

EDUT 3372**Research in STEM Education to Support Inquiry-based Learning**
Section 060, Spring 2026**Class Information:**

Time: Hybrid Online with Weekly Synchronous Sessions (ZOOM or in-person)

Day: TBD for Synchronous Sessions

Final: Online

Instructor Information:

Name: Dr. Pradeep M. Dass

Office: BEP 226

Office Hours: By Appointment (meetings via Zoom or Phone)

Telephone: 903-566-7109 (office)

Email address: pdass@uttyler.edu (best mode of communication)

Course Overview:

This course prepares future STEM educators to engage in both STEM education research and basic scientific research. It provides students with a comprehensive understanding of research methodologies, enabling them to support middle and high school students conducting long-term research projects such as science fairs, independent studies, or capstone projects. The course emphasizes evidence-based instructional strategies, inquiry-driven learning, and the integration of research practices into STEM education. Students will develop skills in designing, conducting, and analyzing research to foster a research-driven learning environment for their future students.

Student Learning Outcomes:

By the end of the course, both mathematics and science preservice teachers will be able to:

1. **Design and implement an inquiry-based research project** aligned with disciplinary standards in **science and/or mathematics**, demonstrating how scientific and mathematical reasoning complement each other in authentic STEM investigations (e.g., modeling, data analysis, measurement, and experimental design).
2. **Apply evidence-based instructional strategies** that support **inquiry, problem solving, and mathematical modeling** within STEM contexts, preparing future teachers to guide students in **science fairs, mathematics fairs, capstone research projects, and interdisciplinary STEM competitions**.
3. **Demonstrate safe laboratory, field, and data practices** through completion of required safety training, contracts, and Responsible Conduct of Research (RCR) certification, emphasizing both physical and **data-ethics** safety relevant to math and science research.
4. **Analyze and interpret quantitative and qualitative data** using appropriate **statistical, graphical, and mathematical tools** to draw conclusions, test hypotheses, and evaluate patterns within real-world STEM datasets (e.g., NASA GLOBE data).
5. **Communicate research findings effectively** through a **scientific poster and research paper**, integrating scientific reasoning, mathematical modeling, and data visualization to support claims and explain results.
6. **Support, mentor, and manage student inquiry projects** in STEM classrooms and competitions, facilitating interdisciplinary connections between **mathematical analysis and scientific investigation** to enhance student engagement and achievement.

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The course will prepare pre-service teachers in two key areas:

1. Supporting Students in Long-Term Research and Academic Competitions

- Guide students in designing and conducting independent research projects for science fairs, capstone projects, and academic competitions.
- Assist students in developing research questions, methodologies, and data collection strategies.
- Foster critical thinking and problem-solving skills in student research experiences.

2. Examining STEM Education Research to Understand Evidence-Based Teaching

- Analyze STEM education research literature to apply best practices in inquiry-based learning.
- Evaluate and integrate evidence-based teaching strategies and materials into STEM instruction.
- Utilize STEM research methodologies to assess and improve instructional effectiveness.

Both Areas: Communicating Research Effectively

- Develop the ability to communicate research findings through academic papers, posters, and multimedia presentations.
- Present research findings in clear and engaging formats suitable for professional and educational settings.
- Utilize digital tools and media to enhance research dissemination and STEM communication.

STEM Integration Statement:

This course is intentionally designed for both mathematics and science preservice teachers. Each assignment and project may be contextualized within a single discipline or developed through interdisciplinary STEM inquiry, highlighting how mathematics and science work together in authentic research and classroom practice.

Knowledge Base

The course content aligns with national and state standards for STEM education and prepares future educators to integrate research methodologies into classroom instruction while supporting students engaged in long-term research projects. Course design is informed by the following frameworks and standards:

- **Texas Essential Knowledge and Skills (TEKS)** – Ensuring educators are equipped to guide students in conducting independent research projects that align with state science and mathematics standards.
- **National Research Council's (NRC) Framework for K-12 Science Education** – Emphasizing scientific inquiry, data analysis, and problem-solving to help educators mentor students in authentic STEM research experiences.
- **National Council of Teachers of Mathematics (NCTM) Standards** – Supporting teachers in fostering data-driven decision-making and mathematical modeling in student research projects.
- **Interstate Teacher Assessment & Support Consortium (InTASC) Standards** – Providing educators with strategies to facilitate student-led investigations, develop research literacy, and integrate inquiry-based learning into STEM education.

Learner Expectations

Students are expected to:

- Engage actively in class discussions, reflections, and peer feedback sessions.
- Complete all assignments and projects on time, demonstrating understanding and application of research methodologies.
- Collaborate with peers in developing and evaluating research projects.

