

The Mellon Literacy Project:

What does it teach us about educational research, practice, and sustainability?

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Introduction

The first section of this report begins with a history of the Mellon Foundation's Literacy Program—particularly its emerging vision of supporting large-scale and comprehensive programs of educational research that draw on cognitive science and are designed to produce enduring solutions for core problems of American education. The Literacy Program highlights a set of basic issues concerning the interrelations between research and practice and the sustainability of educational innovations. The second section begins by providing a brief description of the three main programs supported by the Literacy project—The 5th Dimension, Classroom Inc., and Fostering Communities of Learners. From these “cases,” the report then draws lessons about research and practice, sustainability, and other core issues. The third and final section pulls together lessons from the individual cases to develop general conclusions, and concludes by offering recommendations to researchers devoted to the development of educational innovations and to foundations dedicated to supporting them.

Section 1: Background and questions

Developing visions of the Literacy Project

In 1988, the Mellon Foundation initiated a comprehensive program of cognitive science research intended to improve education in “literacy,” defined broadly as encompassing “...the range of what are now often referred to as the linked set of ‘higher order’ skills: listening, speaking, reading, writing, reasoning, and ‘calculating’ (including more complex forms of math/science thinking).” In proposing the program, Neil Rudenstine, then Vice President of Mellon, offered several arguments.¹ First, “literacy” should refer not simply to basic skills, but more importantly to higher order, active forms of literacy, like comprehending what one has read. Second, educational problems involving literacy are so pressing in the U.S. that a sustained program of research is necessary to solve them. Third, the field of cognitive science holds immense promise for productive research into issues of literacy. Several groups of cognitive scientists, working in eminent university centers, offer “...good interaction between theory, research, classroom prototype experiment, teacher training, and other forms of school-related activities.”² Cognitive science “... has the capacity (on a continuous basis) to set intellectual priorities, redefine theory and practice, provide careful assessment, and work collaboratively with teachers colleges, schools and school systems, and (to some extent) community groups.”³ Fourth, “Those organizations that do not have a strong research base, in an established institutional framework, are likely to have a difficult time sustaining [innovations].”⁴

Rudenstine's arguments pointed the way to Mellon's large-scale investment in a Literacy Program. “Only a well-organized effort of this kind is likely to have a chance of

riding out the ups-and-downs of successive reform movements, the vagaries of many local (or not-so-local) funding sources, and the transience of either public or media interest.”⁵

Over the first few years of its existence, the Literacy Program funded a variety of research and development projects, usually in large, established research centers. The projects were diverse: basic cognitive research, applied cognitive research, curriculum development guided by cognitive principles, and attempts to develop and examine educational innovations in their natural context. The last category included two projects that have survived over the years and that are examined in this report, Ann Brown and Joseph Campione’s Fostering Communities of Learners (FCL), and Michael Cole’s The Fifth Dimension (5th D).

In 1991, the Mellon Foundation decided to conduct a systematic review of the Literacy Program. A committee consisting of Jerome Bruner (chair), Marshall Smith, and Edward Smith examined the original principles and assumptions of the Literacy Program, evaluated projects already funded, reviewed applications not funded, and suggested recommendations for future directions. After considerable study, including visits to the various programs, the evaluation committee submitted a final report to the Mellon Board early in 1992.

Several points stand out. The committee reaffirmed the necessity to continue work in the field of literacy, broadly defined as “...ways of helping people think with the aid of text.”⁶ The committee also stressed the importance of cognitive science for the Program: “...new ideas in the cognitive sciences have had a powerful (if still uneven) impact on educational practice. It would be hard to doubt the benefits to be reaped from exploiting these ideas.”⁷ Indeed, the committee declared, “A Mellon literacy research project should derive from first principles about the nature of learning and related cognitive processes. Only projects of this order are likely to influence practice in a fashion that generalizes beyond particular circumstances.”⁸

The committee made other recommendations that shifted the Program’s focus. First, it proposed that: “The setting of literate activity must be taken into account and research that ignores it risks triviality.”⁹ This meant, in effect, that preference should be given to projects that examined the acquisition of literacy in everyday settings such as schools and after-school clubs rather than the laboratory. Second, it proposed an emphasis on dissemination: “...it may well be that all of the Mellon projects should be given more opportunity to get professional help in planning dissemination or in securing wider scale testing.”¹⁰ And third, the committee proposed that: “It takes more than mainline cognitive scientists to create a revolution in schools. The most innovative ideas sometimes come from the interactions between researchers, teachers, and the children they are teaching. We believe that opportunity for live pedagogical feedback [is crucial].”¹¹

In brief, the Bruner committee added several ingredients to the Literacy mix: research should be conducted in real settings; it can be enriched by the insights of teachers and children; and the innovations produced by research should undergo extensive evaluation and dissemination.

Drawing on the insights of this report, the Mellon Foundation eventually decided to restrict support to projects that apply cognitive science principles to the design of educational programs tested in schools or other everyday environments and that evaluate and disseminate the results.

Next, a joint venture between the Mellon Foundation and the Russell Sage Foundation led to important developments. In 1992, the foundations agreed to work jointly on the Literacy Program, with the Mellon Foundation providing most of the funding and Russell Sage managing the projects. After several years of experience with the projects, the foundations decided on a further shift of emphasis in the Literacy Program.

The basic argument was that the problem with the American educational system is not a lack of innovations, but a surfeit of them. Usually, little attention is devoted to evaluating the innovations and to disseminating those that work. Furthermore, dissemination often waters down good innovations, replicating only their surface features and losing their essence.

How can the foundations confront this problem and its effects on literacy? The initial step is to identify innovative programs that appear to be effective. Next, the foundations can organize consortia of cognitive scientists and educational specialists with the expertise to carry out several tasks. These include constructing a “cognitively-informed evaluation” of the programs’ effects on students; identifying essential features of the programs that produce positive outcomes; designing efforts to disseminate these key ingredients; and developing methods to help teachers and other practitioners to implement the programs. Furthermore, an overarching goal of the consortia should be to examine the core issue of sustainability—how to ensure the healthy long life of the program once it spreads beyond its initial implementation. In this approach, cognitive science is not a source of educational innovations; instead, its role is to provide means for evaluating successful innovations and discerning their principal features.

This shift in foundation thinking resulted in expansion and redirection of the FCL and 5th D projects to emphasize issues of dissemination and sustainability. It also resulted in funding of the Classroom, Inc. project, a consortium revolving around computer simulations aimed at fostering literacy skills that can help students make the transition from school to the world of work. After 1994, very few substantive changes were made to the Literacy projects, and no funds were provided to develop new efforts in this area.

This report

Now that work on the three surviving projects is almost finished, the Mellon and Russell Sage Foundations have an interest in examining them in order to inform and improve the efforts of researchers, practitioners, and foundations to foster educational reform and innovation. Hence, I was asked to provide an overview of what can be learned from the three projects about educational research that aims to produce sustainable innovations. It should be made clear at the outset that my goal is not to “grade” the programs of research: it is already widely recognized that the research has been original, innovative, and successful, and that the researchers are extremely talented. Further, my goal is not to evaluate claims about

promoting literacy—for example, the idea that programs designed to enhance advanced reasoning can also teach basic literacy skills. This idea deserves attention, especially given the resurgence of the “back to basics” movement. But I do not discuss it because the task for this report is more general: it is to learn about the process of research in real educational settings, not the products of these particular programs.

