Program Policy Statement

Graduate Certificate in Computer Science Education

Part I. Program History

A. Statement of purpose.

The Graduate Certificate in Computer Science Education prepares teachers for integrating computational thinking across the curriculum and teaching computer science courses in order to address the critical shortage of qualified computer science educators. When the White House identified this as a national priority, The College Board responded by creating the AP Computer Science Principles, and the Computer Science Teachers Association (CSTA) revised its standards accordingly. The National Science Foundation (NSF) provided funding for creating curricula based on the new standards, and the maker movement provided creative ways for students to visualize and demonstrate what they are learning. By earning this Certificate, educators gain key computer science content knowledge and skills for teaching at the K-12 levels, becoming knowledgeable about the new standards, materials, and methods for teaching computer science and integrating computational thinking across the curriculum. Project-based assessment, hands-on workshops, and classroom-based activities immerse candidates in effective practices that could be applied in their local settings.

Although it is intended primarily for educational professionals (who are primarily part-time enrollees) wanting to teach computer science, this Graduate Certificate in Computer Science Education will be open to any graduate students wanting to add to their existing credentials.

B. Current Status.

This Graduate Certificate in Computer Science Education is undergoing the UD Faculty Senate's Academic Program Approval process in the Fall of 2019. If approved, the admissions process will commence in the Spring of 2020.

C. Credential Offered.

The School of Education (SOE) and the Department of Computer and Information Sciences (CIS) are jointly offering this Graduate Certificate in Computer Science Education, which comprises courses taught by SOE and CIS faculty, respectively. Although it can be earned as part of a master's degree, such as the M.Ed. in Educational Technology (EDTC) program, qualified candidates can earn the Graduate Certificate in Computer Science Education as a freestanding credential without necessarily being enrolled in a degree program. Upon earning the Certificate, the student's transcript will indicate that the Graduate College has awarded the Graduate Certificate in Computer Science Education.

Part II. Admission

A. Admission Requirements

Candidates apply for admission via the online application process at grad.udel.edu/apply. This process prompts applicants for the following information:

- First name, last name, phone, email.
- Current degree program (if any), expected completion date, current GPA.
- Academic transcripts of degrees earned previously.
- Brief statement explaining why the applicant seeks to earn this certificate and a discussion of previous experience with computer applications.
- Two letters of recommendation. The applicant provides names and email addresses of the recommenders, and recommendation forms are emailed directly to them from the online application. Instructions are included as to how to return the completed forms electronically.
- A resume or *curriculum vitae* that documents the applicant's prior work experience, publications, honors and awards received, and a summary of educational credentials including documentation of previous experience with computer applications.

B. Application Fee

A $75 application fee is due upon receipt of the online application.

C. Prior Degree Requirements

Candidates must hold a bachelor's degree in any academic field from an accredited college or university. Typically, our applicants have an undergraduate GPA of 2.8 or higher.

D. Transcripts

An unofficial transcript is required with your application. You should visit the Registrar's page of your home institution (post-high school institutions only) to print an unofficial copy to create your scan. If your home institution does not provide this service, ask for a student copy to create your scan. Do not mail official transcripts during the applicant stage.

Please visit http://grad.udel.edu/apply/transcripts/ for more detailed information.

E. Application Deadlines

Admission decisions are made on a rolling basis all throughout the year. Students may start in any academic term. Applicants must apply by November 1 for Spring or Winter admission, and by April 1 for Fall or Summer admission.

F. University Statement

Admission to the graduate program is competitive. Those who meet stated requirements are not guaranteed admission, nor are those who fail to meet all of those requirements necessarily precluded from admission if they offer other appropriate strengths.

Part III. Academic

A. Course Requirements

The Graduate Certificate in Computer Science Education requires satisfactory completion of the four (4) graduate level courses (12 credits) listed below. Each certificate program course must be completed with a grade no lower than a B-; the overall GPA of the Graduate Certificate in Computer Science Education courses must be no lower than 3.0.