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- Apply critical thinking to analyze STEM education research literature and its classroom applications.
- Prepare and present research findings through written and visual formats, including posters and multimedia presentations.

Course Requirements and Grading:

Component	Description	% of Grade
Attendance & Participation	Active participation in all sessions, discussions, and peer-review activities.	5 %
Safety Certification & RCR Module	Completion of safety contract, Flinn Scientific quiz, and Responsible Conduct of Research module.	5 %
Research Project	Semester-long inquiry project (individual or team) using NASA GLOBE or other approved inquiry framework. Includes design, data collection, and analysis.	40 %
Science Fair/Competition Planning	Planning for a specific science fair or competition for school students to participate in.	10%
Research Article Analyses	Two analyses of peer-reviewed articles related to STEM inquiry and research-based instruction.	10 %
Scientific Communication	Research poster and written paper, including drafts, peer feedback, and final submissions.	30 %
Total		100 %

Details of all assignments will be provided within specific modules in Canvas.

Grading Scale: A = 90 - 100; B = 80 - 89; C = 70 - 79; D = 60 - 69; F = <60

Safety and Ethics:

- All students must complete **safety training** and sign the **Science Safety Contract**
- Passing score on the **Flinn Scientific Safety Quiz**

Deliverables:

1. Signed **Science Safety Contract** + completed **Flinn Scientific Quiz**
2. **Inquiry Proposal** (1-2 pages)
3. **Progress Report** (mid-semester)
4. **Scientific Poster** (APA or competition format)
5. **Research Paper** (final submission)

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Section 060, Spring 2026**Weekly Class Schedule:**

Week	Topics / Focus	Assignments / Milestones
1	Introduction to Research in STEM Education	Orientation, course overview
2	Safety Training & Contracts	Submit signed safety contract; complete Flinn quiz
3	Responsible Conduct of Research & NASA GLOBE Training	Register for GLOBE; complete RCR module
4	Developing Research Questions	Submit inquiry proposal
5	Designing Research Studies	Literature review checkpoint
6–7	Data Collection (GLOBE / Field Studies)	Begin data collection; maintain logs
8	Data Analysis & Visualization	Submit midterm progress report
9	Writing the Scientific Paper (Intro & Methods)	Draft sections due
10	Writing Results & Discussion	Peer review of drafts
11	Poster Design Workshop	Draft poster
12	Research Communication & Practice	Poster revisions
13	Practice Presentations	Peer critique and rehearsal
14	Final Poster Session	Present posters
15	Final Submission & Reflection	Submit final paper and reflection

Course Policies:**1. Attendance and Participation**

Attendance and active participation in all class activities and assignments is imperative to your accomplishment of the Student Learning Outcomes of this course. Credit for attendance requires arriving to each class session on time, participating in all class activities, and staying until the session ends. Attendance is a crucial component of this class since there are several peer-interactive/peer-reviewed assignments. Because the ZOOM meeting happens only once per week and there is no formal textbook, missing a ZOOM class meeting means you will miss essential information and experiences.

2. Late Work

There will be a deduction of 10% per day (capped at 50%) for any assignment turned in late unless arrangements have been made with the instructor in advance.

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COURSE RELATED RESOURCES:
Science / Math Competitions & Venues

Competition / Fair	Grade Levels / Scope	Description	Notes/Special Info/URL
GLOBE International Virtual Science Symposium (IVSS)	High school & middle school	A global science fair where students conduct environmental research using real-world scientific protocols.	Information available here .
Regeneron International Science and Engineering Fair (ISEF)	High School	One of the largest international science fairs, showcasing high school student research projects.	Information available here .
Texas Science & Engineering Fair (TXSEF)	High school & middle school	State-level science fair in Texas. Students qualify via regional fairs.	Use “Find-a-Fair” to locate regionals near students.
TEAMS (Tests of Engineering Aptitude, Mathematics, and Science)	Middle & High school (Texas)	A one-day competition combining engineering, math, and science tasks. Organized by Texas TSA.	Good option for interdisciplinary tasks.
TAME Regional Engineering Competitions	Middle & High school	Engineering-challenge competitions run by TAME (Texas Alliance for Minorities in Engineering).	Useful for linking engineering design, math, and science in projects.
Texas A&M Regional Middle School Science Bowl	Grades 6–8	Middle school regional competitions for the National Science Bowl, hosted at Texas A&M.	Teams compete in math & science question rounds.

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Competition / Fair	Grade Levels / Scope	Description	Notes/Special Info/URL
UIL STEM Contests	Grades 6–8	Texas UIL (University Interscholastic League) offers student contests in multiple STEM areas.	More information available here .
American Mathematics Competitions (AMC)	Grades 6–12	A series of mathematics contests designed to develop students' problem-solving skills and prepare them for higher-level STEM challenges. Offered by the Mathematical Association of America (MAA).	More information available here .
Science Olympiad	Grades K–12	A nationwide competition that challenges students with hands-on STEM events covering various science and engineering disciplines.	More information available here .