The foundations’ insightful efforts to define and implement a vision of research into a pressing educational problem bring to the surface such fundamental issues as the relations between basic science and practice, the issue of teachers’ and even students’ roles in the research effort, and the nature of assessment. The evolution of the foundations’ vision—from a focus on cognitive science to an emphasis on questions of teacher education and sustainability—is itself instructive, raising important issues concerning the relative importance of basic research, teacher education, and politics. And the experience of the Literacy projects sheds light on several questions of great interest to the field of educational research:

- ◆ Theory, research, and practice. The Mellon Foundation began with the idea that cognitive science could be fruitfully applied to create innovative educational practice. A later view asserted that the role of cognitive science was to guide evaluation. The question then is how cognitive science operates in the process of developing, evaluating, and sustaining educational innovations. How important is it? What kinds of core principles, cognitive and other, are important for an innovation? How do they operate? To what extent do they produce innovations, sustain them, or derive from them?
- ◆ Evaluation. As mentioned above, the foundations felt that cognitive science had an important role to play in the design of evaluation. What can be learned from the three projects about the kinds of evaluation that can be fruitful for an innovation and the role that cognitive science plays in them? In what ways can different forms of evaluation facilitate the development and dissemination of an innovation? What are some limitations of evaluation?
- ◆ Collaboration. The foundations’ position was that large problems require large and talented groups of researchers to solve them. How well do research consortia operate in practice? What are the tensions, benefits, and disadvantages of collaboration? What guidelines can be given for establishing effective collaboration among researchers?
- ◆ Universities. The foundations assumed that the university offered a solid institutional structure for the conduct of large-scale research. To what extent are such institutions viable bases for long-term educational research and innovation? How have the projects affected institutions of higher education affiliated with them?
- ◆ Dissemination. The foundations’ attention shifted to questions of dissemination, which can be thought of as giving away the innovation, marketing it, or making it available to potential new users. What kinds of strategies are necessary and effective for disseminating basic innovations? Is it possible to achieve widespread dissemination of complex educational innovations?

- ◆ Sustainability. In the end, the foundations were concerned with sustainability—assuring that innovations survive and even flourish over time. What do the projects teach us about factors that promote or interfere with the long-term sustainability of innovations? What are the roles of institutional supports, politics, values, and teacher education?

To answer these questions, I read the projects' proposals, reports, and publications, visited all the sites, interviewed the participants about their experiences and their views on the core issues, and eventually developed the views offered in this report. Eileen Tang ably assisted me throughout the effort and the Russell Sage Foundation's Visiting Scholars Program provided me with the opportunity to write the report during my sabbatical leave.

My thinking about the issues has been influenced by several sources and has evolved over time. I have drawn upon the various reports and documents produced by the foundations and upon at least some of the published literature. I have been influenced by my own experience as a member of two National Research Council committees, one producing a report outlining a strategic educational research plan¹² and the other a plan for future research¹³ based on the How People Learn report.¹⁴ My ongoing experiences with curriculum development and teacher education have provided some perspectives on the issues. But perhaps most importantly, I am indebted to the researchers themselves who have thought deeply about their experiences and who generously gave of their time to share their insights with us.

The result is this report. The next section begins by describing basic dimensions of each program. These include:

- ◆ Context and goals. The social and historical context in which the program developed and the goals that motivated its creation
- ◆ Core principles. The fundamental psychological and other assumptions that underlie the program
- ◆ Basic prototype. The initial version of the innovation as developed by the founder(s)
- ◆ Variants. "Morphs" of the innovation that developed over time
- ◆ Operational structure. The way different components of the program were organized and operated: how researchers worked together, the relative emphasis given to research, evaluation, dissemination, and other activities
- ◆ Dissemination and professional development. The kinds of dissemination and professional development activities the program undertook
- ◆ Research and evaluation. The kinds of research and evaluation studies that the program carried out and some major results

After describing the basic dimensions of each program, I then offer lessons concerning each of the basic issues described above—theory, research, and practice; evaluation; collaboration; universities; dissemination; and sustainability. The third and final

section of this report offers conclusions and then recommendations for researchers and funding agencies.

Section 2: Three Programs

The Fifth Dimension

The Fifth Dimension (5th D)¹⁵ originated at the University of California, San Diego, in the mid-1980s, with support from the Spencer and Carnegie Foundations. At the time of initial Mellon funding in 1991, the 5th D was a “mature” project that had already been operation for approximately 5 years, although without extensive evaluation.

What is the 5th D?

Context and goals

In the 1980’s, the 5th D originated in a social context in which American education was said to be in a state of crisis. America was a “nation at risk” because of the failure of its school system. The founder and associates felt that there was a vital need to reduce the huge Socioeconomic Status (SES) and ethnic disparities in children’s educational achievement that intensified already acute divisions in American society. A secondary goal was to promote diversity in higher education and improve college and university teaching practices. Cognizant of the difficulties involved in trying to introduce radical change into the public schools, the founder of 5th D decided instead to make productive use of children’s unsupervised after-school time by engaging them in playful but meaningful educational activities in the kind of supportive social context that his theory advocates.

Core principles

A core set of principles guides the design of the model after-school activity. Many are in the grand tradition of progressive education, stemming from Dewey and his successors.

- ◆ Some basic principles are psychological, deriving from cultural-historical activity theory.¹⁶ Perhaps the most basic assumption is that “... the formation of mind is essentially and inescapably a sociocultural process; consequently, it can be grasped only by situating individual development in its sociocultural context.”¹⁷ In this view, education involves developing a sociocultural context in which adults and children interact to develop and share knowledge. Learning activities blend play and work, encourage communication among participants, and foster individual and group reflection.
- ◆ The core principles also deal with motivation. The 5th D is designed to provide a mix of play and educational activity that must be interesting enough to attract children’s participation, which is always voluntary. The program provides a context designed to promote “... self-motivated learning within the framework of a voluntarily accepted system of rules.”¹⁸
- ◆ Still other principles represent a political calculus. One principle is that local institutions and universities should support the program, and will support the program, only if it serves their basic needs and interests. The after-school program does this for the local

community by keeping children off the streets and educating them in after-school clubs, and for the universities by putting undergraduates on the streets (or at least off campus) and educating them in the “real world” of wizards and golems. A second principle is that both children and adults must buy into the innovation. To accomplish this, the 5th D offers a mixture of play and education. The former attracts the children, and the latter provides a justification for adult support.

- ◆ Another principle describes a method for working with local communities. The technique—stemming from deeply held values—is to engage in collaborative work with communities, rather than attempting to impose reform from the top down.
- ◆ Several principles control the design of the environment: (a) “Interactive technologies” can afford the children rich opportunities to learn. (b) “It is important to have a mythical/virtual entity, such as the Wizard who stimulates, amuses, oversees, coordinates, and bemuses participants through the telecommunications system.” (c) Competence is not found only in adults and is respected and used wherever it emerges.
- ◆ And finally, there is a moral stance. The project is committed to promoting diversity: “...diversity of legitimate goals, diversity of ways of achieving goals, diversity of participant abilities, diversity of personal histories, diversity of local site cultures, diversity of kinds of literacy promoted.”¹⁹

Basic Prototype

Core principles and a healthy dose of creativity led to the development of the prototypical 5th D, an after-school program that involves children, typically from 6 to 12 years of age, in an environment specially designed to promote literacy through exploration of off-the-shelf computer and non-computer games and activities. The 5th D is a fantasy play world that includes several artifacts intended to help children organize their work. Four of the most important are an imaginary entity, like a Wizard or El Maga, who communicates via e-mail, answering children’s questions and providing direction; a maze that organizes children’s use of progressively more difficult games and materials; computer activities and games; and task cards that help children form goals and engage in particular activities. A coordinator, typically hired by the local community, is responsible for operation of each site. Undergraduate students enrolled in a practicum/laboratory course such as Child Development help the children work with the games (and learn about the games from the children), learn how academic concepts apply (or do not apply) to this real (imaginary) world, and collect data, most often in the form of field notes, concerning 5th D activities.

Variants

It is important to recognize that the 5th D is not a highly specific method for teaching subject matter, but rather a general and open-ended approach to creating a culture of learning that can assume many variations. Indeed, the 5th D project assumes that variations on the prototype are necessary to meet the needs of local communities. The goal is to sustain the “ideal” of the 5th D but not necessarily its particulars. The prototype has been adopted by many local communities and adapted to their distinctive contexts, so that now the 5th D takes

different forms in many sites around the world, from California to Australia, each with its own “personality.” Many sites serve low-income and minority children. All sites aim to mix play and education to create lively activity-centered learning. Although all sites share a family resemblance that identifies them as 5th D, staff members in each locale create distinctive goals and procedures, so that the sites differ in such characteristics as:

- ◆ Themes (for example, primary language maintenance at Eden Gardens, computer literacy at San Marcos, and community service at Whittier),
- ◆ Use of physical and imaginary artifacts (Proteo and El Maga are different locally developed entities, although both serve similar functions), and
- ◆ Participation of adults (in most 5th D sites, undergraduates serve as mentors, but in La Case Magica, a setting for preschoolers, parents sometime assume that role).