All candidates must complete the following three-credit courses:

- EDUC 621: Internet Technologies (Computational Thinking on the Internet)
- EDUC 639: Teaching Computer Science (639 is a special topics course of which this will be the topic)
- CISC 605: Computer Science Principles

Candidates focusing on grades 9-12 must complete the following three-credit course:

- CISC 606: Foundations in Programming

Candidates focusing on grades K-8 must complete one of the following three-credit courses:

- CISC 606: Foundations in Programming
- EDUC 638: Learning Technologies Across the Curriculum
- EDUC 650: Technology and Cognition
- EDUC 611: Introduction to Educational Technology
- EDUC 777: Fostering Technology Based Collaboration
- EDUC 815: Design of Learning Environments

B. English Language Requirements

Courses in the Graduate Certificate in Computer Science Education are taught in the English language and participants must be proficient in English. In order to qualify for graduate study at the University of Delaware, applicants whose first language is not English must demonstrate English language proficiency by attaining a minimum TOEFL score of 100 (iBT), 600 (paper-based test) or 250 (computer-based test), or a minimum IELTS score of 7.0.

C. Scheduling

The following table shows when the courses will be offered. As this table illustrates, it is possible for candidates to earn the certificate within one calendar year.

Course Offering	**Academic Term**
CISC 605, Computer Science Principles	Fall
CISC 606, Foundations in Programming	Winter
EDUC 621, Internet Technologies	Spring
EDUC 639, Teaching Computer Science	Summer
EDUC 638, Learning Technologies	Fall
EDUC 650, Technology and Cognition	Spring (alternates with EDUC 815)
EDUC 611, Intro to Ed Tech	Fall
EDUC 777, Technology Based Collaboration	Spring
EDUC 815, Design of Learning Environments	Spring (alternates with EDUC 650)

Part IV. Assessment Plan

All courses in the Graduate Certificate in Computer Science Education will participate fully in the University of Delaware's course evaluation process. Faculty will meet and discuss both the quantitative and qualitative data collected when candidates complete the online course evaluation at the end of each academic term.

To help ensure 100% participation by candidates earning the certificate, each course will contain an assignment requiring students to complete their online course evaluation. This evaluation assignment will be count for 5% of the final course grade. The wording of the assignment is as follows:

> Your final assignment in this course is to evaluate it. During the last couple weeks of the course, you will receive email at your udel.edu email address instructing you when the evaluation period begins and ends. This email tells you when the course evaluation window is open. You must log on to the course evaluation system within this window of time. The Web address of the course evaluation system is www.udel.edu/course-evals. After you complete the course evaluation, your instructor will give you credit for completing it. The responses you give are completely anonymous. While your instructor will be able to see the ratings and comments, it is impossible for your instructor to

identify the person who gave a certain rating or made a given comment. Once you complete the evaluation, your grade on this assignment will be an automatic A.

In addition to reviewing course evaluations at the end of each academic term, the program's faculty will evaluate end-of-course projects over time and use quantitative and qualitative data to help determine what faculty can do in these courses to help students better perform.

Part V. Grade Requirements

To be considered in good academic standing, a student must maintain a minimum cumulative graduate grade point average (GPA) of 3.00 on a 4.00 scale each semester. To be eligible for the certificate, a student's cumulative grade point average shall be at least a 3.00 and the student's grades in courses counted toward the certificate program shall equal at least a 3.00. A grade below a B- will not be counted toward the certificate requirements but is calculated in the student's cumulative grade point average.

Performance in graduate courses and seminars is evaluated according to the University's Grading Policy. The Graduate College monitors the academic progress of all graduate students and notifies students in writing of all academic deficiencies. The cumulative GPA after each 9-hour increment determines academic standing. In addition to the University policy regarding minimum grade point averages, some departments require graduate students to maintain certain performance minima in their programs of study in all or in particular courses. Failure to meet the stated minima may lead to academic dismissal from the program.

