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DEVELOPMENT RESEARCH IN CURRICULUM: PROPOSITIONS AND EXPERIENCES

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PURPOSE OF DEVELOPMENT RESEARCH IN CURRICULUM

It is not an original opening to complain about the poor relation between curriculum theory and practice. Many observers have already criticized the lack of a clearly defined, well-structured and empirically grounded body of curricular knowledge that has actual relevance for curriculum practitioners.

It is also not highly surprising to notice that curriculum developers, even those from professional institutes, rarely make use of 'curriculum theory', or, somewhat less ambitious, follow a deliberative approach (Walker, 1990). A recent study of curriculum development practices in our country (van den Akker & Boersma, 1993) has underscored the often overly intuitive approach in development projects, resulting in doubtful effectiveness and efficiency.

It is one of our central assertions in this paper that both curriculum development and curriculum research have much relevance to gain from a closer liaison and even fading boundaries between the two activities.

What do we mean by development research in the domain of curriculum?

Perhaps the best explanation can be offered by stating that in our view development research is characterized by its twofold purpose:

(i) development of prototypical products (curriculum documents and materials), including empirical evidence of their quality;

(ii) generating methodological directions for the design and evaluation of such products.

Ad (i) Prototype Development

We consider the following criteria as relevant for the quality of the prototypical products:

- incorporation of state-of-the-art knowledge;
- surplus value compared to current educational practice;
- empirical evidence of practicality and effectiveness.

These criteria should at least be met in trial conditions; within that context a sort of 'existential proof' should be established. Or, in other terms, evidence should be produced that the prototype is viable. Claims for generalization will usually have a limited scope, because the acceptance, practicality and effectiveness in various situations depend on many variables affecting implemention. However, such claims about the potential of the product may considerably increase in power when the prototype has been tested in variety of situations (according to the 'replication logic' of Yin, 1984).

Some essential activities of protype development are:

- a profound orientation on current educational practice, on existing documents and materials, and on available expert knowledge, resulting in a clear basis for choices and decisions in later development activities;
- a careful specification of functions and required characteristics of the products to be developed;
- intensive and systematic formative evaluation, integrated in a cyclic development process (of design, construction, evaluation, and revision) in order to detect implementation problems and to generate and test alternative solutions.

Ad (ii) Methodological Directions

Development research can contribute to a sharpening and elaboration of the (curriculum) development methodology through articulating and applying a systematic design and evaluation strategy, and through reflection on that strategy.

Because prototype development is usually characterized by an exploration of the possibilities, the searching of the boundaries of what is not only conceivable but also feasible, formative evaluation has a crucial role. Therefore we think it is very important to break new grounds in evaluation methods, procedures and instruments that combine informativeness and efficiency. Such evaluation approaches are most supportive for decision making about (re)design and revision.

Propositions about the adequacy of methods will be more persuasive when those

methods:

- have proven to be practical and effective in more contexts and by more (development) researchers;
- have resulted in high quality products (or in products with higher quality than those developed with other methods).

Product quality can be assessed along two procedures:

- an incremental approach, in which each subsequent version is compared with its previous version;
- an experimental approach in which a new product is compared to a control or concurrent version.

It is also possible to make the method itself the main study object through systematic variation of methods/strategies and comparing their effects on the resulting products. As yet such studies are scarce, usually of a limited nature, and the results are rather ambiguous (e.g. Frey, Frei & Langeheine, 1989).

CONCEPTUAL FRAMEWORK FOR DEVELOPMENT RESEACH

Factors Affecting Curriculum Implementation by Teachers

The road of many innovations in education has been paved with complete and half failures. When generic curriculum innovations for large audiences are at stake, many variables may affect the processes and results of change efforts, and usually only a few of those variables can be influenced by the original designers. In our view, the biggest challenge for curriculum developers is to increase the impact of their products by a deliberate anticipation in their design and evaluation activities on the implementation problems of their main audience: *teachers.*