Operational Structure

Typically, the 5th D sites have a university connection. At the outset, the university provides the 5th D prototype, a leader to organize the activity, a general plan for the activity at the particular site, college students who work with the children, and temporary financial support. The long-term goal is for the local site to provide its own funding, leadership, and other support for the activity. This transfer of responsibility can indeed occur, as in the case of La Case Magica, where some very impressive and competent (although in some cases uneducated) parents have assumed major leadership roles.

Researchers in the 5th D consortium and college students in sites around the world interact by means of e-mail, telephone, meetings, and written communication. Participants attempt to develop a common understanding of the project’s goals and assumptions and to create among themselves a productive distribution of tasks and labor. The founder of the project tends to play an influential role in the process, but does not completely dominate it. The research group seems to have a good esprit de corps. Most investigators seem to hold a long-term commitment to the reform effort; their main goal is not academic publication.

Dissemination and professional development

The 5th D has engaged in several forms of dissemination and professional development.

- ◆ A Clearinghouse on the Web provides information to potential adopters of the program and technical assistance to those operating sites.²⁰ The Clearinghouse is mostly a “materials factory,” providing descriptions of sites, directions for implementing a site, task cards, means for conducting site evaluations, addresses of other sites, and the like.
- ◆ A new consortium involving campuses in the University of California system (UCLinks) also operates a web-site.²¹
- ◆ Also useful for dissemination is an excellent CD-ROM.²²

- ◆ The 5th D has developed systematic procedures for training the college students and site managers, usually within the context of the college course they take for credit.
- ◆ Members of the consortium have written a great deal about the project in both scientific journals and accessible publications.
- ◆ Accounts of the project have appeared in the popular press and on television.

Research and evaluation

Research and evaluation efforts have focused on an impressive variety of questions.

- ◆ Success of the program. Early on, before it became part of the Literacy Program, the 5th D appeared to be successful: children volunteered to participate, enthusiastically engaged in the activities, appeared to learn from them, and the concerned adults judged the experience a success. “The fact that children come to the 5th D and spend time there, and that adults routinely encounter them engaged in an activity that is noticeably educational, is reason enough for the ... staff and parents to approve of it.”²³ Nevertheless, in 1991, partly influenced by foundation prodding, the 5th D assembled a team to conduct systematic evaluations of children’s learning in the after-school programs. Using both specially constructed and traditional evaluation measures, Mayer and Blanton examined near and far transfer of reading and mathematics skills, reflection, verbal and communication skills, ability to follow instructions, and problem-solving. Shustak focused on assessing computer literacy. The general finding was that children indeed acquired various “literacy skills” through participation in the informal educational experience of the 5th D, and also learned important computer skills and strategies. To serve the needs of those attempting to develop new sites, the 5th D has made available through the Clearinghouse a standard evaluation battery, along with instructions for its use, and also methods for establishing the fidelity with which sites implement important 5th D principles.
- ◆ Student identity and language use. Duran’s research has focused on how 5th D clubs improve the learning and identity development of children from cultural and language minority backgrounds, particularly Chicanos in California. The research examined the children’s sense of themselves as active agents in learning, their application of available funds of cultural knowledge to the task at hand, their progress in the use of written and spoken English and Spanish, and the different kinds of literacy skills and other forms of achievement that emerge in the course of 5th D activities.
- ◆ Techniques of practice. Gallego, Moll, and Rueda have investigated the nature of routines employed at different sites, the methods used to enculturate children into sites, the techniques considered to be successful in different sites, and the relations of site practices to child outcomes. One major issue currently under investigation is how the non-school like aspects of the 5th D seem to produce positive outcomes and what implications they have for children who are successful in the 5th D but not in traditional classroom settings.

- ◆ Undergraduate learning. Undergraduates participating in the 5th D learn psychology not only through assigned readings, as in most courses, but through reflection on concrete practice in which they have the responsibility for fostering children's learning. Blanton and Bremme have investigated how the 5th D experience contributes to students' learning and affects their attitudes and beliefs concerning learning, teaching, and children.
- ◆ Basic processes of learning. McDermott, Ito, and Greeno have undertaken detailed analyses of learning "butterflies"—beautiful, complex, and often elusive learning moments that occur frequently in the informal and sometimes boisterous setting of the after-school clubs. Analysis of the butterflies includes a focus on the adult-child interaction presumed to nurture learning in the 5th D and an attempt to situate processes of learning in the broader culture of collaboration and institutional contexts. The researchers find, for example, that adults and children take turns in the role of experts and novice, negotiating new social relations as they explore 5th D activities.
- ◆ Cultural artifacts. The 5th D employs various artifacts, including the Wizard (or other mythical-electronic figure) to create for each setting a distinctive culture that helps to organize the children's learning. The mythical figure is intended to serve as a "cultural broker," helping children to engage with the system, question its rules, and receive direction from the adult semi-authority. Vasquez has conducted research on the way in which the Wizard is in fact construed and used in the various sites. The goal is to develop useful principles about how an artificial culture like the 5th D operates and helps to organize learning.
- ◆ Method. Researchers have felt the need to employ several types of research methods in an attempt to understand the rich and complex behavior observed in 5th D settings. Although test scores may provide useful information about outcomes, they do little to illuminate the kinds of learning and social interaction observed in the 5th D. The investigators believe that field notes and records of computer use are better suited to capture the complexity. But how is it possible for researchers to use field notes as a rigorous tool of the research enterprise? The use of field notes requires and leads to different notions of appropriate behavioral units of analysis (for example, Duran's idea of "meaningful interpretive units"). The sheer volume of field notes requires new approaches to data storing and retrieval and new analytic procedures. Similarly, theoretical frameworks like cultural-historical activity theory (CHAT) are used to develop new methods for analyzing behavior in context. The investigators believe that these methods can be more successful than traditional experimental design in analyzing the success of 5th D programs. The 5th D investigators are constantly pushing the margin on method and analytic technique.
- ◆ Sustainability. The issue of sustainability has been built into the research program of 5th D at least since 1986. The researchers have investigated how different types of community institutions can support 5th D activities; what types of university arrangements can contribute to promoting the 5th D; the stages through which 5th D sites develop from implantation, to early development, to life on one's own, and finally institutionalization; and the many contributors to 5th D programs' failure.²⁴

What can be learned from the 5th D?

I first consider some general lessons concerning the relations among research, evaluation and educational innovation, and then what can be learned about collaboration within the research consortium and about universities as contexts for and beneficiaries of the innovation. Finally I discuss the dissemination and sustainability of innovations.

Relations among research, theory, and practice

Core principles are complex. Core principles that lead to development of, are associated with, or define the integrity of an innovation draw in a complex fashion from psychology, education, politics, economics, and values. Psychological principles cannot serve as the only, or even the major, basis on which an innovation can be built. “Cognitive science” in particular is a weak foundation for educational practice, if by cognitive science is meant cognitive analysis of behavior in the absence of thorough consideration of such phenomena as motivation, personality, identity, development, and social interaction, all of which are basic to school learning. Clearly the 5th D has drawn to a much lesser extent on cognitive science than it has on activity theory and cultural theory. (One might say that developing viable educational programs requires going beyond the cognitive science given.)

Useful psychological principles are rich and general. The core psychological principles underlying a complex educational innovation must be both rich and general, which is not to say empty. The richness specifies some real substance that differentiates the innovation from other approaches and guides its development and implementation. The generality of the principles allows for application to diverse circumstances, for creative morphing, and for “personality differences” among variations. At the same time, the richness and generality of core principles can be seen as a limitation on ease of application: they prevent a simple one-to-one mapping between principles and innovation. Important core principles do not permit creation of a cookbook approach to innovation. One cannot simply “apply” research in a mechanical way.

Innovations require magic. No matter how profound and powerful, core principles do not lead to successful innovations without the intervention of creativity. Application of research needs a dose of magic. The Wizard is a good example of an effective innovation that derives at least as much from the creativity of the designer as from the strict application of a core principle. The idea of creating a culture to organize activity may arise from, or at least be consistent with, Vygotskian theory. But the ideas of a Wizard and its mode of operation derive from a whimsical imagination. Theory can guide development, but creativity is required to enliven it. Good theory can result in very dull applications.