Student Research Journals / Publication Venues

Here are several journals (or journal-like venues) that accept **middle school / high school student research**. Some are peer-reviewed, others are more student-friendly. Always check their current submission guidelines.

Journal / Venue	Focus / Audience	Key Features & Notes
National High School Journal of Science (NHSJS)	STEM, high school	Free, online, peer-reviewed. Very student-friendly. https://nhsjs.com/?mainpage
Young Scientists Journal (YSJ)	Ages ~12–20 / high school	International, peer-reviewed, student-led editorial process.
Journal of STEM Education: Innovations & Research	STEM education research	While primarily for educators and researchers, students with strong educational research may submit.

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Journal / Venue	Focus / Audience	Key Features & Notes
STEM Fellowship Journal (SFJ)	STEM research by high school & university students	Open access, peer-reviewed, dedicated to student research. https://journal.stemfellowship.org/journal/sfj
Journal of High School Science (JHSS)	STEAM / science for high school	Publishes research and student ideas.
International Journal of High School Research (IJHSR)	All disciplines in high school research	Publishes high-quality research, indexed by EBSCO & Google Scholar. https://ijhsr.terrajournals.org/
Journal of Emerging Investigators (JEI)	Middle and high school student research	Publishes original research in biological and physical sciences conducted by middle and high school students. https://emerginginvestigators.org/
Journal of Student Research (JSR) - High School Edition	High school student research	A multidisciplinary, peer-reviewed journal accepting research articles from high school students. https://www.jsr.org/hs/index.php/path
The Curieux Review	Middle, high school, and undergraduate college student research	Publishes academic writing, including research papers and review articles, from middle school, high school, and undergraduate students. https://www.curieuxreview.com/

Open Educational Resources (OER) and Free Online Books:

Evidence-Based Practice Resources in Math and Science

The following resources provide research-based insights into effective teaching strategies in math and science education:

- National Academies of Sciences, Engineering, and Medicine. (2000). *How People Learn: Brain, Mind, Experience, and School: Expanded Edition*. National Academies Press. [Available at:
<https://nap.nationalacademies.org/catalog/9853/how-people-learn-brain-mind-experience-and-school-expanded-edition>](https://nap.nationalacademies.org/catalog/9853/how-people-learn-brain-mind-experience-and-school-expanded-edition)

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- National Academies of Sciences, Engineering, and Medicine. (2005). *How Students Learn: History, Mathematics, and Science in the Classroom*. National Academies Press. [Available at: https://nap.nationalacademies.org/catalog/10126/how-students-learn-history-mathematics-and-science-in-the-classroom](https://nap.nationalacademies.org/catalog/10126/how-students-learn-history-mathematics-and-science-in-the-classroom)
- National Academies of Sciences, Engineering, and Medicine. (2018). *How People Learn II: Learners, Contexts, and Cultures*. National Academies Press. [Available at: https://nap.nationalacademies.org/catalog/24783/how-people-learn-ii-learners-contexts-and-cultures](https://nap.nationalacademies.org/catalog/24783/how-people-learn-ii-learners-contexts-and-cultures)
- National Research Council. (2007). *Taking Science to School: Learning and Teaching Science in Grades K-8*. National Academies Press. [Available at: https://nap.nationalacademies.org/catalog/11625/taking-science-to-school-learning-and-teaching-science-in-grades](https://nap.nationalacademies.org/catalog/11625/taking-science-to-school-learning-and-teaching-science-in-grades)
- National Council of Teachers of Mathematics (NCTM). (2014). *Principles to Actions: Ensuring Mathematical Success for All*. NCTM. [Available at: https://www.nctm.org/Store/Products/Principles-to-Actions--Ensuring-Mathematical-Success-for-All/](https://www.nctm.org/Store/Products/Principles-to-Actions--Ensuring-Mathematical-Success-for-All/)
- Lee, J. S., & Galindo, E. (Eds.). (2021). *Project-Based Learning in Elementary Classrooms: Making Mathematics Come Alive*. National Council of Teachers of Mathematics (NCTM): Reston, VA. [Available at: https://www.nctm.org/Store/Products/Project-Based-Learning-in-Elementary-Classrooms--Making-Mathematics-Come-Alive/](https://www.nctm.org/Store/Products/Project-Based-Learning-in-Elementary-Classrooms--Making-Mathematics-Come-Alive/)

