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Exploring the Knowledge and Attitude of Engineering Students in the Imitation of Theoretical Knowledge

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Abstract

In this paper an exploration of the engineering student's knowledge in different engineering simulation tools to validate the theoretical knowledge leaned were conducted. The study cover students from different courses taught at different degree levels. A survey was conducted among the students in the academic years of 2014/2015 and 2015/2016 for students attending the class of Electronics (second year level), power electronics class (third year level) and Electrical measurement class (fourth year level). A personal interview was also conducted to capture the feedback from the learners under interest. The main aim is to accrue the attitude of engineering students to apply the knowledge throughout the Imitation of theoretical knowledge using modern virtual tools.

Keywords: theoretical knowledge, simulation, attitude, engineering, students, education

1. Introduction

The Laboratory based courses have a great impact on education especially engineering courses. However most course's lab is registered in the next semester. The need for Imitate the theory in line with registered subject or pre arranging the lab experiment virtually is of great importance. A study of an online virtual laboratories-simulation laboratories main trends and key issues were highlighted (Balamuralithara & Woods, 2009). The proposed system enhanced the students learning experiences as well the proposed online technology has improved cooperative learning among learners. A study explored the main factors affecting laboratories and considers the lack of clear learning objectives for laboratories and its impact on the effectiveness of laboratories and the research disadvantaged effect. The study concluded a list of essential aims presented along with propositions for future research. Engineer's knowledge beyond absolute pure theoretical knowledge that is traditionally gained in educational laboratories. The nature of these laboratories has been changed over the time with the advances of modern technology (Feisel & Rosa, 2005).

The courses based on Laboratory sessions forms a knee role in scientific education. With the advances of modern tools the nature of these laboratories is changed in which it highlighted the issue that raised regarding the hardware hands-on versus virtual simulated laboratories. In addition, introducing the remote and online laboratories supplements the discussion about these modern tools in reference to traditional laboratories. Those tools at the end realize the same outcome to learners. The current study concluded a review of the literature related to labs in education and appeal several recommendations over different technologies and different educational objectives. It concludes that Hands-on advocates emphasize design skills, while remote lab advocates focus on conceptual understanding (Ma & Nickerson, 2006).

Due to economic matters some laboratories are driven with simulations and remote-access systems only (Nickerson, Corter, Esche, & Chassapis, 2007). This could be an alternative solution for saving university space and spending in physical labs as well could save students' time. Nevertheless, the hands-on laboratories helps engineering student should be exposed to practical environments before graduation. The study presented an assessment comparing versions of remote labs versus hands-on labs in a junior-level mechanical engineering course. The study concluded that students learned lab content equally well from both types of laboratories are implemented (Nickerson et al., 2007).

An application of information technology tools to a laboratory course of electric and electronic circuits is presented (Shuhui & Khan, 2005). A data acquisition device is used to perform various tasks and to develop a virtual instruments (Shuhui & Khan, 2005), (Salah, Musa, Zneid, Sneineh, & Jadin, 2016). Results conclude that to achieve quality education of lab courses the developed virtual labs strongly interrelated the theories and hands-on experimentation (Shuhui & Khan, 2005). An open source general purpose simulation framework is proposed. Students understanding is improved through implementing a subset of entities to the simulation system. The system stores the entities of simulations in which the user can sort out and obtain a detailed history of all entities and its behaver at any time (Roorda & Cartwright, 1994).

2. Methodology

This study focuses on implementing the virtual and simulation lab as a supplement in the form of assignments and homework in line with the relevant course. That is, the hands on lab still to be undertaken. The benefit that the simulation could help students to gain more understanding and the lab registration order supposed to be after passing the relevant course. A survey and an interview of three different levels of students to measure the effectivities of implementing the new technology simulation tools on the quality of learning and the learner's overall performance.

The survey was conducted among the students registered by the academic years of 2014/2015 and 2015/2016. The selected courses were three courses under electrical engineering program. The selected courses are: Electronics class (second year level), power electronics class (third year level) and electrical measurement class (fourth year level). Also a personal interview was accompanied to capture the feedback from the learners attending the selected courses.

