

***ED5507 Introduction to Methods and Strategies for Teaching Computer Science to K-12 Students***

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**By appointment**

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**Asynchronous Course**  
**EDU 5507**

**COURSE DESCRIPTION**

This course is designed to provide teachers and teacher candidates with an introduction to the history, context, methods, and strategies for teaching Computer Science (CS) and Computational Thinking (CT) with students in grades K-12. Through the work of this course, teachers and teacher candidates will engage deeply in the core CS principles (Algorithms and programming, Computing systems, Data and analysis, Impacts of computing, and Networks and the internet) and will learn to design learning environments and learning experiences that promote deep understanding of these principles in their students. The focus in this course is in developing learning experiences for novice CS learners at all age levels.

**RECOMMENDED TEXT(S)**

Bull, G., Garofalo, J., & Nguyen, N. R. (2019). An Introduction to Computational Thinking Through Art, Music, and Games. Society for Information Technology & Teacher Education.

Lynch, T., Ardito, G., Amendola, P. (2020). Integrating Computer Science Across the Core. New York: Eye on Education, <https://doi.org/10.4324/9780429243783>

Other readings to be provided by the instructor.

**COURSE OBJECTIVES:**

In this course, teachers and teacher candidates will:

<b>Objective (Standard #)</b>	<b>Learning Activities /Assignments</b>	<b>Performance Assessment</b>
Develop powerful and effective pedagogical strategies and methods for the teaching of CS to K-12 students. [Manhattanville Standard(s): 1a, 1c; 1e, 3b, CSTA Standards 1, 4, 5]	Group Discussions, Readings	Annotated Bibliography  Lesson Sequences Plans for 3 age levels – elementary school, middle school, high school
Learn to develop curricular plans and activities that involve their K-12 student in the 5 CS principles: Algorithms and programming, Computing systems, Data and analysis, Impacts of computing, and Networks and the internet [Manhattanville Standard(s) 1d, 1e, 2d, 3b; CSTA Standard(s) 2, 4]	Group Discussions Class workshop sessions Reflections on Learning	Lesson sequences (see below)
Develop proficiency in CS Education standards and the ability to evaluate them critically. [Manhattanville Standard(s) 1a, 1e, 5d; CSTA Standard(s) 2, 3]	Group Discussions Readings	CS Standards Analysis
Understand and develop connections between CS and the core K-12 content areas. [Manhattanville Standard(s) 1a, 1d, 3d, ; CSTA Standard(s) 4d]	Group Discussions Readings	Lesson sequences (see below)

**COURSE REQUIREMENTS** (specify percentage of grade for each)

**1. Attendance, Participation, Professional Disposition (APPD) – 10%**

Students are expected to fully participate in all aspects of the course.

**2. Group Discussions – 10%**

Students will be routinely asked to participate in group discussions about course readings, course activities, and relevant teaching methods and strategies.

**3. Annotated Bibliography – 15%**

Students will create an annotated bibliography which will contain entries for each of the course readings. These entries will ask students to summarize and then respond critically to these readings.

**4. Lesson Sequences Plans for 3 age levels – elementary school, middle school, high school 40%**

As indicated in Unit 7 below, students will be required to create lesson sequence plans that address the teaching of CS to students at the elementary, middle, and secondary levels. These lesson plans will focus on the teaching and development of advanced CS skills.

**Note:** Fourteen hours of Field Experience will provide the foundation for lesson sequences, which will build on observed curriculum and methods. These must include Elementary and Secondary levels and diverse schools. This experience provides candidates with experiences in a variety of communities and across the range of student developmental levels of the certificate, experiences in high need schools, and experiences with each of the following student populations: socioeconomically disadvantaged students, students who are English language learners and students with disabilities. Further details will be discussed in class.

**5. CS Education Standards Analysis – 15%**

Student will examine and analyze standards for Computer Science Education from two of the most influential CS Education professional organizations – CSTA and ISTE. This analysis will focus on both a deep understanding of these standards as well as a critical understanding of the assumptions and/or biases inherent in these standards.

**6. Reflection on learning – 10%**

Throughout the course, students will be asking to reflect on their own learning process, as well as their products.