Books and Articles

- Science Buddies. (n.d.). *Teacher resources and science fair tools*. Science Buddies. Retrieved from <https://www.sciencebuddies.org/teacher-resources/science-fair-tools>
- National Science Digital Library (NSDL). (n.d.). *STEM education resources for teachers and students*. National Science Digital Library. Retrieved from <https://nsdl.oercommons.org>
- Visionlearning. (n.d.). *STEM teaching and learning modules*. Visionlearning. Retrieved from <https://www.visionlearning.com>
- National Science Teaching Association (NSTA). (n.d.). *Increasing student participation in science fair competitions*. NSTA. Retrieved from <https://www.nsta.org/resources/increasing-student-participation-science-fair-competitions>
- National Council of Teachers of Mathematics (NCTM). (2016). *Providing opportunities for students with exceptional mathematical promise*. NCTM. Retrieved from https://www.nctm.org/uploadedFiles/Standards_and_Positions/Position_Statements/Providing%20Opportunities%20for%20Students%20with%20Exceptional%20Promise%20%28Oct%202016%20R%29.pdf

OER Websites and Journals

- **Texas STEM Education Toolkit (TEA)** – Provides guidance, curriculum resources, and best practices for implementing STEM education in Texas schools. [Available at: https://tea.texas.gov/academics/college-career-and-military-prep/texas-stem-education-toolkit](https://tea.texas.gov/academics/college-career-and-military-prep/texas-stem-education-toolkit)
- **National Science Teaching Association (NSTA) Open Resources** – Provides access to science education research and instructional strategies. [Available at: https://www.nsta.org](https://www.nsta.org)
- **STEM Teaching Tools** – A collection of research-based teaching practices for STEM educators. [Available at: https://stemteachingtools.org](https://stemteachingtools.org)
- **American Association for the Advancement of Science (AAAS) Project 2061** – Science literacy resources and curriculum tools. [Available at: https://www.aaas.org/programs/project-2061](https://www.aaas.org/programs/project-2061)

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- **PLOS ONE – Open-Access STEM Education Research** – A peer-reviewed journal featuring studies on STEM teaching and learning. [Available at: <https://journals.plos.org/plosone/>](https://journals.plos.org/plosone/)
- **National Science Teaching Association (NSTA) Open Resources** – Provides access to science education research and instructional strategies. [Available at: <https://www.nsta.org>](https://www.nsta.org)

UNIVERSITY POLICIES

UT Tyler Honor Code

Every member of the UT Tyler community joins together to embrace: Honor and integrity that will not allow me to lie, cheat, or steal, nor to accept the actions of those who do.

For a full list of university policies including information related to the topics listed below, click [here](#).

- Students Rights and Responsibilities
- Campus Carry
- Tobacco-Free University
- Grade Replacement/Forgiveness and Census Date Policies
- State-Mandated Course Drop Policy
- Disability Services
- Student Absence due to Religious Observance
- Student Absence for University-Sponsored Events and Activities
- Social Security and FERPA Statement
- Emergency Exits and Evacuation
- Student Standards of Academic Conduct

UT Tyler Resources for Students:

- UT Tyler Writing Center (903.565.5995), writingcenter@uttyler.edu, <http://www.uttyler.edu/writingcenter/>
- UT Tyler Tutoring Center (903.565.5964), tutoring@uttyler.edu, <https://www.uttyler.edu/tutoring/>
- The Mathematics Learning Center, RBN 4021, This is the open access computer lab for math students, with tutors on duty to assist students who are enrolled in early-career courses.
- UT Tyler Counseling Center (903.566.7254) <https://www.uttyler.edu/counseling/>

COLLEGE OF EDUCATION AND PSYCHOLOGY (CEP) VISION AND MISSION

Core Purpose of College of Education and Psychology:

To prepare competent, caring, and qualified professionals in the fields of education, psychology and counseling, to foster discovery and to advance the knowledge base in our respective disciplines.

EDUT 3372**Research in STEM Education to Support Inquiry-based Learning**
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The CEP will be a global leader in responding to needs in the fields of education, psychology, and counseling, with a focus on the East Texas region, by creating innovative academic and scholarly pathways and partnerships.

Mission

The mission of the CEP is to prepare competent and passionate professionals in the fields of education, psychology, and counseling; to advance knowledge and expertise; and to impact these fields locally, regionally, nationally, and internationally.

UT TYLER'S SCHOOL OF EDUCATION STANDARDS FOR EDUCATOR PREPARATION PROGRAMS

The School of Education is committed to teaching and implementing the [Texas Educator Standards](#) at the highest level. The School of Education faculty use the Texas Educator Standards, along with the Interstate New Teacher Assessment and Support Consortium (InTASC) [standards](#) used by educator preparation programs throughout the United States.

[TEKS for Science](#)

[Code of Ethics and Standard Practices for Texas Educators.](#)