Innovations lead to basic research. Although core principles guide its development, a rich innovation leads to unanticipated and complex outcomes that raise basic questions for research. The 5th D produces learning phenomena that are too rich to be explained by the theory that helped to create the environment where they occur. Understanding children’s learning in the 5th D thus becomes an important challenge for research, as in the case of the “butterflies” or the analysis of adult-child social interactions that are at the core of the 5th D. The lesson is that the “application” of knowledge to educational practice itself creates the

need for basic research. Lewin is quoted as saying that there is nothing so practical as a good theory. But it is also true that there is nothing so theoretically stimulating as innovative practice.

Innovations lead to new research methods. The 5th D experience also shows that innovations may produce behavior too complex to study by means of conventional methods alone. Hence, the researchers need to develop new techniques for studying the phenomena produced by the innovation. Innovations produce not only the need for new theory, but new methods as well.

Evaluation

Evaluation creates tension. The need for evaluation introduces tensions into the effort to create an innovation. On the one hand, the developers of an innovation can easily believe it to be successful when children and adults engaging in it are enthusiastic and indeed joyful. Also, the developers properly resist the use of traditional evaluation methods like achievement or intelligence tests that are grossly inadequate for the task of capturing the complex learning that can easily be observed. On the other hand, the essence of a scientific approach is the desire to avoid the attractions of self-delusion. Further, there is a real need to convince others—politicians, foundations, local agencies, and universities—of what appears obvious to the innovators. The problem for the developer of an innovation therefore is how to create (or see that others create) and employ evaluation methods that come as close as possible to being faithful to the complex phenomenon, comparable across situations, practical to administer, and informative to different audiences. Not an easy task!

Different evaluation goals require different methods. The work of the 5th D makes abundantly clear what may be already well known, namely that different types of evaluation are needed for different phases and aspects of an innovation. To develop the innovation, “formative” evaluation is needed to establish whether a particular method such as task cards works as well as it could and, even more importantly, how it can be improved. Another kind of evaluation focuses on student “outcomes” such as grades, acquisition of computer skills, and the like. Still another kind of evaluation attempts to describe aspects of individual or social processes of learning, like independent motivation, sense-making, or interactions with peers or adults. Evaluation may be employed to investigate the fidelity of program implementation; despite acceptable variation, the “soul” of the program needs to be preserved. Evaluation may also be employed to compare the success of different programs.

Obviously, one method cannot meet all these needs. One of the impressive aspects of the 5th D is that it has made creative and appropriate use of methods ranging from field-notes to standardized tests to accomplish various goals of evaluation.

Evaluation and research are not easily distinguished. Questions of evaluation sometimes overlap with basic research issues. For example, the attempt to determine what a child is “really learning” in the course of adult-child interaction in the 5th D is in part an inquiry into social cognition and in part a component of the evaluation of the program. Creative evaluation may require basic research and contribute to it.

Meaningful evaluations of complex phenomena are almost impossible to do (with scientific rigor). There are many ways in which evaluation proves inadequate. First, it is very difficult to measure with rigor the complexity of learning, the originality of thinking, and the personal significance of motivation. In general, the more significant the psychological phenomena, the harder it is to measure them. Second, it is very difficult, if not impossible, to isolate particular features of the innovation that cause a specific outcome. All things but one are hardly ever equal. The kind of experimental/control group study in which a “variable” is isolated is virtually impossible to conduct in the real world of education. As Cole puts it: “... design experiments involving educational activity are complexly constructed social systems in which it is simply not possible to be sure at all times what combination of factors is at work to produce the phenotypical appearances. All such systems are emergent products not only of factors identified as internal to the system, but factors that involve the necessary openness of such systems to the social systems in which they are embedded.”²⁵ Third, it is very difficult to compare variants of an innovation, especially when the “personality differences” are large and they operate in settings that vary in significant ways, for example, in cultural values and in local social-political conditions. In these different settings, overt behaviors—like successful use of English language or critical thinking—may have different meanings, just as they do in different cultures, with the result that simple comparisons are not possible.

Collaboration among researchers

It is possible to have a successful research consortium (even among professors!) The 5th D experience suggests that there can be genuine collaboration among university researchers. Although there were exceptions and occasional tensions, the consortium, although distributed across several universities, generally seemed to work smoothly despite some substantial differences in point of view. Members of the consortium report many benefits to the project as a whole and to their own work. Researchers with different talents and interests made contributions that strengthened different aspects of the project. They reported that over a period of time they learned to listen better to one another and to see how another researcher’s results can be interpreted for use at a local site. They learned to draw upon one another’s work in different ways, sometimes eliminating duplication of effort. The researchers also report that they influenced and enriched each other’s perspectives (sometimes after an initial period of discomfort). Indeed, some found that compared with the work of the consortium, the individualistic approach of the university is isolating and dull. (Of course, perhaps these are kinds of people who chose to work on the project in the first place.) In any event, the 5th D participants spoke of their common work as “resource and a refuge.” The 5th D has managed to achieve a well functioning consortium, and several factors may help to explain its success:

The consortium works in part because of its founder’s openness. Although the 5th D originated in extensive collaborative work among many talented individuals, it does have a founder, a very powerful first among equals. Founders can play many different roles in “collaborative” projects. From the outset, Cole has been willing to share the 5th D. He has stressed productive variation, indicated that much can be learned from studying failures, organized and energized researchers and community leaders, and somehow managed to

engage independent individuals in a common enterprise. A charismatic leader need not doom a collaborative effort.

The consortium works in part because of the commitment of its members. One might characterize the 5th D consortium as a “movement.” Its highly competent members are committed to and passionate about social reform and believe that their work contributes to it. The consortium works well partly because its members share a common vision and basic set of values. The 5th D consortium is not an effete ivory tower club.

The consortium works in part because of the value placed on diversity. The fact that morphing and diversity have been values of the project from the outset encourages different activities and approaches on the part of researchers. Acceptance of morphing leads to tolerance of variation in researcher activities, approaches, and goals. Greater tolerance leads to less friction and perhaps a looser form of collaboration. The 5th D does not attempt a top-down, highly coordinated type of interaction. It is not a well-oiled, smoothly functioning machine; it encourages a kind of cooperation with independence and within a set of shared values.

The consortium works in part because of the researchers’ involvement in local 5th D sites. Involvement in the consortium seemed most effective when researchers were actively involved in a local site. Perhaps such involvement increased commitment to the project goals; perhaps commitment to the project enhances involvement. In any event, sustained contact with a functioning 5th D site certainly infuses the research issues with life, may promote shared understanding among researchers, and may help researchers to see the need for substantial collaboration.

Yet extreme morphing may interfere with cooperative work. Once the morphing becomes extreme—as it may when the 5th D spreads among the different University of California campuses participating in UCLinks—researchers may develop disparate goals, profess different values, and be reluctant to share. Probably real collaboration among researchers can be maintained only within a relatively small in-group sharing common values. The possibility of intimate collaboration seems to diminish as the size of the group increases.

Effects on and of the university

Students in higher education can benefit from “field work” courses organized around an educational innovation. The 5th D has contributed to university instruction by providing a useful model for a field-based undergraduate learning experience centered on an educational innovation. Research has shown that undergraduates obtain considerable intellectual benefits from attempting to assimilate their work with children into the theories and research introduced in the university classroom. A “field work” experience of this type can serve as an important component of a liberal arts education for students of psychology, human development, and similar disciplines and may help to persuade them that a career in education or some form of human services is attractive. Student participation in the 5th D can be of great value as well to students of education. Indeed, Blanton claims that the 5th D has transformed the School of Education at Appalachian State University.

It is not easy to implement a fieldwork model. At the same time, the 5th D experience makes it clear that implementing the model is not easy. Universities are among the most conservative of institutions and do not accommodate easily to novel teaching arrangements.

The university is not the ideal setting for a research consortium focusing on educational innovation. The 5th D experience also leads to reflections (by the researchers and by me) on the role of the university as a productive venue for the kind of collaborative work required by large-scale educational innovation:

- ◆ It is difficult for the lone university researcher to sustain a commitment to the 5th D. A critical mass of faculty within a university is required to provide mutual support and resist the individualism of the university.
- ◆ Many universities are organized around production of basic research; tenure is granted for demonstrably individual achievement, usually in the form of publications. Some universities promote competition among peers for scarce tenured positions. This ethos conflicts with the kind of collaboration required in large-scale educational research. The bottom line is that participation in a project like the 5th D may make it difficult for a faculty member to get tenure.
- ◆ Research universities tend to down-play “applied research,” practice, and community involvement (and teaching as well), yet projects like the 5th D cannot function without an enduring commitment to local communities and a willingness to undertake unorthodox forms of research.
- ◆ Other universities and colleges that place high value on practice and community involvement may be suitable settings in which to operate 5th D programs but may not employ faculty skilled in research.
- ◆ Shifts in university administrations can be as devastating to the research enterprise as shifts in political control in local communities.
- ◆ It is not easy to get some universities to cooperate with other universities, let alone school systems or community institutions.

