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LEARNING ANTENNA SIMULATION TO ENHANCE TECHNICAL COMPETENCY OF AVIONICS STUDENTS

IKE YUNI WULANDARI[1,2], E EMA[2], *A ANA[1], NARWIKANT INDROASYOKO[3], HENI PUSPITA[1,2], ANDRIANA[1,4], RAHMAD HIDAYAT[5]

[1]Departemen Pendidikan Teknologi dan Kejuruan, Universitas Pendidikan Indonesia, Jl. Dr. Setiabudhi No. 229 Bandung, Indonesia
[2]Departemen Teknik Elektro, Fakultas Teknik, Universitas Nurtanio, Jl. Pajajaran No. 219, Lanud Husein Sastranegara, Bandung, Indonesia
[3]Politeknik Manufaktur Negeri Bandung, Jl Kanayakan No 21 Bandung, Indonesia
[4]Departemen Teknik Elektro, Fakultas Teknik, Universitas Langlangbuana, Jl. Karapitan No.116, Bandung, Indonesia
[5]Departemen Teknik Elektro, Sekolah Tinggi Teknik Mandala, Jl. Soekarno Hatta, No. 597, Bandung, Indonesia
*Corresponding Author: ana@upi.edu

Abstract

The aim of this study is to examine the achievement of the technical competence of avionics students through the learning approach of the laboratory antenna simulation. Using a method of examining reputable article sources that have benefits and contribute to learning media, data is collected through Vos Viewer while observing bibliometric reviews that generate metadata. Then, the observed data use to review the theory, reliability, and validity to produce a learning model for antenna simulation to be performed in the laboratory. This simulation learning model will later facilitate the learning of avionics students in the laboratory, so it is expected that the students can use the knowledge and improve their skills upon learning avionics. The results of this study recommend avionics students to conduct antenna simulation learning because antenna design requires specific calculations that are obtained from simulation learning.

Keywords: Antenna simulation, Avionics, Enhance competency, Simulation learning, Technical competence.

1. Introduction

The transition period in the workplace, which focuses on integrating knowledge, skills, and attitudes into education, is the goal of competency-based education (CBE) and will lead to the quality of education of students from avionics in learning [1]. As graduates often have sufficient knowledge but lack the required skills and attitudes in the workplace, competency-based education needs to be improved [2].

There are many educational changes and different applications among CBE educational programs [3], which means that the implementation of CBE is challenging and it will continue to be a challenge for teachers [4]. Applied CBE to the teaching team in the teaching process, but the study does not investigate whether the application of CBE principles have an impact on students' satisfaction with learning [5]. The purpose of this study is to provide simulation learning to improve CBE.

Several researchers have investigated how simulated learning can improve students' roles in the simulated training environment [6]. Simulation learning can be used in vocational and professional education, for example in medical and health education [7]. Evaluated team learning, teamwork, and discipline, and found that simulated learning could improve self-confidence, knowledge, leadership, teamwork, and communication skills. Training activities were generally seen as an important and useful way of learning and creating relevant work experience for students [8].

Limited time for hands-on on-site study for avionics professional education students, safety factors for students, and on-site resource management, and regulations encourage discussion of the principles of the problems they face in the countryside. However, developing a single set of theories is not enough. These principles are taught and practiced using experimental learning tools, namely simulation [9]. The simulation in the laboratory is aimed at improving students' understanding of the avionics student transmission channel training material so that students can measure and control a series of experiments and predict and analyse the results.

Simulation provides realistic learning opportunities that allow students to practice skills, problem-solving, and decision-making in a relatively safe environment, and requires careful planning so that its use is based on an understanding of program-based learning professional [10]. Simulations have been used to teach complex skills for many years. In the healthcare field, the simulation can be interpreted as an event or situation that is performed as closely as possible to clinical practice in order to instil confidence in new nurses and allow them to experience the clinical setting without compromising patient safety [11].

Interprofessional simulations offer students the opportunity to practice communication skills in a safe and authentic environment [12], as well as situational learning [13]. In aviation, attempts have been made to use simulator evaluations to make flight control systems more practical and reliable in order to reduce the burden on pilots in emergency situations [14] and to reduce rotor vibrations [15]. Investigate flight environment simulation systems and ground-level test facilities with displacement uncertainties and disturbances great heat, thus presented a new optimal and robust adaptive control structure. Therefore, for aviation professional students, particularly in the avionics field, there is a need for a student simulation learning approach to improve expected skill outcomes.

