

# 9 Building bridges: how research may improve curriculum policies and classroom practices

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## Abstract

*Curriculum development is almost notorious for its weak relationship with research. Socio-political arguments usually dominate curriculum decision making (in most, including European, countries, with all their variety). Priorities for curriculum projects seldom arise from systematic monitoring and analysis of practices and outcomes. Available research-based knowledge is often insufficiently used during the development process. And empirical information about actual uptake and implementation of curriculum innovations is often lacking. Altogether, one may conclude that curriculum development is hardly an evidence-based enterprise, in contrast to much policy rhetoric nowadays. Probably, few people would argue for an overly strong evidence-based strategy of curriculum development – this would be in contrast to the often value-driven nature of most curricular decision making. However, many would like to experience a more evidence-informed approach to curriculum problems.*

*This article will explore how a better cross-fertilisation between educational research and curriculum development could strengthen the information base for curriculum policies and classroom practices.*

*After an effort to articulate our conceptualisation of curriculum and curriculum development (building on van den Akker (2003) and Thijs and van den Akker (2009)), the exploration's emphasis will be on the potential of curricular 'design and development research' (D&DR), a rapidly emerging research approach that combines three related goals:*

- *optimisation of curricular interventions and products (for example, curriculum frameworks and educative materials)*
- *curriculum design principles (as a contribution to the knowledge base)*
- *professional development (of all participants).*

*The role of research will be outlined for the various stages of curriculum development, with particular attention given to:*

- *quality criteria for curriculum interventions*
- *adequate research methods and procedures*
- *knowledge growth and generalisation issues.*

## The problematic fate of most curriculum reforms: could research help?

Curriculum reform has a dubious reputation, with more sobering than real and lasting success stories. One could even say, as a universal experience, that large-scale curriculum reform has a tendency to fail (Cuban, 1992; Fullan, 2007; Leyendecker, 2008). Hargreaves and Fink (2006, p. 6) put this succinctly: *“Change in education is easy to propose, hard to implement, and extraordinarily difficult to sustain.”* And it could be argued that curriculum changes belong to the hardest category.

Notwithstanding big investments in research and development, and in-service education, the target group of teachers often appears poorly informed about an intended innovation, while its practical application remains limited, and its impact on student learning is unclear. Simple explanations for innovation failures are inadequate, but a few gaps are often visible:

- weak connections between the various system levels (national, local, school and classroom)
- lack of internal consistency within the curriculum design
- insufficient cooperation between various actors in educational development.

The general pattern is that the worlds of policy, practice and research are widely separated. A crucial challenge for more successful innovations in education is to build bridges between many levels, factors and actors.

How could research help in addressing educational challenges? The kind of help usually varies across different types of research. Plomp (2009) distinguished various questions, aims and functions of research including to describe, compare, evaluate, explain, predict, design and develop. One may also discern various primary orientations of research: theory, practice and policy. Much policy-oriented research in education occurs through surveys, monitoring and assessment, and focuses on (descriptive) measures about actual practices and outcomes. However, the central orientation in this article will be on research that focuses on curriculum *‘improvement and innovation’*, under the label of D&DR.

D&DR in education is a relatively new approach, with its roots in the early nineties (for our own efforts in the curriculum domain, see van den Akker and Plomp (1993) and van den Akker (1999)). Since then, they are documented in a

number of special issues of prominent journals (for example: *Educational Researcher*, 32, 1, 2003; *Educational Psychologist*, 39, 4, 2004; *Journal of the Learning Sciences*, 13, 1, 2004; *Educational Technology*, 45, 1, 2005), and in a number of books (for example: van den Akker *et al.*, 2006; Richey and Klein, 2007; Kelly *et al.*, 2008; Reinking and Bradley, 2008; Plomp and Nieveen, 2009). For pragmatic reasons, the broader label of D&DR is used here, while recognising that there are a number of related and more specific terms used in the literature (see overviews in van den Akker, 1999; van den Akker *et al.*, 2006; Plomp and Nieveen, 2009).

