Chapter 12

Curriculum Design and Development for Computer Science and Similar Disciplines

Igor Schagaev
London Metropolitan University, UK

Elisabeth Bacon
University of Greenwich, UK

Nicholas Ioannides
London Metropolitan University, UK

ABSTRACT

In this paper, curriculum design and development for computer science and similar disciplines as a formal model is introduced and analysed. Functions of education process as knowledge delivery and assessment are analysed. Structural formation of curriculum design is presented using definitive, characteristic and predictive functions. The process of changes in the discipline is also described and analysed. The authors then develop an algorithm to determine the core of the discipline and functions of the core moving and merging are introduced.

1. INTRODUCTION

Computer Science is a relatively new and fast growing discipline for teaching. It absorbs different theoretical and technical results from different disciplines and creates a fusion which penetrates and influences many aspects of human life. Computer Science is, in fact, the theoretical base for the fastest ever growing area of technological

development, that of Information Technology (IT). At first glance, Computer Science as a discipline should absorb its own technical applications (IT), but previous attempts to do this failed.

This work attempts to form a logical *core* of *curriculum design* for computer science and similar disciplines. Initially, the main terms used are defined and the role of education as a very important driving force in the improvement of life for the society at large is identified (Section 2); then existing models of *curriculum develop-*

ment and their drawbacks are briefly discussed (Section 3). Curriculum design as *information processing* is then analysed (Section 4) and further developed by the introduction of three main functions in discipline construction: *definitive, characteristic* and *predictive* (Section 5). The *core* of the discipline, the way of its selection and its main features: *moving* and *merging*, are analysed and discussed (Section 6) and finally further work and open problems in the further development of our approach are presented (Section 7).

2. SCIENCE, KNOWLEDGE, SKILLS, CURRICULUM: DEFINITIONS AND CLASSIFICATIONS

The main terms used in this study are general and have a variety of meanings which depend on the human activity that they may be used for. It is, therefore, necessary to define the specific meaning of these terms for the work presented here. Complete description of each term can be found in The New Penguin English Dictionary (2001).

- **Science:** 1. The study, description, experimental investigation and theoretical explanation of the nature and behaviour of phenomena in the physical and natural world; 2. Branch of systematized knowledge of study.
- **Knowledge:** 1. Information, understanding acquired through learning or experience; 2. The total body of known facts or those associated with a particular subject; 3. Justified or verifiable belief, as distinct from opinion *(Phil)*.
- **Skills:** Special abilities in particular field acquired by learning or practice.
- **Curriculum:** The courses offered by an educational institution or followed by an individual or group;
- **Latin:** running, course, course of study, programme

- **Computer Science:** Study of the construction, operation, and use of computers

A more holistic approach to the word *curriculum* assumes that it should be placed between the *aim of education* and the *learning outcome*, where the *aim* is "what we want to achieve" and the *learning outcome* is "what we are able to measure". A major question raised here about the *learning outcome*, as this term assumes to express in one sentence the result of education, is whether we can actually do this!? This term will not be used here and its applicability is out of the scope of this work.

Curriculum design was analysed by Aristotle: "For the formal nature is of greater importance than the material nature" (Jeans, 1930) and Confucius: "He who learns but does not think is lost; He who thinks but does not learn is in great danger", clearly identifying the necessity of reflecting on what one has learned.

The idea of this work is to build an algorithm of *Curriculum design* and development for *Computer Science* disciplines using our own recent theoretical results and experience during the redevelopment of an existing module within the Faculty of Computing of the London Metropolitan University.

The terminology shows that *Science* differs from *Knowledge* by the indirect introduction of *the Subject* (an agent) to receive *Knowledge*. In spite of its well-deserved recognition, the Penguin Dictionary has, in our opinion, a serious mistake in the definition of the word *Knowledge* by using the too general and absolutely not essential in this context term *Information*. Long discussions on the interrelations of this term are presented in the number of books written by N. Wirth, E. Dijkstra, W. Turski and others. Our opinion about the relation between *knowledge* and *information* is shown below and the efficiency of this description is further elaborated below:

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