

## **Work-In-Progress: Tackling DEI Issues in the Classroom Through Interactive Historical Fiction**

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An active member of ASEE for over 25 years, Dr. John K. Estell was elected in 2016 as a Fellow of ASEE in recognition of the breadth, richness, and quality of his contributions to the betterment of engineering education. Estell currently serves on the ASEE Board of Directors as the Vice President of Professional Interest Councils and as the Chair of Professional Interest Council III. He has held multiple ASEE leadership positions within the First-Year Programs (FPD) and Computers in Education (CoED) divisions, and with the Ad Hoc Committee on Interdivisional Cooperation, Interdivisional Town Hall Planning Committee, ASEE Active, and the Committee on Diversity, Equity, and Inclusion. Estell has received multiple ASEE Annual Conference Best Paper awards from the Computers in Education, First-Year Programs, and Design in Engineering Education Divisions. He has also been recognized by ASEE as the recipient of the 2005 Merl K. Miller Award and by the Kern Entrepreneurial Engineering Network (KEEN) with the 2018 ASEE Best Card Award. Estell received the First-Year Programs Division's Distinguished Service Award in 2019.

Estell currently serves as an ABET Commissioner and as a subcommittee chair on ABET's Accreditation Council Training Committee. He was previously a Member-At-Large on the Computing Accreditation Commission Executive Committee and a Program Evaluator for both computer engineering and computer science. Estell is well-known for his significant contributions on streamlining student outcomes assessment processes and has been an invited presenter at the ABET Symposium on multiple occasions. He was named an ABET Fellow in 2021. Estell is also a founding member and current Vice President of The Pledge of the Computing Professional, an organization dedicated to the promotion of ethics in the computing professions.

Estell is Professor of Computer Engineering and Computer Science at Ohio Northern University, where he currently teaches first-year programming and user interface design courses, and serves on the college's Capstone Design Committee. Much of his research involves design education pedagogy, including formative assessment of client-student interactions, modeling sources of engineering design constraints, and applying the entrepreneurial mindset to first-year programming projects through student engagement in educational software development. Estell earned his BS in Computer Science and Engineering degree from The University of Toledo and both his MS and PhD degrees in computer science from the University of Illinois at Urbana-Champaign.

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## Introduction

Since its release as a video game in the 1980s, *The Oregon Trail* has taught and inspired multiple generations about a significant historical event: the beginning of Westward Expansion. Initially developed for use in a text-only environment, this simulation was designed to present students with active learning experiences involving those migrating along the Trail [1]. The game allows a player to outfit a wagon and then lead a small party on a 2000-mile trek while being cautious with supplies, keeping a good travel pace, and learning how to cross a river. While this educationally-focused game has achieved near cult-like status, it has also generated complaints concerning the lack of representation of those outside of the provided white male protagonist avatar [2]. Although the most common complaint involves the stereotypical portrayal of Native Americans, another issue raised concerns the erasure of the female experience through such means as the inability of gender selection by the user and problem scenarios falling within the male domain [3]. As women are stakeholders in educational software and make up roughly half of the audience, it is essential they see themselves being positively represented.

The project described here serves as the culminating design experience in the first-year programming sequence at Ohio Northern University (ONU). For context, Programming 1 is offered in the first semester, where students learn the basics of sequence, selection, and iteration using C++. The following Programming 2 course builds upon this foundation, using Java as the language for introducing the object-oriented programming paradigm, event handling, and graphical user interfaces. Preceding the term project, the Programming 2 course uses an internal, team-based “sandbox” activity for introducing student teams to both software engineering and communication skills by developing an abbreviated version of the classic *The Oregon Trail* game [4]. This helped prepare teams for working on the prior term project: developing educational software supporting various service-learning activities with real-world clients [5]. Unfortunately, increasing enrollments have made using external clients no longer viable. To remedy this while still retaining the value of developing educational software, the sandbox exercise was expanded such that a full version of *The Oregon Trail* would be created. However, this was approached such that the project would properly address the lack of diversity, equity, and inclusion (DEI) content found in prior commercialized versions of the game. Together with efforts at ONU to incorporate DEI-related content into curricula, it is hoped that requiring first-year students to “write in a different voice” than that typically found in the genre would help raise awareness of the various representation issues commonly found in computer games.