The initial focus in this article is on summarising a set of concepts and perspectives that help to increase the transparency and balance of curriculum analysis, development and discourse. The focus will then shift towards curricular D&DR.

## Curriculum: what's in a name?

When there is a myriad of definitions for a concept in the literature (as is the case with curriculum), it is often difficult to keep a clear focus on its essence. In these cases, it often helps to search for the etymological origin of the concept. The Latin word '*curriculum*', related to the verb *currere* (running), refers to a '*course*' or '*track*' to be followed. In the context of education, where learning is the central activity, the most obvious interpretation of the word curriculum is, then, to view it as a course, trajectory, or "*plan for learning*" (Taba, 1962). This very short definition (reflected in related terms in many languages) limits itself to the core of all other definitions, permitting all sorts of elaborations for specific educational levels, contexts and representations. Obviously, contextual specification is always needed in curriculum conversations to clarify the perspective.

Given this simple definition, a differentiation between various levels of the curriculum has proven to be very useful when talking about curricular activities (policy-making, design and development, evaluation, and implementation). The following distinctions appear to be helpful:

- international/comparative (or '*supra*' level)
- system, society, nation and state (or '*macro*' level) (for example, national syllabi or core objectives)
- school and institution (or '*meso*' level) (for example, school-specific curriculum)
- classroom (or '*micro*' level) (for example, textbooks and instructional materials)
- individual and personal (or '*nano*' level).

The supra level usually refers to international debates or agreements on aims and quality of education, and it is sometimes fuelled by the outcomes of

internationally comparative studies. Curriculum development at the supra and macro levels is usually of a *'generic'* nature, while *'site-specific'* approaches are more applicable for the levels closer to school and classroom practice. Moreover, the process of curriculum development can be seen as either narrow (developing a specific curricular product) or broad (a long-term, ongoing process of curriculum improvement, often including many related aspects of educational change, for example, teacher education, school development and examinations).

In order to understand problems of curriculum decision making and enactment, a broader description of curriculum development is often most appropriate. It is usually a long and cyclical process with many stakeholders and participants in which motives and needs for changing the curriculum are formulated; ideas are specified in programmes and materials; and efforts are made to realise the intended changes in practice.

Moreover, curricula can be represented in various forms. Clarification of these forms is especially useful when trying to understand the problematic efforts to change a curriculum. A common broad distinction is between the three levels of the *'intended'*, *'implemented'*, and *'attained'* curriculum. A more refined typology (van den Akker, 2003) is outlined in Table 9.1.

**Table 9.1: Typology of curriculum representations**

<b>Intended</b>	Ideal	Vision (rationale or basic philosophy underlying a curriculum)
	Formal/written	Intentions as specified in curriculum documents and/or materials
<b>Implemented</b>	Perceived	Curriculum as interpreted by its users (especially teachers)
	Operational	Actual process of teaching and learning (also, curriculum-in-action)
<b>Attained</b>	Experiential	Learning experiences as perceived by learners
	Learned	Resulting learning outcomes of learners

Traditionally, the intended domain refers predominantly to the influence of curriculum policy-makers and curriculum developers (in various roles). The implemented curriculum relates especially to the world of schools and teachers. And the attained curriculum relates to students.

Besides this differentiation in representations, curriculum problems can be approached from various analytical angles. For example, Goodlad (1994) distinguished three different perspectives:

- *'substantive'*, focusing on the classical curriculum question about what knowledge is of most worth for inclusion in teaching and learning

- ‘*technical-professional*’, referring to how to address concrete tasks of curriculum development
- ‘*socio-political*’, referring to curriculum decision-making processes, where values and interests of many different individuals and agencies are at stake.

Some might argue that this list is too limited as it refers specifically to curriculum issues for ‘*traditional*’ planning for learning in schools, and does not include the more ‘*critical*’ perspectives that are amply present in curriculum theory literature (for example, Pinar *et al.*, 1995). However, from a primary interest in curriculum improvement, the three perspectives seem useful and appropriate.

