

Add-on Computer Science Endorsements: A Community Effort

Donna Shea, Ph.D.

College of Education

Mississippi State University

Starkville, Mississippi, USA

dshea@colled.msstate.edu

Shelly Hollis

Center for Cyber Education

Research and Curriculum Unit

Mississippi State University

Starkville, Mississippi, USA

shelly.hollis@rcu.msstate.edu

Leanne Long, Ph.D.

Research and Curriculum Unit

Mississippi State University

Starkville, Mississippi, USA

leanne.long@rcu.msstate.edu

Abstract—In this experience paper we will share the process we used within our NSF CSForAll Research Practitioner Partnership Network Improvement Community (NIC) to inform the creation of two add-on computer science endorsements for teachers in Mississippi. These additions to a standard teaching license, a K-8 endorsement and a 7-12 endorsement, are available for pre-service teachers to obtain prior to graduation, as well as for in-service teachers to obtain through an online program. There can be many barriers to developing endorsements in this relatively new K-12 education space. Through the work of our NIC we learned that time, cost, location, and relevance were all important aspects that teachers were concerned with, while the university departments were more focused on capacity, enrollment, rigor, and funding. We will describe how working through a NIC smoothed the way to creating endorsements that are recognized by teachers as valuable and accessible and by the university as rigorous and relevant.

Keywords—network improvement community, computer science, education, teaching license, endorsements

I. INTRODUCTION

In 2017, through the CSForAll program, the National Science Foundation (NSF) funded the Mississippi State University (MSU) Research and Curriculum Unit (RCU) project, CS4MS NIC: Growing Teacher Competency and Capacity, which focuses on growing teacher competency and capacity in computer science education. While the first goal of the project centers around professional development for a specific high school computer science course, the second goal of this project is to work with MSU College of Education (COE), the Department of Computer Science and Engineering (CSE), and the Mississippi Department of Education (MDE) to develop appropriate licensure and endorsement pathways for computer science teachers. This goal led to the collaboration between the newly formed RCU Center for Cyber Education (CCE) and faculty and administration from both the COE and the Department of CSE at MSU to lay the foundation for the creation of courses for computer science endorsements. The grant project's NIC played an integral part in providing feedback which would impact the ultimate set of courses and time commitment required for the endorsement. Collaboration between practicing teachers, post-secondary computer science faculty, and COE administrators is a critical component to creating an add-on endorsement for both pre-service and in-

service teachers that is rigorous but achievable both in terms of cost and time commitment.

II. COMMUNITY COLLABORATION

Upon being awarded the NSF grant, the COE math and technology faculty along with COE administrators and CSE faculty and administrators worked with the members of the RCU-CCE at MSU to determine how best to approach the task of determining appropriate courses for an endorsement in computer science. The group looked at the blueprint for the Praxis Subject-Area Assessment for Computer Science, College Board standards associated with the newly created Advanced Placement Computer Science Principles course, and the Mississippi College and Career Readiness Standards (MCCRS) for Computer Science to begin considering what content was most appropriate for K-12 teachers. Once content objectives were narrowed down, the CSE group looked at courses within the computer science curriculum and the COE group looked at their courses to identify which, if any, could be used to meet those objectives and best prepare teachers to cover the competencies within the K-12 MCCRS for Computer Science.

Ultimately, it was determined that two endorsements would be necessary to meet the needs of teachers from kindergarten through high school. The group decided that elementary teachers would not need the same level of coursework that high school teachers may need in order to be sufficiently qualified to teach the state-approved computer science standards. Therefore, a K-8 endorsement and a 7-12 endorsement were determined most appropriate. The group came back together over several sessions to decide upon the best courses for each endorsement.

III. IDENTIFICATION OF COURSES

It was determined that a course needed to be developed for the K-8 endorsement to cover the gap in material that was found within the COE courses. Also, there was a course that was co-taught between COE math faculty and CSE faculty which was determined appropriate for the K-8 endorsement. It quickly became evident that CSE courses were necessary to cover the content of the 7-12, particularly 9-12, MCCRS and thus those courses were identified.