If a graduate student fails to make satisfactory progress toward all degree requirements, permission may be denied to continue in the degree program. At the close of each semester, winter session or summer session, in those circumstances deemed appropriate by the department or program faculty exercising its professional judgment, the faculty of each department or program may evaluate the progress of a graduate student toward meeting the academic standards of the program in which the student is enrolled. In addition to graded course work, academic standards include, but are not limited to, professional, ethical, clinical and other standards required of graduate students. In the case of dismissal, the program director is required to send a report to the Graduate College that states the faculty vote on the decision causing dismissal and the justification for this action. The Graduate College will notify a student in writing when the student is being dismissed for failure to make satisfactory progress in the program and provide procedures for the student to appeal the action.

Part VI. Financial Aid

Because it is designed primarily for working adults who already have day jobs, the Certificate in Computer Science Education has no funding built in for offering financial support from the certificate program itself.

Part VII. Departmental Commitment and Expectations

This proposal results from collaboration between the School of Education and the Department of Computer and Information Sciences in order to address the critical shortage of computer science

educators. In 2016, President Obama addressed this shortage in his State of the Union address. When the White House made this a national priority, NSF provided funding to address it. Here at UD, Professors Pollock, Mouza, Atlas, Harvey, and Hofstetter participated in these NSF projects, among others.

Mouza and Pollock received a Unidel interdisciplinary grant to study and create this certificate. They encouraged the State of Delaware to follow the lead of other states in making computer science a requirement. In 2017, Governor John Carney signed into law Delaware House Bill 15, which mandates that all public high schools, including charter schools, must offer at least one computer science course at the high school level by the 2020-2021 school year. Further, in 2017 the Delaware Department of Education adopted computer science standards for grades K-12, making it necessary for teachers to implement pedagogical practices that integrate computer science across disciplinary content (e.g., in math, literacy, etc.).

By establishing this Graduate Certificate in Computer Science Education, the University of Delaware is creating our state's first pathway for Delaware teachers to be recognized as being formally prepared for teaching these courses. Delaware has 20 school districts and over 200 schools, all of which must demonstrate efforts to integrate computer science content.

Part VIII. Faculty Expertise

The following professors from the School of Education and the Department of Computer and Information Sciences constitute the faculty of the Graduate Certificate in Computer Science Education program:

Chrystalla Mouza, Distinguished Professor of Teacher Education and Director of the School of Education at the University of Delaware

Dr. Chrystalla Mouza's research focuses on the design and empirical study of pre-service and in-service teacher preparation experiences on the use of technology. Much of her work focuses on urban teachers and the ways in which they can use computing with disadvantaged students as a means to improve access to digital resources. Dr. Mouza is the recipient of the 2010 Distinguished Research in Teacher Education Award from the Association of Teacher Educators and serves as Chair of the AERA Special Interest Group for Technology as an Agent of Change in Teaching and Learning. Dr. Mouza served as co-PI of the NSF Partner4CS grant.

Lori Pollock, Alumni Distinguished Professor, Computer and Information Sciences, University of Delaware

Dr. Lori Pollock brings nationally recognized experience and commitment to the teaching of computer science, graduate student mentoring, and undergraduate research. In addition to working with graduate students, she has successfully engaged and mentored 52 undergraduates in individual research (28 female and 24 male students) for 22 years and was awarded the University of Delaware Excellence in Teaching Award in 2001 and ACM's SIGSOFT Influential Educator Award in 2016. Dr. Pollock served on the 2016 CSTA Task Force to revise the K-12

CS Standards. She mentors women in computer science through her leadership in CRA-W and the Grace Hopper Celebration of Women in Computing. She was PI on the NSF BPC grant, which created a CS service-learning model, and the NSF Partner4CS grant, which implements professional development for teachers each summer.

