# TEACHING TECHNOLOGICAL TOOLS FOR ELECTRICAL ENGINEERING STUDENTS TOWARD PROFESSIONAL ROUTINE

**Ayuba Adamu**
Electrical Engineering Department
Abdu Gusau Polytechnic Talata Mafara
*ayubaadamu20@gmail.com*
*08065579677*

## Abstract

*This work aims to define and demonstrate the importance of technological tools in the teaching of subjects in the Electrical Engineering graduate course at various levels of their undergraduate studies. A parallel between the theoretical contents and their practical applications will be done taking into account a curricular grid of the mentioned course, since some of the assignments of the engineer is to have skills and abilities to apply mathematical, scientific, technological and instrumental knowledge to the engineering. In the text we will be addressing 2 tools that have various professional and didactic applications in the field of electrical engineering: MATLAB, and MPLAB, as well as the importance of teaching these tools and the benefits acquired by the student when entering the increasingly competitive labor market of this country which is increasing exponentially. In addition, a survey was conducted to evaluate the students' opinions on the subjects of this work.*

*KEYWORDS: Technological Tools, Matlab, Mplab, Electrical Engineering.*

## 1.0 INTRODUCTION

The economic development of a given country is directly related to the Engineering area. There is a significant relationship between the percentages of GDP verified for the sub-sectors of the economy and the offer of Engineering courses in each region of Brazil, as noted by Pereira et al. (2012) [2] and can conclude that Engineering is one of the main factors of country's development and the Engineer is certainly an agent that fosters economic growth. This factor is decisive in the production of great added value goods or technological innovations, and weighs favorably in the trade's balance of any nation (Lobo & Silva Filho, 2012). However, [5] the teaching in the undergraduate courses does not always follow market trends or the speed with which new technologies are created.

Universities and university centers must meet the demands of the national market. In order for the country to reduce regional discrepancies, it is necessary to invest mainly in the training of more and better engineers, always innovating and investing in order to provide the best training experience for the student.

The student, in turn, must do his part too, always taking full advantage of the opportunities that are given to him. In the same way that technological innovations improve the production of a certain product or the accomplishment of a certain service, they can be used to improve the student's experience, bringing him closer to the professional environment and, in turn, stimulating him to use the new technologies and to act in the development of other advances. According to W. Brian Arthur, in "The Nature of Technology", new technologies appear by combining existing technologies and therefore could be said that existing technologies generate new technologies..." (Arthur, 2009).[1]

An undergraduate course in the Engineering area needs to be constantly updating, seeking revisions in its curricular bases in order to integrate scientific and technological knowledge with economic and market knowledge. One way to achieve this integration is through technologies and tools that are used in practice and which, too, have great didactic value. To prove the above statement, this text will approach two computational tools and a device that assist in the course of graduation in Electrical Engineering, as well as its relationship with the course subjects, in a generic way. The choice of the Electrical area was given because it is an intrinsic part of the country infrastructure.

## 2. ELECTRICAL ENGINEERING

Electrical engineering is one of the newer branches of engineering, and dates back to the late 19th century. It is the branch of engineering that deals with the technology of electricity. Electrical engineers work on a wide range of components, devices and systems, from tiny microchips to huge power station generators.

Early experiments with electricity included primitive batteries and static charges. However of Induction, the actual design, construction and manufacturing of useful devices and systems began with the implementation, which essentially states that the voltage in a circuit is proportional to the rate of change in the magnetic field through the circuit. This law applies to the basic principles of the electric generator, the electric motor and the transformer. The advent of the modern age is marked by the introduction of electricity to homes, businesses and industry, all of which were made possible by electrical engineers. Some of the most prominent pioneers in electrical engineering include Thomas Edison (electric light bulb), George Westinghouse (alternating current), Nikola Tesla (induction motor), Guglielmo Marconi (radio) and Philo T. Farnsworth (television). These innovators turned ideas and concepts about electricity into practical devices and systems that ushered in the modern age.