3. Results

The sample of survey and interview was open to all students attending the said classes from both genders. The majority is from male genus is due to that the electrical engineering program the students majority is from males as shown in Figure 1. This reflects the fact that the majority of electrical and electronic in addition to mechatronics students are males. However, this may not be the case when considering computer and telecommunication engineering students as it is almost have much closer percentage of both genders.

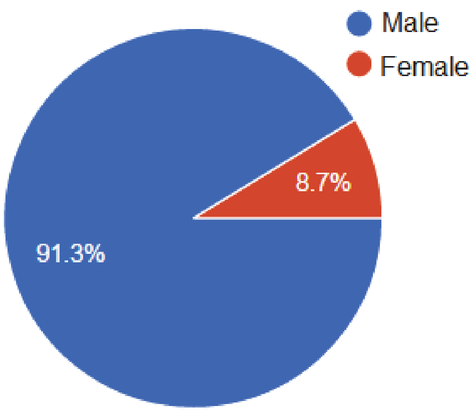

Figure 1. Participants distribution by genus

The computer simulation models the real life or theoretical and mathematically derived designs cases on a computer tools to obtain the system behavior. By adjusting different variables and parameters the simulation tools could predict the system behavior. These predicted results are much crucial especially in the initial design process.

Several engineering tools available for simulation of electrical and electronic circuits. Each tool has a different capabilities as well different level of difficulty. Being far from code programing and with the aid of graphical user interface throughout block building makes the simulation tools easy to be used by non-provisional. However, some of these tools need a particular level of proficiency. This could clarify the variety of using these tools by students at different study levels as shown in Figures 2 to 4.

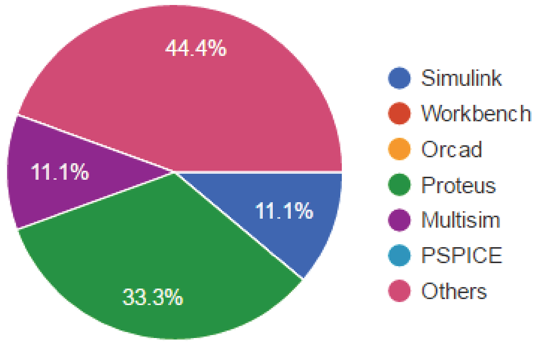

Figure 2. Electrical Measurement course

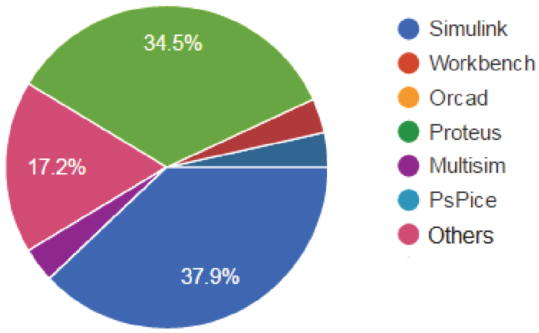

Figure 3. Power Electronics course

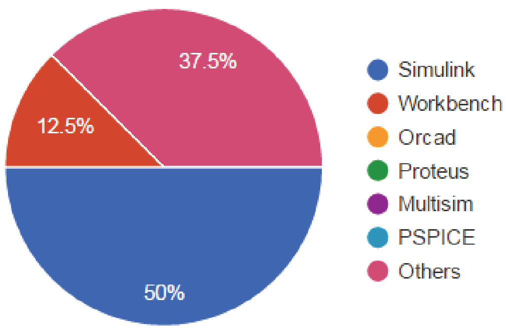

Figure 4. Electronics course

The differences could not be only related to the students study level; it could be related to the nature of the subject. In addition, some these tools are implemented as a part of some subject. Though, students learned how to use these tools within the subject. As well, experiencing the tool through the assigned tasks to be apart of course evaluation and examination.

A quick comparison of the main and popular simulation tools that are mostly used by electrical and automation engineering students are summarized as in Table 1.

The main aim here is to provide some contextual understanding related to different tools used in imitation of theoretical knowledge. The common aspects the learners may refer to during the selection of proper tool such as the level of difficulty, user friendliness, availability and compatibility. However, the issue is quite different if we look at from educators view when proposing the required guidance for the selection of the proper tools.