Dissemination

Dissemination should be multifaceted. Dissemination is partly a sales campaign. The 5th D has used different forms of dissemination—including academic publications, television shows, the Web-based Clearinghouse, speeches, and a CD-ROM—to reach different audiences. This is as it should be. The scholarly publication, even if unread (or maybe especially if unread) may play a special role in bestowing scientific legitimacy on an innovation, but will not win over the hearts and minds of the public at large. Other forms of dissemination, especially in the mass media and on the web, are necessary to spread the word. One would not object even to 5th D commercials during the Super Bowl.

A base in school systems may be useful for dissemination. The 5th D has traditionally been skeptical of working with school systems, on the understandable grounds that they are

too bureaucratic and conservative to support significant change. The main locus for 5th D activities has therefore been after-school centers, which typically are independent of school systems and other organizations. Yet this very independence makes it hard for 5th D dissemination efforts to reach after-school centers. Perhaps 5th D dissemination efforts could profit from closer association with at least some school systems that are willing to institute different kinds of informal education, including after-school clubs. If a large school system is on board, it may be possible for the 5th D to reach many more children than it does now. On the other hand, one does not want the school system to sink the 5th D ship. There is some indication that the 5th D is moving in the direction of closer association with schools that are displaying increasing interest in after-school programs.

Sustainability

Innovations live and die in the body politic. Educational innovations are embedded in a larger social-political context that influences them in many ways. It establishes need: thus the 5th D was developed partly in response to the evident need for after-school services for children and youth. The social-political context provides opportunities for development of an innovation, as when restrictions on affirmative action led the University of California to support UCLinks as a way to encourage and increase minority enrollment. The social-political context imposes financial limitations in public support for school and after-school activities (and, indeed, for almost every form of financial aid for children and youth). It also provides financial opportunities, as when 5th D activities were incorporated into the California and North Carolina state budgets. In brief, educational innovations live and die within the body politic. And the health and desires of that body surely exert enormous influence over the development of the innovation—greater influence no doubt than scientific evidence in the form of evaluation studies or position papers offered by foundations. One cannot underestimate the power of the social-political system to influence educational practice.

Innovations live and die in the local context. Educational innovations are also influenced by the local social-political context. For example, in San Diego, the 5th D finds it useful to operate in the context of community organizations that promote social reform, like the Solana Beach Coalition for Community Education. Indeed, many 5th D personnel—the researchers, the coordinators, local community activists—are social reformers at heart. Successful operation of the 5th D requires a supportive university context that encourages or at least tolerates “field work” courses in which undergraduates staff the after-school clubs and learn from the experience. Similarly, the 5th D deliberately operates almost entirely outside of the public school system in order to avoid bureaucracy and preserve flexibility.

Willingness to accept and even value morphing is a key to sustainability. The 5th D does not define sustainability as literal replication, and instead, to its considerable credit, has a high tolerance for diversity in both means and ends. Adaptation to new circumstances is the essence of sustainability, not imitation or stability of the prototype. Sometimes morphing results in better practices and outcomes than does the prototype. Evolution, after all, can be productive.

This kind of flexibility of course results in dilemmas. When is a morph a productive variation or a “lethal mutation”?²⁶ If the goal is to have communities adapt the program to local needs, then literal sustainability is not desirable and it is no longer clear what constitutes a legitimate implementation of the program. What is a 5th Dimensionally correct morph? The project’s core principles may provide guidance in making the judgement, but they are flexible too. (Will there be morphs of core principles?) Similarly, if morphing is valued, what is the role for a common system of evaluation such as that available through the 5th D clearinghouse? Presumably communities may have to pick and choose among its tests to find what they need and value.

University-community collaboration is key for the sustainability of the 5th D, but is not a relevant model for other educational innovations. The 5th D model requires collaboration between university and local community. The university provides the prototype and the personnel; the local community ultimately needs to provide financial support to maintain the innovation. The university attempts to adjust the prototype to the needs of the local group, which in turn exerts a high degree of control over the process of development and implementation.

But many educational innovations do not depend on such close collaboration with universities or researchers generally. Although they may benefit from interaction with universities, school systems in particular can rely on their own personnel to operate innovations. The key issue is whether the educational institution decides to finance, nurture, and support the innovation, not whether it is willing to work collaboratively or at all with any outside institution.

Values can undermine sustainability. Education is significantly a matter of values. We may or may not think that it is desirable for our children to think critically, to enjoy art, or employ scientific method. In matters of value, “objective” evaluations may be irrelevant, particularly to the person who maintains a fundamentalist point of view in which scientific evidence is not accorded high respect. Thus, in one setting parents did not value the 5th D view of learning as a cooperative, interactive activity: instead, they wanted the children to learn “... manners, deference, obedience,” and to use tools like computers “the right way.”²⁷ This kind of value orientation undermines progressive education generally and is hard to overcome.

Similarly, the long-term viability of any university-community collaboration depends in part on values. Does the community feel that children’s welfare warrants substantial financial investment (that might require increased taxation)? Does the university feel that community involvement is a good use of faculty time and that the after-school club is an appropriate setting for undergraduate or graduate student learning? The answers to these questions are by no means obvious at a time when spending for the public good is under political challenge and university concern with the volume of faculty publication borders on the pathological.

Conversely, values promote sustainability. To promote an educational innovation is to assert a set of values. 5th D personnel work hard at and push the program because they

believe in progressive education and diversity. A program will not be sustained unless researchers and particularly practitioners accept the values underlying it.

Sustainability requires that the innovation needs to get into practitioners' minds. Dissemination strategies may spread the 5th D widely but at the same time fail to convey the its spirit. The 5th D is a not a maze or a Wizard. It is a set of ideas, principles and strategies that can be used to construct and operate learning environments. The principles and strategies that comprise the 5th D and other complex innovations are ineffective unless assimilated by the minds of practitioners. They need to understand what the purpose of the Wizard is and how it can be modified to meet local needs. They need to understand how a child is trying to make sense out of a task and how to adjust the task card accordingly.

The landscape of educational reform is littered with silly replications of the surface form of many innovations, but not their substance. Professional development therefore is a major key to sustainability. Whether the practitioners are college students, coordinators, or teachers, they need extensive support in learning how to assimilate the ideas underlying the innovation, make them personally meaningful, and use them effectively in their local settings. The 5th D attempts to do this largely through a field-based college course, apparently with considerable success.

Educational technology should be as be simple and "low-tech" as possible. Limited budgets force many 5th D centers to make do with relatively old software operating on relatively old machines. These are generally adequate so long as they can run basic programs, and permit web access and e-mail communication. In the real world of schools and after-school clubs, it is hard to provide the very latest in hardware and software. Insisting on use of the latest technology can cripple an innovation.

Classroom, Inc.

Classroom, Inc. (CRI) originated in the work of Lewis Bernard in the early 1990s, with support from various foundations, but almost none from Mellon and Russell Sage. Both foundations nevertheless played a major role in locating university research collaborators for CRI, and then in supporting selected research projects at Indiana University and the Learning Research and Development Center (LRDC), University of Pittsburgh.

What is CRI?

After describing key features of CRI, I turn to dissemination and professional development activities, and then research and evaluation.

Context and Goals

The development of CRI was sparked by Lewis Bernard's interest in education. Morgan Stanley, the investment bank he was associated with, had adopted a school serving low-income, minority students, but unfortunately did not achieve the extent of improvement desired. Bernard therefore became interested in learning how a private entity could establish a productive relationship with a school so as to promote its students' academic achievement and eventual occupational success. At the same time, he noticed that, despite the increasing importance of technology in the workplace, most students had limited access to technology, and what they did have was poorly utilized. Therefore, he surmised that use of technology, in the form of simulations of real-world settings, could elevate academic achievement and improve problem solving and workplace skills.