Since its early beginnings, the field of electrical engineering has grown and branched out into a number of specialized categories, including power generation and transmission systems, motors, batteries and control systems. Electrical engineering also includes electronics, which has itself branched into an even greater number of subcategories, such as radio frequency (RF) systems, [3] telecommunications, remote sensing, signal processing, digital circuits, instrumentation, audio, video and optoelectronics. The field of electronics was born with the invention of the thermionic valve diode vacuum tube in 1904 by john Ambrose Fleming The vacuum tube basically acts as a current amplifier by outputting a multiple of its input current. It was the foundation of all electronics, including radios, television and radar, until the mid-20th century. It was largely supplanted by the transistor, which was developed in 1947 at AT&T's Bell Laboratories by William Shockley,

**What does an electrical engineer do?**

" Contrary to what Lealman believed that an electrical engineer is more of domestic installation and maintenance which is not that at all an Electrical engineers design, develop, test and supervise the manufacturing of electrical equipment, such as electric motors, radar and navigation systems, communications systems and power generation equipment, another portion of Electrical Engineering is Electronic Engineering "Electronics engineers design and develop electronic equipment, such as broadcast and communications systems from portable music players to global positioning systems (GPS)."

If it's a practical, real-world device that produces, conducts or uses electricity, in all likelihood, it was designed by an electrical engineer. Additionally, Electrical Engineers may conduct or write the specifications for destructive or nondestructive testing of the performance, reliability and long-term durability of devices and components.

Today's electrical engineers design electrical devices and systems using basic components such as conductors, coils, magnets, batteries, switches, resistors, capacitors, inductors, diodes and transistors. Nearly all electrical and electronic devices, from the generators at an electric power plant to the microprocessors in your phone, Computer, and other domestics electronic Equipment use these few basic components.

Critical skills needed in electrical engineering include an in-depth understanding of electrical and electronic theory, mathematics and materials. This knowledge allows engineers to design circuits to perform specific functions and meet requirements for safety, reliability and energy efficiency, and to predict how they will behave, before a hardware design is implemented.

Sometimes, though, circuits are constructed on bread board or prototype circuit boards made on computer numeric controlled (CNC) machines for testing before they are put into production.

In this present day [3] Electrical engineers are increasingly relying on computer-aided design (CAD) systems to create schematics and lay out circuits. They also use computers to simulate how electrical devices and systems will function. Computer simulations can be used to model a national power grid or a microprocessor; therefore, proficiency with computers is essential for electrical engineers. In addition to speeding up the process of drafting schematics, printed circuit board (PCB) layouts and blueprints for electrical and electronic devices, CAD systems allow for quick and easy modifications of designs and rapid prototyping using CNC machines, with this short summary we founded it necessary to shown how important it is to teach student some electrical engineering software during their undergrounded studies so that there will be introduce with rigorous design and example of such software are Mplab, Matlab, PC suit, Protus, Circuit Simulator etc.

## 3. MATLAB

MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation. Typical uses include but not limited to the following:

- Math and computation
- Algorithm development
- Modeling, simulation, and prototyping
- Data analysis, exploration, and visualization
- Scientific and engineering graphics
- Application development, including Graphical User Interface building

During graduation, the student is introduced to a series of books to complement the learning process. Some are used by teachers as the course basic bibliography. Others are used as complements. However, a trend can be observed in the Engineering books: the addition of chapters and sections referring to the use of MATLAB. [6] MATLABTM is high-performance matrixing software (Matrix Laboratory).

It is a set of tools developed to solve mathematical problems. It contains several specialized toolboxes, which are made by contributions from the developers of their manufacturer; Mathworks TM, enabling the software to solve various functions and problems in different and specific areas of engineering (Duarte Filho, 2010). The MATLAB [5] commands are closer to how we write algebraic expressions, making it easy to use. Currently, MATLAB is defined as an interactive system and a programming language for technical and scientific computing in general, integrating the ability to perform calculations, graphical visualization and programming (Tonini & Couto, 1999). This software is extremely important for the analysis of control systems, dynamic system modeling and process automation (Duarte Filho et al., 2013).

In the course of Electrical Engineering, which is the object of this study, several disciplines that deal with the analysis of electrical circuits use MATLAB for more efficient resolutions, calculations of demand and installed load, as well as the matrices that represent the electric flow during distribution and transmission of energy?

