Iowa Science Teachers Journal

Volume 23 | Number 1 Article 2

1986

To Start with Impact

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Many science educators and curriculum coordinators are now asking science teachers to plan their courses — perhaps their entire science curricula — around current issues and problems. Such procedures require identifying local concerns, regional problems, national controversies, and global crises to use as unit themes, application focuses and course titles for school science offerings.

Such a departure from tradition is traumatic for many teachers since it introduces a view of science and science study alien to their own experience. Science teachers are part of the 3 percent of our citizenry who have completed college with a major in science. As such, they find it difficult to identify with the interests, abilities, and perceptions of the other 97 percent; yet most of them believe science education should be for all. NSTA has proclaimed that science is so important that it should be required for "every student everyday he/she is in school."

The Iowa Department of Public Instruction has produced curriculum tools in a variety of areas to help schools assess the effectiveness of their programs. The science tool recommends attention be focused on three dimensions of science, namely *concepts, processes,* and *impact.*

The concept and process categories are traditional. These are widely accepted as desirable, perhaps even essential. Teachers have always thought in terms of basic content. To define content in terms of concepts (in place of isolated facts) suggests organizational rules for the various disciplines of science. Many recent curriculum development efforts are merely a re-ordering of the concepts peculiar to a particular science.

Although process never attained the prominence sought for it during the past three decades, many teachers grounded in the "new" programs of the 60's are comfortable with an emphasis on processes and feel a continued need for such an emphasis.

Among some leading science educators, emphasizing science processes became a fad. Focus on process often separated scientists (who were concerned with content, per se) and educators (who were enamored with what scientists do).

Somehow the identified science processes became axioms, something which everyone could accept and support. And yet these considerations, when present at all in the curriculum, tended to be conveyed at a descriptive/informational level, as additional content to be learned. Many educators were preoccupied with this new content and argued over the number and definitions of these processes — the behaviors which characterize the actions of practicing scientists.

Perhaps the best known listing and treatment of science processes is Science — A Process Approach. This entire elementary school program was developed by the American Association for the Advancement of Sciences. Many teachers

continue to find this treatment valuable and fascinating, usually because it is so alien to their own experience with science and science study.

But is it fair to characterize science by either content (the products produced by current and past scientists) or processes (the glamorized behaviors which permit scientists to produce new understanding of the universe in which they find themselves)? To do so seems akin to presenting music as solely the compositions produced by the masters (the products of their effort) or a careful analysis of the skills they possessed which enabled them to create such work.

The inclusion of the category of *impact* in the DPI criteria reflects the new focus of science education in the past decade. Most leaders in the field of science education agree that dealing with the applications of science is essential as we strive toward general scientific/technological literacy for all. Such literacy they deem is essential in a democracy whose citizenry is called upon to make decisions affecting the future of the natural world.

Science may be meaningful, important and approachable through focus on its impact on the daily lives of all people. Its applications for individuals may be the starting point where interest can be generated, curiosity ignited, and new experiences encouraged. The impact of science brings to attention current investigations, problems and issues, and situations where decisions must be made by society as a whole.

Start with impact? Many science teachers react skeptically. How can anyone consider the impact of science and technology without first knowing some basic science concepts and some of the processes scientists use? Many successful students of science apparently do not truly understand or internalize much of what they studied in science courses. Most retain those explanations derived from real world experiences but forget the laws, theories, processes and ideas of science so carefully taught.

Perhaps all real learning must start with impact, a real situation. In order to examine and resolve a situation, processes can be suggested, perhaps those similar to the means used by scientists acting as interested detectives. Perhaps by focusing on problems, issues, real-life situations, and applications of science (i.e. IMPACT) a better reason for learning basic science concepts will emerge. When students really need to deal with a phenomenon, a problem, some impact of science in their daily lives, they will be motivated to wrestle with it, thereby escaping the teacher's dogmatic insistence that "you first need to know" before you can hope to deal effectively with a problem.

Perhaps engaging students in problem resolution isn't a bad idea. If information and procedures are really important and necessary, won't the students be the first to realize it? What a change this would bring into science courses, students wanting "to know" and wanting to be able "to do" in order to deal with a given impact problem.

Instead of considering impact as a third category to be added to effective science programs — the category that gives teachers the most problems and the most questions, and the one most classes never quite have time for, impact could be the starting point.

Impact may be the best and obvious "organizer" for the curriculum, a starting point rather than an end point.