

# A computational introduction to STEM studies

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We report on the content and preliminary results for an introductory programming course titled “Media-Propelled Computational Thinking,” (abbreviated MPCT and pronounced iMPaCT). MPCT was developed for freshman college entering students program at the University of Texas at El Paso (UTEP), a primarily Hispanic-Serving Institution (HSI) serving the sister cities of El Paso and Ciudad Juarez. MPCT is intended to provide meaningful experiences of relevance to students considering STEM majors including computer science that also fortifies their qualitative understandings of foundational math and physics concepts.

MPCT’s activities are intended to provide analytical challenges typical of STEM professions and to motivate additional inquiry. Students construct sequences of short (typically 4-10 line) programs that directly generate computer graphics in a manner that exposes foundational mathematical and physical principles describing the evolution of familiar dynamic systems such as ballistics. Lessons are designed for each student to master the particular lesson’s challenges, and the next lesson builds upon the previous, using students’ newly acquired knowledge to solve the next set of challenges. MPCT’s activities are designed to be engaging while still providing analytical challenges typical of STEM professions. MPCT uses programming and multimedia as a way to expose and explore mathematical concepts required to solve some challenges.

Rather than focusing on the syntax of programming languages, MPCT focuses on the use of programming to examine the mathematics of familiar dynamic phenomena. Programming is introduced in an immersive and conversational manner - students begin by modifying simple programs that manipulate raster images. Programming constructs such as for and while loops, if-statements, functions, and objects are presented in contexts where they simplify program construction.

Variants to MPCT are being implemented and evaluated for a variety of alternative contexts including discipline-specific introductions to programming and integration into high school curricula.

Preliminary results show that students who are enrolled in MPCT and Precalculus (taught in modules) tend to progress through the Precalculus course faster than students who are not enrolled in MPCT.