Pedagogical Inquiry Grant Report

Computer Science Major Curriculum Revision, Summer 2024

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What was the outcome of your project and how did it align with your original goals as stated in your application?

Our week-long summer workshop resulted in the completion of the ACM SIGCSE Committee on Computing in Liberal Arts Colleges' "Workbook for Distinctive Computer Science Curricula" (Holland-Minkley, et al., 2024). As part of this facilitated process, we drafted an aspirational identity statement, developed program design principles and learning outcomes, mapped these learning outcomes as well as our current major requirements to ACM/AAAI/IEEE CS 2023 curricular guidelines, reflected on alignments and misalignments, and started to imagine curricular innovations.

We were grateful to have an external facilitator who established a timeframe for our activities, guided collaborative design activities, gave us individual assignments, and guided our synthesis of individual work products. While we adopted some new decision-making processes (particularly fist-to-five voting), we were surprised by how much we agreed on core values. It was nonetheless essential to have the workshop facilitated by someone outside our department, so that the four of us could focus our full attention on the work before us. Two surprising benefits were that our external facilitator asked challenging and eye-opening questions about our external context and helped us recognize when our collaborative work products were "good enough" to move forward.

We continued to meet for one hour weekly through the fall semester to develop new courses and major requirements. Albert Schueller (Mathematics and Statistics) generously agreed to serve as an external facilitator for this portion of the work. During the fall working group, we individually envisioned new curricula in accordance with our agreed-upon program design principles and learning outcomes, identified common themes and courses, mapped new and revised courses to CS 2023, synthesized new major requirements, developed a transition plan for the next four years. We submitted course and major revision proposals in December 2024. We revised our proposed learning outcomes in response to feedback from the Assessment Committee, and our curricular proposals were approved at the faculty meeting of January 29, 2025.

In conclusion, we have met our goals for this Pedagogical Inquiry Grant. We plan to propose further revisions to existing courses as we build up the new curriculum and those revisions become imminent. We also plan to revisit the structure of the senior capstone experience and senior assessments.

What sense do you have at this point that your project has enhanced student learning and what will you be looking at in the future to know whether the project was successful?

We are optimistic that our project will enhance student learning, for the reasons given in the rationale for our major change proposal. However, its implementation will span the next 4-5 years as we roll out the curricular changes from the new 100-level courses up to the senior capstone, working around scheduled sabbaticals.

We will assess the new curriculum through our usual sources of assessment data.

- We will pay particular attention to student course evaluations for new and revised courses.
- We will need to revise our standard oral exam questions in response to changes in the required courses for the major as well as the revised departmental learning outcomes. The first students to matriculate under the new major requirements will graduate in 2029.
- Although we plan to eventually develop a written exam tailored to Whitman's curriculum, we may continue to use the ETS Major Field Test as our written senior exam for a few years beyond 2029. This will let us compare student learning of CS concepts and skills to a national baseline and across our curricular revisions (before, during, and after). Redesigning our senior exams may require another PIG; we should consider redesigning the written and oral exams together.
- We will continue our program of senior exit interviews to assess new graduates' experiences in the major, considering both individual courses and what they gained from the major as a whole.
- We will continue to monitor student destinations, both for summer experiences and after graduation.
- We will consider how to address the curricular revision in data collection for our department's first external review, which should be scheduled for no sooner than 2029.

What were the limitations or failings of this project, and how, in retrospect, might they have been better addressed or remedied?

This project required a significant time commitment from each of us: ~60 hours per person over the summer and fall, about evenly split between individual and collaborative work. Without the self-imposed pressure to submit curricular proposals in December, rather than waiting another year to begin implementation of our revisions, we might have spent even more time.

In particular, we started talking about revisions to our senior capstone course to address some "pain points" and in response to our new departmental learning outcomes, but we are not yet prepared to propose these revisions.

As we expected, it was not possible to address all of the CS 2023 knowledge units in our relatively small major curriculum, compared to CS majors housed in engineering schools which

are the main audience for CS 2023. In particular, the choice between CS 267, 310, 317, and 372 was the result of a last-minute compromise as the curricular proposal deadline approached. We had initially planned to require CS 372 in particular, but we decided not to privilege the particular content of that course over courses that are equally central to other areas of computer science. As a result, we still have some adjustments to make to ensure essential content we assumed students would see in CS 372 will be addressed in lower-level required courses. On the other hand, the structure of this requirement provides room for growth as we fill our fifth tenure line and consider the full range of possible "tracks" through the CS major.

In developing a transition plan and course proposals, in some cases it was difficult to determine whether we should revise an existing course or propose a new course. Some of these decisions were made for pragmatic rather than ideal reasons - particularly the need to continue offering the existing course for current majors while requiring the new/revised course for students who matriculate this fall.

Finally, while John Stratton took on the work of revising CS/Pre-Engineering requirements in response to the revised CS curriculum, we have yet to tackle revisions to CS-Geology and the CS minor. We are open to discussions of a combined CS-Mathematics major or other combined majors.

How do you envision sharing the results of your work with other colleagues at Whitman (or elsewhere)?

We have already shared our work externally at the annual meeting of the SIGCSE Committee on Computing in Liberal arts colleges. See our presentation proposal and slides. Here is a formal citation:

> William Bares, Janet Davis, John Stratton, and Jordan Wirfs-Brock. "Re-envisioning the Computer Science Major at Whitman College." Presented at *Innovations and Opportunities in Liberal Arts Computing Education*, an Affiliated Event at the *ACM Technical Symposium on Computer Science Education* (SIGCSE '25), Pittsburgh, PA, February 26, 2025.

Our work will be included alongside other institutions' curricular revisions in future presentations and publications on applying the "Workbook for Distinctive Computer Science Curricula."

The workbook is based in large part on Dee Fink's work on backwards course design. As such, most aspects of the process are not specific to computer science.

Albert Schueller agreed to facilitate our fall working group as an opportunity to learn about our curricular revision process with an eye towards future curricular revisions in the Mathematics & Statistics Department. Assuming our schedules align, we would be delighted to return the favor and facilitate a curricular revision process in our sister department or other departments.

To introduce our work to a broader audience, we would be happy to offer a Faculty Forum talk or a CTL panel discussion about our experiences. However, timing this may be difficult, with three

out of four department members having sabbatical leave scheduled in the next two academic years. It might be best to present to the faculty after we have all returned from our sabbaticals and are in the midst of implementing our proposed curricular revisions.