

## MSAEP UM-UWC Linkage Report Visit to Columbia, MO October -November 2018

Submitted by Prof. Dorina Kosztin, Teaching Professor, and Prof. Meera Chandrasekhar, Curators' Distinguished Teaching Professor

Visitors: Mark Herbert, Department of Physics, UWC and Ron Engelbrecht, Subject Advisor, Metro South Educational District, Cape Town.

Hosts: Dorina Kosztin, Meera Chandrasekhar, Karen King and Douglas Steinhoff, Department of Physics, University of Missouri, Columbia.

Mark Herbert, from the Physics Department at UWC, and Ron Engelbrecht, Subject advisor of the Metro South Educational District in Cape Town, visited the University of Missouri Physics Dept from October 13, 2018 to Nov 2, 2018. Their work is related to two proposals, and "Developing Modeling Implementation and Leadership Practices for High School Physics and Physical Science Teachers" submitted by Dorina Kosztin and "Modeling Workshop for High School Physics and Physical Science Teachers" submitted by Meera Chandrasekhar.

During their visit, Mark and Ron collaborated with Dorina Kosztin, Meera Chandrasekhar, Doug Steinhoff and Karen King.

The objectives of Prof. Kosztin's proposal were:

Objective 1. Learn about developing leadership program for teachers through horizontal and vertical articulation of content and pedagogy through a visit to MU's Wipro-Science Education Fellowship grant project.

Objective 2. Learn about modeling curriculum implementation at local school districts associated with the A TIME for Physics First program.

Objective 3. Develop summative evaluation tools to research the effectiveness of implementing modeling curriculum in the pilot classrooms schools in the Western Cape region.

Objective 4. Explore opportunities for funding to continue the modeling workshop project and establish a long-term teacher professional development and leadership project at UWC with MU collaboration.

Objective 5. Finalize alignment of South Africa Curriculum and Assessment Policy Statement (CAPS) Physics concepts for grades 8-11 with content and pedagogy in the Exploring Physics (EP) curriculum.

and:

The objectives of Prof. Chandrasekhar's proposal were

Objective 1. Finalize alignment of South Africa Curriculum and Assessment Policy Statement (CAPS) Physics concepts for grades 8-11 with content and pedagogy in the Exploring Physics (EP) curriculum.

Objective 2. Train selected 8-11 grade teachers to function as lead teachers in the future (train-the-trainer model).

Objective 3. Teach 8-11 grade science teachers physics content utilizing modeling pedagogy.

Objective 4. Disseminate methodology and content beyond the three Metro Education districts.

Objective 5. Explore opportunities for funding to continue this project and establish a long-term teacher professional development and leadership project at UWC with MU collaboration

We note that some of the objectives of both proposals are addressed in this trip report. The rest will be addressed in Chandrasekhar's trip report following her visit to UWC in June-July 2019.

In order to achieve these partially overlapping objectives during Mark Herbert and Ron Englebrecht's visit, (hereafter referred to as Mark and Ron) they conducted the following activities:

- A. Visit the Physics 2330 classes at MU.
- B. Work on completing the alignment of physics content to be used in the upcoming summer workshops at UWC (to be conducted with the guidance of Meera Chandrasekhar); and discuss possible funding opportunities for these workshops.
- C. Visit administrators and classrooms in the Columbia Public Schools.
- D. Attend the Wipro Science Education Fellowship project meeting.
- E. Attend a Science Education conference at MU.
- F. Initiate a new contact with Bill Folk of the College of Agriculture, Food and Natural Resources.

These activities are described in more detail below.

- A. Visit Physics 2330 classes (MU persons involved: Karen, Meera and Doug). Addresses Objective 2 of Kosztin's proposal.

Physics 2330 is a class specially designed for elementary education majors. The class uses a hands-on and discussion based methodology, very similar to the methods that one expects the students to use in their future classrooms. The class uses an app named Exploring Physics which was authored by Dorina Kosztin and Meera Chandrasekhar, and is the same app that is used for instruction in the UWC summer workshops. Two sections of the class were taught in Fall 2018 by Karen King and Meera Chandrasekhar, respectively. Doug has also been an instructor for this class in previous semesters.

Mark and Ron attended several classes during their visit. They interacted with the students in the class, took detailed notes of the methods and materials used, and had several discussions with Karen, Doug, Meera and the teaching assistants about the class. Both said it was particularly useful for them to observe how discussions are conducted in the class, and to

observer the various techniques such as exit slips, group responses, sorting and decision making methods, and designing of hands-on experiments.

- B. Content alignment and funding opportunities (MU persons involved: Dorina, Meera and Doug). Addresses Objective 5 of Kosztin's proposal and Objective 1 of Chandrasekhar's proposal.

A preliminary alignment of the Exploring Physics content with the South African content standards (CAPS) has been conducted over the past two years. We continued this alignment process and completed our draft of the alignment during this visit. Ron will now ask his classroom teachers to examine this alignment and provide comments.