Bernard then asked John Black, a professor at Teachers College Columbia University who is skilled in educational software and trained in cognitive science, to do the first prototype of a banking simulation. The pilot testing of this product yielded mixed results. On the one hand, the prototype was a huge success with students; they were very engaged and enthusiastic when using the simulation, and they seemed to be learning. However, the teachers had difficulty interacting with the children during the simulations, and required considerable help to make effective use of the software. These results suggested that any attempt at dissemination would have to include a large professional development component.

At the end of the pilot testing, Bernard, along with Madeleine Lacovara and several others, decided to create a non-profit organization, CRI, to continue their work. The overall goal was to develop and disseminate as widely as possible high quality software simulations that would help students learn workplace skills. CRI devoted considerable effort to professional development, incorporating face-to-face interaction and mentoring to help teachers make the most of the new simulations in the classroom. Significant resources were also invested in building new simulations of work in various industry sectors, such as manufacturing and hotel management. CRI also established an internal research department.

Core Principles

CRI's initial work was not based on a clearly elaborated set of principles analogous to those at the heart of 5th D or FCL. The intuitions leading to the program were basically that:

- ◆ Good education involves getting students enthusiastically engaged in activities as similar as possible to what they will need to do in key real-life settings, such as those in business and industry.
- ◆ Computer simulations enable students to develop a desire to learn; an understanding of how to utilize knowledge in problem solving situations; and an appreciation of the value of education and literacy in today's society.
- ◆ Professional development needs to involve face-to-face interaction, particularly coaching and mentoring designed to help teachers learn how to utilize technology in the classroom.

It is interesting to observe how academic researchers described what they saw as core principles underlying CRI. According to LRDC, the basic ideas are:

- ◆ There is a need for skilled, competent and flexible problem-solvers in the workplace.
- ◆ The school curriculum must foster the kind of competence and flexibility needed in the workplace.
- ◆ Fostering these skills requires that students become involved in a workplace culture and engage in its activities. Cognition is situated in particular contexts.
- ◆ Simulations can help to do this without the problems demands of real job experience, like the need to produce, which may interfere with learning.
- ◆ Simulations can encourage discussion and reflection, which we know are effective in producing understanding and metacognition.

Clearly, these principles are consistent with and elaborate the original set of intuitions, and both sets of ideas are consistent with general principles of progressive education.

Basic Prototype

The original Chelsea Bank software engaged students—usually from low-income, minority groups—as tellers and customer service representatives performing a variety of banking activities. As they use the software, students work in small groups, usually of three, collaborating in the solutions of problems posed by the simulation. Further, the simulation provides students with immediate feedback, allowing them to reflect on the results. Teachers do not actively work on the simulations. Instead, they act as facilitators, helping students team with one another as necessary to make the most of the learning interaction.

Variants

After creating Chelsea Bank, CRI developed approximately 11 simulations, each of which is designed as a virtual company within a particular sector of industry. For example, Court Square Community Bank focuses on banking and economics, whereas Green Mountain Paper Company exemplifies manufacturing. When using any of the simulations, students are required to undertake a particular job within the company, and to make decisions and solve problems from the perspective of that job. The simulations thus enable students to learn about the types of jobs that exist within different industry sectors, and hopefully to develop realistic career aspirations.²⁸ At the same time, all of the simulations require skills in mathematics, social studies, science, and language arts, and require similar types of complex decisions and critical thinking. Further, many of the problems posed by the simulations raise issues of ethics and social awareness.

Operational Structure

CRI itself undertakes four major activities: development of simulations; in-house research; development of methods and materials for professional development; and dissemination/ professional development. In 1999, CRI reported a plan to serve approximately 64,000 students and 1,800 teachers and staff developers in nearly 350 sites.²⁹

Simulations: A software team, several industry experts, and a group of teachers and students work together to produce a simulation, which is then tested in selected schools.

In-house research: Some CRI research is directly concerned with the effectiveness of the simulations themselves—for example, a yearly survey of teachers' and principals' perceptions of the strengths and weaknesses of CRI simulations. Other projects examine student outcomes on a broader scale, for example work-related beliefs.

Development of methods and materials for professional development: CRI develops materials—for example, teachers' manuals, multimedia materials—to support teachers' use of the simulations. A district cannot use CRI simulations unless it also acquires CRI professional development materials.

Dissemination and professional development: CRI also conducts major dissemination and professional development efforts (described below). Revenues from these activities provide only a small portion (10 percent) of the CRI budget. CRI remains viable by soliciting and receiving considerable funding from individual donations and foundation grants, many from large businesses.

At the same time, separate groups at LRDC and Indiana University conduct several types of research, to be discussed below. In general, there was little contact between the two university research groups, and between LRDC and CRI. The story of the relations between CRI and the research groups is complex, and I make an effort to tell part of it below.

Dissemination and professional development

At present, the leaders of CRI believe that in a typical district, about 20 percent of the teachers can easily use the innovation, another 20 percent never get it, and the remaining 60 percent need help, prodding and pushing, but can eventually become effective at using the

simulations. The target therefore is this last group, which can tip the scales in the direction of widespread CRI use in a district. From this perspective, it is essential for CRI to “market” the simulations along with professional development and support.

At CRI, dissemination is highly organized and extensive, usually operating at the district or even statewide levels. In general, CRI attempts to select districts already committed to professional development and technology. Once retained, CRI then introduces the program to administrators and trains specialists to run workshops designed to introduce teachers to techniques for using the simulations in the classroom. Then professional development and long-term support of the effort begins in earnest.

Over the years, CRI maintains contact with teachers, staff developers, and administrators by sending monthly newsletters and other communications that include descriptions of such topics as:

- ◆ A program designed to provide educators with a paid residency at the central CRI offices
- ◆ A High School Level I Institute to train teachers in use of simulations
- ◆ The Second Annual Survey of users’ experiences with CRI
- ◆ A program to enable experienced CRI teachers to mentor new teachers in New York City
- ◆ A new simulation involving the sports media industry (supported by Time Warner Cable and ESPN)
- ◆ Institutes to be held in Houston, Iowa, and West Virginia
- ◆ Links between CRI simulations and mandated performance standards in New York City
- ◆ Internal research reports on student work beliefs and teacher beliefs
- ◆ Reports on research conducted at LRDC and Indiana
- ◆ System Initiatives in such places as Houston and New York City

In addition, CRI provides an Internet-based resource center, Supporting Professionals with Online Technology (SPOT), which allows teachers using CRI in the classroom to communicate with each other. SPOT allows teachers to find lesson plans, classroom activities, related web sites, and standards for all of the CRI simulations. CRI has also developed web-based courses, which have become a major focus of the research group at Indiana University.

West Virginia provides an example of CRI dissemination in action. First, CRI determined that the state’s political climate favored implementation of widespread

educational innovations. West Virginia is a small state with a history of cooperation among a governor and a state legislature from the same political party, who control the state Department of Education. Before involvement with CRI, the state had already invested heavily in both technology and professional development: 20 percent of money allocated to technology was earmarked for professional development. Also, the School to Work Office and the Department of Education were part of the same administrative division, thus favoring implementation of an educational innovation that addressed school-to-work issues. With such a receptive political climate, CRI was easily able to demonstrate how their simulations met a state need. Because a majority of the cities in West Virginia are small, there are few places to send students to get work experience. Hence, the CRI workplace simulations were ideal for giving students exposure to different industries and careers. All of these factors allowed CRI to work with West Virginia on a large scale to effect statewide change.

CRI continues to grow and prosper, so that my description of CRI's activities is already out of date.

Research and Evaluation.

I begin with an overview of research and evaluation conducted at the Learning Research and Development Center at the University of Pittsburgh.

Survey and analysis of simulations. Kurt VanLehn and colleagues³⁰ surveyed 142 workplace simulations and analyzed the 39 most promising along the dimensions of appropriateness of content, learnability, usability, engagement, and available teacher support. The results suggest that although simulations can be a useful part of a school-to-work program, only a few are suitable for classroom use, including Project Challenge, designed for management training, and Court Square Community Bank, created by CRI. The researchers' analyses identify essential features of simulations and thus point the way to more effective design.