## The vulnerable curriculum spider’s web

One of the major challenges for curriculum improvement is creating balance and consistency between the various components of a curriculum (*‘plan for learning’*). What are these components? The relatively simple curriculum definition by Walker (1990) includes three major planning elements: content, purpose and organisation of learning. However, curriculum design and implementation problems have taught us that it is wise to pay explicit attention to a more elaborated list of components. Elaborating on various typologies, we have come to adhere to a framework (see Table 9.2) of ten components that address ten specific questions about the planning of student learning.

**Table 9.2: Curriculum components**

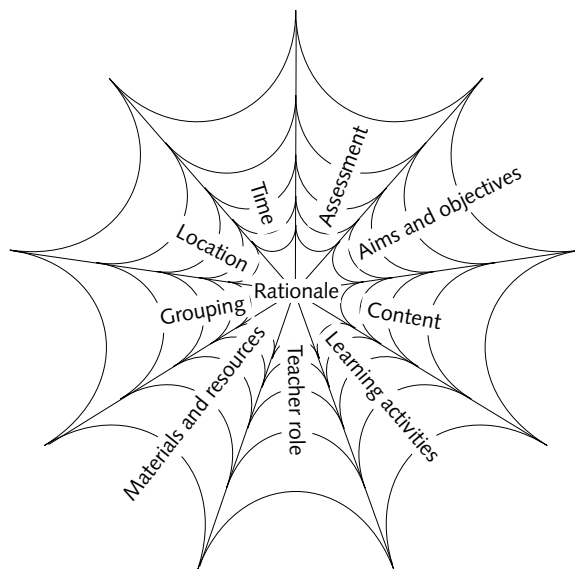
<b>Rationale or vision</b>	Why are they learning?
<b>Aims and objectives</b>	Towards which goals are they learning?
<b>Content</b>	What are they learning?
<b>Learning activities</b>	How are they learning?
<b>Teacher role</b>	How is the teacher facilitating learning?
<b>Materials and resources</b>	With what are they learning?
<b>Grouping</b>	With whom are they learning?
<b>Location</b>	Where are they learning?
<b>Time</b>	When are they learning?
<b>Assessment</b>	How to measure how far learning has progressed?

The ‘*rationale*’ (referring to overall principles or central mission of the plan) serves as a major orientation point, and the nine other components are ideally linked to that rationale, and preferably also consistent with one another. For each of the components many sub-questions are possible, not only on substantive issues (see the next section), but, for example, also on ‘*organisational*’ aspects. For example, sub-questions concerning grouping, location and time would include:

- grouping
  - how are students allocated to various learning trajectories?
  - are students learning individually, in small groups, or in whole classes?
- location
  - are students learning in class, in the library, at home, or elsewhere?
  - what are the social and physical characteristics of the learning environment?
- time
  - how much time is available for various subject matter domains?
  - how much time can be spent on specific learning tasks?

Our preferred visualisation of the ten components is to arrange them as a spider's web (Figure 9.1), not only illustrating its many inter-connections, but also underlining its vulnerability. Thus, although the emphasis of curriculum design on specific components may vary over time, eventually some kind of alignment has to occur to maintain coherence. A striking example is the trend of integrating ICT into the curriculum, with initial attention usually on changes in materials, resources and location. Many implementation studies have exemplified the need for a more comprehensive approach and systematic attention given to the other components before one can expect robust changes.

Figure 9.1: Curricular spider's web





The spider's web also illustrates a familiar expression: every chain is only as strong as its weakest link. This seems to be a very appropriate metaphor for a curriculum as it points to the complexity of efforts to improve the curriculum in a balanced, consistent and sustainable manner.

## Perspectives on substantive choices

A classic approach to the eternal question of what to include in the curriculum (or even more difficult, as well as urgent, what to exclude from it) is to search for a balance between three major sources or orientations for selection and priority setting.

- Knowledge: what is the academic and cultural heritage that seems essential for learning and future development?
- Society: which problems and issues seem relevant for inclusion from the perspective of societal trends and needs?
- Learner: which elements seem of vital importance for learning from the personal needs, educational needs and interests of the learners themselves?