The most well-known overview of factors affecting the implementation of educational innovations is provided by Fullan (1991), who distinguishes: (a) characteristics of the change itself, (b) school variables (e.g. the role of the school principal), (c) implementation furthering strategies (e.g. inservice education), and (d) other external factors (especially related to policy and support from national or lower administrative levels). All these factors influence the way individual teachers use a new curriculum or instructional approach. Some variables have a more profound impact than others, also depending on their actual role in a specific implementation strategy. The categories (b), (c), and (d) refer to 'conditional' factors, having an indirect influence on the classroom practice, while the product characteristics (a) usually have a more direct effect. Thus, although product characteristics are not the sole factor, the importance is undisputed when substantial innovations are at stake. Carefully designed and validated materials can make a major contribution to change, as has been underscored by several review studies (Crandall and Associates, 1982; Emrick & Peterson, 1978).

What are potentially affecting characteristics of the change itself? Fullan (1991), elaborating on earlier work of Rogers and Shoemaker (1971) and Doyle and Ponder (1977-78), enumerates the following: need and relevance; clarity; complexity; and quality and practicality of materials. It should be noted that each of these characteristics does not refer to objective features but to subjectively attributed characteristics that may vary with the particular context and personal judgments of individual users. Moreover, one should realize that initial opinions of users, before concrete experiences with the new approach, are usually rather superficial. The very interaction between new products and teachers in their user context may lead to other perceptions of the innovation proposals. A careful anticipation on that user perspective during the development process may contribute to more effective implementation (van den Akker, in press).

A Typology of Curriculum Representations

The interest in implementation issues originates from the disenchanting results of many evaluation studies on the fate of all sorts of curriculum innovations. Many products appear to be poorly spread, use is often discrepant of the original developers' intentions, and tangible student outcomes are often hard to observe.

A useful framework for a more precise problem analysis is the distinction between various curriculum representations as made by Goodlad, Klein and Tye 1979):

- *ideal* curriculum: the original ideas and intentions of the designers;
- *formal* curriculum: the written curriculum (documents, materials);
- *perceived* curriculum: the interpretation of the users (especially the teachers) of the curriculum;
- *operational* curriculum: the actual instructional process in the classroom;
- *experiential* curriculum: the reactions and outcomes of the students.

In many evaluation studies the emphasis has been on a comparison of the ideal (and sometimes the formal) curriculum with the experiential curriculum, often revealing a large gap. Although such results are an important signal, it is often difficult to draw conclusions about the nature of the causes, let alone to suggest possible solutions, without having accurate information about intermediate stages in the implementation process. Without such information it is also too simplistic to blame specific groups (for example, 'naive' designers or 'reluctant' teachers) for disappointing results. An insightful illustration of these problems has been offered by Sabar (1986), who made a careful analysis of the route of an Israeli science curriculum innovation, revealing dilutions and distortions on several levels. It appeared that the developers, while constructing curriculum materials, had faced serious problems in reaching a clear and consistent operationalization of their ideals. Moreover, they presumed that potential users might experience difficulties in realizing the proposals in the classroom practice. For those reasons the developers themselves reduced their innovative aspirations beforehand. As a

consequence, the written curriculum reflected only faintly the initially proclaimed ideals. In those cases where the materials arrived in the schools, all kinds of persistent problems hindered an acceptable realization of the instructional process. [Comparable findings appeared from a study on the implementation of a new Dutch curriculum for secondary social studies (van den Akker & Kuiper, in press).]

In situations like these, there is a risk that student outcomes are measured in classrooms where the curriculum in question has hardly been implemented, if at all, as originally intended. Moreover, it is rather common in evaluation practices that student outcomes are measured with standardized test instruments that are rarely attuned to the specific innovation goals.In view of the above, it is easy to understand why clear effects on student learning have seldom been found in evaluations of innovation projects. However, it would be wrong to conclude that curricular and instructional materials don't make a difference. Those products can have substantial influence on actual classroom practices, as the prominent role of textbooks in instructional processes is a widely accepted fact of school life (Westbury, 1990).

