Thomas O'Kuma – TYC Physics Professional Development

1. From your perspective, what are the two things that your disciplinary professional organization or discipline-based NSF-funded project does particularly well in support of your work as an educator? Please be specific about how this activity works and why it is effective. Add web links if available.

The two most obvious aspect of my physics NSF-funded projects do well in support of my work as an educator are providing professional development in physics pedagogy primarily and content secondarily and providing a network connecting our portion of the physics community together.

My involvement with NSF-funded two-year college (TYC) physics professional development projects started in 1991. The TYC Physics Workshop Project (http://tycphysics.org/default.htm) started in 1991 providing opportunities for two-year college faculty only originally, but expanded to include high school faculty starting in 2002. In 2006, the ATE Project for Physics Faculty (http://www.physicsworkshops.org/) expanded this to include technical education.

In 1991, two powerful pedagogically approaches with a physics education research base had compelling evidence for them to be presented to existing TYC physics faculty, most of whom did not experience these approaches during their formal education. The first approach, microcomputer-based laboratory (MBL)[1-3], provided a way of infusing technology (computers, interfaces, and sensors) with well crafted curriculum[4-5] into the introductory physics courses. Twenty-four 3-day intensive workshops have been given over the last twenty years on this very important approach. After the workshops, participants were expected to implement the workshop ideas and materials. Many of the participants did implement the MBL approach with many of them getting funding from their administrations because they had received training through the workshop on how to implement this technology in a powerful way.

The second approach was a "low-technology" approach involving pencil and paper activities that a participant could use immediately in their classes. The Conceptual Exercise/Overview Case Study[6-7] (CE/OCS) approach provided training for the participants with them leaving the workshop with classroom-tested materials. Twelve 3-day intensive workshops have been given over the last twenty years on this very important approach. Additionally, this approach has been incorporated in many of the other types of workshops that we have done. Besides most of the participants implementing some of the CE/OCS ideas after the workshop, one participant used these ideas to develop his entire curriculum, called Spiral Physics, which has been used by many others (http://web.monroecc.edu/spiral/).

Since the early years of this endeavor, many additional workshops have been offered that incorporate some of the MBL or CE/OCS ideas. Using ideas developed from the CE/OCS workshops, books on ranking tasks and TIPERs (Tasks Inspired by Physics Education Research) have been published[8]. During this project, the first assessment instrument on electricity and magnetism ideas was developed, extensively tested and revised, and finally published[9].

The 3-day workshops were emersion workshops. Participants worked together, ate meals together, and stayed together during the entire time. There was 20 to 22 hours of training on the main workshop topics; an additional 4 to 6 hours of development and participant presentation time; and 2 to 3 hours of project related discussions.

The second aspect of these workshops is the networking of the participants among themselves and with the workshop and project leaders. Many participants (roughly 50%) choose to attend more than 1 workshop (since we had several different workshop topics over the years). We encouraged participants to give talks and posters at section and national meetings of the American Association of Physics Teachers (AAPT) and at their colleges or high schools. Hundreds of the participants choose to do so. We would hold informal and occasionally formal gatherings of participants at national AAPT meetings. Many of the participants have become active in AAPT and sections of AAPT as a consequence of this networking. Some of the participants have collaborated with workshop and project leaders to continue their projects or to help with other projects. Some have created their own projects. Scott Schultz of Delta College in Michigan and Todd Leif of Cloud County Community College in Kansas have created a project called the New Faculty Experience for Two-Year College Physics Faculty (see website: http://www.aapt.org/Conferences/newfaculty/tyc.cfm) in collaboration with AAPT. This project is designed for new physics faculty at two-year colleges.

This networking part of the projects is very important. Dwain Desbien, who is the co-principal investigator on the ATE Project for Physics Faculty since 2006 was a new faculty in the mid-1990s and early participant of the TYC Physics Workshop Project. His involvement in these early workshops inspired him to become active nationally and to want to help lead the "next generation" of workshops and other endeavors.

2. If you could propose (and obtain funding for) one new activity to engage community college instructors in professional associations and other discipline-based projects related to teaching and learning, what would it be? Describe the activity, explain why it is needed and why it is not currently available.

I would propose a "Center for Two-Year College Physics" that would be sponsored through the AAPT. The center would coordinate existing TYC physics projects (such as the New Faculty Experience project and the ATE Physics Workshop project) and create other new projects that are needed. One example of other projects that need to be done, but are not currently being done, is conducting national conferences. We need to have national conversations (conferences) on program needs like the need to establish a successful preparation of future teachers program at your TYC or a national look at ignored program areas like conceptual physics or algebra-based physics. Another example of other projects is the need to address community needs like coordinating surveys of physics programs to know how many students take this course, how many are in technical programs, and many other questions. We need to visit exemplary TYC physics programs so others can emulate these successful programs (like the SPIN-UP/TYC project – see website: http://aapt.org/Projects/spinup-tyc.cfm). Since AAPT is a national association, the Center would not be tied to any one college or any one individual. It would have the ability to serve the diverse TYC audience.

The Center concept is needed to help coordinate the limited resources that are available for TYC physics efforts into a national "master plan". The Center would provide a maximum number of services, yet requiring minimal infrastructure. Funding for the Center is not currently available since it does not "fit" into any funding agency's category. This concept does not fit nicely in the TUES or ATE program. AAPT, by itself, cannot afford to invest the necessary funding into a TYC Center.

References:

[1]See Dan MacIsaac's (Buffalo State University) website for a brief summary of MBL research in physics with a fairly comprehensive list of references. http://physicsed.buffalostate.edu/danowner/whyMBL.html

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[5]R.K. Thornton and D.R. Sokoloff, *Tools for Scientific-Thinking*, Vernier Software, Portland, 1992; D.R. Sokoloff, R.K. Thornton, and P.W. Laws, *RealTime Physics*, John Wiley and Sons, 1996.

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[9]D.P. Maloney, T.L. O'Kuma, C.J. Hieggelke, and A.V. Heuvelen, "Surveying students' conceptual knowledge in electricity and magnetism", Am. J. Phys. Suppl., **69**, S12-S23 (2001).