## 4. MPLAB

MPLAB is a Windows program package that makes writing and developing a program easier. It could best be described as developing environment for a standard program language that is intended for programming a PC. Some operations which were done from the instruction line with a large number of parameters until the discovery of IDE "Integrated Development Environment" are now made easier by using the MPLAB. Still, our tastes differ, so even today some programmers prefer the standard editors and compilers from instruction line. In any case, the written program is legible, and a well documented help is also available. MPLAB consists of several parts: - Grouping the projects files into one project (Project Manager) - Generating and processing a program [4] (Text Editor) - Simulator of the written program used for simulating program function on the microcontroller. Besides these, there are support systems for Microchip products such as PIC Start Plus and ICD (In Circuit Debugger).

## 5.0 METHODOLOGY

In order to demonstrate the importance MATLAB and MPLAB have for undergraduate student in the department of Electrical Engineering a survey was done with number of 50 students of undergraduate level in Electrical Engineering department at different level of study, from different institutions in order to check their various interests in the tools under review.

The research consisted of six questions that were thought to check three main points: how much the graduate knows about the subjects and their willingness to know, for those who do not know; what is their interest in try to know the tools under review, how was their experience in using the tools and what is the importance, for thus that know the tools.

The questioner was design in such a way questions are applied to the student as well as the answer options

1) Do you know a tool called "MATLAB"?

YES ( ) NO ( )

(1) If yes, rate how this tool has met your needs:

Very well: ( ) Well: ( ) I don't know: ( ) Bad: ( ) Very bad: ( )

2) If not, rate your interest in learning how to use it:

High interest: ( ) Some interest: ( ) I do not know: ( ) Low interest: ( ) No interest at all

3) Now, regardless of the answer to the first question, classify the importance of teaching this tool for the graduation in Electrical Engineering:

( ) Very important: ( ) some importance: ( ) I don't know: ( ) Little importance: ( ) Not important at all: ( )

1) Do you know a tool called "MPLAB"?

YES ( ) NO ( )

(1) If yes, rate how this tool has met your needs:

Very well: ( ) Well: ( ) I don't know: ( ) Bad: ( ) Very bad: ( )

2) If not, rate your interest in learning how to use it:

High interest: ( ) Some interest: ( ) I do not know: ( ) Low interest: ( ) No interest at all

3) Now, regardless of the answer to the first question, classify the importance of teaching this tool for the graduation in Electrical Engineering:

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**GRAPH ON QUESTION RELATED TO MATLAB**