A major concern for educational developers is the search for an effective design of such products. Does it help to make the materials more prescriptive and specific in their guidelines? To what degree and in what way? How to cope with the 'dilemma of explicitness' (Fullan & Pomfret, 1977), referring to the risk that the more detailed the directions in the materials, the stronger the teachers will tend to adapt them? And, especially for generic curriculum development: How to attain sufficient clarity and specificity so that teachers know exactly what they are ought to do, and, at the same time, how to maintain the attractiveness and acceptability of the proposals for a wide variety of settings, personalities and circumstances (Walker, 1980). Adequate answers to these questions can only be found through a more in-depth analysis of the perspective and problems of the central persons involved in implementation: the teachers. Special attention should be paid to both curriculum representations that refer primarily to teachers/users: the perceived and operational curricula.

Teachers as Learners

Implementation implies a process of learning new roles (and often unlearning old ones) for teachers (van den Akker, 1988). Changes are required in teaching behavior as well in beliefs, attitudes and understanding. The initial implementation phase, when neither familiarity nor prior commitment can be expected, will be dominated by the need for clarification and exploration. Drawing on the distinction of Goodlad *et al.* (1979), one might argue that the (instructional or lesson) materials, as an instance of the formal curriculum, should help teachers consider such questions as:

- What is the intention of the ideal curriculum?
- How does it relate to current ideas and practice (perceived curriculum)?
- How can it be used in the classroom (operational curriculum)?
- How will it influence students (experiential curriculum)?

Of course, not all of these questions have to be answered at the same time. Some problems will be of a greater and earlier concern than others. The concept of 'developmentalism' (Loucks & Lieberman, 1983) suggests that the concerns of teachers about a new curriculum will change from more 'self-oriented' concerns early in the process to more 'task-oriented' concerns as they begin to use it. Later on, when they have gained some confidence in the new procedures, they can focus more on the 'impact' of the curriculum on the students. Materials can support teachers with their initial 'survival' concerns by anticipating potential user problems as much as possible and offering practical advice to prevent or solve such problems.

Research on teacher planning (Clark & Peterson, 1986) has revealed the interrelations between the thinking processes of teachers before, during, and after instruction. It has become more evident that changing the practice of teachers requires more attention to the stage of pre-active planning. Materials can activate and support such planning and provide a clear orientation to the teaching task by pointing to critical features of lessons and by offering suggestions about how to deal with emergent problems during the instructional

process. When such orientation results in a more precise and reasoned plan for action, the chances for a better balance between a person's own intentions and situational influences during the task increase. Afterwards the teacher should have a more precise base for reflection on the process and his/her own role in it. Such metacognitive activities increase the potential for steering one's own learning process.

Thus, it seems desirable that materials, intended for a teacher's initial use, should contain a large amount of 'procedural specification': that is, very accurate how-to-do-it advice, focused on essential but apparently vulnerable elements of the innovation. With such help teachers should be stimulated to a task orientation and to concrete role-taking experiences.

An Illustrative Study

This approach can be illustrated by a study in the domain of primary science education (van den Akker, 1988), where several implementation problems appear to be quite universal (cf. Harlen, 1985):

- lesson preparation as a complex and time-consuming chore;
- a lack of background knowledge and confidence in subject matter and skills by the teacher;
- great difficulty in changing the teaching role, especially in regard to forms of inquiry learning;
- an unclear view on, and little realization of, learning effects with the pupils.

For each of these problems, a set of potentially fruitful procedural specifications was formulated:

Lesson preparation: estimation of time; list of resources and provisions; suggestions for task orientation (like own trials with unfamiliar task elemants); stimulation to active study of lesson descriptions (for example, by asking questions about one's own situation or by structuring expectations about the results).

Subject matter: concise and clear information about central elements; outlines of concepts

and activities; possible questions and answers; suggestions about how to deal with knowledge (with an emphasis on operational questions) and objects.*Teaching pattern:* suggestions for grouping and for the distribution of tasks, roles and materials; sequence of activities, including suggestions for starting up, for the selection of topics, for discussion, and for the avoidance or solution of learning problems; possible variations and responses in the instructional process.