Table 1. Popular simulation tools used by electrical and automation engineering students

Tool	Level of difficulty	Self-learned	Capabilities
Simulink	Moderate	No	Simulation, Modeling
Multisim	Easy	Yes	Simulation, Design
Proteus	Easy	Yes	Simulation, Design, Virtual instruments tools
Pspice	Difficult	No	Simulation, Design

The list could not be limited to the tools shown only. However, these tools that are the most recent advised tools as many of the popular publishers adds on simulation examples of their updated editions of textbooks on the electrical engineering area. Electronics course for example publishers are refer to Multisim and Pspice as a main simulation tool.

The responses of students to the question related to the effect of much they get some knowledge about simulation tools are presented in Figures 5-7 for Electronics, Power Electronics and Electrical Measurement courses. It can be noted from the responses that students are most likely agree to the statement of getting knowledge about simulation tools in addition to the core object gaining better understanding of the theory throughout the using modern virtual tools.

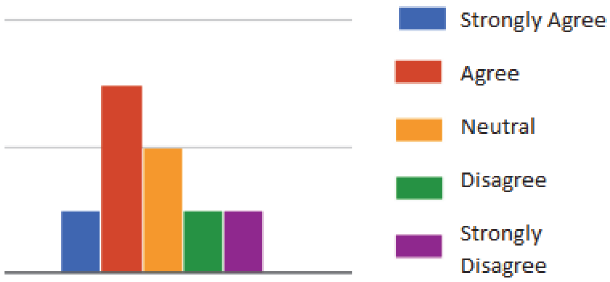

Figure 5. Gets knowledge about simulation tools (Electronics)

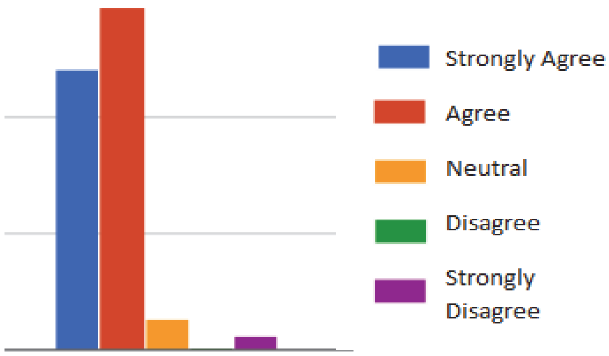

Figure 6. Gets knowledge about simulation tools (Power Electronics)

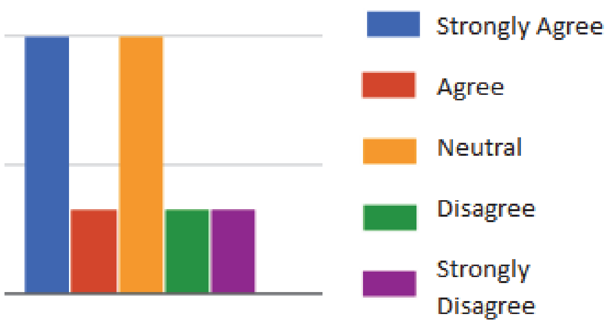

Figure 7. Gets knowledge about simulation tools (Measurement)

The Power Electronics course can be considered as an interdisciplinary which confluence of three fundamental main fields of: power, electronics and control. Whereas the control part now widely used in industries including computer and microcontrollers control parts. Furthermore to the tools listed in Table 1. Some other tools such as Labview have a capabilities that extends beyond simulation. It can be used; in addition to the simulation and modeling; as a tool for faults diagnoses (Hammadi, Ishak, Saadon, & Salah, 2011) or as a virtual instrument (Salah et al., 2016) with the aid of compatible data acquisitions devices (DAQ).

A study on post completing the relevant subject and the effect of related simulation tools on procedure and gaining of practical courses experience had shown a significant improvement at which majority of student could:

1. Completing the experiment within the due time of the lab comfortably.

2. Much understanding on how to troubleshoot their experimental test bench.
3. More accurate and precise results.
4. Gives more confidence to learners during executing a specific experiment.

4. Conclusion

The paper has presented a scope of the engineering student's knowledge in different engineering simulation tools from different courses and different study levels. Results had shown that implanting such tools could help engineering students to get better understanding of the theory throughout the using modern virtual tools. The attitude of learners mostly towards the used of the graphical interface tools at which less programming and setting to be carried out rather that capabilities of the specific tool.

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