Answers to these questions usually constitute the rationale for a curriculum. Inevitably, choices have to be made involving compromises between the various orientations (and their respective proponents and pressure groups). Often, efforts fail to arrive at generally acceptable, clear and practical solutions. The result of adding up all kinds of wishes is that curricula tend to become overloaded and fragmented. Implementation of such incoherent curricula tends to lead eventually to student frustration, failure and dropout.

How to create a better curriculum balance? Easy answers are not available, but a few alternatives seem to have some promise. First, in view of the multitude of (academic) knowledge claims, it sometimes helps to reduce the large number of separate subject domains to a more limited number of broader learning areas, combined with sharper priorities in learning aims (focusing on basic concepts and skills).

Second, referring to the avalanche of societal claims, more interaction between learning inside and outside the school may reduce the burden. However, the most effective response is probably to be more selective when reacting to all sorts of societal problems. As Cuban (1992) phrased it clearly: schools should not feel obliged to scratch the back of society every time society has an itch.

And third, looking at the learners' perspective, worldwide, many interesting efforts are going into making learning more challenging and intrinsically motivating by moving from traditional, teacher- and textbook-dominated

instruction towards more meaningful and activity-based learning approaches. Obviously, ICT creates new challenges, but it also offers new opportunities for addressing the substantive dilemmas described.

## Development strategies

To sketch curriculum development as a problematic domain is actually an understatement. From a socio-political stance, it often seems more appropriate to describe it as a war zone, full of conflicts and battlefields between stakeholders with different values and interests. Problems manifest themselves in the (sometimes spectacular and persistent) gaps between the intended curriculum (as expressed in policy rhetoric), the implemented curriculum (real life in school and classroom practices), and the attained curriculum (as manifested in learners' experiences and outcomes). A typical consequence of these tensions is various frustrated groups of participants blaming each other for the failure of reforms or improvement activities.

Although such blaming games often seem rather unproductive, there are some serious critical remarks to be made about many curriculum development approaches worldwide. Firstly, many curriculum reform efforts are characterised by overly big innovation ambitions (especially those of politicians) within unrealistically short timelines and with very limited investment in people, especially teachers. Secondly, often there is a lack of coherence between the intended curriculum changes with other system components (especially teacher education and assessment/examination programmes). And lastly, but not least, timely and authentic involvement of all relevant stakeholders is often neglected.

From a strategic point of view, the literature has offered us many (technical-professional) models and strategies for curriculum development. Three prominent approaches are Tyler's (1949) '*rational-linear*' approach, Walker's (1990) '*deliberative*' approach, and Eisner's (1979) '*artistic*' approach. As it does not fit within the purpose of this article to explain these models in particular, the reader is referred to the educative text of Marsh and Willis (2003) and the overview of prominent approaches in Thijs and van den Akker (2009).

Obviously, the context and nature of the curriculum development task at hand will determine to a large extent what kind of strategy is indicated. It is noteworthy that we are beginning to see more '*blended*' approaches that integrate various trends and characteristics of recent design and development approaches in education (for an overview and a series of examples see van den Akker *et al.* (1999) and van den Akker and Kuiper (2008)). Some key characteristics of these are:

- Pragmatism: recognition that there is not a single perspective, overarching rationale or higher authority that can resolve all dilemmas for the curriculum choices to be made. The practical context and its users are in the forefront of curriculum design and enactment.
- Prototyping: evolutionary prototyping of curricular products and their subsequent representations in practice is viewed as more productive than quasi-rational and linear development approaches. Gradual, iterative approximation of curricular dreams into realities may prevent paralysis and frustrations. Formative evaluation of tentative, subsequent curriculum versions is essential for such curriculum improvement approaches.
- Communication: a communicative-relational style is desirable in order to arrive at the inevitable compromises between stakeholders with various roles and interests, and to create external consistency between all parties involved.
- Professional development: in order to improve the chances of successful implementation, there is a trend towards more integration of curriculum change and professional learning and development of all individuals and organisations involved.

