensions and angles of a part or all of a particular geometrical structure. Its purpose is to achieve the creation of precise geometric shapes that reflect a specific objective.

It is also known as the science of transferring dimensions from reality to paper while preserving the relative relations between these dimensions [2]. Free drawing is one of the types of drawings in which a utility is used such as computer, protractor, calliper or ruler, pencils and charcoal. Free drawing is taught as a subject in engineering colleges, helping to provide skills, In the development of the ability to visualize geometric shapes in the void, and to apply them in a quick and correct manner. It should be noted that these skills are necessary for interactions with professionals in the early stages of various engineering projects, as well as their importance in the initial stages prior to the use of computerized drawing techniques , The courses of free drawing deal with a number of basic issues, the most important of which are the methods of presentation such as the perspective, the econometric and the Monog method, as well as the representation of different materials: Kalmati, luster and chromium, In addition to the use of colours, the formation of integrated art paintings of a project [3].

Humans has developed a schematic representation in two directions based on the purpose of that representation:

Technical drawing, technical drawing.

I. Technical drawing:

used in showing the aesthetic aspects of things without attention to dimensions and angles accurately.

II. Technical drawing (engineering):

Pays great detail in the accuracy of dimensions and angles without attention to aesthetics significantly, which we will address in this research. The earliest

geometrical drawing is the horizontal projection of a castle design, developed by the Chaldean engineer Claudia in 4000 BC, engraved on a stone slab. The engineering drawing does not need talent but needs to be drawn accurately by someone who has mastered the rules and scientific foundations of this science.

The science of engineering drawing has become closer to other sciences, especially engineering, where an engineer or researcher who does not know or mastered the method of expression in her field of competence is considered to be illiterate in her profession. Engineering is the language of scientific communication between engineers to exchange their scientific and practical ideas specialty is therefore called the language of engineers.

This language is defined by rules and bases. Despite the slight difference in some details of these rules and conventions between different countries, they all agree in the basic rules. ISO has developed special specifications for engineering drawings, and the Standardization and Quality Control Authority has prepared standards for engineering drawings in Iraq. All Iraqi engineers are required to refer to them when implementing their drawings.

3. Steps to develop the skill of engineering drawing:

Build visual skills by developing visual observation skill and viewing. The development of visual cognition, through the activation of the mind, and the group of subjective elements seen by the person, so the development of this skill is linked to the development of culture, knowledge and science of learners in addition it linked to the optical power of memory. The visual separation skill, through the division of visual patterns or relationships, as well as the fragmentation of the architectural or architectural vocabulary from the surrounding environment, in order to identify the individual characteristics of each of them, as well as by identifying the different relationships between all the different vocabulary and structures. Develop visual communication skills by observing work during drawing. The skill of visual analysis: by identifying the patterns and visual relationships in the built environment, it should be noted that in this step is linked memory and mental inventory [4].

4. Conditions to be met in modern engineering education:

- Learn a building actor on good planning to the project (Project Based).
- Integration of the development of concepts of engineering drawing, mathematics and science within the applied content.
- Great interaction with industry.
- Wide use of modern information technology.
- Devoting the efforts of faculty members towards the development of the engineering profession as mentors from more than one source to provide information.

5. Importance of engineering drawings

Geometric drawing is a basic widespread dialect concerned for shapes and designs Furthermore may be managed for by particular architects What's more Makers. It needs ten lines to every particular offering for implication. The engineering drawing develops the borders of imagination in man and provides effort and time. The inner part designer's ability might not lie in drawing An delightful What's more useful configuration to At whatever building, Anyway Previously, passing on as many thoughts of the customer, those mechanical and the development. Those current creators ought to create as much experience clinched alongside passing on as many thoughts Toward making outlines to those building's downfalls that would be integrated, Furthermore Creating inner part interfaces that depict every last bit components of the outline What's more its points.

6. Shortcomings in designing alumni today as we see them

- Scientific exaggeration.
- Lack of understanding of manufacturing processes.
- Lack of ability in design and creativity.
- Everyone believes in the ability to analyze.
- Narrow vision of engineering and related disciplines.
- Poor communication skills.
- A little experience in working as a team.
- Lack of a clear understanding of quality and methods.

7. Studying the effect of drawing class on the engineering education

A sample was used in this research by the students of the freshman students in the chemical engineering department in the engineering drawing. A group of students of the chemical process engineering branch was studied and two objectives were conducted:

First: the bond between training times to raise the student's efficiency.

Second: The relationship of engineering drawing to other engineering subjects.

The first study consisted of 17 students whose grades were reduced during 6 weeks through simple and complex exercises. By plotting the relationship between student symbols and grades for six weeks it has been found a clear improvement in grades despite the increasing complexity of exercises. This indicates that the subject is understandable and can be created through the number of hours. These results lead us to the importance of this class in the sciences studied in the second subject.

The second object consisted of 15 students, their grades ranged between (75-95) in the engineering drawing class. This class of students was followed up with some engineering lecturers in the Department of Chemical Engineering, University of Technology. Their grades were analyzed for some engineering subjects such us (AutoCAD, Engineering Workshops (Labs), graduation Project, Hysis program (Computer Design)). When drawing Histogram between these classes subjects and the same students, it has been noticed that an important relationship between engineering drawing and the rest of the lessons. This results demonstrate by the superiority of the good students in the engineering drawing and this indicates the impact of this lesson in widening the student's perception and increasing their engineering prospects, which benefited the student in two ways, the first in the rest of the lessons of the different stages of study and the second is to find a job opportunity after graduation through the submission of many of the engineering features. And development of the student thought the right direction is planning first and then economic feasibility and financial allocation and implementation of the project and this is required through integrated engineering education.