2. Research Method

A general research synthesis of the review literature on simulation and competency building was conducted by examining studies based on bibliometric reviews [16]. A bibliometric review is a method of extracting metadata related to document subjects to help understand future trends in simulation and student competencies [17]. Given the recent literature on using simulations and mastering bibliometric descriptive analysis functions and content analysis, it is well suited for the purposes of this review, supplemented by searching for secondary data for relevant documents in Google Scholar. The review of the analysed articles was carried out over a period of 10 years from 2010 to 2020.

The selection of articles takes into account the appropriateness of the subject and the proposed objectives. Each review examines citations that identify a keyword search strategy for simulated learning published in English for further review. Phrases that are not based on simulations or based on insufficient data are excluded from the metadata.

Furthermore, the selected article will be scrutinized specifically on the advantages and influences of antenna simulation training used in the laboratory. The data extracted from the keyword search process can be viewed with the VoS Viewer application to take into account the renewal of topics and variables as well as novelties. Figure 1 is a visualization network for learning through simulation. On the right side, a pretty big yellow circle indicates that simulation research is still an interesting and well-researched topic and discussion.

Figure 2 is an explanation of the overlay of the simulation learning visualization. It can be seen that the research existed in 2016. In Fig. 3, the thick motif based on the display density, which is the focus of attention with a thick and increasing color density, is still in the simulation topic.

From the results of the previous visualization, it can be seen that the matrix between the data and the facts found so they can later be analysed and written in an article.

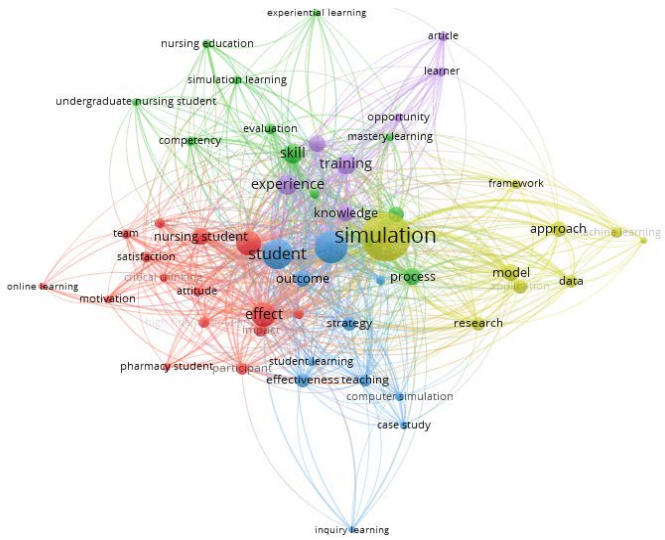

Fig. 1. Network visualization of simulation learning.