D&DR is an approach that incorporates some of these characteristics, and it becomes even more promising when knowledge growth is added to it. D&DR can strengthen the knowledge base in the form of design principles that offer heuristic advice to curriculum development teams. It can do this, more than in common development practices, if deliberate attention is paid to the theoretical embedding of design issues, and empirical evidence is offered about the practicality and effectiveness of the curricular interventions in real user settings.

However, there are several persistent dilemmas for curriculum development that cannot easily be resolved, let alone through generic strategies. For example, how can aspirations for large-scale curriculum change and system accountability be combined with the need for local variations and ownership? The tension between these conflicting wishes can be somewhat reduced if one avoids the all too common '*one size fits all*' approach. More adaptive and flexible strategies avoid detailed elaboration and over-specification of central curriculum frameworks. Instead, they offer substantial options and flexibility for schools, teachers and learners. Although struggles about priorities for aims and content remain inevitable, the principle of '*less is more*' should be pursued. However, what is incorporated into a core curriculum should be clearly reflected in examination and assessment approaches.

The '*enactment*' perspective (teachers and learners together create their own curriculum realities) is increasingly replacing the '*fidelity*' perspective on implementation (teachers faithfully following curricular prescriptions from external sources). That trend puts even more emphasis on teachers as key people in curriculum change. Both individual and team learning is essential (Fullan,

2007). Teachers need to get out of their customary isolation. Collaborative design and piloting of curricular alternatives can be very productive (see, for example, Handelzalts, 2009), especially when experiences are exchanged and reflected upon in a structured curriculum discourse. Interaction with external facilitators can contribute to careful exploration of the 'zone of proximal development' of teachers and their schools. Cross-fertilisation between curriculum, teachers, and school development is a *conditio sine qua non* for effective and sustainable curriculum improvement. The increasingly popular mission statements of schools to become attractive and inspiring environments for students and teachers can only be realised when such integrated scenarios are practised.

## The potential of curriculum D&DR

Various motives for initiating and conducting curriculum D&DR should be mentioned. A basic motive stems from the experience that many research approaches (for example, experiments, surveys and correlational analyses), with their focus on descriptive knowledge, hardly provide prescriptions with useful solutions for a variety of D&DR problems in education. Probably the greatest challenge for professional designers is how to cope with the manifold uncertainties in their complex tasks in very dynamic contexts. If they do seek support from research to reduce these uncertainties, several frustrations often arise: answers are too narrow to be meaningful, too superficial to be instrumental, too artificial to be relevant, and, on top of these, they usually come too late to be of any use. Curriculum designers do appreciate more adequate information to create a solid ground for their choices and more timely feedback to improve their products. Moreover, the professional community of developers, as a whole, would be helped by a growing body of knowledge of theoretically underpinned and empirically tested design principles and methods.

Another reason for curricular D&DR stems from the highly ambitious and complex nature of many curriculum reform policies in education worldwide. These reform endeavours usually affect many system components, are often multi-layered including both large-scale policies and small-scale realisations, and are very comprehensive in terms of factors included and people involved. These radical '*revolutions*', if promising at all, cannot be realised on the drawing table.

The scope of diverse needs is often very wide, the problems to be addressed are usually ill specified, the effectiveness of proposed interventions is mostly unknown beforehand, and the eventual success is highly dependent on implementation processes in a broad variety of contexts. Therefore, such curriculum reform efforts would profit from more evolutionary (interactive cyclical and spiral) approaches, with integrated research activities to feed the process (both forwards and backwards). Such an approach would provide more

opportunities for *'successive approximation'* to the ideals and more strategic learning in general. In conclusion: curricular D&DR seems a wise and productive approach for curriculum development.

## Features of curricular D&DR

Curricular D&DR is often initiated for complex, innovative interventions for which only very few validated principles are available to structure and support the design and development activities. Since, in these situations, the image and impact of the curricular intervention to be developed are often still unclear, the research focuses on realising limited, but promising, examples of these interventions. The aim is not to elaborate and implement complete interventions, but to come to (successive) prototypes that increasingly meet the innovative aspirations and requirements. The process is often iterative, cyclic or spiral: analysis, design, evaluation and revision activities are iterated until a satisfying balance between ideals and realisation has been achieved.