**Accommodation policy:** Manhattanville is committed to creating a learning environment that is equally accessible and participatory for all students. Students with disabilities who are seeking accommodations must register with the Center for Student Accommodations (CSA) in order to engage in the intake process. Students choosing to use their approved accommodations must renew their letter every semester with CSA. In addition, students are responsible for providing their professors with their approved accommodation letters and discussing their needs. For more information, please contact the Center for Student Accommodations:

## CLASS STRUCTURE

### *Units*

This course is organized around a set of units. They are:

**Unit 1** - Introduction to the course and introduction to the teaching of CS to K-12 students.

In this unit, students will become familiar with the objectives and structure of the course, as well as the required texts, materials, and other course structures. Additionally, students will become familiar with the CSTA and ISTE standards for teaching Computer Science.

**Unit 2** - Methods and Strategies for teaching Computer Science to K-12 students.

In this unit, students will be introduced to a set of teaching methods and strategies (including relevant research) for teaching CS to K-12 students: experiential learning, project/problem based learning, managing levels of abstraction.

**Note:** this work on developing research based and developmentally appropriate pedagogies for the teaching of computer science to k-12 students will be a theme that runs throughout the remaining units and is a critical part of the **Practice CS skill(s)** cycle described below.

**Unit 3** - Teaching CS with Unplugged and Low Tech activities

In this unit, students will be introduced to the use of unplugged and low tech activities for teaching CS skills to K-12 students, such as sorting algorithms, knitting, and music making.

**Unit 4** - Teaching CS through Block Based Coding

In this unit, students will be introduced to teaching CS skills through the use of block based coding (e.g., Scratch) with K-12 students.

**Unit 5** - Teaching CS through Robotics

In this unit, students will be introduced to teaching CS skills through the use of robotics (e.g., LEGO Mindstorms) with K-12 students.

**Unit 6** - Teaching CS through Text-based Coding

In this unit, students will be introduced to teaching CS skills through the use of text based coding (e.g., Python) with K-12 students.

**Unit 7** - Putting It All Together - Designing CS Projects and Units for K-12 students.

In this cumulative unit, students will design extended lessons and/or units that address teaching CS skills to K-12 students. Lesson sequences and/or unit plans will be developed each level of K-12 education – elementary, middle, and high school.

### *Iterative Cycles*

This course will utilize iterative cycles within each unit, which include:

1. **Read/Annotate/Discuss** – Students will read relevant sections from the required texts and respond to them via an Annotated Bibliography and/or Group Discussions.
2. **Practice CS skill(s)** – Students will participate in experiences which will allow them to practice CS skills and relevant pedagogical strategies and techniques.
3. **Design/share possible learning activities** – Students will design learning activities utilizing the featured CS Skill(s) and pedagogical strategies.
4. **Play test learning activities** – Students will try out one another's learning activities and offer constructive feedback to their classmates.
5. **Reflect/share on learning process** – Students will reflect on their learning process and share their reflections with the instructor and one another.

**CLASS SCHEDULE**

Here is the schedule for this course.

Week #	Unit	Topic(s)
1	<b>Unit 1</b> Introduction to the course and introduction to the teaching of CS to K-12 students.	Course structure Key assignments Course norms and expectations CSTA/ISTE Standards analysis
2	<b>Unit 2</b> Methods and Strategies for teaching Computer Science to K-12 students.	Methods, part 1 Experiential learning, project/problem based learning, managing levels of abstraction.
3	<b>Unit 2</b>	Methods, part 2 Managing levels of abstraction, core curriculum connections
4	<b>Unit 3</b> Teaching CS with Unplugged and Low Tech activities	Unplugged activities, part 1 (elementary level activities)
5	<b>Unit 3</b>	Unplugged activities, part 2 (secondary level activities)
6	<b>Unit 4</b> Teaching CS through Block Based Coding	Block based coding with elementary students
7	<b>Unit 4</b>	Block based coding with secondary students
8	<b>Unit 5</b> Teaching CS through Robotics	Robotics with elementary students.
9	<b>Unit 5</b>	Robotics with secondary students.
10	<b>Unit 6</b> Teaching CS through Text-based Coding	Text based coding with elementary students
11	<b>Unit 6</b>	Text based coding with secondary students
12	<b>Unit 7</b> Putting It All Together	Putting It All Together - Designing CS Projects and Units for K-12 students. In this cumulative unit, students will design extended lessons and/or units that

		address teaching CS skills to K-12 students. Lesson sequences and/or unit plans will be developed each level of K-12 education – elementary, middle, and high school.
13	<b>Unit 7</b>	Continued work on lesson sequence planning
14	<b>Unit 7</b>	Final work submitted Looking ahead to EDXXXX – Advanced Methods and Strategies for Teaching Computer Science to K-12 Students

### **DISPOSITIONS and ACADEMIC HONESTY**

The School of Education values collaboration, emotional maturity, flexibility, honesty and integrity, professionalism, respect, responsibility, and reverence for learning.

