

Curricular Affairs Committee of the Faculty Senate

To: The UVM Faculty Senate

From: Curricular Affairs Committee of the Faculty Senate, Laura Almstead, Chair

Date: March 7, 2019

Re: Approval of a proposal for a new Minor in Computer Science Education submitted the College of Education and Social Services

At its meeting on March 7, 2019, the Curricular Affairs Committee approved the actions recommended in the following memo.

The Curricular Affairs Committee approved a proposal for a new Minor in Computer Science Education from the Department of Education in the College of Education and Social Services (CESS). The proposed new minor was developed in collaboration with the Department of Computer Science in the College of Engineering and Mathematical Sciences (CEMS). If approved by the Faculty Senate and Board of Trustees, the minor will be offered beginning fall 2019.

Program Description, Rationale, and Justification

The proposed Minor in Computer Science Education (CSE) is designed for students interested in teaching computer science in schools and other settings. The curriculum reflects the important knowledge and skills that computer literate students and teachers will need in order to communicate and interact in today's technological world. All courses in the proposed minor align with the Vermont Agency of Education's (VT AOE's) endorsement standards for teaching computer science and will be offered either through the Department of Computer Science or the Department of Education. Each of the courses includes a focus on the increasing computational thinking and literacy needed in today's schools and/or communities. This focus will enhance the knowledge and experience of both Education majors who are preparing to teach computer science in grades 7-12 and non-Education majors who will work in professions that may require teaching about computational literacy. Upon completion of the proposed minor students will be able to:

- Plan and implement instruction that demonstrates knowledge of computer science principles and practices and allows secondary students to use computer science in problem-solving and decision-making situations.
- Keep current with the use of technology in education and issues related to legal and ethical use of technology resources.
- Design and implement activities which reinforce verbal and written technical communication skills central to computer science.
- Use the basic steps in algorithmic problem-solving to design solutions.
- Use effective management strategies for teaching computer science.
- Use appropriate instructional strategies for teaching computer science.

Of central significance is the collaboration between UVM's Computer Science and Education departments in program design and implementation. This alliance provides an opportunity for innovative programming, rich dialogue, and collaborative teaching and research between faculty in both departments. Additionally, it provides an opportunity for each department to update and expand its curriculum to ensure that all students who graduate with a CSE minor will have a deep understanding of computational thinking and its significance in transforming education, as well as practical and meaningful ways to integrate computer science into their teaching practice. The new CSE minor will build on the legislature's commitment to support programming to increase educational opportunities, particularly for those students who have traditionally been underserved in computer science education and careers. In addition, the creation of the new minor aligns with the state's demonstrated interest in promoting STEM education, a strategic goal of UVM, CESS, CEMS, the VT AOE, business leaders, and the state government.

Evidence for Demand

Computing represents two-thirds of projected new STEM jobs in the US, however less than 3% of college students earn a degree in computer science, and only 8% of STEM graduates major in Computer Science (https://csedweek.org/resource_kit/blurbs). Vermont's minimal adoption of computer science education standards places it in the bottom tier in the US with nine other states. The proposers indicated that only eight high schools in VT offer an Advanced Placement (AP) Computer Science Principles course and only 26 teachers (>1%) are licensed to teach computer science.

Relationship to Existing Programs and Anticipated Impact on Existing Programs

The proposed Computer Science Education minor is similar in content and title to the Computer Science minor. The Computer Science minor offered by CEMS is 18 credits with at least nine credits at the 100-level or above, and allows students to select from any CS course to fulfill these requirements. The proposed CSE minor includes 19 credits with five specified CS courses (two that are at the 100-level) and a course in teaching computer science in secondary schools (EDSC 237). Importantly, the curriculum of the proposed CSE minor is fully aligned with the VT AOE endorsement standards for licensure to teach computer science in Vermont. Students minoring in Computer Science will not be able to enroll in the proposed CSE minor.