To what extent do these D&DR activities differ from what is typical for design and development approaches in professional practices? What are the implications of the accountability of researchers to the *'scientific forum'*? At the risk of exaggerating the differences, let us outline some of them based on what is known about routinised, standard patterns in curriculum development practices. Of course, a lot of activities are more or less common for both approaches, so the focus will be on those additional elements that are more prominent in design research than in common design and development practices.

### *(1) Preliminary investigation*

A more intensive and systematic preliminary investigation of curriculum tasks, problems and context is made, including searching for more accurate and explicit connections of that analysis with state-of-the-art knowledge from literature. Some typical activities include: literature review, consultation of experts, analysis of available promising curriculum examples for related purposes, and study of current practice case studies to specify and better understand the needs and problems in intended user contexts.

### *(2) Theoretical embedding*

More systematic efforts are made to apply state-of-the-art knowledge when articulating the theoretical rationale for curriculum design choices. Moreover, explicit feedback to assertions in the design rationale about essential characteristics of the intervention (substantive design principles) is made after empirical testing of its quality. This theoretical articulation can increase the *'transparency'* and *'plausibility'* of the rationale. Because of their specific focus,

these theoretical notions are usually referred to as *'mini'* or *'local'* theories, although sometimes connections can also be made to *'middle-range'* theories with a somewhat broader scope.

### *(3) Empirical testing*

Clear empirical evidence is delivered about the practicality and effectiveness of the curriculum for the intended target group in real user settings. In view of the wide variation of possible interventions and contexts, a broad range of (direct/indirect and intermediate/ultimate) indicators for *'success'* should be considered.

### *(4) Documentation, analysis and reflection on process and outcomes*

Much attention is paid to systematic documentation, analysis and reflection on the entire design, development, evaluation and implementation process, and on its outcomes in order to contribute to the expansion and specification of the methodology of curriculum design and development.

Typical questions for D&DR are:

- What are the essential features of successful interventions (for complicated challenges or *'wicked'* problems) (Kelly, 2009)?
- How do these interventions operate in real life?
- How can they be designed and implemented?

In view of its aim, D&DR is never a *'quick fix'* operation, but it usually takes a long trajectory, where the research is intertwined with continuous development activities, from problem formulation up to and including implementation.

More than most other research approaches, D&DR aims at making both practical and scientific contributions. In the search for innovative *'solutions'* for curriculum problems, interaction with practitioners (in various professional roles: teachers, policy-makers, developers, and the like) is essential. The ultimate aim is not to test whether theory, when applied to practice, is a good predictor of events. The interrelation between theory and practice is more complex and dynamic: is it possible to create a practical and effective curriculum for an existing problem or intended change in the real world? The innovative challenge is usually quite substantial, otherwise the research would not be initiated at all. Interaction with practitioners is needed to gradually clarify both the problem at stake and the characteristics of its potential solution. An iterative process of *'successive approximation'* or *'evolutionary prototyping'* of the *'ideal'* intervention is desirable.

Direct application of theory is not sufficient to solve these complicated problems. One might state that a more *'constructivist'* development approach is preferable: researchers and practitioners cooperatively construct and test workable

interventions and articulate principles that underpin the effects of those interventions.

Another reason for cooperation is that without the involvement of practitioners it is impossible to gain clear insight into potential curriculum implementation problems and to generate measures to reduce these problems. New interventions, however imaginative their design, require continuous anticipation of implementation issues. Not only for 'social' reasons to build users' commitment and ownership, but also for 'technical' benefits to improve their fitness for survival in real life contexts. Therefore, rigorous testing of practicality is a *conditio sine qua non* in D&DR.

## Emphasis on formative evaluation

As has become clear in the previous sections, formative evaluation holds a prominent place in curricular design research. The main reason for this central role is that formative evaluation provides the information that feeds the optimisation of the intervention and the cyclical learning process of curriculum developers during the subsequent loops of a design and development trajectory. It is most useful when fully integrated into a cycle of analysis, design, evaluation, revision, etc., and when contributing to a curriculum's improvement.

