# Computing Education Task Force

College of Literature, Science and Arts
Progress Report Summary
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Task Force members
Task Force charge
Progress report slides

Computing profoundly affects society, expanding new opportunities in scientific discovery and creation of new forms of human communication, while also perpetuating injustices. LSA is uniquely positioned to identify and shape how computing intersects with social and liberal needs, but it has thus far approached computing in unstructured, *ad hoc* ways. Providing systematic research support, teaching support, and infrastructure to support LSA's engagement with computing could position LSA as a national leader to shape the future of computing and society. Since October 2020, the Computing Education Task Force (CETF) has interacted with stakeholders on and off campus, as well as the Advisory team, in a set of coordinated efforts to learn where computing education takes place in LSA and what needs exist. These efforts include individual interviews, surveys of faculty and students, meetings with LSA Student Government, searches of course guide descriptions and course syllabi to surface the current state of computing education, and investigation of efforts by peer institutions.

Some LSA courses use computing in significant ways, but don't necessarily *teach* computing. Separately, there are short classes and workshops that provide technical training. These offerings are not well integrated into the undergraduate curriculum. Critically, there are insufficient courses to provide students with fundamental skills and knowledge to leverage technical skills to answer substantive questions in a particular field and to understand how the implementation of technology and policy impacts society. We need better educational pathways that integrate and coordinate opportunities, showing LSA students how to translate their computing education in an LSA context into career opportunities beyond college.

We have identified three themes in how LSA uses computing and where we see needs in computing education: **Computing for Discovery**, **Computing for Expression**, and **Computing for Justice** (or **Critical Computing**), defined on page 3. After conducting work to date, we present the Dean and executive committee with the following ***preliminary recommendations***:

1) **Convene a broad community charged with shaping computing education across all three themes**. LSA has a talented set of faculty whose research aligns with these themes. Harnessing this group to develop a community of practice for computing education *across all three themes* would benefit LSA students through the creation of new courses, new credentials, and new academic pathways. None of our peer institutions has created a comprehensive strategy across humanities, social sciences and natural sciences for providing computing education to its students who *use* computing but are *not* computing professionals.

This community might invite departments to reflect on and report on how the computing themes intersect with their curricula, identify needs, and brainstorm internal and collaborative solutions. LSA could charge an *ad hoc* committee to collaborate on identifying new course opportunities, especially foundational courses aimed at discovery and expression as well as team-taught "overlap" courses. Aligned with these efforts, new degree pathways and credentials, such as a digital studies major and CS+X or DS[1]+X degrees, should be developed with a goal of broadening participation of LSA undergraduates across all computing education themes.

2) **Establish coordinated pathways for students to develop credentialed skills and knowledge that they can leverage in their academic and professional career.** Existing courses do not prepare the majority of LSA students to *develop* and *apply* computing within a disciplinary context. The College should establish the means for undergraduates to engage the specific and computational skills they need for credentials in their field, including both traditional and short courses. Other courses could be incentivized to leverage these credentials, applying those skills to address questions germane to a particular research discipline. This training can provide a springboard into activities managed by the Opportunity Hub, such as internships and experiential opportunities involving data wrangling and analysis, visualization and modeling, creative storytelling, and other activities now common in the digital workforce.

3) **Create a persistent home for new computing education courses and pathways.** This broad approach to computing education in LSA risks dissolution if not established in a protective structure. To increase the capacity for computing education, LSA needs to develop faculty who can collaborate on developing and co-teaching computing in disciplinary contexts. To realize and nurture the opportunities of these recommendations, we recommend creation of a new program, tentatively termed *Program in Computing for Society and Science* (PiCSS) that would be the shared academic home of new foundational courses and degree programs.

4) **Create a new College-level academic position for leadership in Computing, Information and Data**. Computing cuts across academic divisions. Peer institutions are creating new organizational structures to support leveraging the possibilities of computing. Lack of these structures and leadership has led to failed efforts in peer institutions. Provisioning secure computational infrastructure and establishing policies for information access and data management are not just academic issues to be taught, but also practical issues that need to be solved, within the College.

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## **Appendix**: Definitions of Computing Education in LSA

[1] CS=Computer Science, DS=Data Science

# Definitions of Computing Education in LSA

**Computing for Discovery**: A central capability of computing is its unique ability to facilitate discovery. Computing encapsulates automation, the ability to define a process and repeat it many times. The power of computing for automation enables model building, data mining, computational statistics, numerical analysis, first-principles simulations, and machine learning/artificial intelligence applications to science, engineering and other disciplines. Increasingly, research discoveries are powered by advanced computing capabilities that allow manipulation and exploration of complex, often massive, data collections, the so-called fourth paradigm of science.

**Computing for Expression**: The computer has been called humanity's first meta-medium: the first medium that could be any other medium (text, photography, movies, etc.) and make it interactive. Computing can be used to communicate and engage with others in ways that we couldn't previously, which might include use and production of apps, virtual reality environments and games, social media, and the creation of new models that can be realized via simulation. Block chain technologies facilitate new forms of expression in production and rights management.

**Computing for Justice (**or **Critical Computing)**: Now pervasive in our everyday lives, computers have immense cultural, social, and political influence. It is therefore imperative to ask who is supported by computing, who is oppressed by it, and how these outcomes impact the human experience. We should ask whether inequities that are reinforced or magnified by computing technologies are a justified consequence, or signal a need for technological refusal, or if we can create alternative models of and infrastructures for computing that further welfare, justice, and equity.