Learning effects: exemplary descriptions of potential learning effects by the pupils; suggestions as to how to measure and evaluate these effects.

In an experiment (with extensive observation and videotaping of teaching and learning processes in 40 classrooms) it could be demonstrated that materials incorporating these characreristics were highly effective in reducing the implementation problems of the teachers, resulting in very successful lessons, from the perspective of both the designers and the users.

Implications for Development Strategy

This central idea of 'procedural specification', which is also applied in the domain of courseware design (van den Akker, Keursten & Plomp, 1992; Voogt, 1993), seems to be important for starting up the learning process that is associated with curriculum change. The materials are most effective when they stimulate the teachers to a more elaborate and accurate 'internal dialogue' about the what, when, how and why of their own teaching role, and provide them with clear advice about the implications of these matters for classroom practice. However, one should avoid the risk of overwhelming the teacher with an exhaustive string of prescriptions. Therefore, the procedural specifications should be focused on essential elements of proven vulnerability during implementation. This requires that design and construction activities are alternated by evaluation and revision activities. These interwoven activities imply a phased, cyclic, and adaptive approach, characterized by a continuous alteration of the generating of ideas, realization of materials,

and empirical testing. Creativeness, a strongly emphasized factor in the idea-oriented approaches of many designers, should be used within a more structured, implementation oriented strategy that combines development and research elements in a kind of 'formative research' (cf. Walker, 1992) or 'engineering'. Early, iterative, and intensive formative evaluation is the keystone of this approach. A systematic and profound evaluation of draft materials enables the designers not only to test and improve the practicality and effectiveness of their products, but also to reflect on and, if necessary, readjust their ideals. Thus, formative evaluation should especially contribute to improving the consistency between the different curriculum representations through informing the various participants in the innovation process about potential frictions in the long chain from ideals to student outcomes.

The question remains for how long a period and to what degree teachers should be supported with highly specific materials, aiming at initial use with high fidelity to the original intentions of the designers. The answer will probably vary for each innovation, the user context and other facilitating conditions. Some authors (e.g. Ben-Peretz, 1991) argue that only an active adaptation by the teacher, aimed at an exploration and optimal use of the potential value of the materials, can ultimately contribute to effective student learning and professional growth of the teacher. That point of view can be incorporated in a stepwise strategy that starts with stimulating the teacher to engage in a new situation with the help of specific 'practice materials'. Such materials can reduce the personal uncertainty that is almost inevitable at the implementation of substantial changes. They may also reduce the chance that premature adaptation occurs, even before concrete experiences with the essentials of the innovation and its effect on the students have been gained. Next, this learning-by-doing can be strenghtened by reflection, exchange of experiences, discussion, and feedback from colleagues and others. Moreover, additional materials development (or redesign) may contribute to the professional growth of the teachers and their sense of ownership. And, of course, also the external support of other persons and agencies can increase the effectiveness of the implementation and

institutionalization of the innovation (see Fullan, 1991). However, also those intermediary target groups (school principals, teacher educators and advisors, administrators, textbook publishers, test developers) seem well served by providing them with concrete examples of how more general (curriculum) innovation frameworks can be elaborated in the form of practical and effective materials.

All these efforts, though, may only succeed if designers no longer think of teachers as 'gatekeepers' who should be overwhelmed or circumvented, but as partners in interactive and purposive learning processes.

EXAMPLES OF DEVELOPMENT RESEARCH

In the previous section we already summarized the first study of what has evolved as a series of development research projects in recent years. Below we present a brief overview of the contexts and emphasis of these (completed and ongoing) studies in our Department of Curriculum in the Faculty of Educational Science and Technology:

I van den Akker (1988): exemplary curriculum materials for primary science.

II van der Geest (1991): courseware for computer-assted writing instruction (mother tongue) in secondary education.

III Voogt (1993): courseware for inquiry-based physics in secondary education.

IV Kessels (ongoing): training programmes in business and industry.

V Keursten (ongoing): courseware for geography in secondary education.