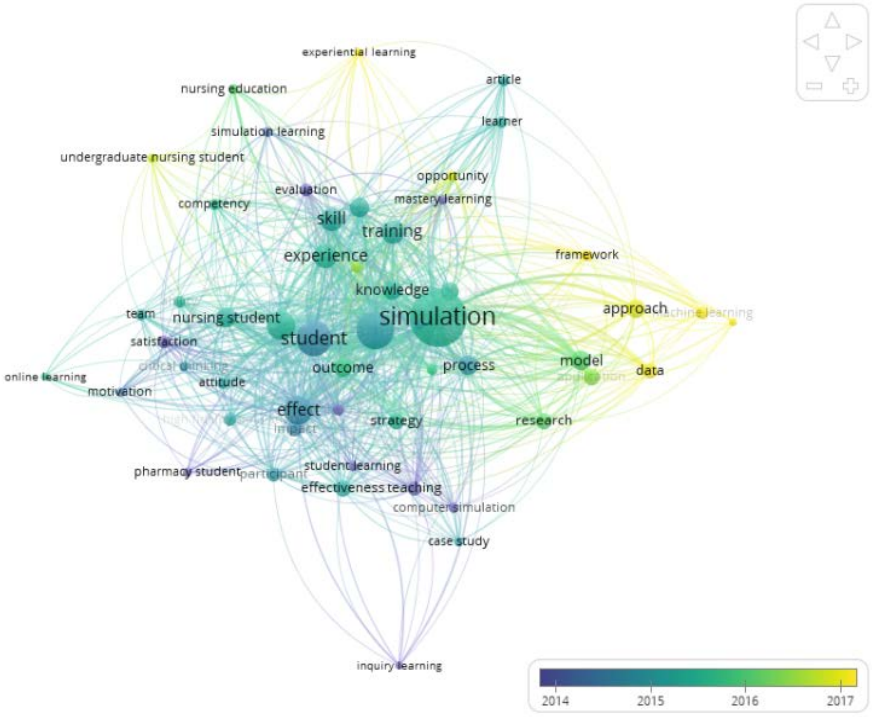

Fig. 2. Overlay of simulation learning visualization.

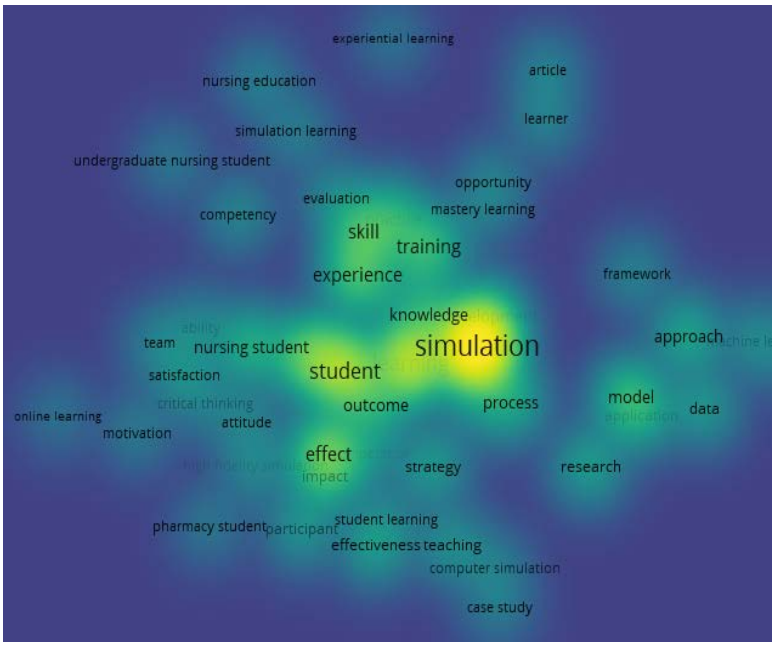

Fig. 3. Density of simulation learning visualization.

3. Results and Discussions

3.1. Network visualized

Network visualizations can show undirected graphical structures and relationships between entities. Features or data points are shown as nodes, and the lines represent the relationships between them. The screen in Fig. 1 shows a simulated learning unit connected to another node on the network and shows the data differences related to the simulation learning topic. Furthermore, Fig. 2 is the overlay protocol. The overlay protocol is an application widely used in academic research groups and industrial partners to investigate rapid deployment on a network. Also, overlay simulation shows the distribution of the simulation topics from one year to the next, recognizable by the color. The green color explains that the simulation topic is still running in 2016. And the last, in Fig. 3. is about the density of simulation learning. You can see that the simulation theme is yellow in density simulation. This means that the topic is still feasible and still widely debated by researchers. So, there are many ways to explore this topic.

3.2. Antenna modelling

Antennas are very useful for transmitting sound waves, both audio and radio. The antenna material is a conductor that can conduct electrical current. Figure 4 displays one of the microstrip antenna substrate materials that can be used, namely Roger Duroid RT5880, and can be used as one of the antenna models [18].

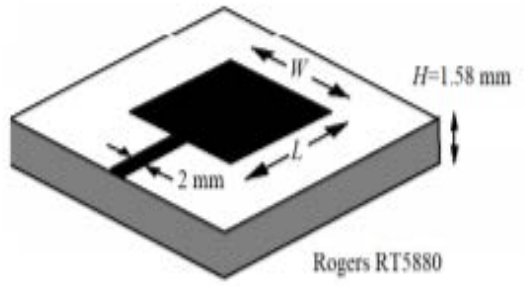

Fig. 4. Microstrip antenna modelling.