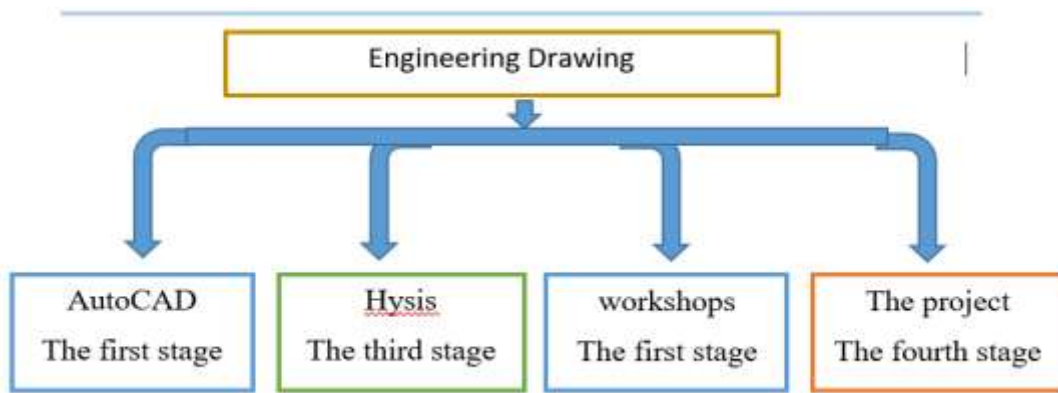


Figure 1: Direct and indirect association of drawing with different stages

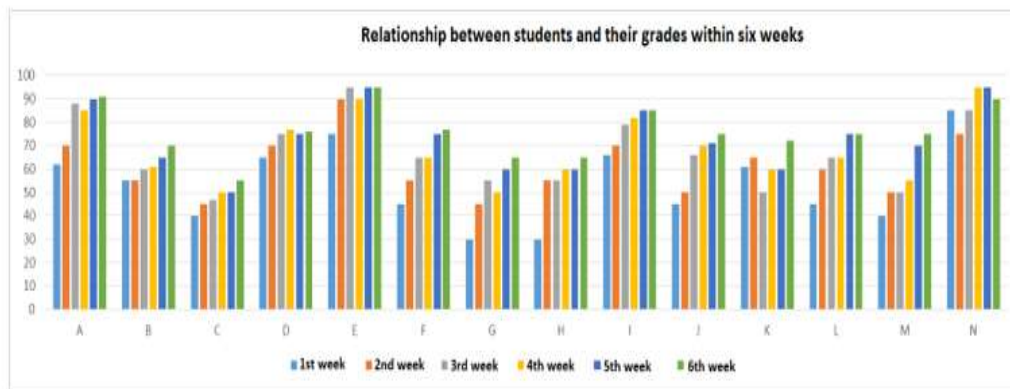


Figure 2: Relationship between student's homework and their grades within six weeks

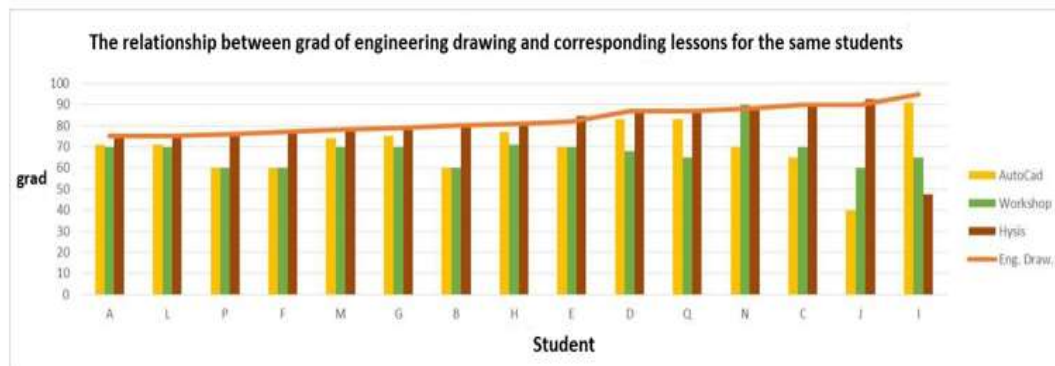


Figure 3: The relationship between student and degrees of four engineering materials

8. Conclusions & Recommendations

1. Keen attention to the art of engineering drawing to develop the engineer's perception to reach the creative goal.
2. Excellence in this field of engineering opens the horizons for excellence in other fields, especially engineering disciplines, and this is proven by the study of this research.

3. The creativity in the field of engineering drawing is limited to scientific excellence, but opens up horizons for communication with new ideas that may reach the invention.
4. Do not stray away from this skill towards electronic computing because it weakens the skills of manual and sensory engineers.

5. Giving this lesson the utmost importance in terms of the curriculum and methods of teaching and credit hours.
6. Adopting the teaching of the drawing for a full year according to the engineering departments and not limited to one course, which diminishes the actual benefit of this important lesson.
7. Introducing modern means of getting closer to students such as video, modern ceremonies, stereoscopic models and realistic exercises carried out as laboratory equipment.
8. Encourage students who excel in this field by giving them extra work carried out through their sketches to be displayed in an exhibition during the various events of the colleges.
9. Create a team of specialists to enter the drawing in the design of the requirements of each section of the equipment, maps and equipment.

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