Title of Study: The HumAn Learning Project, Phase 4: Mitigating Grade Surprise--A Study of Students' Grade Expectations Using Learning Analytics and Assignment Performance in General Education Courses at Indiana University

Principal Investigator: Jennifer Meta Robinson, Anthropology

Co-Principal investigators: Jill K. Robinson (Chemistry), John Arthos (English), Logan Paul (Informatics), Chung-chieh (Ken) Shan (Computer Science)

Year/Semester Awarded: 2018/Spring

Number of undergraduate students who were subjects of your study: >6600 in 2018

Number of graduate students who were subjects of your study: 0

Estimated number of student records used in your study: NA

Please indicate the type(s) of data you are using to conduct your research, placing an X next to each category? Select as many categories as needed to describe your research.

_x___ **Student Demographics** - which includes characteristics such as ethnicity, race, and class standing

_x___ **Student Preparation** - such as transfer credits, prerequisites, curriculum requirements, pre-college classes and remedial educational programs

_x___ **Student Performance** - as understood by course grades, GPA, persistence, retention, engagement indicators and graduation rates

_x___ **Student Choice** - as understood by selection of major, inflection points and pathways toward graduation

Please select the level(s) that your research addresses, placing an X next to each level. that applies Select as many levels as needed to describe your research.

_x__ Course Level

____ Program Level

_x__ Institutional Level

What is the estimated number of student records you are using in your study: __NA____

Executive Summary

Grade surprise occurs when students' internal expectations are not met by external assessments (Mellers et al. 2013). Investigation into grade expectation usually compares final course grades and assumes a differential means surprise. This study of four large, general education courses in oral communication, anthropology, chemistry, informatics, and computer science probes the first high stakes assignment of the semester. A formative moment, students may experience surprise that impedes their progress. However, with appropriate interventions, surprise may be mitigated or leveraged for positive outcomes. We brought together institutional and course performance quantitative data with student survey responses to validate and analyze the negative consequences of grade surprise. We surveyed students about their grade expectations before the assignment, just after, and upon receiving the actual grade. Our key findings include that Indiana University general education students are primed for grade surprise; that grade penalties are not equally distributed; that grade surprise affects a significant number of general education students in these courses; that novel visualizations of student responses uncovering new dimensions of grade surprise, including through topic modeling, sentiment analysis, Sankey tracking, and competence and self-awareness

comparisons uncover new dimensions of grade surprise; and that faculty can be inspired to leverage the phenomenon of grade surprise.

Narrative

Initial Findings

- **Phase 1** of the project, completed in 2015, uncovered important demographic trends in success among 2719 students and 30 AIs involved in a single, multi-section, general education course in anthropology at Indiana University Bloomington.
- **Phase 2,** complete in 2016, (1) refined our understanding of these trends within the course using multivariate modeling and comparisons to student success in other IU general education courses, (2) assessed variability of student success across sections of the course, (3) analyzed student performance over time, and (4) piloted a discipline-based intervention designed to close demographically-based learning gaps.
- **Phase 3,** completed in 2017, extended this research to general education courses in oral communication, anthropology, and chemistry in order to understand and impact large numbers of IU students in the important early years of their college education.
- **Phase 4,** completed in 2018, added two new large, general education courses in informatics and computer science to create a comprehensive proxy for broad scope of the undergraduate curriculum. Together these five courses address A&H, S&H, and N&M content and teach about 6300 undergraduate students per year. They also provide important variations on the large class theme, including large lecture, discussion, fieldwork, performance, laboratory work, undergraduate teaching assistants, and graduate student associate instructors. Our emphasis on understanding grade surprise offered a potentially important window on student success—bringing together student demographics and success indicators with assignment-based performance and student articulations about their performance. The results could have implications for recruiting and retaining majors, fostering success among diverse student groups, and retention to the third semester.

Research objectives. The overall objective of this research is to improve student success in very large, general education courses in the humanities, sciences, technology, engineering, and social sciences by understanding and intervening in the phenomenon of grade surprise—the unrealistic expectations students have for their grades. We also sought to understand the degree to which surprise may correlate with various reference points, including high school and course GPA, demographic characteristics, and personal attitudes. We used a new synthesis of learning analytic data, course performance data, and student surveys to find patterns that can aid course design and curriculum-wide interventions to (1) discern success patterns and (2) identify intervention points that can leverage grade surprise to positive effect, to prepare for later studies in which we can improve course-based learning and retain students in the semester and subsequently. We have special interest in (1) closing the achievement gap that persists between underrepresented students and majority students, particularly within majors and in the sciences and (2) recruiting and retaining majors and minors in our departments.

