



AWARE RESEARCH DOCUMENT

Introduction

AWARE (Advanced Weather Awareness and Response Education) is a game-based learning application that aims to teach weather and STEM career awareness to middle and high school students. *AWARE* was developed in coordination with experts at the National Weather Center. By interacting with authentic, in-game representations of tools and data streams, students gain an understanding of weather-based systems, which they can apply to the real world.

The Importance of Weather Education

Severe weather events pose a significant threat to human health and safety. According to the National Weather Service, tornadoes account for 109 deaths annually in the United States. Hurricanes cause 108 fatalities, and floods cause 75 (U.S. Department of Commerce). Existing studies of responses to natural hazards suggest that providing education about the science, risks, and safety behaviors associated with such hazards is necessary to raise awareness and adapt effective changes (Stewart et al., 2015).

Common misconceptions about severe weather include “natural disasters are chaotic events that cannot be predicted,” and “human activity does not affect the susceptibility of a region to the impacts of a natural catastrophe” (California Department of Education, June 2019). *AWARE* addresses these incorrect assumptions by providing the student with opportunities to make decisions concerning the welfare of citizens in the game world.

Game-Based Learning

Game-Based Learning (GBL) has been shown to be an effective tool for increasing student engagement and motivation (Jabbar & Felicia, 2015). GBL provides an immersive learning environment that helps meet the needs of contemporary students (Anastasiadis et al., 2018). By providing clear goals, direct and immediate feedback, a balance between ability level and challenge, and a sense of control, GBL supports many of the components associated with student achievement.

GBL has been used effectively to teach STEM, non-cognitive, and life skills (Adame et al., 2017; Lee et al., 2016; McDonald, 2017). This indicates GBL is a useful tool that can be applied to various domains and objectives.

Standards

AWARE addresses the following Next Generation Science Standards:

MS-ESS3-2: Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.

HS-ESS3-1: Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

Objectives

By the time students complete *AWARE*, they will be able to accomplish the following objectives:

- Given scaffolded data and information, the student can interpret that data to make predictions about possible natural hazard events.
- Given an emergency scenario and a set of possible emergency management decisions, the student can balance the economic and safety repercussions of their decisions.
- The student can assess technologies and strategies that can be used to mitigate the damage caused by natural hazard events.
- The student can describe how different STEM professions contribute to the prediction and mitigation of natural hazard events.

AWARE places the student in the role of an emergency manager. The student is given scaffolded data in the form of authentic weather products. Over the course of the game, they will unlock new products and incorporate them into their decision making. As each new product becomes available, the student will be



instructed on its use and the scientific principles involved. They will also develop skills related to map reading by translating information in weather products to their main regional map and colored overlays of economic density, population density, and flood probability.

The balancing of economic and safety concerns is an integral part of emergency management. Since safety is always necessarily constrained by the availability of technology and resources, the allocation of limited resources in the game both reflects authentic emergency management and affords engaging gameplay choices.

AWARE includes 45 technologies based on current, historical, and theorized future technologies. Each provides unique benefits the

student can research within the game. Their authenticity has been vetted by experts from the National Weather Center. As the student progresses through the game, they will choose which technologies to research based on cost, availability, and potential benefits. Through this evaluation, the student will gain a deeper understanding of the relevant technologies.

Within the game, students are exposed to advisors representing different STEM careers. These advisors provide the students with advice and instruction. They also ask questions relevant to the learning tasks. Answering these questions provides the student with opportunities for reflection and immediate feedback.

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