

RESEARCH INTERESTS

My interests in research fall under the following broad categories: Teacher Development; Technology Integration; and Student-centered Learning (or Student-regulated Learning). Effective professional development is a multi-dimensional endeavour. One of these dimensions addresses the need for ongoing, omnipresent and collaborative teacher development. My research currently encompasses an investigation into the creation and maintenance of a Community of Practice (sometimes known as a Professional Learning Community), which is intended to support this dimension of teacher development. Within this same research, I am also interested in Information Communication Technology Integration in the context of secondary science. Currently, along with 21 teachers, I am investigating data logger integration in senior high science classrooms to discover potential benefits/concerns for students in their quest to reach curricular outcomes. Ultimately, this underlying focus, and my theoretical stance, is one embracing student regulation. The creation of educational contexts which support student inquiry in science is showing signs of providing for this student regulation.

Research Productivity

Throughout the past two years of research, I identified an already-existing informal Community of Practice (CoP) and began a process of presenting ideas to them regarding the possibilities of hand-held data loggers and how they can be used in ways that support science student inquiry. At the same time, these teachers presented concepts to me. Together we became a more formal CoP of educators attempting to increase the level of student-owned scientific inquiry in their school. Data was collected (interviews, focus groups, online postings) which resulted in teacher beginning to see the potential of these technologies for science inquiry. Evidence of this work has led to numerous publications (MacDonald, 2008a, 2008b, 2009; MacDonald & Larter, 2007a, 2007b). Some of our findings from this researched are outlined below.

Science sub-cultural influence on pedagogy. Science teachers related their need to have the knowledge of those who have come before them transmitted to students. This may be the expression of a sub-cultural value of what good science and good science teaching is. The sub-culture of science teachers and its proliferation may be predicated on the nature of science, which necessarily involves the transmission of knowledge. That is, science teachers may want to teach in the same way that science exists – which is not an unreasonable desire. Another desire held by these teachers is to increase student inquiry through the use of technology and other means. Yet, they feel that good teachers will do a disservice to their students if they do not cover the curriculum outcomes. Therefore, there is a strong inclination in the community to invoke transmission as an efficient way to cover those outcomes.

Science teachers want to find a balance between their perceived traditional core values of what science teaching is and student inquiry. These teachers appear to believe that both types of pedagogies are needed but that the sub-culturally dominant transmission outweighs inquiry as the safer way to (Figure 1).

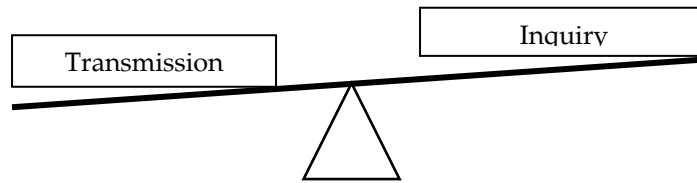


Figure 1: Transmission Outweighs Inquiry

Despite the fears that teachers may have regarding a threat to their sub-cultural identity, the integration of hand-held data logging technology appears to be showing signs of being an agent of change in teaching and learning. The integration of this technology has not been solely focused on the technology itself. It has also focused on how teachers can collaboratively re-examine their own practice concerning student inquiry in science through a CoP. Findings from this study suggest that teachers can integrate technology in ways that encourage student inquiry, as long as the legitimacy of the sub-cultural values is not challenged. Technology could be seen as a threat to teachers. However, as a non-threatening form of professional development, a CoP which respects sub-cultural values may be the key to encouraging student inquiry through technology integration. To do this, the CoP needs to be significantly directed by the teachers to alleviate their fear that outsiders may disregard these norms and practices.

