

# Learning AR/VR applications through Directed Research Studies in Biomedical Engineering Educational Programs

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**Abstract**— Advances in new technologies have changed traditional education methods in the field of biomedical engineering dramatically in the past few decades. The expansion of technologies into different disciplines of engineering sciences and biology attracts many students with different educational backgrounds to pursue higher education in biomedical engineering. DRS (Directed Research Study) is a methodology of teaching that allows students to choose and focus on a specific knowledge area they interest to learn while understanding other core concepts of biomedical engineering principles integrated into one teamwork project.

## I. INTRODUCTION

Many biomedical engineering educational programs offer a wide range of engineering and science principles responding to the fast progress and innovations in healthcare and biomedical engineering. Choosing from these topics can be overwhelming for many students, especially for those who graduated from different bachelor programs that are not directly related to the field of bioengineering. This paper discusses how DRS helped students who were interested to learn the applications of Virtual and Augmented Reality applications in medicine and healthcare at the beginning of their education program by learning how to develop an application to simulate the movement of the lungs in a virtual reality environment according to the received airflow signal as a part of a project that is divided into different knowledge areas of engineering principles between the different students.

## II. METHODS

Understanding learners' technical backgrounds and expectations is essential at the beginning of DRS to know which knowledge area that they are interested to explore. According to the feedback from students, they were divided to work on specific tasks in different technical knowledge areas of a project that was focused on the human respiratory system that requires to learn and study the following topics of biomedical engineering:

- 1- Airflow instrumentation and data acquisition.
- 2- Processing of airflow signal.
- 3- Medical Image segmentation.
- 4- Filtering of the lungs medical imaging.
- 5- Simulation of the lungs for AR/VR applications.

More areas can be added according to the number and the topics of interest to study by the students. In DRS students can work on the assigned tasks independently without counting on the progress of other stages of the project. The main concept is to providing guidance as well as tracking for the progress of

each student to ensure that they know how to search, study, and develop their tasks.

## III. RESULTS

The progress in every stage of the project varied from one student to another due to different factors. Every finished task in every stage was extended for further challenges and development. In general, students were able to know how to explore and learn the topics of their interests besides learning other main core knowledge areas of biomedical engineering in a logical sequence and related to each other in one project. In Addition, students who were interested in learning AR/VR were able to animate 3D lung model using "Blender" and use it in "Unity" to research how to control the movement of the lungs using the received air flow signal through a serial connection.



Figure 1. Animated 3D models in "Blender" to be used in AR/VR Applications.

## IV. DISCUSSION & CONCLUSION

DRS can be an efficient method for teaching a wide range of different topics in biomedical engineering especially for students who have different technical backgrounds and are interested in exploring and learning specific topics while understanding other general and important processes and applications in the same field of study.

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