VI van den Berg (ongoing): inservice course for primary science.

VII Roes (ongoing): inservice courses for mother tongue and physics in secondary education.

A common characteristic of all these studies is the recognition of the pivotal role of the

teacher in implementation processes. The design approach is very much focused on his/her user perspective.'Backward mapping' from that position, efforts are made to operationalize and communicate the innovative ideals in the materials in such a form that teachers feel both challenged and well supported to teach the suggested lessons in such an effective manner that the students reach the intended results.

The principle of 'procedural specification' has appeared to be very fruitful and returns in all studies. It has also been applied in a large scale project for primary science in which an elaborate set of thirty instructional units has been developed. This set (published in 1990) has in very short time become the most prominent source in teacher education about primary science.

Studies in which the design principles have been applied in the development of courseware (focusing on the 'lessonware' for teachers and studens) for secondary education (van der Geest, Voogt, Keursten) have clarified the potential but also the limitations of print material for a successful curriculum implementation. Also for that reason the studies of van den Berg and Roes explore whether embedding of innovative curriculum materials within inservice scenarios increase the chances at effective implementation.

The study of Kessels focuses on both design principles and more comprehensive development strategies. It promises to produce interesting results in a domain where still little scientific knowledge is available.

CHARACTERISTIC METHODS AND INSTRUMENTS

As underlined before, we tend to attach great value to all kinds of formative evaluation that provide information which is helpful in improving the 'external consistency' between the various curriculum representations. [One may also distinguish the 'internal consistency' between the different components of an instructional product (the 'formal' curriculum), but that is usually less problematic since in that domain less external and social-

political influences play a role. Perhaps that is the reason that the task of curriculum designers is more complicated than the task of instructional designers].

Excellent overviews of appropiate methods, procedures and instruments for formative evaluation (as core component of development research) have already been offered by Flagg (1990) and Walker (1992). In this paper we will not describe all methods in our studies, but focus on an instrument that has proven to be very helpful: the 'curriculum profile'.

A curriculum profile is an instrument to evaluate the operational curriculum. It consists of: (i) a definition - in operational terms - of lesson components which are considered essential by the designers, and (ii) a description of possible configurations in realizing those components, with a differentiation between:

- 'treshold' elements (necessary for an acceptable implementation)
- 'ideal' elements (strenghthening the implementation)
- 'unacceptable' elements (weakening the implementation).

Thus, a curriculum profile is an instrument that links the ideal and the operational representations of a curriculum.

Such a profile can be used in more informal or formal ways, depending on the stage in the development process and the purpose of the study. In initial stages of development work it can be very stimulating to challenge designers to describe their ideals in operational terms of classroom activities. We have experienced very vivid sessions in discussing such profiles with designers. In later stages a curriculum profile can be a very efficient tool in assessing the degree of correspondence between the original ideas and the actual classroom process in various settings, either in an experimental approach (e.g. van den Akker, 1988) or in a series of case studies (e.g. Voogt, 1993). Moreover, we have used curriculum profiles as an instrument in several summative evaluation studies (van Aert & van den Akker, 1990; van den Akker & Kuiper, in press).

The various studies in which we have used a curriculum profile show a rather wide

variation in curriculum domain (subject matter) and scope (the duration of the curriculum units varied from 2 to 9 hours). Data gathering methods have also varied: direct observation with note taking, videotaping of lessons, writing protocols from audiotapes. Obviously, the most appropiate method depends on the aim, nature and context of the particular study. We have also good experiences with combining curriculum profile data with additonal information about the perceptions of the teachers (where we prefer interviews above questionnaires) and of students (e.g. by analyzing of worksheets of students, see Voogt, 1993).

EPILOGUE

As stated in the beginning of this paper, we think that both the professional practice of curriculum development and the knowledge-oriented curriculum research have a lot to gain by closer interaction, and, on some parts, even integration. Such an approach may reduce the sterility of much curriculum 'scholarship' and improve the quality and impact of many development projects in which idealistic intentions and big investments often tend to evaporate in a disturbingly short periods.

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