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ABSTRACT

Unprecedented developments in information technology and a steady expansion of the free-market system are posing challenges to the status-quo of all professions, including science education. In order to make improvements in their practices in line with the exponential growth of information and the demands of increasingly well-informed consumers, it is imperative that professionals network with each other. This paper highlights the importance of networking as a powerful and constructive way of accomplishing better practices in science education. It discusses what networking is and highlights different interactions, including interactions with professionals outside academe, interactions with professionals inside academe, and interactions with consumers. It is concluded that the future of science education will depend on how science educators network among themselves and with others from related and diverse disciplines in an age of information and free-market economy. Contains 11 references. (JRH)

Considerations for Networking for Better Practice in Science Education

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Introduction

Unprecedented developments in information technology and a steady expansion of the free-market system are posing challenges to the status-quo of all professions including science education. Professions which are prepared to make improvements in their practices in line with the exponential growth of information and with the demands of increasingly well-informed consumers will have a better chance of survival in years to come. In order to do so, it is imperative that professionals must be able to network with each other much more than in the past. How to improve science education through networking is a major challenge facing science educators.

Over the past several decades, science education has been constantly undergoing changes, especially in curriculum, instruction and assessment. Efforts to implement national standards in science due to increased public demand for world class education have brought considerable attention to science education in the United States. While addressing reform in curriculum, instruction and assessment, it is equally critical to explore ways of improving practice in science education. In this context, the importance of networking as a powerful constructive way of accomplishing better practice in science education should not be underestimated.

What is Networking?

Merriam-Webster's Dictionary (1993) defines networking as "the exchange of information or services among individuals, groups or institutions"

(p. 780). For the purpose of this paper this definition is augmented to include the extension "...for better practice." Networks consist of nodes and links, and the degree and direction of the interactions between and among the nodes. In science education, nodes may represent science educators inside and outside the academe, related professionals and consumers (i.e., students, parents and the general public), either individually or as clusters (or groups). Links may represent the pathways and flexibility of interactions between any two or more of these nodes. From a human resource standpoint, networking is a complex process and dependent largely on the nature of the interactions among the individuals who form the nodes in the network.

In science education, the interactions may take any of the following forms: teaching, learning, mentoring, providing feedback, communicating, discussing, debating, self-regulating, success seminars, colloquia, sharing curriculum resources, etc. Also, it should be pointed out that, from a professional sense, practice in science education involves teaching, research and service, each of which either stands alone or overlaps with the others depending upon the nature of the network. Therefore, networking for better practice in science education should include the following interactions: Interactions with Professionals Inside the Academe; Interactions with Professionals Outside the Academe; Interactions with Consumers.

Interactions with Professionals Inside the Academe

Forming professional communities of practitioners is a practical way of networking for improved practice within science education. As Tippins, Nichols and Tobin (1993) said, one factor that would bring education professionals together is mutual access for discussion, sharing practices, collaboration within the context of teaching, and a collective focus on learning. Science educators involved in teacher education should reflect on science learning in actual classrooms on a continuous basis and, to that extent, be willing to work together with other teacher educators and school teachers as a community.

For example, funded grant projects (i.e., Eisenhower Title II; NSF/State) have resulted in creation of professional development networks among school teachers and teacher educators designed to improve both teaching and learning in an atmosphere in which all participants share equally in teaching and learning from each other. Such "integrated" networks depart from the traditional hierarchical configuration of expert (e.g., university faculty) telling the novice (e.g., classroom teacher) what they should or shouldn't be doing. Within this integrated network configuration, postsecondary faculty are actually teaching K-12 students while at the same time K-12 faculty are team-teaching with postsecondary faculty involved with teacher preparation in science and mathematics. The success of an integrated (vs. Hierarchical) network configuration can be measured in terms of the degree to which classroom teachers (K-12) become further involved in their own professional development and advancement, the degree to which they serve as role models or facilitators for improved practice on the part of their peers, and ultimately the increased interest and performance of their own students in science. In turn, by abandoning rigid guidelines and hierarchical structures, integrated network organizations minimize the “barriers” to successful cross-institutional, cross-fractional and cross-location projects. For other examples of networking with professionals within academe, see Stannard, O'Brien and Telesca (1994), and Simmons (1994).