To date, the most significant findings of our study include:
- Students in these five, large, general education courses are primed to experience grade surprise because their high school GPAs are lower than their GPAs in these courses.

- Grade penalties are not equally distributed, with underrepresented minorities, first-generation, and 21st Century Scholars students receiving greater GPA decreases from high school than their majority peers.
- A survey instrument has been designed to gauge grade surprise that can be used across different courses in different departments.
- The percentage of courses reporting that they were very surprised or surprised by a grade on first major assignment were as follows: Informatics 50%, Chemistry 50%, Anthropology 38%, Public Speaking 36%, and Computer Science 23%.
- Novel ways have been developed to understand student survey responses, including Sankey, frequency, topic modeling, and sentiment analysis.
- Differences between grade expectations immediately before and assignment to immediately after an assignment is theorized to indicate degree of confidence.
- Difference between grade expectations immediately after an assignment and actual grade is theorized to indicate degree of self-awareness.
- Grade surprise, both positive and negative, is theorized as a leverage point in student success.
- Giving the questionnaire constitutes an intervention because the questions help students reflect on their preparation and performance, and thereby supports agency in their own study habits and practices.
- Putting big data in dialogue with the smaller places of teaching and learning can empower and inspire faculty decision-making and targeted learning interventions.

Potential gap in the findings
These results point to the "apples and oranges" character of the general education curriculum, raising questions about comparability as well as about students' ability and institutional preparation to navigate these differences. One of our courses under study uses a single large lecture scaffolded by numerous developmental pathways for students into a course that could make or break student hopes and dreams for a career in medicine. A second course uses a video-streamed lecture as the core of its design while graduate students from diverse departments across campus coach thousands of students in small sections to overcome a fear commonly acknowledged to be worse than death. The third course dispenses with large lecture to offer a highly coordinated, small-course experience taught by graduate students to about 1000 students per year where students gain intensive attention and regular feedback on their work but rely on inexperienced instructors. While these courses may seem quite varied, the University nonetheless expects students to move among them successfully. Thus, they create a multi-disciplinary, first-year curriculum difficult but important to study.

Reflection about the Process
We are excited about the potential of this study to link institutional data on learning and student progress (e.g., demographics, college preparation, g.p.a., retention, choice of major, time to degree) with classroom success data (assignment and course grades) and student experience of these phenomena (expectations, responses, plans). We believe such comprehensive links within a particular course, much less among a multi-disciplinary first-year curriculum, are rarely done well. We believe that we have the potential to set a new standard for learning analytics—one that keeps faculty and student performance and reflection in the analytical mix with institutional

big data. We plan to continue to press on this goal by refining our multivariate modelling of these factors in student success and by designing and implementing classroom interventions based on our findings.

Changes Undertaken
We planted the seeds of change for our students by, essentially, building an intervention into our survey instrument. After asking student to reflect on their expected and actual grades on the first assignment, we asked them to plan changes they could make in their performance in the future. Providing the space for such planning is, potentially, going to impact future behavior.

Plans to further this work
With continued funding for data analysis, we plan refine our understanding of grade surprise such that we can leverage that phenomenon for greater student success. We plan to design interventions to aid in that success, to implement and test them, and disseminate those that are effective. Possible interventions include:

- instantiating the questionnaire in each course regularly to prompt student reflection about their preparation strategies, competence, and self-awareness.
- training instructors and associate instructors on how to talk to students before and after major assignments in ways that leverage grade surprise.
- providing generalized or course-specific instruction *before* the first assignment to leverage surprise.

Further questions to ask about the data include:

1. We now know how many students are in the 3 surprise categories for each course, the actual grades received, the difference between before and actual grades, and the difference between after an actual grades. We need to further uncover the demographic correlations in those categories
2. Which students raised their grades over the semester in each course (based on end-of-semester final grades, compared with first assignment grade),
   - Who are they demographically?
   - Who are they by surprise category?
   - Were there common strategies or mindsets demonstrated by students who raised their grades in later evaluations in the course?
   - What trajectory do they tend to follow?
3. Having done some textual analysis of the survey's open comments in each course, we need to understand patterns by:
   - surprise category
   - demographic categories
   - theme, including on locus of control, responsibility, effort, and confusion/clarity.
4. We plan to follow students longer term, particularly for those who take a sequence of courses as in the sciences.

