



# MarineXR: Comparing the Impact of Two Different Ocean AR Experiences on Student Motivation and Engagement

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**Abstract.** Augmented reality is increasingly used as a learning tool in educational settings. There are a wide variety of different AR implementations ranging from simple 3D model viewers to more interactive and dynamic content such as videos and animations. We developed two different types of AR experiences around ocean education: (1) a "tap-to-place" highly-immersive narrated experience that uses the principles of gamification, simulation, role-playing to engage students in scientific concepts around basking sharks and (2) a species learning modules that use realistic and animated 3D representations of marine and freshwater species to teach students about their physiology, morphology and ecology. We conducted a controlled experimental study comparing the impact of each experience on motivation and student engagement. We tested each module in a large, first-year environmental sciences class under remote learning conditions (~200 students). We measured how motivation, engagement, engrossment, and cognitive load differed between the two groups within the context of their attitudes towards science (as assessed by the Modified Attitudes Towards Science instrument). The results of the study and its consequences will be discussed.

**Keywords:** Augmented Reality, Serious Games, Marine Biology, Gamification, Simulation.

## 1 Introduction and Background

### 1.1 Types of Augmented Reality Experiences

Augmented reality may use a combination of text, images, animations and videos to engage students in science learning; however, the type of content used in AR designs may impact its effectiveness as a learning tool [1]. Furthermore, design decisions for augmented reality applications are vitally important because AR may infer a high cognitive load on the user [2]. A recent study [3] determined that the combination of 3D models and animations are the most impactful content type for memory and motivation within AR design; however, within this type of AR experience there has been little research into different variations of AR design.

### 1.2 Types of Augmented Reality Experiences

In this research project, we tested different types of dynamic AR experiences that employed two different approaches to AR design using 3D models and animation (Fig. 1). We conducted a controlled experimental study comparing the impact of two different AR experiences in a large, first-year environmental sciences class under remote learning conditions via Zoom (~200 students). We measured how motivation, engagement, engrossment, and cognitive load differed between the two groups within the context of their attitudes towards science (as assessed by the Modified Attitudes Towards Science instrument).

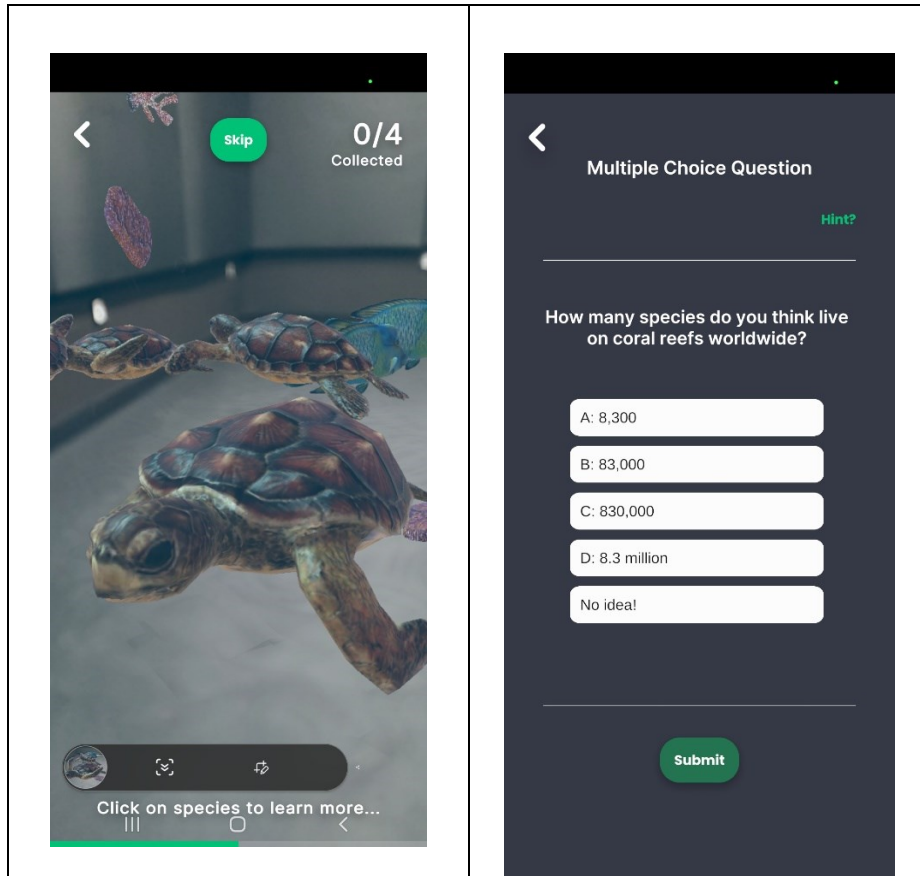


Fig. 1. Screenshots of user experience in MarineXR augmented reality experiences.

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