Physical Science Study Committee

A Look Back

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DECISIONS about formal education are always a matter of dispute, since it is a matter of making choices (Kliebard, 1977) about: what should be taught? How it should be taught? Why it should be taught? To whom? Should knowledge be distributed differentially based on capacities and or destinations? Answers to these questions emerge from complex interactions among several factors such as educational philosophy, social needs, political philosophy, educational psychology, and cataclysmic events such as Sputnik, war and inflation (Mitzel, 1982). School being a social institution, these factors operate at different levels of decision-making — ideological, societal, institutional and instructional. In the decision-making process, there are two basic issues that curriculum people need to address—one pertains to the nature of theories in behavioural sciences (Schwab, 1969, 1983) and the second deals with the role of factors and interest groups in curriculum decisions (Kliebard, 1986). This article will explore the second, with a focus on the Physical Science Study Committee (PSSC) project.

Decisions regarding curriculum do not come from any prescribed rules or regulations. More accurately, decisions about curriculum neither result from empirically verifiable generalisations nor from any experimental finding (Kliebard, 1977). Curricularists have to decide among competing choices (Kllibard, 1982) while being aware of a multitude of factors and possible interactions among those

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factors. There are several subject fields such as history (Charlton, 1968) and psychology (Huebner, 1968; Greene, 1971) that will help curriculum people better understand problems while making ad hoc decisions. However, deliberation seems to be the best mode to help look from different angles with different lenses in making curriculum decisions (Schwab, 1969, 1983). An analysis of the PSSC project reveals a dominance of scientists (physicists) in its work of developing the curriculum and that it proceeded undemocratically.

Historical Background

Success of scientific research and development during World War II convinced the U.S. President Roosevelt of the need for continued support to scientific research and development (Crane, 1976, p. 18). Vannevar Bush, Director of the Office of Scientific Research and Development, upon request from the President prepared a document outlining a national policy for science titled *Science — The Endless Frontier.* This document provided a strong impetus for the establishment of the National Science Foundation (NSF) in 1950. The NSF was constituted to support basic scientific research, initiate programme to strengthen scientific research potential, and support science education programme at all levels (Crane, 1976).

Initially, the NSF supported research and teaching at the college level. But, there were two potential sources that inspired the involvement of the NSF in pre-college science education. A first source was a widely read book by Dewitt (1955) titled *Soviet Professional Manpower* describing scientific manpower supremacy of Russia. Second, a group of professional physicists was concerned about secondary school science—"keenly aware of the inadequacies of science instruction on the secondary school level" (Little, 1959a, p. 34). In their university and college teaching assignments, they had long been dissatisfied with the high school background of their students. Under these circumstances the Physical Science Study Committee came into existence.

The Physical Science Study Committee (PSSC)

Soon after the establishment of NSF, their educational efforts came under stringent scrutiny. In 1955, the chairman of the House Subcommittee of the Committee on Appropriations, Mr. Thomas, raised a fundamental issue at the NSC Appropriation hearings for 1956: "... the National Science Foundation is trying to take over in this country the college and universities and lay down the pattern and control... a large part of this justification is predicated on fear of what Russia is doing" (cited in Crane, 1976, p. 46). The arguments between Mr. Thomas and Dr. Alan Waterman, Director of the NSF, clearly illustrate two concerns that are commonly heard today—one pertains to the centralisation and nationalisation of education (Weiler, 1990) and the other pertains to "banality and anxiety" (Edelman, 1977) evoked by the language of Japanese technological advancement.

Apart from the politics of centralisation and concern about Russian supremacy in the late 1950s, general agreement prevailed that much of the science taught in schools does not reflect the current state of knowledge and that it does not necessarily represent the best possible choice of material for instructional purposes (Crane, 1976, p. 57). For example, review of textbooks revealed that whole paragraphs have been carried from decade to decade even when some of the materials were outdated (Compton, 1953, p. 538; see also Michels, 1957). This position has been made clear in the early draft of PSSC textbooks— "This is a physics textbook in the making. Its aim is to serve as a draft from which a new secondary school textbook, *appropriate to the subject in the middle of the twentieth century* (italics added) can be produced" (PSSC, 1957-59, Vol. 1, preface, p. vii).

The first effort to design a new high school physics curriculum was begun on November 27, 1956 with a grant of US$303,000 allotted to the Physical Science Study Committee. Prof. Jerrold R. Zacharias of the Massachusetts Institute of Technology (M.I.T.), USA. was the chairman of the PSSC projects (Welch, 1978). The first major meeting was held in December 1956. The committee worked around four major issues (Little, 1959b), one of which was that the textbooks in general reflected a scientific outlook that dated back half a century and was no longer representative of the views of the scientific community (cited in Little, 1959b, p. 1; Krug, 1960, p. 327).

Having outlined the historical background of the PSSC and the major thrust of the project, a brief analysis of the project was given along four dimensions— (1) Who were the participants of the Project? (2) Was the tryout biased? (3) Was the feedback effective? and (4) Was the projects implemented on its merits? Each of these aspects will be analysed in the background of theoretical propositions.

Who were the participants in the project?

Several theoretical models for curriculum development have evolved since the PSSC project with as many as nine participants (Schwab, 1983). However, prior to the project, available literature on curriculum development identifies two models — one prepared in 1932 by the National Society for Study of Education (cited in Osborn, 1960) and the other proposed by Tyler in 1949. The National Society for Study of Education suggested three basic factors in the curriculum development, viz. a subject-matter specialist, a classroom teacher or supervisor, and a specialist in science teaching. This model is limited to instructional element of curriculum and does not take into account the learner and the society. Tyler is more development phase. Watson (1959) confirms Kopfers view that "study" aspect of committee work was of short duration.