Dissemination of these and related SLAF results

2018   Robinson, J. M., J. K. Robinson, J. Arthos, L. Paul, K. Shan. **"**Grade Surprise in Introductory Courses—Learning Analytics Collaborative Research in Anthropology, Chemistry, Oral Communication, Informatics, and Computer Science." Indiana University Office of the Vice Provost for Undergraduate Education. December 6.

2018   Robinson, J. K. FACET Mosaic Conference. Indiana University.

2018   Robinson, J. M. and J. Arthos. "Understanding Grade Surprise: Learning Analytics in First Year Classrooms across the Curriculum." Inaugural Learning Analytics Webinar. Center for Learning Analytics and Student Success. Indiana University. November 14.

2018   Robinson, J. M., J. Robinson, J. Arthos, C-C. Shan, L. Paul. "Understanding Grade Surprise: SOTL and Possibilities for Using Big Data in Three First-Year Courses." International Society for the Scholarship of Teaching and Learning, Bergen, Norway. October 25.

2018   Robinson, J. M. "Big Data in Small Places: SOTL and the Possibilities for Transformation of First-Year Courses." Indiana University Southeast, New Albany, Indiana. Sept 28.

2018   Robinson, J. M. "Scaling Up for Learning: Community, Collaboration, and Analytics. P.A. Mack Award Keynote. Faculty Center for Excellence in Teaching. Indiana University. Nashville, Indiana. May 20.

2018   Robinson, J. M., J. Robinson, J. Arthos. "Grade Surprise in Three First-Year Courses: Using Big Data to Understand Teaching and Learning in Anthropology, Chemistry, and Oral Communication." Framing the Future of Learning Analytics and Student Success Summit. Indiana University. Bloomington, IN. April 11-13.

2018   Robinson, J. M., J. Robinson, J. Arthos, K. Shan, L. Paul, N. Onesti. "Mitigating Grade Surprise: A Study of Students' Grade Expectations Using Learning Analytics and Assignment Performance in General Education Courses at Indiana University." Framing the Future of Learning Analytics and Student Success Summit. Indiana University. Bloomington, IN. April 11-13.

2017   Robinson, J. M., J. Robinson, J. Arthos. "Grade Surprise in Three First-Year Courses." Center for Learning, Analytics, and Student Success. IU. Dec 1.

2017   Robinson, J. M. "HumAn Learning: Transforming Patterns in the Cultures of College with Learning Analytics and SOTL." European Scholarship of Teaching and Learning Conference. Lund University, Sweden. June.

2017   Robinson, J. M. "Learning Analytics: Data Mining Registrar Data." Anatomy Educational Research Institute. American Association of Anatomists Innovations Grant. Indiana University. July 11. Invited.

2016   Robinson, J. M., M. Gopalan. "The HumAn Learning Project: Mind the Gaps in a Multi-Section General-Education Course." Center for Innovative Teaching and Learning, Indiana University, December 2.

2016   Robinson, J. M., M. Gopalan. "Discovery Analytics for Teaching and Learning." Center for Innovative Teaching and Learning, Indiana University, November 15.

2015   Robinson, J. M. "The HumAn Learning Project: Learning Analytics in a Multi-Section General-Education Ethnography Course." American Anthropological Association. Denver. November.

2015   Robinson, J. M. "Deconstructing the Strange/Familiar Strategy In Higher Education." Panel Chair. Anthropological Association. Denver. November.

2015   Robinson, J. M., B. Yuhas, R. Butorac. "The HumAn Learning Project Phase 1 Report." Center for Innovative Teaching and Learning, Indiana University, November.

2015   Robinson, J. M. "The HumAn Learning Project," Student Learning Analytics Kick-off Event. Center for Innovative Teaching and Learning, Indiana University, February 4.

Additional Grants

2018   Submitted to AAU—Groth, Rehrey, JM Robinson, Shephard with JK Robinson, Paul, Shan.

2018   Robinson, J. M. Overseas Conference Grant. Office of the Vice President for International Affairs. Indiana University. $800.

2018   Robinson, J. M. FACET/Mack Center Scholarship of Teaching and Learning Travel Grant. Indiana University. $750.

2017   Robinson, J. M. "Learning Analytics for Strategic Intervention (LASI) in a Multi-Section General-Education Course." Mack Center for Inquiry on Teaching and Learning Fellowship. Indiana University. $2000.

2017   Robinson, J. M. Overseas Conference Grant. Office of the Vice President for International Affairs. Indiana University. $1000.