Thus, the basic contribution of formative evaluation is quality improvement of the curriculum under development. 'Quality', however, is an abstract concept that requires specification. During development processes, the emphasis in the criteria for quality usually shifts from relevance to consistency, practicality and effectiveness.

'Relevance' refers to the extent to which the intended curriculum is perceived to be a relevant improvement to practice, as seen from the varied perspectives of policy-makers, practitioners and researchers. 'Consistency' refers to the extent to which the design of the curriculum is based on state-of-the-art knowledge and how the various components of the intervention are consistently linked to each other (cf. the curricular spider's web). 'Practicality' refers to the extent to which users (and other experts) consider the intervention as clear, usable and cost-effective in 'normal' conditions. 'Effectiveness' refers to the extent to which the experiences and outcomes resulting from the intervention are congruent with the intended aims. Also, issues of scalability and sustainability may be included in a broad interpretation of effectiveness.

The methods and techniques for evaluation will usually be attuned to that shift in criteria. For example, adequate evaluation of consistency can start with comments of critical friends on initial drafts and then move on to more systematic expert appraisal. Practicality is often tested via micro-evaluations and

try-outs in real classroom practices. Evaluation of effectiveness usually requires (more large-scale) field tests. In later stages of formative evaluation, methods of data collection will usually be less intensive, but with an increasing number of respondents (for example, an achievement test for many students at the end compared to an in-depth interview with a few experts at the beginning). See Nieveen (2009) for more elaborate explanations and suggestions for these shifts in formative evaluation.

Formative evaluation within D&DR should not only concentrate on locating shortcomings of the intervention in its current (draft) version, but especially generate suggestions on how to improve these weak points. Richness of information – notably salient and meaningful suggestions for how to make an intervention stronger – is therefore more productive than standardising methods for collecting and analysing data. Efficient procedures are also crucial. The lower the costs in time and energy for data collection, processing, analysis and communication will be, the bigger the chances of actual use and impact on the development process. For example, samples of respondents and situations for data collection will usually be relatively small and purposive compared to sampling procedures for other research purposes. The added value of getting ‘productive’ information from more sources tends to decrease because the opportunities for ‘rich’ data collection methods (such as interviews and observations) are limited with big numbers. To avoid an overdose of uncertainty in data interpretation, often triangulation (of methods, instruments, sources and sites) is applied. These arguments especially hold true for the early stages of formative evaluation, when the intervention is still poorly crystallised.

## Generalisation of curricular design research findings

The most practically relevant outcome of curricular D&DR is its contribution towards optimising the curricular product and its actual use, leading to better instructional processes and learning results. However, a major contribution to knowledge gained from D&DR is in the form of (both substantive and methodological) ‘design principles’ for supporting developers in their task. These principles may be captured in (a growing set of) heuristic statements of a format such as:

- *If you want to design intervention X [for purpose/function Y in context Z]*
- *then you are best advised to give that intervention the characteristics  $C_1, C_2, \dots, C_m$  [substantive emphasis]*
- *and to do that via procedures  $P_1, P_2, \dots, P_n$  [methodological emphasis]*
- *because of theoretical arguments  $T_1, T_2, \dots, T_p$*
- *and empirical arguments  $E_1, E_2, \dots, E_q$ .*



Thus, the design principles include not only statements about the (substantive) *'what'* and (methodological) *'how'* of the intended interventions, but also offer theoretical explanations and empirical underpinning to justify these knowledge claims. Obviously these heuristic principles cannot guarantee success, but they are intended to select and apply the most appropriate (substantive and methodological) knowledge for specific design and development tasks.

