Certificate of Proficiency in STEM Education

a. Curriculum outline - List of courses in new program - Underline required courses

STEM 2003 The Art of STEM Communication

2 Electives chosen from: (3 hrs must be 3000/4000 level)

ARSC 1201 Introduction to Teaching STEM Subjects & ARSC 1212 Field Experience in Teaching STEM Subjects

STEM 2103 Knowing and Learning in Science and Mathematics

STEM 4333 History and Philosophy of Science for Science Teachers

CATE 4073 Introduction to Teaching Programming in the Secondary Schools

BIOL 3273 Inquiry and Modeling in Science Education

CHEM 3273 Inquiry and Modeling in Science Education

PHYS 3273 Inquiry and Modeling in Science Education

MATH 2903 Functions, Foundations and Models

EDST 4113 Teaching and Funding Outdoor & Informal Education

b. Total semester credit hours for proposed program: 9

c. New courses and new course descriptions:

1. STEM 2003 The Art of STEM Communication

It is widely known that breakdown of communication contributes to mistrust and misunderstanding of the scientific enterprise. In this dynamic, interdisciplinary course including guest lectures, socio-scientific issues, and theatre-style methods, students will learn to communicate complex STEM topics clearly and effectively using research-based practices from the field of education.

2. ARSC 1201 Introduction to Teaching STEM Subjects

This course is for STEM majors to explore ideas and issues relating to math, science, and computer science literacy in our society and to consider teaching as an additional career path. Students will develop effective communication and presentation skills of STEM topics utilizing instructional strategies that maximize engagement and learning.

3. ARSC 1212 Field Experience in Teaching STEM Subjects

After learning strategies for engaging students and organizing a lesson, student pairs plan and teach several student-centered lessons (choice of math, science, or computer science) in a local middle school classroom, assess student understanding, and revise lessons based on feedback. For STEM majors exploring teaching as an additional career option.

4. BIOL 3273 Inquiry and Modeling in Science Education

Study science practices with an emphasis on modeling and inquiry for learning/teaching. Includes practical, philosophical, cognitive, and disciplinary specific dimensions of doing science in academic and nonacademic settings. Includes planning and implementing multiple scientific inquiries, engaging in reflective practices, writing and presenting scientific information. Safety issues are included.

5. CHEM 3273 Inquiry and Modeling in Science Education

Study science practices with an emphasis on modeling and inquiry for learning/teaching. Includes practical, philosophical, cognitive, and disciplinary specific dimensions of doing science in academic and nonacademic settings. Includes planning and implementing multiple scientific inquiries, engaging in reflective practices, writing and presenting scientific information. Safety issues are included.

6. PHYS 3273 Inquiry and Modeling in Science Education Study science practices with an emphasis on modeling and inquiry for learning/teaching. Includes practical, philosophical, cognitive, and disciplinary specific dimensions of doing science in academic and nonacademic settings. Includes planning and implementing multiple scientific inquiries, engaging in reflective practices, writing and presenting scientific information. Safety issues are included.

d. Program goals and objectives:

1. To attract STEM majors to explore issues in STEM literacy and develop communication strategies from the field of education that will be beneficial to any STEM-related career.

2. To increase the pool of potential teachers of STEM subjects to help address the critical shortage of teachers in math, science, and computer science at the secondary level.

3. To increase enrollment in the STEM education (former UAteach) courses to keep them viable and offered on a regular basis to ensure that the University of Arkansas will be able to continue to prepare math, science, and computer science teachers at the secondary level.

e. Expected student learning outcomes:

1. Students who earn this certificate in STEM Education will improve their ability to communicate STEM concepts from fields such as science, engineering, medical professions, mathematics

2. Students who earn this certificate in STEM Education will be able to explain STEM topics in a way that engages a class or other audience, using research-based strategies.

3. Students who earn this certificate in STEM Education will have a deeper understanding of how people learn math, science, and computer science.

4. Students who earn this certificate in STEM Education will have an opportunity to explore their interests by choosing three elective courses relating to STEM education.

5. Students who earn this certificate in STEM Education can apply up to 9 hours that will transfer to the Minor in STEM Education. To earn the Minor in STEM Education, students will earn 15 credit hours in STEM education courses that can be applied to the teacher licensure program for Math, Biology, Chemistry, Physics, or Computer Science if they decide to become teachers.

f. Documentation that program meets employer needs:

Of the vast number of STEM majors on campus, most will enter professions where communicating complex information in science, math, computer science, engineering, medical professions, etc. is highly valued. Offering a certificate in STEM education in which STEM majors can learn valuable skills for explaining and teaching information in any employment situation will be an important contribution to the purpose of this university and to future employers of these students. Not only will the experience of the certificate courses benefit the students, it serves as a gateway into becoming a teacher of STEM subjects, exposing students to the idea of taking more courses to earn teacher licensure while earning their STEM degree. Most of the courses in the certificate can be applied to the Minor in STEM Education or to the teacher licensure program for math, biology, chemistry, physics, and computer science. Due to the shortage of teachers in STEM subjects throughout Arkansas, especially in school districts with less than 3,500 students, attracting STEM majors to the certificate program will increase the pool of students who may decide to continue to become teachers.

Forman, L. M., McKenzie, S. C., & Ritter, G. (2018). Arkansas Teacher Supply. Arkansas

Education Reports. Retrieved from https://scholarworks.uark.edu/oepreport/58

Koerber, A., Provencher, J., & Starkey, J. (2020) Leadership Communication in the

STEM Workplace: A Qualitative Study, Technical Communication Quarterly, DOI: 10.1080/10572252.2020.1794047

McBride, E., Oswald, W., Beck, L., & Murray, A. (2019, November 29). "I'm just not that great at science": Science self‐efficacy in arts and communication students. https://doi.org/10.1002/tea.21603

g. Student demand (projected enrollment) for proposed program: 50

h. Program approval letter from licensure/certification entity, if required: This certificate does not lead to certification/licensure.

j. Scheduled program review date (within 10 years of program): 2029-2030