In order to explore future funding opportunities we conducted several discussions regarding the primary goals to be addressed. Several different ideas were discussed, and Mark and Ron discussed the many needs of the Cape Town school districts. Their visits to Columbia Public Schools classrooms and discussion with school administrators helped them advance a few ideas that they felt were critical to changing how science is taught - the biggest takeaways being smaller classroom sizes, better hands-on materials, and development of teachers' content, methodological and leadership skills. Another big component of attracting funding is to obtain support from school administrators in the Cape Town districts and to develop a coherent, sustainable support in the administrative structure. This process began last summer, and Ron wishes to cement some of this support as we try to define goals that are important to the school districts and we move forward to seek funding.

- C. Visit administrators and several classrooms in the Columbia Public Schools. Addresses Objective 2 of Kosztin's proposal.

Mark and Ron visited Columbia Public Schools (CPS) several times, with visits arranged by Doug, who is a retired CPS science teacher. They first visited the science coordinator, Mike Szydlowski. This visit was of particular value to Mark and Ron, since CPS switched over to modeling-based 9th grade physics about 10 years ago. They had to make several changes, including reducing class size, acquiring materials, creating common exams, aligning to new Missouri science standards, and training teachers through the MU-based professional development program A TIME for Physics First (run by Meera, Dorina and Karen), and training new teachers as the trained teachers retired or left. A detailed discussion of these issues ensued between Ron and Mike Szydlowski (who hold similar positions in Cape Town and Columbia, respectively). Ron felt that the experiences CPS went through were particularly useful as Cape Town launches on a similar initiative.

Visits to classrooms focused primarily on high school physics classes at Battle, Hickman and Rock Bridge High School. They visited classrooms for honors, regular and special education students. Observing a variety of teachers teaching the same content was very helpful to them. Classrooms visited:

- Rock Bridge High School: Freshman physics – Travis Gabel, Honors physics Cathy Dweik and Physics 2 - Kory Kaufman
- Hickman High School: Freshman Physics & Freshman Honors physics – Josh Soper, AP Physics – Paul Scofield and Special Education teacher (Mr. Willenberg). Math department (Mrs. Steinhoff)
- Battle High School: Freshman Honors physics teacher and Science Department Chairs – Marsha Tyson
- Jefferson Middle School: District Science Chair (Mr. Szydlowski), and 8<sup>th</sup> grade science
- West Middle School: Special Ed. Teacher (Mrs. Schmidt)

D. Attend a meeting of the Wipro project. Addresses Objective 1 of Kosztin’s proposal.

The Wipro Science Education Fellowship project is a project for K-12 science teachers in mid-Missouri, funded by the Wipro Foundation in India, and run by Meera, Dorina and Karen. The project aims to have teachers collaborate across grades and across subject areas and develop leadership skills. This project was of great interest to Ron and Mark, who have been working on getting teachers across different grades to collaborate and align their teaching and learning processes. Mark and Ron spoke in detail with a lot of the teachers, discussed teachers’ chosen research articles, and examined their work and preparations for presentations.

This visit focused our conversations on seeking external funding to extensive discussions of teacher leadership, what it means, how it can be self-identified by teachers, and grown. Teachers often identify leadership as something that is present only in certain identified titles in their school systems, and do not realize that working among peers and sharing their techniques both constitutes leadership and brings about positive change.

E. Attend the Science Education conference.

The College of Education had organized a research conference at the Alumni Center on October 24. During this day-long event a keynote speaker made a presentation, and several groups presented research posters. Mark and Ron got to speak to several groups, and at that time also met with Prof. Bill Folk, who is interested in collaborating with them.

F. Develop new contact with Prof. Bill Folk in order to pursue funding. Addresses (partly) Objective 2 of Kosztin’s proposal, and Objective 4 of Chandrasekhar’s proposal.

Prof. Bill Folk, from CAFNR, is currently the PI of an NIH grant titled Linking Science & Literacy for All Learners for program 6th-8th grade science teachers. The goal of this program is to (1) Develop grade-level STEM multimodal text sets and linked inquiry activities that address NGSS and CCSS-ELA.RST standards, and (2) Provide support for using the text sets and linked inquiry activities, with special attention to the needs of diverse learners.

Prof. Folk is interested in expanding this program to South Africa, and writing an add-on proposal to NIH for the purpose. He is planning to visit UWC in late February 2019 and will be

meeting Mark and Ron at that time. He is currently scheduled to meet school district teachers and administrators at the Metro South Educational District in Cape Town and to give a talk at UWC.

This visit addressed several objectives of Kosztin's proposal, and a few objectives of Chandrasekhar's. We continue to discuss opportunities to explore funding to develop teacher leadership and professional development in our monthly Skype meetings. Work on the summative assessments (objective 3 of Kosztin's proposal) is in progress. Other objectives of Chandrasekhar's proposal will be addressed during her June/July 2019 visit to UWC.