It is not uncommon in D&DR for such knowledge, especially the substantive knowledge about essential curriculum characteristics, to be partially extracted from the resulting prototype itself. That is one of the reasons that make it so profitable to search for and carefully analyse already available curricula to generate ideas for new design tasks. However, the value of that knowledge will strongly increase when justified by theoretical arguments, well articulated in providing directions, and convincingly backed up with empirical evidence about the impact of these principles. Moreover, these heuristic principles will be additionally powerful if they have been validated in the successful design of more interventions in more contexts. Chances for such knowledge growth will increase when D&DR is not conducted through isolated studies, but conducted within the framework of research programmes, because projects can then build upon one another (*'standing on shoulders'*). Such a strategy also increases the chances of achieving a sharper insight into the essence of successful interventions versus variations in other features.

Since data collection in D&DR, especially during formative curriculum evaluation, is often limited to small (and purposive) samples, efforts to generalise findings cannot be based on statistical techniques, focusing on generalisations from sample to population. Instead, one has to invest in *'analytical'* forms of generalisation (Yin, 2003): readers/users need to be supported to make their own attempts to explore the potential transfer of the research findings to theoretical propositions in relation to their own context.

Reports on D&DR can facilitate the task of *'analogy reasoning'* through a clear theoretical articulation of the design principles applied, and by reflecting on the results afterwards. Moreover, it is helpful to offer a careful description of both the evaluation procedures as well as the implementation context. This is particularly the case since a detailed description of the process-in-context may increase the *'ecological'* validity of the findings. Consequently, others can estimate in what respects and to what extent transfer from the reported situation to their own is possible. Another option, that may stimulate exploration of possibilities for (virtual) generalisation and transfer to various settings, is to organise interactive (network) meetings with experts and practitioners from related contexts to discuss the plausibility of the research findings and recommendations for related tasks and contexts.

In view of the rapidly growing, but still relatively modest, familiarity of (curricular) D&DR to the wider audience, it is wise to invest much in the *'transparency'*, *'plausibility'*, *'trustworthiness'* and *'reconstructiveness'* of its arguments and findings. Also at stake is the *'credibility'* (expertise in depth and breadth, and track record) of the research team and its partners.

Last, but not least, curricular D&DR may offer drafts of various relevant curriculum versions (with proven consistency and practicality) that can be compared in more quantitative, large-scale, (quasi-) experimental studies. Obviously, these more summative evaluations are best done by other independent researchers not previously involved in the design stage.

## Epilogue: knowledge growth through international cooperation in curricular design and development research

The previous section has already touched upon the promise of (programmatic) cooperation in (curricular) D&DR. The Consortium of Institutions for Development and Research in Education in Europe (CIDREE), with its strong focus on curriculum development and research, seems an excellent forum for international exchange and collaboration in this domain. All CIDREE member institutions have an interest in the high quality of their work and particularly in research-informed approaches for their curriculum activities. However, although there is not a systematic overview of the specific practices of the various institutions, it seems fair to say that, probably for all partners, there is quite some room for improvement in bringing the worlds of (curriculum) development and research closer together. Actually, on a broader level, it is realistic to note that in many countries the worlds of policy, research and practices in schools and classrooms are more separated than is desirable. There are no simple mechanisms to bridge all such gaps, but a few things would help to address some of these challenges. In particular, it would be attractive to invest in:

- creating a systematic overview of relevant D&DR (or related) approaches in curriculum development by CIDREE institutions
- exchanging these findings and stimulating capacity building on D&DR across CIDREE institutions through publications, workshops and seminars
- organising joint symposia within existing conferences; for example, in recent years the annual European Conference on Educational Research (ECER), in particular through its Curriculum Network, has already been used for several such meetings; the best example being a symposium on Curriculum Development Research in European Curriculum Institutes organised by Nienke Nieveen from SLO (the Netherlands institute for curriculum development), on 27 September, 2010 in Helsinki.

Thus, knowledge sharing and distribution through systemic partnerships and networks seems relevant. The impact of such efforts will grow if the cooperation between D&DR professionals is elaborated further (in specific projects or more in general) through the involvement and joint professional development of many other partners, notably teachers, school leaders and teacher educators.

The more these collaborative patterns become reality, the more D&DR will provide a very promising avenue for successful (effective and sustainable) curriculum improvement and innovation.

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