Recognize and incorporate sub-cultural norms and practices. The sub-culture of secondary science teachers holds that the nature of science involves the transmission of knowledge from generation to generation. This belief may manifest itself in classroom transmission pedagogies. The sub-culture of science teachers may also appear to believe that transmission pedagogies are effective for covering curriculum outcomes. Transmission is viewed as an acceptable and supported norm within this sub-culture. If teachers are going to re-examine this tension between transmission and inquiry then their sub-cultural norms must be acknowledged and addressed. By doing this, teachers will not perceive these experiences as a threat to their core values. Meaningfully involving teachers in the CoP process will provide inherent value to their work. Teachers in this study have and will continue to engage in their own authentic inquiry. As an authentic and collaborative mode of professional development, a CoP can provide a context where teacher reflection may lead to important findings regarding if, how and when to integrate technology in inquiry ways. It is these teacher-owned discoveries which truly matter in science education. A CoP also provides a context whereby deep teacher reflection may lead to a re-examination of teacher beliefs and practices.

Balancing the pedagogical economy. These teachers are not comfortable with transmission as the dominant pedagogy as they also value student inquiry. It has been found that these teachers engage in an economic, cost/benefit analysis to guide their pedagogical choices. They ask themselves two questions: 1. Do they teach in student-owned ways of teaching and integrating technology like student inquiry, which result in a high benefit for student engagement, but cost a great deal of time and may not cover all curriculum outcomes?; or 2. Do they engage in transmission pedagogies which may result in lower student engagement but have a low time cost and high number of curriculum outcomes reached? These teachers want to do what is best for their students

and they also want to continue to collaboratively engage in the CoP to examine their teaching beliefs and *balance their pedagogical economy*.

Gender may make a difference. Last year, we discovered that these technologies are not appreciated by all students. As well, it was found that student-led inquiry as the pedagogical approach does not suit all learners. One of the most obvious differences, teachers related, was between males and females. Girls appeared to be engaged less often and with less intensity than males. This recent finding requires more thorough and intentionally organized research, which is currently being investigated during the 2008-2009 school year.

Gender and Technology in Science

Secondary School. Through the use of our now established collaborative Community of Practice mechanism, new questions have emerged, which is necessitating a shift in the research. Last year, we were researching how teachers can collaboratively work together. Now, we are considering student interactions with data logger technologies. The research seeks to discover if data logging technology, integrated in inquiry ways (where students ask and answer their own science questions), improves all students' self-efficacy in science. Stereotypically, one learning style preferred by males, is that of using technology in the classroom to support learning. Our current, preliminary research findings suggest that this may be true. Girls differ from boys regarding their interest in using these devices in particular ways. If this is true, how will teachers address the needs of both girls and boys? This research will explore this question. We will find out if boys and girls differentially appreciate data loggers in their science classroom. We will also examine underlying effects of teacher actions on students' sense of self-efficacy in science, as self-efficacy predicts achievement in science. If gender differences do exist, we will then find out how these differences may be addressed so as to not disadvantage either gender.

Post Secondary Education. If there are indeed differential gender tendencies toward technology integration in science – our research suggests that males appear to appreciate technology more than females – then one way to investigate this is by looking a predominantly male population. This is currently being done with an all-male student population at Holland College Trade and Technology Centre (Summerside). A Physics instructor is acting as a research collaborator at that site where we are investigating gender issues concerning student inquiry which is supported with technologies like data loggers.

Other Research Interests

New Learners. Along with the research interests already outlined, I am also involved with a team of UPEI researchers investigating “New Learners.” New learners are those who come to university with a new way of learning through the use of technology. This longitudinal, mixed-method study is examining the potential differences between the way they learn and the way University teachers teach. If there are

differences, we want to identify how university pedagogy can more fluidly address New Learners needs. This is exciting research that is already showing stark differences between what we think New Learners need and what is provided for them.

Linking Coursework to School. Another exciting research project involves a collaboration of 43 researchers from across Canada. We are investigation current teacher education concerns/questions. I am a member of a subgroup of these researchers who are investigating how to more uniquely and substantially link Bachelor of Education coursework to the school practicum (and vice-versa). We are developing research projects to investigate ways to value the school context and cooperating teacher's expertise, which may result in a more pragmatic and yet critical and collaborative cooperating teacher, pre-service teacher and faculty advisor relationship.

References

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