

# Adventures in Data Analytics and the Liberal Arts

## Context, Challenges, Lessons

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[Denison's Data Analytics Program](#) formally launched in the Spring semester of 2016 on the heels of an 18 month development phase and initial quasi-competitive “new-program/major” challenge offered by our (at the time) new University President. Our development process was heavily influenced by our context as a small, liberal arts, undergraduate only institution. The context and constraints we faced seem to mirror the challenges of similar institutions developing data analytics/science (DA/DS) curricula. Specifically, new programs must often invent with limited resources in faculty time, financial support, possible dedicated lines, physical space, broad faculty buy-in, and opportunity to develop new courses.

Additional challenges we overcame include aggressive timelines, developing external, professional partners, a need to compromise, the need to build programs that would integrate into the liberal arts, hiring skilled faculty (if this even an option), communicating value to institutional partners and beyond, and hidden startup costs. Our program jumped these hurdles through a combination of institutional support, creative problem solving, perseverance, unexpected allies, and definitely a bit of luck. Perhaps our successful experience in designing, launching, and stewarding an interdisciplinary data analytics major integrated into the liberal arts can be of value to other programs in similar, or more preliminary stages.

## Data Analytics at Denison

As a result of the quasi-competitive initial proposal process and constraints our program quickly steered toward an interdisciplinary approach to a data driven curriculum. Initially there were two teams of faculty developing similar ideas (one natural science and the other social science). These teams quickly merged to broaden the base of support and ideas, presenting challenges in finding common ground on the structure and content of the curriculum. Ultimately the people involved and norms of compromise led to a proposal that was a better fit to our institutional mission, student demand, university leaders, other faculty, and outside audiences. This is a reason our program trended toward a data “analytics” rather than “science” frame, and earned vocal support by senior staff and a near-unanimous vote of faculty.

Our no-prior-experience-necessary curriculum marries the broad based critical thinking, creative problem solving, and communicative aspects of the liberal arts with a project based approach to learning data analytics skills and processes, applied to a wide variety of domains and problems. The major is positioned to appeal to both math/cs students looking for more applied data driven experience and non-science majors looking for more depth and experience with DA techniques, theory, and practice.

This is largely achieved through a three tier approach: (1) foundational and intermediate courses in math, computer science, and an introduction to data analytics; (2) synthesis and deepening of skills through an experiential practicum class, advanced methods course, and required summer internship/research experience; (3) senior research, application through other interdisciplinary domains, and additional DA/DS related electives as advised for a student's trajectory. Since our major was designed as a B.A. program rather than a B.S. the elective advising is critical in helping students prepare for graduate training who are not already majoring or minoring in Math/CS programs.<sup>1</sup>

As of the start of the 2020-21 academic year our program is a vibrant part of our institution and broader community. We currently have 145 declared majors evenly distributed across class years, a nearly even gender balance among majors, and a strong international cohort. In our context, DA is already Denison's 5<sup>th</sup> largest major and each year we teach our intro class to roughly 10% of the student body. Demand for the major and classes far exceed expectations and our leadership committed resources to allow us to hire dedicated lines and administrative support.<sup>i</sup> We have cultivated a number of external partners who serve as pipelines for internships, mentors, and collaborators on class projects. Lastly, our first two graduating classes demonstrate impressive success in placement and grad school admissions.

## Challenges and Lessons

While we are certainly grateful for these successes and tackled many challenges, we continue to refine our curriculum to better serve our students, adapt to a changing environment, and grapple with new puzzles. As a way of closing, below are some specific challenges and lessons our journey highlights:

- **Compromise and People are key.** Our early deliberations over of more math, CS, more domain application, and more practical courses nearly led to a cycle of stagnation. Ultimately our team's ability to compromise prevented an unsustainably massive major that was just a union of math & CS unintegrated into other disciplines, and letting perfection stand in the way of a functional program.
- **Explicit commitment to interdisciplinarity critical to faculty support.** In our undergraduate liberal arts context skepticism of DA/DS programs as too pre-professional and/or zero-sum expansion of science at the expense of arts & humanities were significant hurdles. Concrete curricular linkages and broad faculty engagement in planning was crucial in combatting this stereotype.
- **Leverage the liberal arts.** While a DS approach with primarily math and CS courses is a tried and true pathway to success at large institutions, especially for students on highly technical professional and graduate trajectories this isn't always a good fit for SLACs. There is an audience and demand for graduates with strong technical skills and deep experience in multiple domains, communication (written, visual, and verbal), and creative/critical thinking. All institutions can do this, but this is an area where DA/DS in the liberal arts may be advantaged in delivering on the value proposition.
- **Technical depth can be a challenge.** Given the previous point, achieving a solid balance of math and CS should a DA/DS major is like performing a highwire act. Undergraduate majors cannot do it all and must choose an audience for majors and external partners. We bridge this through advising students to more electives, a flexible curriculum that allows for double majors and minors, and an ongoing development of an optional B.S. track.
- **Resources and leadership commitment.** Anecdotally it seems a lot of undergraduate institutions are asking faculty to develop DA/DS programs solely from repackaging existing classes, without any commitment to new faculty or course releases, and minimal allocation to critical administrative, physical space, and ongoing needs. All are critical to a successful program, especially at SLACs. Our senior staff's commitment to providing at least one new faculty line (and more once we grew), course releases from home departments to get up and running, partial admin support, and openness to new courses proved essential to success. Still physical space, technology resources, and staying on the radar as other strategic initiatives emerge are understandable, but continuing puzzles.

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<sup>i</sup> For more detailed information see our [website](#), [program resume](#), and [Havill \(2019\)](#).

<sup>ii</sup> We currently have 4 FTE lines, a visiting line, an associate director with teaching and administrative roles, and an interdisciplinary faculty director teaching in their home dept. Core DA faculty include a Data Ecologist, Operations researcher, Statistician, Computational Humanist, and Political Scientist. Colleagues from Math, CS, Economics, Philosophy, Biology, Physics, Anthropology/Sociology, Psychology, and English contribute to program governance and occasionally offering introductory and elective courses.