Examination of content knowledge and transfer. A research team led by Michelene Chi examined the effect of simulations on domain-specific and general knowledge. A laboratory-based study³¹ showed that students not only learn about the banking industry after using CRI's Court Square Community Bank, but also acquire general knowledge and problem solving skills, such as the ability to assume different perspectives.

Examination of how students learn using simulations. Chi also investigated how students learn with simulations. For example, a recent study³² demonstrated that students were able to assimilate more tacit workplace knowledge when actively using a simulation than when merely reading about the same topic in a textbook. Another study showed that collaborating on a simulation in small groups helps students to generate novel ideas (they do not merely restate the ideas contained in the simulation episodes) that are later used in individual problem solving sessions.

Ethical reasoning. Gaea Leinhart investigated whether use of CRI simulations produces changes in understanding of workplace ethics. Specifically, the research question was whether "...students will begin to develop a coherent ... ethical system ... [that] reflects

the presence of a complex, nuanced reasoning system and not just a list of appropriate actions for specific situations.”³³ The results demonstrate that students do indeed grapple with the ethical dilemmas presented in such simulations as Court Square Community Bank, and apparently as a result develop higher levels of ethical reasoning than do students who had not used the simulation.

Joinable Society. One question is whether low-income, minority students using the CRI simulations learn to view society as “joinable” and to understand what it takes to participate in the world of work. Leinhart and colleagues³⁴ employed semi-structured interviews to investigate students’ understanding of paths leading to a job; skills necessary for a job; the nature of a typical workday; and how current decisions affect chances of pursuing a particular career. Students using the Court Square Community Bank simulation demonstrated deeper understanding of all these issues than did a control group who did not use the simulation.

In brief, the LRDC group has examined the nature of simulations, the ways students learn from them, and what they learn, including knowledge of specific jobs, problem-solving skills, ethical reasoning, and knowledge about the ways one can get a job. In general, the LRDC conceptualization is imaginative, the findings rich, and the work can be of practical use.

I turn now to a description of work at Indiana University.

Analysis of the simulation. Thomas Duffy’s detailed examination revealed both strengths and weaknesses in the Chelsea Bank simulation.³⁵ On the one hand, the simulation creates authentic banking problems similar to those encountered in the workplace; the learning of banking practice is self-directed; and the simulation provides several useful scaffolding methods. On the other hand, the simulation provides little opportunity for interaction or reflection on interpersonal and ethical problems. Furthermore, the software design essentially makes each decision a multiple-choice question, so that students do not seem to learn the workplace skills in depth. Teacher coaching might provide opportunities for deeper learning, but teachers receive little guidance on how to foster their students’ learning. Despite such criticism, Duffy concludes that the simulation did provide a strong environment for problem solving.

A later study analyzed how the content of the simulations compared to state and local standards.³⁶ The results showed that CRI’s learning objectives for the simulations³⁷ correlated nicely with national, state and local academic standards. Thus, there is an indication that the CRI software (as exemplified by Chelsea Bank) provides opportunities for learning skills highly relevant to existing school curriculum and standards.

Analyses of learning and problem solving. Researchers conducted several studies examining students’ behavior as they worked with the Chelsea Bank simulation. The analyses uncovered a variety of interesting results concerning both thinking and social behavior. Use of the simulations seems to promote a high level of engagement, active learning, teamwork, information processing, and reading and writing.³⁸ Students’ problem-solving strategies include:

- Focusing on the problem
- Using specific learning from the Chelsea Bank simulation
- Applying general background knowledge
- Making predictions about problem solutions
- Collaborating in solving problems
- Recognizing confusion
- Making changes in possible solutions
- Seeking help³⁹

The problem solving skills learned in one simulation generalize to other simulations, despite differences in content.⁴⁰

These studies on problem solving strategies also highlight the collaborative nature of work on the simulations. Collaboration involves “mutual verbalization/ visualization,” meaning that the students read together from the computer screen, and then jointly construct solutions as they enter them into the computer, editing and evaluating on the fly.⁴¹

Development of assessment materials. The video studies indicated a need for more careful, deeper assessment of what the students were learning. Led by Roger Farr, the Indiana group therefore developed a range of assessment methods: performance-based assessments that described student behavior during simulations, short answer tests that investigated specific learning, and self-assessments that help students learn how to evaluate their own learning.

The performance assessments created for Chelsea Bank and Green Mountain Paper Company involved complex workplace tasks that required specific knowledge and general problem solving skills.⁴² Both thinking-aloud procedures⁴³ and correlations with standardized achievement test scores⁴⁴ were used to establish the validity of the performance assessments.

Short answer tests for the Chelsea Bank and Green Mountain simulations were intended to provide teachers with an easy means for assessing learning as the simulation progresses, allowing them to alter their coaching efforts as necessary for individual students.⁴⁵ The tests incorporated multiple-choice questions on vocabulary and content, as well as several open-ended questions that required use of decision-making competencies found in the simulation episodes.

The investigators also created student self-assessment methods that were designed to help students become aware of, and then improve, their own learning, as well as a manual presenting guidelines for teachers on how to discuss these and other assessments effectively in one-on-one conferences with students.⁴⁶

Teacher role and perceptions. One goal of CRI is to change teachers' perceptions about their role in student learning, as well as about the nature of that learning itself. The Indiana researchers addressed this issue in several ways. First, surveys and interviews indicated that most teachers utilized a "hands-off" approach, remaining passive while their students worked on the simulations.⁴⁷ Most often, teachers did not interact with students unless they were stuck. When teachers did interact, they tended to be directive or to give a simple answer to a question without follow-up. The lack of in-depth questioning prevented teachers from determining whether their students were learning at a deep level or whether they were just going through the motions to complete the simulation scenarios.

Development of support materials for teachers. This research indicated that teachers need to learn effective ways to guide their students' learning. The Indiana group therefore worked on creating teacher support materials in a variety of media. They created a video series, "Teaching Problem Solving with Classroom, Inc. Simulations," along with a companion written guide, designed to help teachers understand and implement effective strategies for interacting with their students during simulations.

The Indiana group also turned to the question of whether professional development could be taught at a distance, using Web-based courses. These courses, however, were not very successful. Enrollments were low, and teachers felt the courses were too demanding for only a single credit. Feedback on the courses is still being analyzed, and a detailed report on using distance learning to teach such "tough" topics as the subtleties of teaching is forthcoming.

What can be learned from CRI?

The main thrust of CRI is development of simulations and associated activities, and dissemination. In both of these, CRI has been extremely successful. Although supporting in-house research, CRI is not primarily a research enterprise. This is the context in which I consider questions about research, theory and practice, evaluation, coordination, dissemination, and sustainability.

Relations among research, theory, and practice

Successful innovations can develop without an extensive theoretical foundation. The inspiration for CRI's simulations had little basis in theory or research. The initial assumptions were simply that students need practice in the skills useful for real jobs; schools do not effectively provide such practice; and simulations might help. To be sure, technical knowledge was required to implement the initial intuition, and therefore CRI retained a technically sophisticated individual to create a workable prototype. But the inspiration for the project came from a person knowledgeable about the financial world, not from a researcher.

This is not an aberration. Educational innovations of various sorts—activities, manipulatives, games, television shows, and textbooks—need not, and often do not, stem from research. This is not to deny, of course, that researchers too may possess the creativity to devise innovative educational activities (viz. the Wiz). But at least some inventive school

practices—perhaps most—arise not as deductions from research, but from the intuitions of creative individuals, from practitioners’ wisdom, and the like. Later, psychologists can employ a core set of theoretical principles to facilitate understanding of the innovation, but the principles did not produce the innovations in the first place.

Ideas and tools. Research and theory may provide means for understanding, evaluating, and improving the innovation. Much of the research conducted by LRDC and Indiana provided useful insights into the simulations and how students and teachers used them. For example, VanLehn provided a scheme that could be used to evaluate, understand, and design new simulations. Duffy offered a useful critique of the CRI simulations and suggestions for improving them. Leinhart’s research on the joinable society broadened understanding of students’ concepts of the world of work and led eventually to a simple test, easily administered by school personnel, to measure students’ views of the joinable society. Farr’s research supplied useful methods for assessing complex performance on the simulations.

This is what psychological researchers and theorists do best. They look closely at behavior to examine the extent to which students employ certain types of problem-solving strategies (Chi). This helps to enrich (or replace) existing views of what students learn or how they think. They examine the ways in which teachers facilitate students’ use of the simulation (Farr). They develop new methods, like performance assessment, for describing or measuring behavior (Farr). In short, psychology can offer ideas for understanding education and tools for measuring it.