Terrence Harvey, Associate Professor (Teaching Track), Computer and Information Sciences, University of Delaware

Dr. Terry Harvey implements research-based teaching practices for CS at UD. He has been involved with broadening participation in CS for high schools and middle schools since 2009. He uses problem-based learning to address classroom issues for under-represented groups at the University of Delaware by adopting teaching strategies that minimize group performance differences. His Software Engineering classes work with real clients, developing projects to make the world a better place. He has worked with the graduate women's student group (CISters) and was instrumental in the group's development of outreach programs for undergraduates. He was awarded the University's Excellence in Teaching Award in 2009. He was co-PI on the NSF BPC grant, which created a CS service-learning model, and Dr. Harvey is co-PI on the NSF Partner4CS grant.

Austin Cory Bart, Assistant Professor, Computer and Information Sciences, University of Delaware

Dr. Cory Bart's goal is to create technical scaffolding that can support educational experiences for students and aid instructors. He has created and continues to create technological tools that are useful at levels from kindergarten to undergraduates. He is proficient both as a software developer and a curriculum developer. Through his experiences, Dr. Bart has come to recognize and appreciate the human element in teaching and learning, and how software can be used to support that process. Dr. Bart is involved in spearheading a number of computer science and digital education projects including the CORGIS project, BlockPy: A Dual Block/Text Python Coding Environment; Pedal: A Python Feedback Toolset; CT@VT: An introductory Computational Thinking curriculum for non-STEM majors with Data Science; PythonSneks: An open-source introductory Python curriculum for non-CS majors; and Curriculum Materials Packaging: A CSSPLICE-funded working group to standardize curriculum material packaging. He is participating faculty on the NSF Partner4CS grant.

Teomara Rutherford, Assistant Professor of Education, University of Delaware

Dr. Teomara Rutherford's research focuses on learning and motivation in digital contexts and around STEM. She examines the choices students and teachers make as they engage with learning technologies and the factors that lead students to choose to participate in STEM environments and careers. She serves as PI or Co-PI on four National Science Foundation grants focusing on student interactions with technology, most recently receiving an NSF CAREER award to examine students' in-the-moment motivations and emotions as they work within a digital mathematics learning tool.

Fred Hofstetter, Professor of Education, University of Delaware

Dr. Hofstetter coordinates the EDTC master's program in educational technology. He authored the GUIDO Ear-Training Lessons, the Atari Music Learning Series, Temporal Acuity Products' NoteBlaster note-reading game, the Random House book Making Music on Micros, the Prentice-Hall book Computer Literacy for Musicians, the Wadsworth book Multimedia Presentation Technology, and the McGraw-Hill books Multimedia Literacy, Advanced Web Design, and Internet Technologies at Work. Originally specializing in music, Dr. Hofstetter now supports projects across the curriculum and teaches general education courses in multimedia and Internet technologies. His latest book is Computational Thinking on the Internet, which grew out of his involvement as a CT Faculty Member in the NSF Project, Infusing Computational Thinking into General Education, directed by PI Lori Pollock and Co-PIs Chrystalla Mouza, Kevin Guidry, and Kathleen Pusecker. Dr. Hofstetter developed the Podium multimedia software and the Serf learning management system. His latest software is iSeeNcode, which is a classroom observation app developed under an IES grant with PI David Coker.

Part IX. Facilities

The Graduate Certificate in Computer Science Education program builds upon the strengths of University of Delaware by leveraging existing resources in the School of Education and the Department of Computer and Information Sciences. Do2Learn, the College of Education and Human Development (CEHD) maker space, is an area where students, faculty and staff create, educate, design, and learn about educational projects ranging from programming to 3D printing, stop-action video creation, gardening, and sewing with conductive thread.

The state-of-the-art UD MakerGym situated in Pearson Hall features equipment, tools, training and other resources for project-based instruction. It is a central hub for UD's Innovation, Design and Entrepreneurship Action (IDEA) Network. Cross-discipline collaborations are a hallmark of the new UD Maker Gym and Idea Network, which aims to spark student and faculty success by combining the emphasis on interdisciplinary cooperation with the innovation mindset that is studied, taught and put into practice by Horn Entrepreneurship. The Student Multimedia Design Center (SMDC) in the Morris Library provides state-of-the-art facilities for creating projects involving interactive media.