These values are indicated by respectful action towards college faculty and classmates in classrooms and on-campus. We believe that a candidate's ability to behave professionally and respectfully is a diagnostic of his/her ability to behave professionally and effectively as an educator. We, therefore, expect candidates to model as graduate students the same behaviors they will follow in their own practice as educators.

Unprofessional or disrespectful behavior may result in a grade being lowered and other serious sanctions. Such behavior will be reported to the Associate Dean for action. See the Graduate Handbook for details.

Teaching rests on personal relationships built on absolute trust and respect. All forms of academic dishonesty undermine that trust.

Academic dishonesty includes falsification of assignments, unpermitted collaboration, unpermitted prior knowledge of test content, unpermitted use of materials created for other classes, and plagiarism. Plagiarism is presenting the language, organization, plans, materials, graphics, and/or any ideas created by anyone else as one's own original work.

All forms of cheating and plagiarism are serious academic offenses. Plagiarized papers and fraudulent assignments and exams will receive a ZERO. Students who are found to be plagiarizing and/or cheating will NOT be given the opportunity to improve on the grade. They will also be reported to the Associate Dean for consideration of further sanctions up to expulsion from the program.

**APA BIBLIOGRAPHIC FORMAT STYLE:**

The School of Education at Manhattanville College requires that written coursework and assignments (papers and projects, in-text citations, endnotes/footnotes, and the reference page) in all education classes at both the undergraduate and graduate level follow the APA bibliographic format style as stated in the *Publication Manual of the American Psychological Association* – 7th edition. The only exception to this requirement is for English courses (ENE) offered within the Education curriculum, which can require APA and/or MLA.

The Manhattanville College Library has copies of the *Publication Manual of the American Psychological Association* – 7<sup>th</sup> edition available at the Reference Desk for in-library use. The Library also provides one page written handouts with examples of the correct APA bibliographic formatting style and provides links to online Web sites providing examples of the correct APA bibliographic formatting style. Assistance from a librarian is available at the Reference Desk of the Library. A copy of the book can be purchased through the campus bookstore.

# MANHATTANVILLE CONCEPTUAL FRAMEWORK (CF) STANDARDS

MANHATTANVILLE CONCEPTUAL FRAMEWORK ELEMENTS	MANHATTANVILLE CONCEPTUAL FRAMEWORK INDICATORS
1a. Learning and Teaching	Combines a depth of knowledge of academic disciplines with understanding of pedagogical theory and research
1b. Learning and Teaching	Demonstrates knowledge and use of multiple assessments and appropriate diagnostic techniques
1c. Learning and Teaching	Demonstrates teaching driven by reflective practice within the context of a community of learners
1d. Learning and Teaching	Develops developmentally appropriate strategies based on structure and method of the discipline
1e. Learning and Teaching	Applies educational theory to classroom practice
2a. Diverse Learners	Demonstrates respect for and values all children
2b. Diverse Learners	Demonstrates knowledge of child development
2c. Diverse Learners	Demonstrates understanding of how to foster self-esteem, motivation, character and civic responsibility
2d. Diverse Learners	Considers the challenges likely to be encountered by diverse learners and strategies to help diverse learners meet those challenges.
2e. Diverse Learners	Demonstrates a belief that all children can learn. Provides a supportive environment for diverse learners and treats all students equitably
3a. Liberal Arts	Models strong speaking, writing, reading and listening skills
3b. Liberal Arts	Demonstrates sound knowledge of educational technology in planning, designing, delivering, and evaluating effective learning experiences
3c. Liberal Arts	Demonstrates a broad knowledge of the liberal arts
3d. Liberal Arts	Demonstrates a deep understanding of the content appropriate to the teaching specialty and relevant applications of that content.
3e. Liberal Arts	Demonstrates a commitment to motivate and enable all students to attain high standards of academic achievement
4a. Family, School and Community	Demonstrates an understanding that the involvement of the home enhances the work of the school
4b. Family, School and Community	Promotes child-focused collaboration with parents, staff and community organizations
5a. Professionalism	Is committed to a life-long pursuit of learning and professional growth
5b. Professionalism	Utilizes reflection as a tool for self-growth, program assessment, and instructional effectiveness
5c. Professionalism	Assumes a professional role within the organizational system of the school



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5d. Professionalism	Is responsive to research and best professional practices
5e. Professionalism	Interprets and implements regulatory, professional, and ethical standards.