

Gamification and Computer Science Education

Mark Sherriff

Associate Professor
sherriff@virginia.edu

<http://marksherriff.com>

Department of Computer Science
University of Virginia
Charlottesville, VA
434.982.2688

"We work to improve student motivation and learning through empirical evaluation of pedagogical techniques."



SCHOOL of ENGINEERING
& APPLIED SCIENCE

A screenshot of a web-based gamified course interface. At the top, it shows the user's name "Matt Biondi, The Bard" and their level "Level 15 Knight". It also displays "No Lab Affiliation / 9 VP Available / 9 VP Earned" and "Total XP: 108450 XP / To next level: 15250 XP". The interface is divided into several sections: "Available Quests" with sub-sections for "Main Quests" (e.g., "The Final Boss"), "Raid Quests" (e.g., "More Fun That It Is Good"), and "General Quests" (e.g., "Think You Can Take Me?"); "Quest Info" for the selected quest "More Fun That It Is Good"; "Completed Quests" (e.g., "Game On! Pt. 2"); and "Quests Under Review". At the bottom, there is a "Turn In" button and an "Achievements" section with "Look What I Found!". Below the interface is a game scene with a character and a text box from "General Meade" asking "Where should I actually begin?" with options: "'Meade-Arrives' 'Pickett's Charge' 'Town' 'Hill' 'Retreat'".

Gamification has been used in many different ways to motivate individuals to wholly participate in some activity. Gamification involves the application of game mechanics to tasks typically considered to be void of fun. In the classroom, this often materializes as a set of mechanics meant to motivate students to learn more effectively. For example, courses will often challenge students to earn experience points (XP) instead of simply grading assignments, or offer classes/titles (e.g., wizard) to students as they earn various achievements within the course. Courses may even allow students to purchase special items that benefit the student on homework or exams, or provide special skills to the students that can motivate them to think differently about the coursework.

Gamification Evaluation and Investigation with GamerCard

Proponents of gamification intuit that game elements increase student motivation, provide a more useful mindset for understanding educational progress, and provide useful help and/or feedback throughout the course. While this is understandable, it is not necessarily the case that game elements lead to improvements in the classroom, and thus care must be taken to study how and in what ways gamification can be useful and/or detrimental to student learning.

It is plausible that gamification (or some particular aspects of gamification) might have negative effects on students in the classroom. Care must be taken by the instructor to ensure that mechanics align well with course and learning objectives, a design feat that is often quite difficult.

It is thus important to identify an intellectual framework for how individual elements of gamification affect the learning experience. Our tool, GamerCard, provides a platform for instructors to test and evaluate various gamification methods in the classroom in an empirical fashion.

Designing Empirical Education Research Studies (DEERS)

Researchers require evidence to determine the efficacy of teaching and learning interventions. Replications or comparisons of data across studies that address common research questions provide a basis for theory building. An increase in empiricism in Computer Science Education (CSEd) Research will move the field from “scholarly teaching” to the “scholarship of teaching and learning” (SoTL) providing the foundation for meta-analysis and the generation of theories about teaching and learning in computer science. Scholarly teaching is the application of current ideas or trends about teaching and learning, like flipped classrooms, as a classroom intervention with no planned methodology. SoTL moves scholarly teaching towards rigor, through a formalized plan and empirical evaluation, with the intention of peer review. SoTL is the application of empiricism to CSEd that can build the theory for teaching and learning in computer science.

Our project provides for summer workshops for CS educators to learn more about how to do good empirical studies in CS education. We work with them throughout the year on their studies, helping them from inception through data analysis and publication. We also put on workshops at the major CS education conferences on how to create good research questions.

RECENT RESEARCH DEVELOPMENTS

- GamerCard has been used in multiple iterations of our upper-level game design course and was published at ASEE in 2016
- DEERS has helped produce multiple new research projects across the country and new faculty are signing up for upcoming workshops

RECENT GRANTS

- NSF – Collaborative Research: Transforming Computer Science Education Research Through Use of Appropriate Empirical Research Methods: Mentoring and Tutorials

SEAS Research Information

Pamela M. Norris,
Executive Associate Dean for Research
University of Virginia
Box 400242
Charlottesville, VA 22903
EngineeringResearch@virginia.edu
434.243.7683



SCHOOL of ENGINEERING
& APPLIED SCIENCE