It is argued that the first test run were in a small number of schools having mostly teachers and pupils of above-average capabilities (Watson, 1959). Over 12,500 students constituted the test group for 1958-59. Mr. Ferris, Associate Director for the Test Dvelopment Division, ETS, who worked with the PSSC also reported that, on the average, the initial group of students was certainly the "upper crust" of the ability range for which the new course was designed (Ferris, 1959). This makes one suspicious about the purpose of the project, i.e. to legitimise the value of the programme.

Was the feedback effective?

The role of teachers and administrators was primarily to provide feedback to the scientist-writers (Duschl, 1985). According to Welch, "Scientists were usually hesitant to accept the criticism of their science from school teachers..." (cited in Welch, 1979, p. 288). Therefore, the efforts were counter-productive to some extent as noted by Easley: "The full cooperation and appreciation of professional educators will be needed to give the work of the PSSC the support it deserved" (Easley, 1959, p. 5). Demanding cooperation of high school teachers, Little, Assistant to the President, Educational Services, and a member of the steering committee of the PSSC project remarked, "He and his students are the customers of this product" (cited in Little, 1959a, p. 35). The language and tone of the remark summarise the lack of deliberation needed in the process of the curriculum development. The dominance of scientists and resistance (and detached role) of teachers portray the counter-productive role of actors.

Was the project implemented on its merits?

A review of PSSC textbooks (PSSC, 1965; 1971; 1976a, 1976b, and 1976c) indicates that the thrust was on updating the content. There were four general features to the PSSC curricula—updating content, variety, laboratory, and thematic focus. The first, updating content was mostly concerned with the transmissionist view of knowledge and the other three were concerned with the instructional approaches (for brief description of the three, see Welch, 1979, pp. 289-90).

The PSSC project was implemented only on its merit of updating the content for the usefulness of the other features (instructional approaches) were not empirically verified on a representative sample. The preface of PSSC (1971) makes the updating aspect amply clear: "Five years have passed since the appearance of the second edition. During this time science education has made further advances.

In particular, new courses on the junior high school level provide entering physics students with a much better background and approach than was the case five years ago. ...the course now starts directly with the study of light, the former Part II. We have deleted most of the Part I of the previous edition". Further, there were a series of 'Advanced Topic Supplements' which took up "additional fundamental ideas" that were intended to serve as an extension of the PSSC course... (PSSC, 1966, preface, P.V. PSSC, 1972a, 1972b).

Merits of a project is to be evaluated from mutiple angles. The try-outs and feedbacks should have strengthened the project in its content, organisation, learning devices, etc. Also, portraying physics as a structure with a fairly solid foundation and emphasising experimental rather than theoretical aspect of physics may not really project the structure of physics (Diederich, 1969).

Conclusion

Although many authors portray curriculum development as rational, an analysis of the decision-making processes of the PSSC project revealed that the project was dominated by scientists and that it lacked eclectic and deliberative approach. The try-out and feedback which should strengthen the curriculum do not seem to have happened in the PSSC project. The roles of actors were counter-productive to the development of a well-thought curriculum. These findings lead to two propositions, one of which is theoretical and the other practical.

The theoretical proposition is that the analytical ideal (the assumption that the whole is best understood by a study of its component parts) is fine but the practical side of its worth in curriculum development should be optimal combination of our analytical ideal (Hodson, 1985). For example, in curriculum development the role of each participant should be given due weightage. The analytical ideal is valuable only if it can be translated into practice. To help identify the optimal combination, Connelly (1969) alerts the curriculum designer about the two kinds of diversity—diversity among disciplines and diversity in disciplines. Because of these diversities, there is a problem in accepting any subject field as a model for curriculum development (Schwab, 1962).

To clarify the above position, an analogy of photography to the teaching-learning process given by Welch (1979, p. 303) seems appropriate in this context. "In recent years new cameras, improved film, automatic focusing, and lenses to do most of the things have been developed... There is evidence of considerable activity. But has the quality of photography been changed?" Isolated and unbalanced (focusing only on one aspect and ignoring other factors) efforts cannot reach fruition. All elements that make up a phenomenon need to be accounted for and well integrated. As in the case of theories, curriculum development often takes one aspect and develops that resulting in unbalanced edge of one element over the other. In the PSSC project, updating the content is the one aspect which took over the PSSC project. Accordingly scientists took charge of the curriculum department. Curriculum designers often lose sight of the requried balance among the different aspects of curriculum development. An analysis of similar projects will help to realise the unhealthy dominance of factors in curriculum development.

The practical proposition is that curricularists should prepare themselves to master the art of deliberation (Schwab, 1983) and look from different angles wearing different lenses (Schwab, 1969). Analysis of curriculum projects is a powerful tool for examining each factor's contribution to the curriculum development. Regardless whether or not one agrees to the others' role, an analysis could certainly help participants in curriculum development to understand their own and their colleague's position. Without an analysis it would be impossible to understand how curriculum projects are carried through from conception to completion. To help realise the urgent need for such a preparation, it will be desirable to enquire into the processes and dynamics of similar curriculum projects such as Chemical Bond Approach (CBA, 1964; Pode, 1966).

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