

Motion for New Program
Graduate Academic and Curriculum Committee
(To be submitted in paper and electronic form along with any addenda)

Title of Motion: Graduate Certificate in Teaching Computer Science 7 - 12

Submitted By: Director of the MS in Computer Education program with the approval of the members of the Department of Mathematics and Computer Science.

Date Submitted: April 11, 2011

It is moved that Fontbonne University, through the MS in Computer Education program within the Department of Mathematics and Computer Science, offer a Graduate Certificate in Teaching Computer Science: 7 - 12. (This will be an online certificate.)

Department: Mathematics and Computer Science

Type of Program:

- Major
- Minor
- Concentration
- Certificate**

Proposed Date of Implementation: Pending funding. Preferred date is fall 2012.

Estimated Enrollment: 10 per semester (fall and spring) – along with estimated enrollment in similar certificate: K – 8. The newly-proposed courses could be taken by current and future students earning the MS in computer education degree provided the prerequisites are met.

Financial Impact (describe and list amount): For financial impact please see additional comments

- Faculty -
- New Library Holdings
- Equipment
- Audio-visual / software

Effect on currently enrolled students (if any): None, some may choose to earn the certificate while earning the full degree. The newly-proposed courses could be taken by current students earning the MS in computer education degree provided the prerequisites are met.

Rationale:

In an era when technology permeates so many aspects of daily life in America the country is facing a critical shortage of computer scientists.

The need to improve science, technology, engineering and mathematics (STEM) education in the United States is a well documented issue. Additionally, recent reports state that the U.S. is facing a severe shortage of computer security specialists and engineers with the skills necessary to meet the country's cyber security needs. The once alluring field of computer science faced a 43% drop in enrollment between 2003 and 2006 according to the Computer Research Association headquartered in Washington, D.C. While recent reports released by the Association

indicate that students choosing to major in computer science have begun to rise since the economic crisis and fall of Wall Street, the overall graduating class of 2008 was the smallest graduating computer science class in 10 years.

One theory suggests that the declining interest in the field can be traced to the lack of exposure to computer science at an early age. The opportunity to explore computer science and technology driven fields does not exist for many U.S. students in middle and high school classrooms—a time when students are actively seeking answers to the question, “What do you want to be when you grow up?” National surveys in 2005 and 2007 asked students directly why they do not enroll for computer science courses in high school. Student responses indicated a conflict between elective computer science courses and mandatory core courses as well as limited availability of computer science courses. Additionally, the surveys showed that when multiple computer science classes are offered, there is a significant drop in the numbers of students electing to take a second computer science course. Researchers hypothesize that the first computer science class high school students take fails to spark an interest in this subject. (Gal-Ezer and Stephenson, 2009)

In these same surveys, when asked to identify the challenges they believed made teaching computer science difficult, teachers highlighted access to relevant ongoing professional development. No clear and consistent criteria for computer science teacher certification exists in the United States and frequently teachers must be certified to teach another discipline before being allowed to teach computer science. Computer science programs in high schools are often under-funded and the distinction between true computer science and technology literacy tends to be blurred. (Simard et al., 2010)

Fontbonne University is prepared to help meet this challenge. We know that K–12 students learn about computer science because they have teachers who can teach them. By taking existing K–12 teachers, who know pedagogy, and teaching them computer science, we will be empowering teachers to incorporate and introduce computer science to students in their classrooms. Making computer science accessible across grade levels will generate interest in the subject from a wider pool of students, while also developing logical thinking and problem solving skills in all students.

Fontbonne University proposes a certificate program for K–8 (and 7 -12) teachers in computer science education. Housed in the Mathematics and Computer Science Department, courses will cover a range of programming languages and also include methodologies of teaching computer science. Designed as an online graduate certificate program, Fontbonne’s program will be accessible to any interested K–8 (or 7-12) teacher. Additionally, the instructor pool for Fontbonne’s certificate program is extensive—as with the potential student pool, instructors and students are not bound by location. With a history of strong online education programs, Fontbonne is able to professionally develop any instructor and show that person how to teach online.

In a recent online survey to 2000 educators, 70 of whom completed a short survey, the following results were obtained.

- 84.1% said that having a solid foundational knowledge of computer science relevant to the grades they teach was important to them.
- 72.9% said they would be willing to take computer science courses in an online format
- 87% said they would be willing to pursue a certificate in teaching computer science provided the tuition was paid.

The Graduate Certificate in Teaching Computer Science Program would be an innovative and futuristic addition for any university with high quality and effective teaching at the heart of its mission. There is a good fit between the proposed certificate and Fontbonne University's mission statement. Fontbonne's mission states, among other things, that it will educate students to think critically and to assume responsibility as citizens and leaders. While it is true that not all students need to become computer scientists, it is true that all students need to understand and function in an increasingly technological world. Students in the K-12 environment will gain the knowledge they need only if their teachers have that knowledge to impart. This certificate would ensure that teachers are prepared to teach the concepts and skills of computer science to their students. A major emphasis of computer science is critical thinking. Practice in thinking critically transfers to other disciplines and to the "real world." The proposed certificate would not only help prepare teachers and their students to be citizens and leaders, it would prepare them to be "digital citizens", those who can function in the digital world in which we now live.

