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Introduction
In the second quarter of 1989 a precoded written questionnaire was submitted to a stratified random sample of 1134 physics, chemistry, biology and general science teachers in lower secondary education (age 12 through 15/16) in The Netherlands. Purpose of this survey was to supply representative, descriptive research data on the actual teaching practice. Data were collected on a.o.:
- use of textbooks and other curriculum-materials;
- the science subjects instruction topics;
- the science subject instructional process (a.o. relation between the content of science subject instruction and real-life phenomena/applications students are acquainted with);
- mode of presentation and student engagement;
- laboratory and field work.
One of the results was that as grades rise biology, physics and chemistry teachers place less emphasis on real-life phenomena and applications students are acquainted with and pay more attention to formal subject-specific concepts and principles (Kuiper & Alting, 1990).
The survey was the first part of the so called Science Subjects Assessment Study (SSAS) and resulted in empirical base-line information for the implementation of 'basic education'. Basic education refers to the reform in view of lower secondary education. The most important characteristics of this reform are:
- the implementation of a core curriculum of 15 subjects - a.o. physics/chemistry and biology - for both lower general and vocational education (age 12 through 15), starting from August 1993;
- standardised attainment targets for all 15 subjects;
- no changes in the current categorial structure of lower secondary education.
The most important aim of basic education is a curriculum reform. As far as the science subjects (physics, chemistry, biology) are concerned, the necessity is urged to relate subject-matter to real-life phenomena and applications students are acquainted with (so called 'contexts'). Besides there ought to be more opportunity for less receptive, more activity-based student engagements (especially conducting experiments). According to many such a reform of the science subjects curricula is necessary in order to promote the formation of
meaningful concepts, to facilitate the application of concepts to realistic situations and to make instruction more attractive and motivating for students (cfr. De Lange, 1987). The curriculum reform in view has its roots in the constructivistic theory of learning and instruction (Jonassen, 1991, 1992; Tobin, Kahle & Fraser, 1990; Tobin & Gallagher, 1987). General conclusion from the survey is that there is a considerable gap between the ideals (the curriculum reform in view) and the actual teaching practice (Kulper & Alting, 1990).

This paper describes the objectives, design and results of the second part of SSAS. Purpose of this part of the study is an explorative description and analysis of the teaching practices of some exemplary science subjects teachers. We know curriculum reform is a complex, refractory and multidimensional process, demanding the possible use of new or revised materials, the possible use of new teaching approaches and the possible alteration of beliefs (Fullan, 1991). The assumption on which the second part of SSAS is based, is that the study of exemplary teaching performances of experts - by focusing on successes, exciting experiments and positive facts (Pennick & Yager, 1983) - could provide support to the improvement of the science subjects teaching practices in the direction of the curriculum reform in view (cfr. Berliner, 1986; Pennick & Yager, 1986; Shulman, 1988; Tobin & Fraser, 1987). Recently several small-scale research efforts on exemplary science teaching were initiated in the USA, Australia and Israel (a.o. Ben-Zvi, Hofstein & Carmeli, 1990; Fraser, Treagust & Tobin, 1990; Gallagher, Bien & Karunaratne, 1990; Tobin & Fraser, 1987; Tobin & Fraser, 1990; Yager & Bonnstetter, 1990).

Research question
The central research question of the second part of SSAS is: Which recommendations for the development and implementation of context-bound and activity-based science subjects education (in the period of basic education) can be distilled from the teaching practices of some exemplary teachers? The study of the exemplary teaching practices focuses on (cfr. Fullan, 1991):
- curriculum-material (kind, use, the teachers' perception of its quality and practicality);
- teaching approaches (use of contexts, opportunity for activity-based student engagements);
- the teachers' opinions on the curriculum reform in view (need, clarity, complexity).

Primary focus of interest is what actually happens in the science subject classroom (cfr. Tobin & Gallagher, 1987). An important objective of the study is the formulation of specifications for designing context-bound and activity-based curriculum-materials.

Design, Instruments and procedures
Between October 1989 and June 1990 8 case studies (1 pilot not included) were conducted, focusing on the exemplary teaching practices of 4 biology and 4 physics teachers in lower secondary education. The teachers were selected from the 856 teachers who completed the survey-questionnaire. They were selected because, as appeared from the survey, they obviously tried to relate the content of science subject instruction to the world outside the classroom and spent a substantial amount of time to laboratory work.
Data were collected by means of:
- direct observation of lessons, per case in one group per relevant grade; altogether 76 lessons (34 physics, 42 biology) were observed; the course of the observed lessons was recorded on paper;
- textbook analysis (checklist);
- an extensive interview with each teacher at the end of the observations; topics were the course of the observed lessons (use of contexts, opportunity for activity-based student engagements), use of and opinion on the textbook involved (quality and practicality), and opinion on the curriculum reform in view (need, clarity, complexity);
- an analysis of some achievement tests (developed by the teachers themselves);
- submission of a precoded questionnaire to students (per case all groups in all relevant grades); the questionnaire contained precoded items on students' perception of the operational curriculum (teacher approaches, student engagements), students' attitudes to the science subject involved and students' opinions on the textbook involved; altogether 865 student questionnaires were completed (294 physics, 571 biology; pilot not included).

All case studies were conducted by one and the same researcher. Data were reported per case. Consequently each case study report was sent to the teacher involved for validation.

Results, conclusion and discussion
All 8 case study reports have been approved by the teachers involved. The data are analysed at the moment. The results of the observations, interviews and textbook analysis will be described and discussed in the paper.

References


