Collaborative Curriculum Development Among Science Educators from Primary, Secondary, and Tertiary Schools: Promoting mutual challenge and support.

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Relationships Among Educators in Universities and Schools

To a great extent, a hierarchical relationship exists, in matters of curriculum and pedagogy, among educators in successive divisions (i.e. primary, secondary, and tertiary) of the school system. Although not always the case, teachers in primary (elementary) schools often look to high school science teachers for advice about subject-matter and teaching strategies. In turn, teachers in both of these divisions frequently get similar information from members of faculties of science. University education faculty tend to share pedagogical approaches with teachers of science in elementary and secondary schools. On the other hand, members of university faculties of science and education tend to work independent of each other.

Science educators from elementary and secondary schools and faculties of science and education should reach a state of mutual assistance (a kind of 'mutualism') in each other's curriculum development and pedagogical approaches. Some questions about such collaborations might be: i) In what aspects of their work would they collaborate?, ii) To what extent would collaborations be 'equitable?,' and iii) What factors might affect the nature of collaborations?

Research and Development Approaches

In order to answer questions of the type listed above, science educators from elementary and secondary schools and faculties of science and education were engaged in programmes of collaborative curriculum development facilitated by action research, in concert with naturalistic methods of data collection and evaluation.

The project was conducted over a five month period between January and June of 1996. Two teachers of science in elementary and secondary schools interacted with three members of the Faculty of Science at the University of Western Ontario, along with a professional educator (LB).

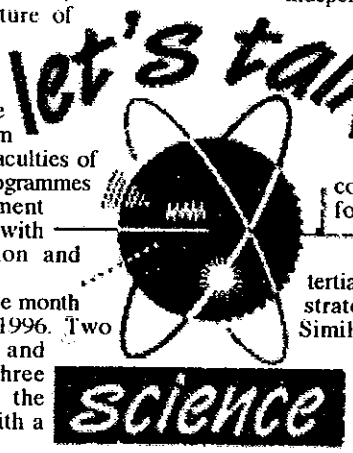
The project followed the general pattern below:

1) Participants first reflect on their current attitudes, skills, and understandings about: i) products of science and technology (e.g. laws, theories, inventions), ii) the nature of practice in science and technology, iii) outcomes for science education, and iv) pedagogical approaches for various outcomes. Surveys, self-reflecting journal entries, and interviews facilitate this.
2) Participants meet for several hours (at UWO) to: i) share their current attitudes, skills, and understandings, and ii) collaborate in curriculum development in each of their cases. Samples of their work and records of their discussions are stored.
3) Participants refine their plans and implement them in their respective teaching situations. Samples of their work and that of their students, self-reflecting journal entries, records of interviews with them and their students, and anecdotal records are stored.
4) The above steps are repeated twice more, although the nature of interactions and research approaches evolve as does the curriculum development.

Research and Development Findings

Data support the following claims:

1) Teachers of science in elementary schools readily adopted, with confidence, teaching strategies provided by tertiary education personnel (LB) enabling students to conduct and evaluate open-ended experiments and studies of their own design and dealing with problems of their concern;
2) Science teachers in secondary schools only expressed mild interest in teaching strategies provided by tertiary education personnel (LB) which may have enabled students to conduct open-ended experiments and studies of their design and dealing with their problems;
3) Teachers of science in secondary schools most readily adopted pedagogies enabling students to understand products of professional science and technology;
4) Teachers of science in elementary and secondary schools appeared to change their understanding of methods of scientific problem setting and solving;
5) Students in elementary schools demonstrated: i) realistic understanding of the nature of scientific problem solving, ii) expertise in design of tests to evaluate predictions and explanations, iii) enjoyment of independent problem solving activities;



Discussion

More complete mutualism, in matters of curriculum and pedagogy, among science educators in primary and secondary schools and university faculties of science and education appears to be feasible, under certain conditions. Participants must come to recognize, for example, educators in other groups can contribute to aspects of their work. In the present study, educators in secondary and tertiary schools came to appreciate general teaching strategies contributed by elementary teachers. Similarly, educators in faculties of science and secondary school science came to appreciate perspectives and approaches dealing with the nature of practices in science and technology which were offered by the tertiary education professional (LB). As educators from the four groups spend increasing amounts of time in collaborative curriculum development more changes to concepts, beliefs, and practices may be expected.

One of the most important changes which can come from shared curriculum development and which, in turn, can facilitate mutualism among science educators at different levels, is a new set of priorities for science education outcomes. There is a long tradition of affiliation between university scientists and secondary school science teachers. Indeed, the latter, for various reasons, tend to serve the former in selecting and encouraging a small, elite group of students for further study in academic science. These functions are achieved, to a great extent, through a complex process of glorification of products and processes of professional science and technology. Science educators in elementary schools, by contrast, do not have this affiliation and tend to emphasize more general learning outcomes, such as integrated thinking skills. Our findings suggest that educators in faculties of education may have an important role to play in bringing these two cultures together to a point at which their goals for science education are more compatible. At the same time, education and science faculty members may collaborate more with each other and with science teachers in elementary and secondary schools.