Computers can play a significant role in networking science teachers, prospective teachers and teacher educators across communities. Using the Internet to link teachers is being encouraged and even financed by public and private funding agencies. The Florida Department of Education, in conjunction with science and mathematics educators, has developed the Electronic Curriculum Planning Tool (ECPT) which will enable teachers to collaborate in terms of designing of science and mathematics lessons. As teachers begin to develop, refine, implement and evaluate new course curricular and assessment methodologies, they will be able to develop a large database of quality science lessons - which can then be electronically communicated to other professionals in the same or varied disciplines. Such a contemporary technology-based environment would enable science teacher educators to interact effectively with preservice and inservice science teachers in presenting and sharing effective classroom practices in addition to engaging in professional dialogue.

In addition to the Internet, traditional technology could also play a vital role in networking science education professionals. For example, Barrow

(1995) reported how the telephone was used for networking new school teachers with university science educators in a project named Phone Assistance for Teachers of Science. Those involved in science education should take advantage of both traditional and contemporary technologies for building professional communities.

Science educators should not overlook research while networking for better practice. Rather than engaging in isolated studies, science educators should consider interacting with each other to identify problems and conduct collaborative research studies. Such collaborative research studies should involve K-12 practitioners whose classrooms are, in essence, the laboratories for appropriate research. Concomitantly, classroom teachers should serve as "teacher researchers," that is, individuals who are systematically designing, implementing, and evaluating methodologies in instruction and assessment that reflect advancements in our understanding of the teaching and learning process. According to Albert Shanker, president of the American Federation of Teachers, "without good research, we [educators] will continue on an endless cycle of mistakes and the loss of successful insights and discoveries" (cited in Marshall, 1993, p. 25). As Yager, Lutz, and Craven III (1996) said "we are doomed to failure unless we integrate change, collaboration, and strong research base into science teacher education programs" (p. 93). Science educators should take such insights seriously and call for more research into the use of technological applications including the Internet quality and other networking efforts and their impacts on science instruction.

Dissemination of research findings on effective science instruction in a timely fashion is critical for making changes in teaching and learning of science. How to disseminate research findings electronically is being explored by science educators. As a result, online electronic journals (e.g. The Electronic Journal of Science Education, Information Technology & Disabilities) are appearing on the Internet. Recently, the U. S. Department of Education funded a 25 million dollar National Eisenhower Educational Clearing House for Science and Mathematics (located in Columbus, Ohio) to gather all science education curricula and research materials available to date and make them electronically available on the information superhighway in the near future. Science educators must take advantage of these facilities and make such fruitful applications of computer technology part of their practice.

Interactions with Professionals Outside the Academe

Science educators should consider networking with professional groups outside academe, as a step towards reform (Yager, Lutz, & Craven III, 1996). Examples of such groups are the National Institute for Science Education, National Eisenhower Clearinghouse for Mathematics and Science Education, local and national policy research groups, AAAS's Project 2061, etc. Yager et al., also advocate the importance of science educators having collaborative relationships with local and state education department officials. For example, the Florida Department of Education has established six Area Centers for Educational Enhancement (ACEE). The Centers represent a collaborative network among school districts, postsecondary institutions, regional service providers (e.g., Title I; School Improvement Office; Human Resources Management Development), the Department of Education, and community agencies. Each region has a "unique" opportunity to embark upon the development of their own network design while at the same time not losing sight of the overarching mission of establishing a K-16 seamless articulation across curriculum, instruction and assessment. In turn the ACEE should support improved academic success for all students. Within this context, the Centers network efforts focus less upon differentiation and more upon integration of services, functions, tasks and locations. Establishing a regional K-16 ACEE can strengthen the frequency and quality of interactions across participating groups, build common vision, support local efforts at school improvement and teacher professional development.

