

# School of Engineering

Andrea L. Welker, Dean

A focus on Integrative STEM education has been building nationally, with recent emphasis on “design pedagogy,” which utilizes the Technology and Engineering components of STEM to engage students in a highly integrative, intradisciplinary fashion with deeply authentic teaching and learning experiences. Recently, the Next Generation Science Standards (NGSS) recognized the value of the T&E of STEM and explicitly included engineering design into both their framework and detailed standards for preK–12 education.

The School of Engineering at TCNJ has substantial experiences and expertise in K–12 Technology and Engineering education, as well as Integrative STEM education. The School of Engineering’s Department of Integrative STEM Education has had strong STEM-oriented education programs since approximately 1987, when a strong shift towards design pedagogy occurred in the department’s teacher preparation curriculum.

The Department of Integrative STEM Education started the country’s first Integrative STEM teacher preparation program in 1998: the preK–6(8) iSTEM program (originally named “Math/ Science/ Technology”). For the past several years, the iSTEM undergraduate program has been the largest disciplinary content area for teacher education candidates at TCNJ. Additionally, TCNJ has been strongly involved nationally, serving on important national committees on PK–12 Technology and Engineering Education, and has led the development of STEM teaching methods and has published substantially in the field.

## Master of Education in Integrative STEM Education

36 credits

Program code: STEM\_MED01

Manuel Figueroa, Associate Professor (figueroa@tcnj.edu)

This program is designed for in-service, certified teachers. The program offers an intellectually stimulating course of study that provides its students with integrative, design-centric teaching and learning methods applicable across preK–12 grade levels. Key components of the Integrative STEM M.Ed. program include:

1. Integrative: Substantial emphasis on Integrative (cross-curricular) methods, between STEM components but also, and as importantly, includes valuable connections with non-STEM content areas.
2. Design Pedagogies: Design pedagogies can be described as design-centric Problem/Project-Based Learning (PBL) methods and are covered extensively within the program. Design processes (the “T&E” of STEM) require higher levels of cognitive thinking, and importantly, often include highly contextualized frameworks.

3. Content Area Knowledge: Content in individual STEM areas is covered throughout the program within both Methods and Content courses, yielding valuable content/context specific applicability. Additional NJ State content endorsements may be possible depending on individual’s background.
4. Practical Approach: Gives teachers practical skills and knowledge, including curricular writing, inclusive practices, and deep connections to educational standards (Next Generation Science Standards, Common Core, 21st Century skills, etc.). TCNJ college certificates or NJ State certification paths are possible.

### Admission Requirements

Bachelor’s degree with a valid teacher certification.

Graduate Record Exam (GRE) – for test waiver information, please visit <https://graduate.tcnj.edu/apply/>.

Submission of Graduate Application materials, including a Field Setting Report. (See the Graduate Studies website for more detailed descriptions and the most current requirements: <https://graduate.tcnj.edu/>.)

### Graduation Requirements

Cumulative grade point average of 3.0 or higher in the M.Ed. in Integrative STEM program and completion of all program requirements/prerequisites.

### Required Courses

- I. *Teaching & Learning Core* 15 cr.
  - STEM 510/Foundations in Integrative STEM
  - STEM 520/Integrative STEM Pedagogy
  - STEM 530/Integrative STEM Curriculum
  - STEM 610/Emerging Trends & Issues in Integrative STEM Education
  - STEM 660/Creativity & Systems/Critical Thinking in Education
  - STEM 700/Integrative STEM Education Capstone
- II. *STEM Education Content & Research* 9 cr.
  - STEM 631/Math & Statistics for Integrative STEM Education
  - EDFN 508/Introduction to Education Research
  - Any STEM Education elective course (see Design pathway below for options)
- III. *STEM Education Electives* 12 cr.

*Complete the four courses outlined in any of the following pathways.*

*A. Supervisor Certification*

SUPV 520/Supervisor & Instructor Leadership  
 CURR 514/Curriculum: Theory & Practice  
 EDAD 617/Advanced School Leadership:  
 Supervision/ Administration  
 CURR 555/Advanced Curriculum

*B. Design*

*Select any four courses not already taken from the following.*

STEM 635/Data Visualization & Analytical  
 Information Design  
 STEM 641/Biotechnology Systems and Sustainable  
 Design for Educators  
 STEM 661/Architecture & Civil Technology Systems  
 & Design for Educators  
 STEM 671/Mechanical Technology Systems and  
 Design for Educators  
 STEM 681/Electronics Technology Systems and  
 Design for Educators

*C. Research*

STEM 680/STEM Education Research  
 STEM 710/Thesis  
 Any two STEM content courses (listed in the Design  
 pathway)

*D. Inclusive Practice/Special Education (three pathways)**i. Inclusive Practice: English Language Learners*

ESLM 577  
 ESLM 579  
 ESLM 587

*ii. Inclusive Practice: Students with Disabilities*

EDUC 513  
 EDUC 614  
 SPED 501  
 Choose one: RDLG 579, SPED 624, or  
 SPED 648

*iii. Inclusive Practice: Literacy*

RDLG 579 (prerequisite: a course in teaching  
 reading at the undergraduate or  
 graduate level)  
 SPED 624  
 Choose one: EDUC 613, EDUC 614, or  
 SPED 624

*E. Middle School Math*

*Select any four courses of the following courses.*

MATH 591/Number Theory & Systems  
 MATH 594/Patterns, Functions, Algebra  
 MATH 595/Geometry

MATH 597/Discrete Math  
 MATH 598/Calculus  
 STEM 635/Data Visualization & Analytical  
 Information Design

*F. Environmental Sustainability Education*

*Yields Env. Sustainability Edu. Certificate*

ESED 501/Environmental Science for Teachers and  
 Leaders  
 ESED 520/EcoJustice and Socioscientific Issues  
 ESED 600/Equity, Diversity, and Inclusion in  
 Environmental Sustainability Education  
 STEM 641/Biotechnology Systems and Sustainable  
 Design for Educators

*G. Self-Defined*

*Four courses approved by the program coordinator.*

## Graduate Certificate in Integrative STEM Methods

15 credits

Program code: STEM\_CER01

Manuel Figueroa, Associate Professor (figuerom@tcnj.edu)

The Department of Integrative STEM Education offers a one-year graduate certificate (15 credits) in Integrative STEM Educational Methods. Students who complete the STEM core sequence (STEM 510, STEM 520, STEM 530, STEM 610), and the capstone course (STEM660/STEM700) are eligible for the certificate. The five courses can be completed in one calendar year starting every spring semester. Classes meet once a week in the evenings during the spring and fall semesters and twice a week during the summer semester. Classes are taught in a blended format. Additionally, graduates who complete the Master of Education (M.Ed.) in Integrative STEM (36 credits) will automatically receive the certificate in Integrative STEM Educational Methods.

*Required Courses*

STEM 510/ Foundations in Integrative STEM  
 STEM 520/Integrative STEM Pedagogy  
 STEM 530/Integrative STEM Curriculum  
 STEM 610/Emerging Trends & Issues in Integrative STEM  
 Education  
 STEM 660/Creativity & Systems/Critical Thinking in  
 Education  
 STEM 700/Integrative STEM Education Capstone