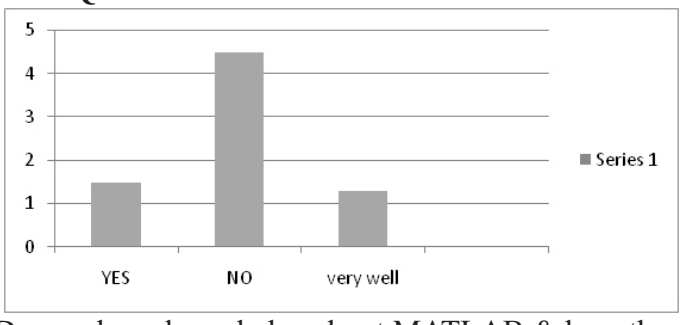



Figure :Do you have knowledge about MATLAB & how these tools meet your need

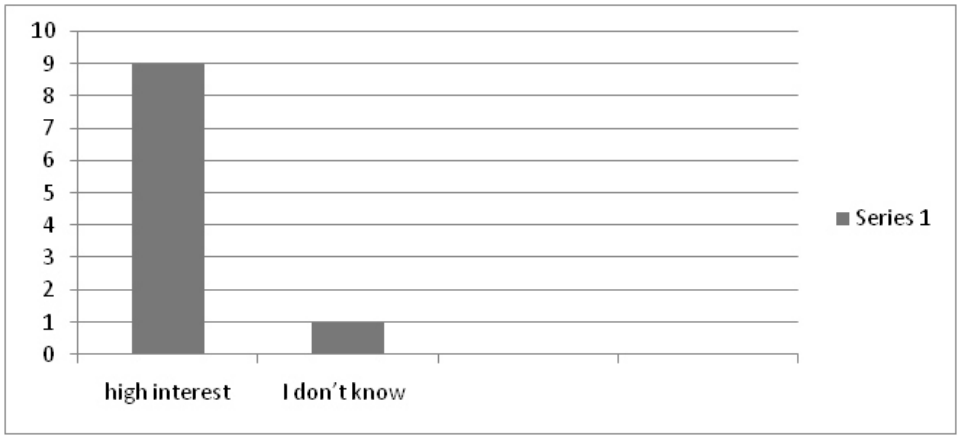



Figure 2:Student interest on learning how to use the software

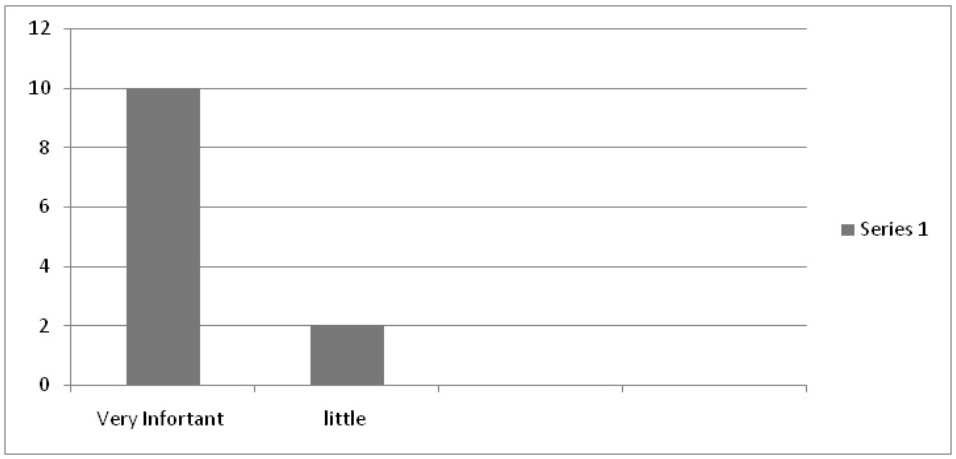



Figure3:Student interest on the important of learning the tools

**GRAPH ON QUESTION RELATED TO MPLAB**

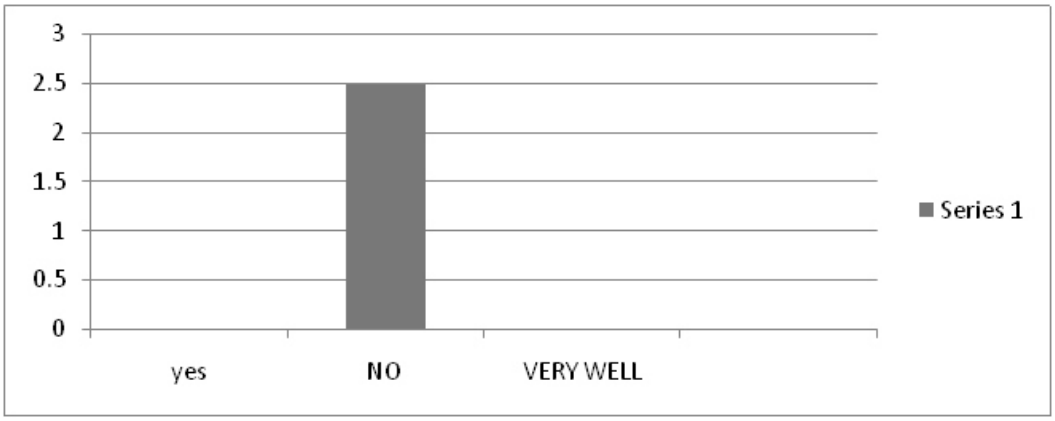
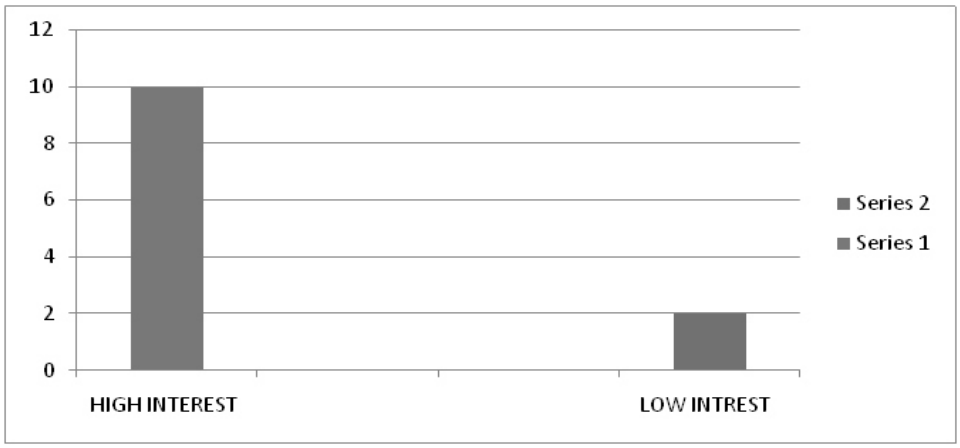