The Higher Education Consortium in Florida, part of ACEE, has a mission to strengthen collaborations between and among science and mathematics educators across the community colleges and universities within the region V it serves. (The region V includes Broward, Palm Beach, Hendry, Collier, Martin and Monroe Counties in Florida.) Such cross-institutional collaborations, while a loosely-structured network, have "enabled" faculty across the participating institutions to discuss issues of common concern, prepare mini-proposals (i.e., through Title II Eisenhower funding) for the redesigning of courses aimed at improving student success in undergraduate science courses. Regional meetings and "Sharing Success" colloquia for improving practice are also part of the Consortium activities.

Professional networks outside academe should also include industries, science museums, community organizations, exploratoriums, etc. The Triangle Coalition for Science and Technology Education is an example of a professional network which involves members from science education, business and community groups with a goal of achieving systemic reform in science education. Other examples include school industry partnerships which have been known to benefit students and enhance practice (Heath, 1994). Heath (1994) estimated over 1,000 partnerships in various configurations in Franklin County, Ohio. Science educators should continue to explore such avenues of collaboration. With the Internet, it is easy to search, locate and establish contacts with professionals both inside and outside academe. Also, it is increasingly common for such networks of professionals to interact with each other via the Internet.

Interactions with Consumers

In an increasingly consumer-oriented free-market economy, consumer satisfaction is paramount to the ultimate success of any business, trade or profession. In education, students, parents and the general public are the key consumers. Using consumers to judge the quality of products and services is a time-tested way of quality control. For example, parents who support public education with their tax dollars expect to see their children do well in school, especially in subjects such as science and mathematics. Science is seen as one of the key subjects for developing personal skills in students that are essential for survival in a science- and technology-dominated world. As a matter of fact, since Sputnik, more is expected of all the science education reform efforts such as Project Synthesis, Science for All, etc. Yet, according to Melear (1993), "reform efforts to date, to teach the hands-on minds-on science and process approach and to address goal clusters other than academic preparation, have been less successful than desired" (p. 137) in the eyes of the consumers.

From a consumer viewpoint, the professional responsibility of each science teacher for providing quality science learning experiences to his/her students is great, and that of the science teacher educator is even greater. Science teacher educators must continue to emphasize meaningful methods of teaching in their preservice courses while not minimizing the importance of strong content background in order to ensure that the science teachers they graduate possess the knowledge and skills to be effective teachers. A recent report by a bipartisan commission of leading educators and prominent public officials raised concerns over the poor content background of school teachers (Miami Herald, 1996). Such reports should not be taken lightly, because currently teacher education is an area of great concern among educators and the general public.

For example, the content knowledge that prospective elementary teachers bring to science methods classes is unacceptable in terms of building student conceptual understanding or uncovering student misconception (Anderson & Mitchener, 1994). Without sufficient content knowledge it is very difficult to build an understanding of innovative teaching methods, and it is a dilemma facing science education as a profession. Science educators should take initiatives to rectify this long-standing problem in teacher education. In the long run, teachers who can provide quality science learning experiences to students not only benefit students but will also help win parental support and consequently establish consumer confidence, a factor critical to the survival of any profession. On the other hand, how to win consumer confidence in science education remains a key issue. To address this issue, science educators should explore avenues of networking with consumers, as consumer feedback would help to develop strategies to serve them better.

Summary

The future of science education will depend on how science educators network among themselves and with others from related and diverse disciplines in an age of information and free-market economy. Further more, in the wake of National Science Education Standards the need for professional networking in science education is critical (Yager, Lutz, & Craven III, 1996). Facilitating quality interactions with professionals in side the academe, outside the academe, and with consumers (i.e, students, parents and the public in general) are a few practical ways of networking human resources for better practice. With the assistance of information technology, networking could take any design and reach any destination. The proposals made in this paper are aimed at improving professional practice in science education in the twenty-first century and keeping the on-going debate on the future of this noble profession alive.

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