Relation to mission, vision and strategic plan:

Recognized by the Higher Learning Commission as a university with strong online programs, the development of a certificate program aligns with tactics II.2 and II.4 of the university's long-range strategic plan.

Fontbonne University Tactic II.2.e:

- II. We will make academic excellence our priority.
- 2. Increase the visibility and academic reputation of Fontbonne University, particularly among prospective students, among institutions of higher education and in the St. Louis community and beyond.
- e. Retain existing partnerships with external agencies...and encourage the development of additional partnerships which support academic excellence.

Fontbonne University Tactic II.4.a:

- II. We will make academic excellence our priority.
- 4. Strengthen and support existing programs and explore the feasibility of new programs that will assist in enrollment growth.
- a. Develop new, innovative and modified programs in traditional, non-traditional, hybrid and online venues.

Fontbonne University Tactic II.4.b:

- II. We will make academic excellence our priority.
- 4. Strengthen and support existing programs and explore the feasibility of new programs that will assist in enrollment growth.
- b. Examine under-enrolled majors to determine how to increase their enrollment by changing marketing strategies, by revising programs or, if necessary, make a determination to discontinue the major.

Fontbonne University Tactic II.4.f:

- II. We will make academic excellence our priority
- 4. Strengthen and support existing programs and explore the feasibility of new programs that will assist in enrollment growth.
- f. Expand the marketing and enrollment efforts for traditional graduate programs.

Does the proposed program replace an existing one? NO (If so, state which program and the rationale for the replacement.)

Course Listing

List all courses required for the program, including those from departments outside the program, by course number and title. Include credit hours for each course.

Required courses	Course title	Credit hours	comments
CED 511	Foundations of Computer Science for Teachers	3	<u>New course</u> – needs to be designed, if approved.
CED 565	The Internet and Education	3	Course exists and is designed for online.
CED 560	The Fundamentals of Programming	3	Course exists and has been designed for online.
CED 540	Programming with C ++	3	Courses exists - needs to be designed for online.
CED 547	Artificial Intelligence and Robotics	3	<u>New course</u> – needs to be designed, if approved.
CED 571	Topics in Computer Science	3	Course exists –_needs to be designed, if approved.
CED 549	Programming in Java	3	<u>New course</u> – needs to be designed for online.
Or	Or		Or
CED 572	Web Programming	3	<u>New course</u> – needs to be designed for online, if approved.

Expected outcomes

Upon earning the certificate students will be able to

- Demonstrate an understanding of the role computer science plays and its impact in the modern world. This will entail
 - Understanding of the social, ethical and legal issues and impacts of computing and attendant responsibilities of computer scientists and users.
 - Knowledge of the contributions of computer science to current and future innovations in the sciences, humanities, the arts and commerce.
- Demonstrate knowledge of digital devices, systems and networks. This will entail
 - Knowledge of data representation and organization.
 - Knowledge of operating systems and networking.
- Write and document computer programs for intended purposes.
- Demonstrate design skills, along with creativity, systematic reasoning and collaborative work skills while writing computer programs.
- Demonstrate knowledge of data representation and abstraction. This will entail
 - Understanding and use of static and dynamic data structures.
 - Understanding and use of primitive data types.
- Demonstrate effective content pedagogical strategies that make the discipline of computer science comprehensible to students 7-12.
- Apply knowledge of learning environments by creating and maintaining safe, ethical, supportive, fair and effective learning environments for students 7-12.

- Design environments that promote effective teaching and learning in computer science classrooms and in online learning environments.
- Promote digital citizenship.
- Demonstrate knowledge of and proficiency in data representation and abstraction. In particular, students will know how to:
 - Effectively use data types
 - Demonstrate an understanding of static and dynamic data structures
 - Effectively use modeling and simulation to solve real-world problems
- Effectively design, develop and test algorithms. In particular students will be able to
 - Analyze algorithms by considering complexity, efficiency, aesthetics and correctness
 - Demonstrate knowledge of two or more programming paradigms
 - Design and test algorithms and programming solutions to problems in several contexts (textual, numeric, graphic, etc) using advanced data structures (e.g., linked lists, queues, stacks, trees, graphs)
- Foster innovation in their students.
- Introduce their students to the joys of being creative.
- Think logically and demonstrate algorithmic thinking.
- Use the problem-solving process that begins with a clear and unambiguous statement of a problem through to the implementation and evaluation of its solution.

Additional information:

State any additional information not covered above that would be helpful to the committee in making its decision.

If approved, distribute to the following:

- Catalog (Associate Academic Dean)
- Registrar
- Fontbonne Policy Manual Volume I
- Advisors' Manual
- Student Handbook
- Part-time Faculty Manual
- Staff Handbook
- Other: