

Section 2: Program Summary

COMPUTER SCIENCE (NR): SECONDARY MAJOR AND MINOR

The University Detroit Mercy (UDM), a Catholic institution whose mission flows from the educational traditions of the Sisters of Mercy of the Americas and the Society of Jesus, exists to provide excellent student-centered undergraduate and graduate education in an urban context. A UDM education seeks to integrate the intellectual, spiritual, ethical, and social development of students. It emphasizes the worth of the individual. Further, the University expects its diverse graduates to be distinguished world citizens, community members, and leaders who:

- Reflect on the meaning of their lives.
 - Think and communicate clearly, imaginatively, and effectively.
 - Process the skills and competencies of a college education.
 - Understand diverse cultural heritages.
 - Have a sense of social responsibility and a desire to serve society.
- (2003-2005 Undergraduate Catalog, 89-91)*

UDM's Core Curriculum consists of a set of requirements (48 hours) based on six objectives that express, in further detail, this academic purpose. The list of approved core courses is published in the *Schedule of Classes* issued for each term. Education students taking their majors and minors in the College of Engineering and Science (CES) must complete the same Core Curriculum as all UDM students with specific recommendations from Core options in Objectives 1, 2, 3, 5 and 6; Objective 4 remains the same as the general core outline requirements. The specific CES recommendations are:

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| Objective 1 | Communication Skills—Take CST 101 Fundamentals of Speech and ENL 131 Academic Writing. |
| Objective 2 | Mathematical and Computer Skills—Take MTH 140 (or MTH 141/142 depending on the program) and Computer Science (Required course depends on program). |
| Objective 3 | Scientific Literacy—At least two courses must be in Natural Science. In some programs, all courses may be selected from Natural Science. |
| Objective 5 | Diverse Human Experience—Two courses from 5A (History and Religious Studies), 5B (Literary Experiences), and 5C (Aesthetic Experiences). Take one course from 5D (Comparative Experiences). |
| Objective 6 | Social Responsibility—Education students choose one course from any of the Ethics courses.)
Contemporary Socio-Political Problems—(Education students choose one course from the general core outline—depending on the program.) |

The Computer Science Major and Minor content courses for Secondary Teacher Education are offered by the Mathematics and Computer Science Department in the CES. The Secondary candidates complete their degree in the College of Engineering

and Science and are advised regarding their major by the Computer Science Department and by the Education Department regarding certification requirements.

The Department of Education, housed in the College of Liberal Arts and Education (CLAE), offers baccalaureate, post-degree, and master's degree teacher education programs with State of Michigan certification in three areas: Elementary Education, Secondary Education, and Special Education. Each program requires the completion of coursework in three areas:

- University core curriculum.
- A teaching major and minor in approved academic areas.
- Professional education, including student teaching.

In addition to these programs, UDM Education Department delivers the same graduate and postgraduate certification programs to cohorts of K-12 Detroit Archdiocese teacher candidates through Experience Plus. All programs may be completed on a full or part-time basis either during the day, late afternoon, evening, or weekend. UDM majors and minors in Elementary, Special Education, and/or secondary education are completed in the following colleges and appropriate departments:

- College of Business Administration
- College of Engineering & Science (Includes Mathematics) and
- College of Health Professions
- College of Liberal Arts

The Department of Education, therefore, works closely with the faculty members throughout the University to ensure that each student is effectively advised and assisted to complete her/his Education program with a quality major and/or minor.

UDM offers initial teacher certification in Computer Science (NR) for students who wish to teach in secondary (Grades 7-12) schools. The programs are available at both the undergraduate and graduate levels. Undergraduates obtain a major or a minor in Computer Science and prepare for a Computer Science (NR) endorsement. At the graduate level, students earn a major or prepare for an additional endorsement. The content of the graduate and undergraduate courses is the same. The secondary Computer Science major is a program of 30 required hours, which is completed in the College of Engineering and Science. The Computer Science minor is a program of 21 required credit hours. MTH 141 Analytic Geometry and Calculus I or the instructor's permission is a co-requisite for CSC 171 Introduction to Computer Science, which is the prerequisite for CSC 172 Introduction to Computer Science II. CSC 172, CSC 345 Software Construction or CSC 441 Object-Oriented Programming, and CSC 449 Operating System are required courses for the Computer Science program for Education candidates and also are prerequisites for the other required courses (CSC 271, CSC 413, CSC 417, CSC 443, CSC 354, and CSC 449). In addition, MTH 372 Differential Equations with Linear Algebra and MTH 402 Linear Algebra with Applications are recommended courses for CSC 445. Computer Science majors, therefore, could potentially complete 34 required hours and a minor 25, if they did not gain the instructor's permission for CSC 171 and took MTH 141 as a co-requisite. Computer Science professors/advisors often recommend that students take additional Computer

Science classes as electives to develop and/or enhance the necessary conceptual understanding and skills; but the students individually make their choices.

A. PHILOSOPHY, RATIONALE, AND OBJECTIVES

Philosophy: The Computer Science faculty members, housed in the Department of Mathematics and Computer Science in CES, and the Education Department faculty in CLAE work together to prepare teacher education candidates for the Computer Science secondary teacher certification. The philosophies of these two departments are complementary and have a common thread: the blending of theory and practice in innovative ways so that the student has multiple opportunities at the University to apply developing knowledge and skills. With the University's mission to work for social justice as a foundation, the departments collaborate to create educators who will serve not only their students, but their profession and society as well. The program is guided by the Michigan State Board of Education's and the Michigan Department of Education's standards, guidelines, policies, and tests as well as the national technology associations, such as the International Society of Technology and Education (ISTE).

Both departments believe that theory and scholarly research need to be placed in the proper historical, social, and political context. They seek to integrate laboratory and field experience into the learning process so that students not only learn about their discipline but also construct knowledge in a real and tangible manner. Students, thus, have the advantage of developing a knowledge and skill base which empowers them to be active, positive contributors to the local, national and global societies. In order to teach students from diverse backgrounds, socio-economic status, and abilities in urban, suburban, and rural settings, UDM Education and Computer Science faculty believe that a strong pedagogy program must be a full partner with academic knowledge.

Rationale: The role of mathematics, science, and technology in today's complex and highly technological society is considered a critical determinant to our future as a global community. According to the National Research Council, "Undergraduate education in science, mathematics, engineering and technology is a critical determinant of our national future." (*Undergraduate Catalog*, 26) Michigan business and government leaders also recognize the importance of computer literacy for all citizens and workers to the economic future of the state. Given this critical importance of computer science in contemporary society, the preparation of teachers in computer literacy and science is driven by the same goal as is the preparation of other professionals at UDM: to prepare "productive entrepreneurs in a global society as engineers, scientists, mathematicians, physicians, dentists, and educators." (*Undergraduate Catalog*, 26) The need for competent teachers, especially in the area of computer science is well known, and this need is particularly pressing in schools in the inner-urban areas. The education of prospective computer science teachers at UDM is, therefore, viewed as a potential contribution to the improvement of urban education, and to education of urban students. To this end, the faculty not only provide content-related knowledge and

skills to students who wish to become teachers, but also guide them in applying the content and teaching strategies they have learned to their own teaching.

Objectives: The general objectives for the preparation of all secondary teacher education candidates, including those with secondary Computer Science Majors and Minors, are delineated in the “Education Department’s Conceptual Framework,” which is published annually along with the “Education Department’s Code of Ethics” in its *Teacher Education Handbook*. This “Framework,” which complements the Michigan Department of Education’s Standards for the Secondary Computer Science programs and the Entry-Level Standards for Michigan Teachers (ELSMT), identifies three dimensions of the role of teacher:

- A *scholar* who uses the research-knowledge base for teaching integrated with the liberal arts and sciences disciplines.
- An *inquirer* who is skilled in decision-making based on ethical, critical, and reflective thinking.
- A *moral agent* who values and acts according to the UDM values and the “Department of Education Professional Code of Ethics.”

These general objectives, in addition to complementing the University mission and the Mathematics and Computer Science department’s philosophy, reflect the key ideas expressed by the Michigan State Board of Education-January 2002 Content Guidelines/Standards (SBE Standards) and the “*Michigan Curriculum Framework Content Standards for Computer Science*”). Additionally, they are aligned with the Michigan Test for Teacher Certification (MTTC).

These content categories have been reviewed by the Computer Science and Education faculty, who believe that the Computer Science program of studies effectively prepares candidates for certification as teachers of Computer Science in the secondary classroom as follows:

TEST OBJECTIVES

Sub area	Approximate Percentage Of Questions on Test
Educational Computing and Technology Literacy	22%
Computer Systems, Data, and Algorithms	21%
Program Design and Verification	19%
Programming Language Concepts	19%
Professional Preparation	19%

Educational Computing and Technology Literacy

- _ Understand basic computer technology operations and concepts.
- _ Understand the selection, installation, management, and maintenance of computer/technology systems and software.
- _ Understand the use of educational and productivity software.
- _ Understand the use of telecommunications and information access resources.
- _ Understand the use of computers and other technologies in research, education, problem solving, and product development.

Computer Systems, Data, and Algorithms

- _ Understand basic characteristics of computer architecture.
- _ Understand characteristics and functions of operating systems.
- _ Understand types and characteristics of computer networks.
- _ Understand types and characteristics of data structures.
- _ Understand characteristics and uses of algorithms.

Program Design and Verification

- _ Apply principles and procedures for designing and preparing a program.
- _ Apply program development and implementation procedures.
- _ Apply program verification principles and procedures.
- _ Apply documentation and communication principles to software development.

Programming Language Concepts

- _ Understand types and characteristics of programming languages.
- _ Understand the characteristics and application of data types and declarations in high-level languages.
- _ Understand types and characteristics of statements, operators, and control structures in high-level languages.
- _ Understand the characteristics and use of program modularization in high-level languages.

Professional Preparation

- _ Understand appropriate materials, methods, resources, and curricula for teaching computer science.
- _ Apply practices that reflect the roles and responsibilities of computer science teachers.
- _ Apply classroom and instructional management methodologies for teaching computer science teachers.
- _ Understand societal issues in computer science.

B. SEQUENCE OF COURSES AND/OR EXPERIENCES

UDM's College of Liberal Arts and Education offers baccalaureate, post-degree, and master's degree teacher education programs with State of Michigan certification in three areas: Elementary Education, Secondary Education, and Special Education. Each program requires the completion of coursework in these areas:

- University core curriculum.
- A teaching major and a teaching minor in approved academic subject areas.
- Professional education, including field experiences and student teaching.

The UDM 48 Hour Core Curriculum is explained in the *2003-2005 Undergraduate Catalog* (89-91) and is published, with a list of approved courses for each of the six objectives, in the *Class Schedule* for each of the three terms (16-18 Term I 2003-2005). Education students are encouraged to select courses that will complement their certification as well as their major and minor areas of study. For example: Computer Science students would be encouraged to select courses in the Math, Science, Social Studies, Literature, and the Fine Arts that would complement their Computer Science major or minor as well as any other area of study they may be pursuing. Those objective areas are:

1. Communication Skills (6 hours; 2 courses—Speech and Academic Writing).
 2. Mathematical and Computer Skills (6 hours—choices in Mathematics and Computer).
 3. Scientific Literacy (9 hours—choices from the Social Sciences and Natural Sciences).
 4. Meaning and Value (9 hours—choices from Philosophy, Religious Studies).
 5. Diverse Human Experience (12 hours—choices from Historical, Literary, Aesthetic, Comparative Experiences and Languages).
 6. Social Responsibility (6 hours—choices from Ethics and Contemporary Social Problems, ranging from Philosophy, Health Services, Religious Studies across Social and Natural Sciences, Criminal Justice, Communication, Women’s Studies.)
1. The sequence of courses listed in Form XX for the Computer Science majors and minors provides a systematic study of the fundamental knowledge of computer science and its methods of reasoning and inquiry. A foundation is thereby established for students’ future pursuits, including a career in secondary education. The UDM Computer Science program for educators prepares teacher candidates to teach the computer-related courses that are offered in secondary schools. Secondary students currently can take courses relating to computer applications and programming. In the area of applications, students might take a one-or two-semester course that focuses on commonly used applications such as word processing, spreadsheets, databases, or Website creation. In the area of programming, students can take (depending on the size and offerings of the school) semester courses in various languages: Java, HTML, and C++. In terms of Website development, secondary students can have classes in FLASH, HTML, and other design programs. Some larger high schools also offer Advanced Placement Computer Science (C++) and courses in television production, which integrate computer/technology with the productions. Middle/junior

high schools and high schools also have computer laboratories located in a central space such as a library or media center as well as specialized computer laboratories located in the academic areas such as business, vocational education, mathematics, sciences, humanities, and the arts. A Computer Science educator may well be expected to collaborate in the creation and maintenance of such laboratories as well as to help colleagues troubleshoot problems with their individual and classroom computers and related technology equipment.

After Secondary Education majors and minors have gained the instructor's permission or passed MTH 141, which is a co-requisite for the CSC 171 Introduction to Computer Science, the initial course for Education Majors and Minors, the candidates take CSC 172 Introduction to Computer Science II. Usually CSC 271 Assembly Language is the next course for majors. CSC 345 Software Construction or CSC 441 Object-Oriented Programming are prerequisites for CSC 413 JAVA, CSC 354 Database Systems and Programming, CSC 443 Data Structures, CSC 445 Numerical Analysis, and CSC 449 Operating Systems, CSC 345 is the next course taken. The five other courses may be taken in whatever order the candidates decide as long as the pre-requisites are met. CSC 417 Unix Systems Programming also requires CSC 449 be taken previously, which controls the sequence to some degree. CSC 469 Seminar in Computer Science should be taken in their final year of study. With the approval of the instructor, students prepare and present paper (s) related to their primary area of interest. In the case of secondary education candidates, that would be in education. The secondary education minors in Computer Science are not required to take CSC 271, 354, and 469; but if they wish to take them as electives, they may.

Based on changes in the Computer Science major for non-educators, the Computer Science and Education faculty are currently reviewing the program. Consideration is being given to adding ENL 303 Technical Writing as well as a proposed CSC course in ethics and another in software engineering and/or project management. The state's panel review of the Computer Science program will be used during that decision making process.

C. VARIED INSTRUCTIONAL APPROACHES

The Computer Science faculty and the Education faculty prepare students to utilize a variety of instructional approaches by modeling creative, logical, and effective teaching practices in their classes. A review of the Computer Science course syllabi reveals the range of teaching methods used by that faculty to instill the skills and knowledge of the discipline: textbooks and other readings; homework exercises; lectures; discussions, including questioning and inquiring; computer programming projects; written papers—reflective and documented; oral presentations; use of other electronic tools, web sites; quizzes; and examinations.

A review of the Education Syllabi on the UDM WEB reveals a similar range of teaching methods practiced by the Education faculty. Educators also include group/team/collaborative activities, building a community of learners, both non-fiction and fiction analysis, field observations and research, written and oral presentations enhanced with electronic equipment/programs, and other education projects and assessment tools. A review of the Education Courses listed in Form XXX, the “Course Descriptions,” and the course syllabi on the WEB link explicates the wide range of instructional methods taught to Secondary and Special Education teacher candidates. EDU 401/402 Introduction to Elementary and Secondary Education I provides a semester long initial field experience with the “Field Research/Case Study” where students observe and work with a teacher in their major and/or minor areas. This project allows them to observe a variety of instructional strategies and to reflect upon their effectiveness and appropriateness for their developing teaching style. EDU 469 Curriculum and Methods of Teaching in Secondary Schools I involves students in a variety of web based, observation, and performance based activities as students learn the basics about curriculum, unit, and lesson design. In EDU 471 Curriculum and Methods of Teaching in Secondary Schools II: Mathematics and Computer Science, students enhance their skills and instructional strategies for teaching mathematics to grades 7-12 students. When computer Science majors are in the course, the objectives and projects are expanded to meet the special requirements for Computer Science. Peer reviews of each other’s presentation are written in class the days of the presentations and submitted for assessment. EDU 448 Reading in the Content Areas also provides the opportunity for candidates to develop strategies for teaching literacy and study skills for various content areas. This class especially develops the computer science candidates’ abilities to communicate technology concepts and skills to other subject area specialists. In addition to a variety of technology methods used and demonstrated in all the Education courses, EDU 459 Instructional Technology and EDU 600 Computer Use in Education teach a variety of instructional approaches for using many kinds of technology to assess various learning styles of students and to accommodate those learning styles. These courses also develop the candidates’ knowledge, skills, and attitudes for applying technology in education settings. As the candidates develop their assignments, the Computer Science candidates focus on computer and other technology concepts and skills. One project has candidates from different areas developing cross-disciplinary materials. These courses were developed to address the Seventh Standard of the Entry Level Standards for Michigan teachers. SED 460 Education and Mainstreaming of Exceptional Persons or SED 560 Exceptional Persons provides candidates with knowledge about principles of mainstreaming and the instructional methodologies and approaches to meet the needs of the various exceptionalities within the “least restrictive environment” and/or the general classroom setting through the use of computers and adaptive technological equipment. Student teaching, EDU 490 Teaching in the Secondary Schools as well as SED 474 Student Teaching in Special Education: Learning Disabilities and SED 484 Directed Student Teaching in Special Education: Emotionally Impaired/Behaviorally Disordered, provide grades 7-12 real teaching experiences with both grade 7-12 cooperating teachers and UDM college

supervisors. Observations early in those courses and eight seminars complement their experiences and encourage self reflection and feedback about their instructional methods in collaboration with grade 7-12 Co-operating Teachers and UDM College Supervisors.

D. ELEMENTARY AND SECONDARY LEVEL PREPARATION DIFFERENCES

The curriculum for the Computer Science content area provides candidates with the fundamental knowledge and skills for teaching at secondary levels and is only available to those education candidates who wish to teach Computer Science in a middle or high school.

E. GENDER EQUITY, MULTI-CULTURAL, AND GLOBAL PERSPECTIVES

Computer Science majors and minors learn to incorporate issues of gender equity, multicultural and global perspectives within their University Core Curriculum courses. Objective IV- Meaning and Value (9 hours), Objective V-Diverse Human Experience (9 hours) and Objective VI-Social Responsibility (5-6 hours) require all students to select classes from Philosophy, Religious Studies, History, English, Human Services, and/or the Fine Arts. Computer Science instructors make deliberate efforts to recruit female and minority candidates for the program and their action is supported at the administrative level. Instructors in the courses of the Computer Science programs take care to provide a comfortable learning environment for those whose voices have traditionally been stifled in the physical sciences and mathematics. The College's success is documented by the National Science Foundation's recognition that the College of Engineering and Science has a highly favorable rate for admission and graduation of women. The College was sought out for recipients of Clare Boothe Luce Scholarships in Physical Sciences and Engineering; it will have two Luce Scholars in programs beginning in fall 2005. The CES supports the development of multicultural and global perspectives with cooperative education opportunities in Mexico and Canada. The Education Courses continue the infusion of equity issues throughout the program.

E. MULTIPLE METHODS OF STUDENT ASSESSMENT

Computer Science majors and minors learn a variety of assessment tools from personal experience in every Computer Science course; which are then adaptable to their own teaching. All Computer Science courses rely on regular quizzes and examinations to assess the students' knowledge. Homework, paper and electronic worksheets, class participation—especially questioning, and formal presentations, computer programming projects, and short papers are regularly evaluated according to specific criteria and included as part of the final grade for the course. The introductory courses, CSC 171 and 172, provide a foundation for self, peer, and the instructor's assessment of computer projects completed in the laboratories which harbinger for the students similar assessments in the subsequent computer science courses.

The Education courses continue to model and to teach a variety of assessment processes, including authentic models and/or other alternative assessments

procedures. In methods EDU 459 and 600 (Education and Technology) assignments must include assessments appropriate to the lesson's or unit's objectives and the specific content being taught. Students become familiar with a variety of electronic assessment tools and practices. EDU 469 Curriculum and Methods of Teaching in Secondary Schools I provides the students with an introduction to secondary curriculum and instructional methods plus a variety of ways to assess, evaluate, and report student progress. EDU 471 Curriculum and Methods of Teaching in Secondary Schools II: Mathematics (The course is enhanced when Computer Science candidates are enrolled to complement the requirements for Computer Science program.) involves candidates in designing computer science units and lessons that have well-articulated outcomes, appropriate instructional strategies, and relevant assessments. Students demonstrate their acquisition of assessment skills through written and oral presentations. They constantly practice assessment methods as they evaluate each other's presentations in the course. The evaluation forms (Located in the appendices of the *Student Teaching Handbook* on the Website) used by the grade 7-12 Co-operating Teachers and the University Supervisors in Student Teaching (490 General Education) and 474 and 478 (Special Education) include evaluation of the assessment practices used by the student teachers to evaluate the performances of their grade 7-12 students.