Chapter 8
Professionalising Natural Science Education and Multipronged Open Distance Learning

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ABSTRACT

Tobias et al. (1995) postulated in their book on "Rethinking Science as a Career" that Master's programs could produce graduates who provide the same level of expertise and leadership as professionals do in other fields. They say that they would do so by having the ability to use the products of scholarship in their work and by being familiar with the practical aspects of emerging problem areas. If we consider natural science consisting of physical sciences, biological sciences, mathematics, geosciences, and computer science, degrees in computer science and geosciences served as credentials for practice, whereas physics, chemistry, and biological sciences served as classical graduate education. Robbins-Roth (2006) collected 22 career descriptions for science graduates ranging from public policy to investment banking, and from patent examining to broadcast science journalism. There are several sectors of the society where the principles and knowledge of these science disciplines are used. On the other hand, there are many of the graduates in these disciplines who either are working in areas completely unrelated to their education and training or are unemployable. The need for preparing the science graduates professionally is well recognized (Schuster, 2011; Vanderford, 2010; Narasimharao, Shashidhara Prasad and Nair, 2011; Chuck, 2011).

INTRODUCTION

Open distance learning (ODL) is viewed as one of the potential system of education to serve the needs of the society (see Ram Reddy, 1988). However, in Indian context this system is often considered as 'second chance' or even 'second grade' education. It is important to analyze the fact that in spite of ODL gaining more and more importance all over the world in response to knowledge society needs, why it is still treated as 'second grade' education by many in developing countries like India. Many factors like equating distance education with correspondence education, ODL following the beaten

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path of hierarchical approach of conventional class room system, industries not realizing the ODL potential, poor repetition of courses that are offered in conventional university system, and laying more emphasis on producing learning resources of high quality than on the development of local capacity; has contributed to this situation (Rangappa and Narasimharao, 2010). The chapter discusses how a multipronged open distance learning incorporating various developments that are happening in the tertiary education system[1] can facilitate professionalizing the natural science education.

Issues in Professionalizing Natural Sciences

The growth and emergence of knowledge and service based industries, knowledge intensive firms coupled with professionalism, and globalization of economies coupled with local socio-economic changes have lead to new and pressing demands on educational institutions and other organizations. These knowledge based economies puts emphasis not simply on skill development but on developing professional skills. The term *professional skill* is used to refer to the skillfulness with which professionals engage in practice. This means there is a need to produce graduates in Natural sciences with the ability of applying their knowledge in practice. There are various issues involved in this.

Preparing the Graduates for the Workplace

In the early part of the 20th century, professional and graduate education took divergent paths as can be seen from pure sciences (physics, chemistry, biology) and applied sciences and technology (engineering, agriculture, medicine). It is generally accepted fact that graduates in applied sciences are trained to enter workplace. In pure sciences, on the other hand the graduates are educated for academics (Schuster, 2009). In the last 50 years more fields are trying to become more professional and natural sciences field also started offering more applied courses (Table 1). However, what is important is to provide students with connections to real-world problems and develop the ability *to bring both scientific knowledge and professional skills to the workplace* allowing them to make a *contribution in the workplace from day one.*

Challenge of Integrating Knowledge from Different Disciplines

Traditionally, the master's degree in the natural sciences has tended to be single-discipline in orientation. However, in work life the graduates need to address issues that require integration of science content. They need to be able to access and identify information, consider ethical and legislative issues, develop communication skills and work in cooperative environments. All this coupled with disciplines becoming part of multi-disciplinary matrix (Okuwada, 2006) puts demand on the graduates to integrate knowledge from disciplines and develop a professional approach to the subject. *This integration cannot be done by simply giving a mix of different disciplines.*

Involving All Stakeholders of Higher Education in the Development of Program

As Braskamp and Wergin (1997) argue that the institutions of higher education need to reorient themselves as active partners with parents, teachers, principals, community advocates, business leaders, community agencies and general citizenry to meet the demands of knowledge society. This is more so in the case of science where there is a paradigm shift towards knowledge production that was socially distributed, application-oriented, trans-disciplinary, and subject to multiple accountabilities (Beerkens, 2009). Thus for preparing the

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