Figure :Do you have knowledge about MPLAB & how this tools meet your need

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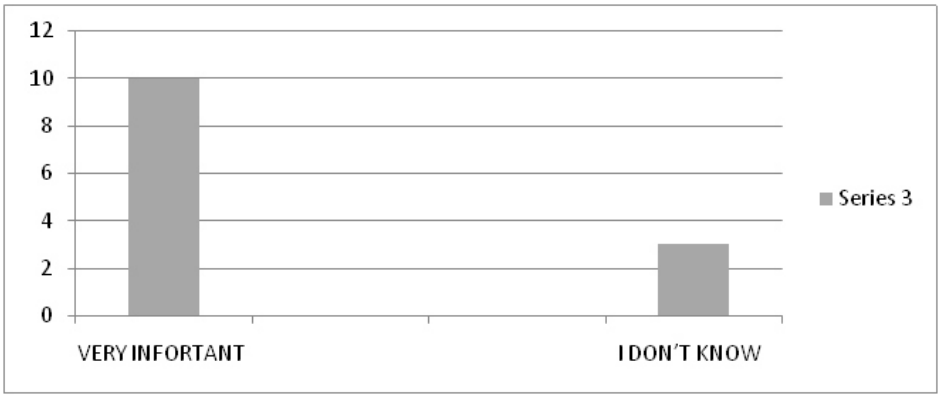


Figure3: Student interest on the important of learning the tools

## 6.0 RESULT DISCUSSION

From the result obtained it was clearly seen that the software are known by the student at the theory level during their classes, with these graphs, two important trends were observed. First, students, even though they do not have a specific MATLAB class, get to know it during the course of the disciplines, especially when they enter the cycle of specific disciplines of the course (i.e electronic engineering, control engineering), which shows that this tool is already incorporated into teaching and makes even more essential its mastery. Another relevant factor is the fact that the students who reported that they did not know or could not form an opinion about the subjects, expressed an interest in learning more about them, as can be seen in Figure 1, of the MPLAB result none of the students know the software, but when ask about their wailing to know the tool all the students interview showed interest in learning, in order to get experience in using the programs and the device. It was also observed that this trend occurred in students who are more advanced in the course, who understand that they will use these tools in their professional field in order to meet up with challenges after leaving their institution.

## 7.0 CONCLUSION

Unlike the basic education, in higher education the proximity to the labor market is a fundamental factor because it can define how the student will be inserted in it after graduating, and helps even in the decision to continue in the professional field for the rest of his life. The university offers the student the tools to facilitate this insertion and helps in his professional growth. This growth, which is also personal, can be observed in the way the graduate looks at the importance of using computational tools and devices that can add much to their training. Among these tools, those that have been detailed through the research shown in this work help to foster their intellectual growth to what will be required in the job market. It was evident that the students interviewed in the Electrical Engineering course understand that it is necessary to have the knowledge and know how to use MATLAB, MPLAB. This knowledge helps the student to choose which electrical area he or she will improve from among the many existing divisions. In any case, bringing the student closer to the job market is a necessity nowadays, applying scientific and technological knowledge to engineering, teaching him to design and conduct experiments and interpret results, and to design and execute systems, products and processes; and any tool, be it MATLAB, MPLAB,PROTUS, or other that helps in this process is of great value.

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Department of Exact Sciences and Technology of the University Center of Bel Horizonte. BeloHorizonte, MG, Brazil.