## Project Approach

With the new “alternative Oregon Trail” approach, the revised term project was introduced to the students halfway into the semester and divided into two distinct phases: (1) working on the game’s design and initial development through sandbox-based exercises, resulting in a scaled-down preliminary version of the application providing proof of concept; and (2) creating the full-scale, playable version. To help students not familiar with the game, the instructors provided

links to various versions of *The Oregon Trail* available via on-line emulators. One lecture was reserved for introducing the project, including covering the project's timeline and emphasizing the use of an interactive historical fiction format. Representation is addressed by creating a version of *The Oregon Trail* requiring a female protagonist; specifically, 13-year-old Hattie Campbell, from the fictional 1847 Oregon Trail diary entitled "Across the Wide and Lonesome Prairie" by Kristiana Gregory [6]. Hattie is introduced to students through a background persona that includes the beginning of her family's trek. Also included from Gregory's book are excerpts from Hattie's diary and a brief overview of life in 1847 America. Finally, simulation models for pace, health, weather, *etc.*, from the 1985 Apple II version of the game were provided [7].

As part of their initial work, students learn about various communicative and analytical tools, such as the entrepreneurial NABC (Needs, Approach, Benefits, and Competition) and MVP (Minimal Viable Product) models. The NABC model [8] is a tool used by developers to identify the critical needs of the client and thus propose a value creation approach that delivers greater benefits than that of the competition. When applying the NABC model, the students use as competition an in-class exercise on packing a wagon for starting out on the Oregon Trail [9] along with the persona of a student involved with the exercise and a scenario illustrating that persona's pains and frustrations. Students are charged with conducting research on the needs of sixth-grade students to develop additional personas and scenarios, from when they then apply the NABC model to pitch a better solution: a computer simulation that each student can play individually. Each team records an NABC-based elevator pitch for instructor review and comment. Next, the teams use an agile software development approach by applying the MVP model [10], where developers show clients a working, but not fully functional, piece of software in order to quickly get their feedback. In this revised project, instructors serve as the "clients."

As historical simulation games require an appropriate storyline to engage the user, teams were tasked with two additional requirements: provide a pacing that allows players to "get into" the story, and provide sufficient historically-based details to make the story "come alive". To assist with these efforts, the students attended an interactive 50-minute online workshop led by award-winning and nationally produced playwright Janece Shaffer to awaken their inner storytellers. This workshop provided a space for students to ideate on the Hattie Campbell protagonist and create story elements that would "hook" the players; for example, in one exercise the students were asked to describe what Hattie always kept in her pocket.

Other mileposts were created to help keep teams both on task and provided with helpful feedback. A design review was scheduled halfway between the MVP and the project submission, where teams provided a short video demonstrating what had been completed on the project and what remains. Two weeks before submitting the final project, each team performed a code review with an ONU alumni volunteer who is currently a practicing software professional. In the final week of the project, teams showed off their games during an App Fair Gallery Walkthrough that was open to the public. Judges recruited from the faculty and programming lab assistants filled out a software application rubric for each team based on a software demonstration and an oral presentation covering the poster containing the team's NABC pitch, storyline synopsis, and key learning outcomes. The rubric results were quickly provided to the teams, allowing them to make final tweaks to their software applications prior to final submission.

## Results and Discussion

The applications created by the students were overall satisfactory: all teams either met or exceeded the DEI requirements of the game and included Hattie in a meaningful way. The students gained knowledge of various software development concepts, including NABC, MVP, personas and scenarios, and storytelling. The Spring 2022 offering of Programming 2 contained twelve teams of 3-4 students, and each created their unique take on the game. Several groups took inspiration from [6] and used diary entries to demonstrate progress within Hattie's journey. Some teams also created original artwork to better engage users playing the game. The students struggled with two elements: (1) engaging in storytelling and (2) creating games free of grammatical errors. All teams included a storyline, but those that struggled tended to have repetitive story elements (*e.g.*, each river crossing had the same statement with only the river's name changed). The instructors believe the grammatical errors are partly due to students' reliance on autocorrect editing features that are non-existent in plain text editors.

The instructors plan to use this project again in the next offering of Programming 2 in Spring 2023. Additionally, the instructors have been awarded an internal grant to develop a general education course with faculty from the English department that will use the Inform 7 platform (designed to create interactive fiction) to teach DEI and multiple perspectives in storytelling with game development. The students' first project in this course will be based on *The Oregon Trail* but will focus on the first-person narrative using real diaries as an inspiration. Instructors will obtain diary examples from various published books and thorough scans of source material at museums specializing in the Oregon Trail and American Westward Expansion.

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