The course syllabi for the two sets of courses, along with the blueprint of the Praxis Subject Area Assessment for Computer Science and the MCCRS for Computer Science, were shared with the NIC. Time was given within a break-out session for each group to study the materials to determine whether they agreed that the courses adequately covered the content. The group found an apparent gap in the strand of networking which was taken back to the COE/CSE group. It was then determined that the material needed to be placed within the newly developed course and that the course also needed to be required for the 7-12 endorsement as well as the K-8 endorsement.

IV. APPROVAL OF ENDORSEMENTS

Once all agreed to the 12 hours that would be required for the K-8 endorsement and the 20 hours for the 7-12 endorsement, the COE worked to write the proposal to be carried before the Certification Commission. When that day came, Donna Shea, Ph.D., NSF grant co-principal investigator and Director of Clinical/Field-Based Instruction, Licensure, and Outreach, presented the proposal to the Certification Commission and it was approved. The proposal was for the K-8 and 7-12 courses for each endorsement, but it was also to ask the Certification Commission to add Computer Science as another area of initial licensure for the COE's Master of Arts in Teaching (alternate route) program. The Certification Commission approved the proposal and it was sent to the Mississippi State Board of Education and approved shortly thereafter.

The following courses were identified as covering the content and pedagogy necessary to teach the K-12 Computer Science Standards for each endorsement:

A. K-8 Endorsement

- TKT 4763/6763 Digital Tools for 21st Century Teaching and Learning
- TKT 4583/6583 Graphics and Web Design
- TKT 4333/6333 Introduction to Computer Science Education
- TKB 4543/6543 Advanced Information Processing

B. 7-12 Endorsement

- CSE/EDS 4990/6990 Computing and Cybersecurity Classroom Integration
- CSE 1284 Introduction to Computer Programming
- CSE 1384 Intermediate Computer Programming
- CSE 2383 Data Structures and Algorithms; CSE 2813 Discrete Math
- TKT 4333/6333 Introduction to Computer Science Education

V. METHODS OF COURSE DELIVERY

The courses for the K-8 endorsements are all split-level courses, some of which could potentially be used as electives within a master's degree. The courses for the 7-12 endorsement are all undergraduate courses and would likely only be taken by those outside of CSE majors to add on this endorsement. All courses will be offered online, so it would be convenient for teachers to take the courses from anywhere in Mississippi. We anticipate that some MSU COE teacher candidates will take the necessary courses to graduate with the additional endorsements to supplement their initial area of licensure. Since the courses are offered online, we also anticipate that practicing teachers will take the courses to add the additional computer science endorsements to their standard Mississippi Educator License.

VI. CONTINUING THE ALIGNMENT OF COURSES AND ENDORSEMENTS

The next step in this process will be working with MDE to identify which endorsement is appropriate for each of the current computer science courses within their approved course manual and to develop a procedure for properly applying the correct endorsement to any new courses that may be developed. We will work with the NIC team make a recommendation to MDE on which endorsement should apply to which courses. In most cases it will be obvious simply based on the grade level of the course in question. However, for courses offered at the middle school level there will need to be some consideration given to the competencies and objectives of the course to determine the appropriate level of experience for the teacher, since the endorsements overlap at the middle school grades.

VII. CONCLUSION

Overall, we have learned through this process that collaboration is the key to building effective CS endorsements. The COE and the Department of CSE must work together to develop courses with the appropriate level of rigorous computer science content balanced with the pedagogical strategies unique to teaching the problem-solving and inquiry skills associated with computer science. Practitioners need to be included in the process to ensure what is created is relevant to their classroom and practical to achieve in terms of their time and financial commitment. The state department of education needs to be involved to make certain that the endorsements are allowable and associated with the appropriate K-12 courses. This project has demonstrated what can be accomplished when a community of stakeholders work together for improvement.