The advantages of microband antennas are attractive features such as lightweight, low profile, low power consumption, and low cost for mass production. However, microband antennas also have a weakness, namely a narrow bandwidth.

The antennas are designed in such a way that they can send or receive electromagnetic waves. The antenna as a transmitter (transmitting antenna) is an electromagnetic converter (transducer) with which the waves carried in a cable transmission line are converted into waves that propagate in free space, and as a receiver (receiving antenna) free space waves are converted into guided waves.

In addition to receiving and transmitting energy, it is generally desirable that the antenna optimize the radiant energy in one direction and suppress the radiant energy in other directions so the antenna also functions as a directional device. With

the above description, the antenna is an important component in a modern wireless communication system.

3.3. Antenna essence

The presence of an antenna is essential in a wireless communication system because any communication application requires antenna properties. Three important fields of application for the use of antennas are telecommunication, radar, and radial astronomy. In the telecommunications field, antennas have priority over cable use for reasons of efficiency, convenience, and possibilities. Plate antennas when used in a tower are installed in numbers with different beam directions and the combined antenna radiation pattern is omnidirectional.

Figure 5 shows the radiation pattern of the antenna. The radiation pattern must take into account several elements, the first being the half-power beam width (HPBW) or the so-called antenna beamwidth. Theoretically, the beamwidth can be designed for a satellite dish. The smaller the beam width, the more directional energy is concentrated on the main beam.

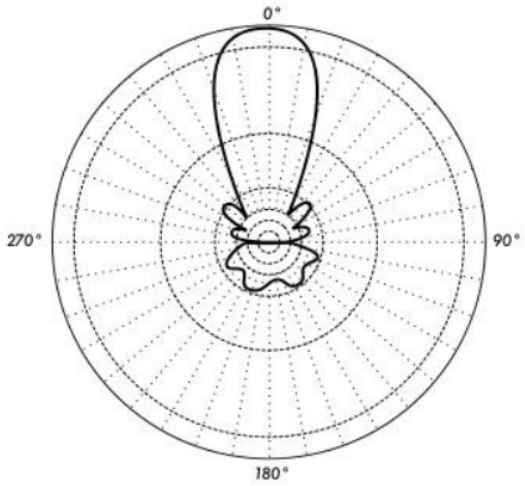

Fig. 5. Antenna radiation pattern.

Radar is an electromagnetic wave system that is useful for detecting, measuring distance, and mapping objects. It detects radio waves or signals emitted and reflected by certain objects. In radar technology, the antenna used must have a very low beam width to have a high resolution and be able to distinguish one object from another. In radial astronomy, an antenna with a very narrow beam width is used for astronomical applications. To get a good signal, radio astronomy needs a large antenna, or a group of small antennas, working together as a very large array.

Antenna radiation pattern, beam width, and other parameters need to be calculated precisely. Hence, we need an approach and simulation of a formulation with acceptable precision. A more precise solution can be achieved with numerical calculations that can be simulated with the help of software. One of the commercial programs is CST Microwave Studio Suit, which is based on finite integration technology. However, there is also software that is free on the internet, and some

are provided in source code, either in Matlab / Octave, C, C ++, or Fortran. You can also use the High-Frequency Simulation Software Tool (HFSS) [19].

More explanation about the antenna that the antenna is the world's electronic eye and ear, which occupies an important place in the field of communication technology. The communication system developed rapidly due to the technical revolution in the antenna sector [20]. Antennas are designed for various areas of modern applications, for example, navigation, telemetry, radar, cellular, satellite communications, global positioning systems for remote sensing [21]. All antenna skills are required for avionics students. Therefore, it is important to include antenna simulation learning as a learning medium in the curriculum of avionics students.

4. Conclusion

Based on the network visualization of simulation in this article, it shows that the topic of simulation is still feasible and is widely discussed by researchers. It is also very important for the learning of avionics students as there are many ways to explore this topic. Antenna simulation as a student learning approach to solving antenna design problems can be effectively implemented as laboratory learning because antenna design requires computational accuracy to get an accurate parameter approach. This can be used as a learning model for avionics students in the laboratory to aid in achieving technical competencies and skills.

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