SIGCSE Committee on Computing Education in Liberal Arts Colleges Feedback on the Beta Version of CS2023

Members of the SIGCSE Committee on Computing Education in Liberal Arts Colleges have been reviewing draft content for the ACM/IEEE-CS/AAAI CS2023 curriculum guidelines as part of their work in preparing a Curricular Practices Volume article about CS Education and the Liberal Arts Context. The following feedback is in response to the Beta Version of CS2023 and elements of its presentation at the SIGCSE Technical Symposium in March 2023.

The liberal arts computing education community appreciates the clear priority the Task Force has put on developing curriculum guidelines that are realistic for a broad range of programs. The presentation of the Beta Version at SIGCSE was very helpful in explaining the Task Force's vision for the CS Core and KA Core. We left that session enthusiastic that the Curricular Practices article we are drafting and its guidance for liberal arts programs can align nicely with the direction CS2023 is taking. The following feedback is not intended to criticize, but to suggest opportunities for refinement as the Task Force works on the Gamma version of CS2023.

Perhaps the most important thing that we heard at the SIGCSE Special Session is that the Steering Committee intends for the CS Core in CS2023 to be comparable in size to Core Tier 1 from CS2013. This was not evident to us from the csed.acm.org Web site, past presentations by the Steering Committee, or even the narrative from the recent Beta document. If that is indeed the intention for CS2023, it is clear that revisions and/or clarifications will be needed for the Gamma Version. The Beta Version lists a total of 279 CS Core hours, compared to 165 Core Tier 1 hours in CS2013. Certainly, some of that difference can be attributed to overlap across the KAs and the CS Core total could be reduced by identifying overlapping hours. However, reducing the total hours to something close to CS2013's 165 hours will no doubt require moving some topics from the CS Core into relevant KA Cores.

As the Task Force looks at overlap, we would like to note that this may dictate how curricula have to be structured in a way that may particularly impact liberal arts institutions. It seems likely that CS Core content that is identified as falling within more than one knowledge area would be content that should go in a prerequisite course. Our study of liberal arts curricula has shown that short prerequisite chains are prioritized for a variety of reasons such as supporting students who do not begin their studies planning a CS major or who wish to complete double majors (as elaborated on in our SIGCSE 2022 paper). For example, many programs try to find ways to avoid having a CS1/CS2/CS3 pipeline that all students complete before branching off into advanced or elective courses. If non-duplication of hours in the CS Core is achieved by lengthening the prerequisite chain in a curriculum, liberal arts programs will find themselves either having to sacrifice an important element of their curricular structures or to support flexible pathways through the curriculum by duplicating the overlapping content in various courses.

The Task Force's introduction of Competency Areas to direct how content is chosen from the KA Core is very interesting and we look forward to seeing these ideas further developed. The ability to identify a programmatic focus or identity and then select KA coverage based on that identity

is important to liberal arts institutions and central to the guidance we are developing for our Curricular Practices article. We hope that the identified Competency Areas of "Software", "Systems", and "Applications" will be presented as possible areas of focus, but not exclusively as the only areas of focus. We would like to see programs empowered to develop custom Competency Areas that align with the mission of their program and their students' needs. This would address the concern that the Task Force has with ensuring program "coherence" but without assuming there are a limited number of ways that a program can be coherent. Coherence can be breadth-based but it can also be achieved through programmatic focus.We note, for example, that a program focused on computing for social good might develop a Competency Area that blends the "Software" and "Applications" areas, whereas a program designed to connect CS and scientific computing might mix parts of "Software" and "Systems" as well as incorporating the AI knowledge area from "Applications". The flexibility to craft distinctive curricula with strengths and compelling narratives about how they support Institutional and departmental missions is a strength of Liberal Arts Computer Science programs. Programs' interest in developing these distinctive curricula is documented in our SIGCSE 2023 paper and the many examples in the Committee repository.

As the Task Force thinks about the final presentation of CS2023, both in a downloadable document and online, it may be helpful to have the ability to explore the curriculum through the Competency Model as well as through the Knowledge Model. We believe, based on your presentation, that this is the intent as reflected in Figure 3 of the Beta draft. This would facilitate curriculum and course design by allowing programs to first reflect on the competencies they wish to develop in their students and then to select KA content as required to support those competencies. This would assist programs in developing coherent curricula that respond to their institutional priorities and mission. Liberal arts programs often also choose to prioritize depth of understanding and ability to learn over broad content coverage. The success of our students in their careers and graduate study affirms the validity of this approach. These programs will more naturally want to view CS2023 through the filter of what deep skills they wish their students to develop and then select the content to be used to achieve those goals.

Something we hope the Task Force can work on is the way the priorities of smaller programs are being described. Again, we recognize the significant effort that is being made to solicit feedback from a variety of programs and to be particularly attentive to the needs of small programs. First, we'll note that not all liberal arts programs are small, and not all small programs follow a liberal arts philosophy. There is significant overlap. However, we are aware from our own work that these are not the same community. Second, most liberal arts programs that have few faculty or offer majors composed of fewer courses do not see this as a disadvantage or something to be compensated for. It seemed that in the presentation of the curriculum guidelines, the options for smaller programs were described as how to "do the best we can" if we cannot achieve the entire breadth of coverage of a larger institution. This is counter to the liberal arts philosophy which values a students' education across the curriculum equally with their academic major. We value small programs as a positive choice that provides students with a high quality education. Liberal arts programs engage in innovative curriculum design work to identify ways to efficiently provide a robust CS education, such as bundling content together in

unique ways. We ask that the Task Force avoid describing what small programs "cannot do" or suggest that CS2023 is designed to help us do the best we can with limited resources. We would like to see CS2023 be a tool for aiding our innovations, not compensating for imagined deficiencies.

Finally, we have a question about the timeline presented in the Beta draft. It indicates that a Gamma draft will come out in "late summer" that will incorporate revisions and have more information about the competency model. At SIGCSE we heard that the target for the Gamma Version is June/July. This difference in timeline has a significant impact on our plans since we do most of our collaboration and writing in the summer. Additionally, a date is not given for the planned release of the final report, but we believe the goal is still to have this complete by December 2023. The timeline indicates that the report will include both the curricular recommendations and also the curricular practices articles. We do not think that this timeline is realistic, at least for groups such as ours that are tailoring our curricular practices articles to the details of the CS2023 report. We are planning to have a revised and expanded version of our article completed by Fall 2023, but it is unclear if the Gamma version will come out early enough for us to incorporate it into our work. Additionally, we will need time to do final revisions based on changes between the Gamma version and the final document. Since the Curricular Practices articles will not be bundled in the same PDF as the curriculum recommendations, we ask that the timeline for release of these two elements of the report be separated. It would also be very helpful to get a more precise timeline for when the Gamma Version will be available.