Initially, the proposers anticipate a modest enrollment in the proposed minor primarily from students in the secondary education program. As part of the joint efforts by the Education and Computer Science departments, a new concentration in computer science in the Secondary Education major has also been developed. All Secondary Education majors must select a content area (30-57 credits). The proposed CSE minor has fewer computer science credits than the concentration, and thus might be more attractive to students looking to focus in another area, but still gain computer science education skills. The minor may also be of potential interest to other education majors (e.g. Elementary Education) as well students majoring in other areas. All of the existing courses in Computer Science will accommodate the anticipated enrollment in the CSE minor and additional Secondary Education majors that select the Computer Science concentration.

Curriculum

As noted above, completion of the proposed Minor in CSE will require five specifically identified computer science courses that are aligned to VT AOE endorsement standards for computer science licensure and EDSC 237 Teaching Computer Science in Secondary School, a new course developed for the minor. EDSC 237 will be in the catalog next year. The courses are detailed in the table on the following page.

Required Courses (19 credits total)		Credits
CS 008	Intro to Web Site Development	3
CS 021	Computer Programing	3
CS 087	Introduction to Data Science	3
CS 110	Intermediate Programming	4
CS 121	Computer Organization	3
EDSC 237*	Teaching Computer Science in Secondary School	3

*Prerequisite of EDSC 216. This course is taken by Secondary Education majors as part of the curriculum; students in other majors will need to take EDSC 216 prior to taking EDSC 237. Electives for the upper-level CS courses are embedded in the curriculum (e.g. CS 021 is the prerequisite for CS 110).

Majors that will not be eligible to enroll in the minor include Computer Science (BS or BA), Computer Science Information Systems, and Data Science. Teacher education students eligible for licensure in grades 7-12 that complete the minor will be eligible for endorsement in Computer Science Education.

Admission Requirements, Advising, and Assessment

With the exception of the majors indicated above and students in the Computer Science Minor, the proposed Minor in CSE will be open to all UVM undergraduates. A co-advisor model will be adopted whereby students will be assigned an advisor in the Computer Science Department and also an advisor in the Education Department. The proposers believe that this will ensure that students are effectively mentored through the content and pedagogical components of the minor.

The primary assessment will be focused on the culminating capstone project administered during the final course in the CSE minor (EDSC 237 Teaching Computer Science in Secondary School). The coordinator of the CSE minor will collect and analyze scores from the EDSC 237 capstone project to identify strengths, challenges, and emerging patterns that may indicate revision to the capstone project and possibly the minor's course sequence. Other assessments will include data collection on the number of students enrolling in the minor as well as their years of entry and completion. The coordinator will collect and analyze program data to assess overall program viability.

Resource Requirements

Given that five of the six courses for the proposed CSE minor are existing computer science courses, no changes in staff assignments are anticipated for computer science faculty. A faculty member in the Department of Education will need to be assigned to teach EDSC 237 as part of their load or an adjunct will need to be hired.

No new costs are anticipated for the first year. As previously discussed, all computer science courses are currently offered through the Computer Science Department. If there is a great demand for this minor, additional sections of the required courses may need to be added to accommodate the demand. It is anticipated that the first cohort of students enrolled in the minor will not enroll in EDSC 237 until Spring 2020 which will necessitate either a current faculty member teaching this course on load or hiring an adjunct. The cost of this new course could be offset by an enrollment of at least 10 students (in the CSE minor or concentration) enrolled in the methods course.

Evidence of Support

Letters of support were provided by Deans Linda Schadler (CEMS) and Scott Thomas (CESS), Chairs Christopher Skalka (CS) and Michael Giangreco (Department of Education), and Peter Drescher, State Director of Education Technology with the VT AOE.

Summary

There is a distinct disparity between computer science employment opportunities and the computer science learning opportunities available for students in Vermont. The proposed Minor in Computer Science Education along with the recently developed Computer Science concentration in the Secondary Education major are part of a joint initiative between CESS, CEMS, and the VT AOE to address deficiencies and gaps in the educational opportunities in computer science in Vermont. This collaboration leverages strengths in both the Department of Education and the Department of Computer Science to provide a valuable opportunity for UVM students. Students that complete the proposed minor will be well positioned to educate the next generation of computer science teachers (grades 7-12) in Vermont and across New England that will encourage and support diverse groups of students as they become computer science literate and consider computer science careers.