Undergraduate Thesis Prospectus

Curriculum Competency Tree Software

(technical research project in Computer Science)

Alternative to Conventional Grading: How Professors are Changing the Paradigm

(sociotechnical research project)

by

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technical project collaborators:

On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.
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General research problem

How can educators teach students more effectively?

Educators disagree about what good education is. Most educators would agree, however, that teaching serves students; teachers are merely the means to this end (Ackoff & Greenberg, 2008). Students have personalized learning styles that correspond with educators' teaching styles. Student performance depends on matching these styles (Chetty et al., 2019).

Curriculum competency tree software

How can students and educators track understanding of material in a course?

Students rely on grades for a variety of reasons: scholarships, course prerequisites, post graduate admissions, employers, etc. (Tychonievich, 2017). Traditional methods of teaching involve assigning percentage grades to assignments and calculating a weighted average of several assignments to produce a final grade. Averaging a student's performance over several assignments produces an amalgamation that is often hard to understand and often unbeneficial for a student (Muñoz & Gurskey, 2015). Making this number more meaningful or finding an alternative form of providing feedback to students is crucial to better serve the students who receive grades.

Because traditional grading relies on assigning a percentage value to an assignment, we see interesting, and sometimes undesirable, behavior. One student earning seventy-five percent on four equal weighted assignments will receive the same final grade as a student who earned three one-hundred percent grades and a single zero percent. Both students average to a seventy-five percent, but there is a significant difference in the understanding of material between the two students. If the zero was in an important prerequisite material that will hinder the student's future success, we do the student a disservice by not explicitly pointing this out. In

traditional testing it is rare to see a single assignment measure a single skill or one important topic. It's possible that the student who received four seventy-five percent grades missed the same important material on each assignment. This is equivalent to the case where the single zero represented one important topic, but it is far harder to determine because traditional grading is assignment-based and tells us little about topics (Tychonievich, 2017). One alternative to this is standards-based grading (SBG) which attempts to break down curriculum into individual learning goals based on topics that are required for a course. This allows for a more tailored educational experience where a student's assignments are based on progress through learning goals (TeacherEase, 2020). This helps produce a more meaningful grade that more accurately shows a student's progress through a course. However, it requires far more resources to manage a class where different students are working on different material and is more expensive to grade.

I will be working on my capstone with Professor Mark Floryan in the Computer Science department to develop a better way for students to track progress through a course. A portion of this research has been done by other students, however, my portion will be done individually. For my capstone, I will complete development of a tool that tracks a student's progress through a course and modifies an individual's curriculum based on performance. I will then conduct a study to see if the tool is useful to students and/or professors.

I will generate the data for my study by implementing this tool within a computer science course at UVA. I will create two groups of students within the same course, where one group will take the original curriculum and the other group will take the new curriculum generated by the tool. Student participation in the study would be optional and those interested will have academic progress tracked and compared across the two groups. I will track the trends in students' grades to see if there are differences in performance.

In the end, we will have a software tool that allows professors to transform their curriculum into a new adaptive version. The software will track a student's progress through the course and adapt assignments based on the student's performance on topics, rather than assignments, in sustainable ways for large scale courses. A study will be produced that looks at the effectiveness of such a tool. The next step would be to iterate the tool after analyzing the study to improve the usefulness and benefits for students.

Alternatives to traditional grading: How professors are changing the paradigm

In U.S. universities since 2010, how have professors advanced alternatives to the conventional grading model?

Assessment methods influence the time and effort that students commit to study (Pacharn, Bay, & Felton, 2012). Some students conserve effort, seeking to do no more than necessary to graduate (Peschl, 2020). Others are ambitious, seeking high grades and the opportunities they promote. To such students, the grade may be more important than learning. They may seek a strategic path toward a high grade (Pacharn, 2012). Professors' views also vary. To some, active participation is essential to education (Ferber, 2020); others equate education with skill development (Tychonievich, 2012).

Professor Michael Schultz-Bergin (2019) allows students to assign themselves grades because standard grading "takes away from learning by discouraging a focus on what you are doing and discouraging taking risks that may lead to failure." Professor Jason Mittell (2016) uses pass/fail grading because "grades often work as an obstruction to learning, rather than a motivation, reward, or neutral assessment." To him, changing the grading culture would "be the most effective and impactful reform" at his institution. Professor Joanna Morris uses written narrative evaluations rather than grades because "with narrative evaluations, students don't

compare themselves to each other; they compare themselves to the best that they can be" (Hampshire College, n.d.).

In standards-based grading (SBG), grades measure degree of mastery. SBG has grown in popularity for K-12 education, but lags in higher education. Professor Jerrid Kruse applies SBG in an education technology course in which students' grades measure attained proficiency in course subjects. Students may resubmit assignments and must demonstrate proficiency with Kruse. Though students reported anxiety about Kruse's unusual policies, they also indicated that the policies induced persistence. At the end of the term, 20 of the 21 students agreed that SBG promoted responsibility; the lone dissenter found the experiment useful. Among the students, 17 agreed that SBG improved learning. According to one: "SBG is a medium for assessment that aligns clearly to learning theory and our goals for students. ... I like using standards rather than points so the focus becomes concepts and ideas" (Buckmiller, Peters, & Kruse, 2017).

In a flexible variant of conventional grading, students may influence the weighting of each assessment. At a Canadian university, Pacharn, Bay and Felton (2012) tested a system in which students determined assignment values (including class participation) within limited ranges. Students could adjust the values until the final exam. The researchers found that students who chose well early in the term had an advantage. High-risk strategies generally did not pay off, and the experiment offered no evidence that the system is advantageous to students. In a specifications grading system, all assignments are pass/fail. Barbara Blodgett (2017) tested a specifications system where completing different combinations of assignments corresponds to letter grades. In some cases, students took more ownership of the course; all students were satisfied with their grades.

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