University research can confer legitimacy on an innovation. In the world of education, another function of research is to provide a stamp of approval or legitimacy. Academics like to believe that their research provides useful information that can persuade educators on rational grounds. This is true, and it is indeed useful and important for a school district to learn from research that a simulation can improve both cognitive skills and ethical judgment. At the same time, educators value research conducted by universities because it has a certain intellectual authority not normally attributed to in-house research, particularly evaluation, which may be perceived as self-interested. (For similar reasons, the consumer probably places greater trust in a government analysis of car safety than in Ford’s.)

It is only natural that a savvy organization like CRI, dedicated as it is to effective dissemination, would want to take advantage of the legitimacy conferred by university research (just as university administrators aggressively publicize it to enhance the status of their institutions). No one can blame CRI for highlighting favorable research studies in its Newsletters and advertising. To its credit, in addition to accentuating the positive, CRI makes available on its web site and other places a comprehensive bibliography of research studies, some of which do not contain wholly positive reports on CRI programs. Nevertheless, it seems fair to say that the CRI promotional literature stresses the positive, as one would expect.

Working with a successful educational innovation can stimulate important research. Just as research can benefit educators, so work with an educational innovation can lead to important research and theory. Research on an innovation as implemented in an educational

setting can bring psychologists out of their customary habitats to examine interesting, novel, and complex phenomena that make new demands on theory and methods. For example, VanLehn's evaluation of the CRI simulation was the first time he looked at school-to-work as a task domain, and doing so required different ways of thinking about simulations and evaluating them. Indeed, the LRDC researchers tended to see their work not so much as an evaluation of CRI, but as a case study that would be a stepping-stone to further investigations of simulations. A successful innovation can offer psychologists and other social scientists useful theoretical and empirical challenges. Indeed, perhaps there are cases in which researchers benefit more from the innovation than it derives benefit from them.

Evaluation

The parent tends to protect the child. Because CRI develops and disseminates the simulations and classroom activities, it tends to be protective of them. After all, CRI has made a significant and material commitment to an idealistically motivated enterprise—its founders could easily be engaged in other, more lucrative activities—and a clear contribution to the public good. It is obvious that CRI simulations have something to contribute to miserably failing schools and that CRI is doing more to improve schools than many people who proclaim the need to do so. The well-meaning CRI parent therefore tends to protect its child and to be suspicious of any interloper.

Suspicion may be warranted. Some independent evaluators have little understanding of what they are attempting to evaluate and employ inappropriate measurement instruments (for example, using IQ tests to evaluate Head Start). Such efforts can certainly produce uninformative, misleading, and inaccurate results, so that developers and disseminators are right to resist them.

On the other hand, one cannot gainsay all evaluations. Some can be meaningful and informative. But even under these favorable conditions, almost any developer or disseminator, including researchers who assume this role, prefers positive evaluations to negative. (Even 5th D researchers who profess great interest in failures were probably not unhappy to discover that their programs often result in significant cognitive gains.)

The result of the protectiveness is tension around research and evaluations conducted by other parties. The developer/disseminator is suspicious of some evaluations, resists others, and exhibits joy and rapture over still others. It prefers research that can help it disseminate the innovation; it is less favorably disposed towards research that suggests modifications (particularly costly modifications) of the innovation. As a result, as pointed out above, CRI's promotional materials selectively highlight research and evaluations conducted by Indiana and LRDC.

There is a need for independent summative evaluation. Developers need time to perfect their innovations. And they have a legitimate interest in promoting their innovation. But eventually there is a need for summative evaluation—data that lead to judgements about whether the innovation actually works (in some meaningful sense of “works”). Sometimes, developers conduct their own in-house summative evaluations. CRI has done this, and such evaluations can provide valuable information. At the same time, the public and the

educational system should insist on objective evaluations conducted by an independent agency. These evaluations should obviously be as meaningful and sensitive as possible. And indeed research of the type conducted by Indiana and LRDC can contribute to that effort. But summative evaluations should not be conducted only in-house.

Can a putative collaborator like Indiana or LRDC also serve as an independent evaluator? On the one hand, summative evaluation requires real knowledge of the thing to be evaluated. If collaborators have that real knowledge, then it may be appropriate for them to conduct summative evaluations. One might argue that 5th D successfully followed that model.

But the model is difficult to implement. For one thing, university researchers do not often have an interest in conducting large-scale summative evaluation. They would rather do research (and in my view that is indeed a better use of their time and talents). For another, acting as evaluator puts the collaborators in an uncomfortable position. Summative evaluation ultimately results in a judgement, and one might argue that collaborators should not be in the business of judging each other.

In brief, independent summative evaluation is necessary, even if upsetting to the innovator/disseminator, because, done well, it can serve the public good in a way that in-house evaluation, although sometimes informative, cannot. Research of the type performed by Indiana and LRDC can make summative evaluation more sensible and sensitive than it usually is. But should university research groups attempt to conduct summative evaluation of an agency with which they are attempting to collaborate? I think probably not. For one thing, evaluation is generally not their main interest. For another, strains on the collaborative relationship might be reduced if an independent agency does the job. This agency should not be retained by the developer—to which it would then be beholden—but by an institution like a school district or other government agency. At the same time outside evaluations offer no panacea: their methods need to be informed more fully than they often are by a deep understanding of the innovation.

Multifaceted evaluation is crucial. The CRI experience confirms what has already seen in the case of the 5th D, namely the clear need for multifaceted evaluation. Researchers from both LRDC and Indiana focused not only on skills or problem-solving strategies, but also on ethical judgement, ideas of the joinable society, personal qualities necessary for success, and interactions between teacher and student. Their techniques did not involve only standardized pre- and post-tests, but observation of classroom behavior during a simulation, examination of performance on special tasks, interviews, study of student portfolios, and fine grained analysis of a laboratory analogue of the simulation.

Coordination among researchers and CRI

Researchers collaborated well within each consortium. Nearly blissful harmony reigned at LRDC and Indiana. Researchers within each group worked well on a common purpose, namely doing research. This is more rare than one might suppose in the university setting, but it is clearly possible. LRDC is an institution with a long tradition of collaborative research in education. Members of the LRDC group have worked together for 20 years,

know each other's expertise, and can complement one another. The three senior investigators formed a collective leadership. At first, they met often to define the tasks, but later were able to work more or less independently. Indiana seemed to be blessed with an effective leader and a congenial group of colleagues (none with issues around tenure) who managed to work out a good mode of collaboration. Obviously, to the extent that they worked on different projects—for example, one on performance assessment and one on a web course—their paths tended to diverge. Even so, there was considerable interaction over work with graduate students, who in some sense provided a useful channel for communication. At both LRDC and Indiana, collaboration more often involved coordinated work on different tasks than constant togetherness and joint work.

In general, the research groups did not interact much with each other. The Russell Sage Foundation made some effort to initiate collaboration between the two research groups but did not achieve a great deal of success. Although the two groups have different styles and interests, some of their work did indeed overlap—for example, the analysis of the simulation itself, the interest in ethical reasoning, and the analysis of how students actually use and learn from CRI. Nevertheless, although they did choose to meet occasionally at the American Educational Research Association meetings, there was little interaction between the two groups. Furthermore, because the LRDC group, and to a lesser extent the Indiana group, did not have much contact with CRI, the latter did not serve as a focal point of contact for the two university groups.

The main story concerns a natural tension between a developer-disseminator and university researchers. One function for research and evaluation is to improve the innovation. Critiques of the simulation can serve to fix it. Analyses of student learning can suggest measurement techniques more informative than available standardized tests. Observations of breakdowns in teacher-student interactions can lead to improved methods for training teachers.

My view from a distance suggests that on some occasions, because of its natural protectiveness towards its baby, CRI may have failed to take advantage of constructive research and evaluation of this type. To be sure, responsiveness to the research would require modification of the innovation. In the short term, that is a nuisance, but in the long term it can be enormously productive. At the same time, there were other occasions on which CRI did respond to and take advantage of the research and evaluation results. CRI cites many examples of how research studies led to very concrete and useful outcomes for its program. For example, the Indiana group helped to develop a teacher's manual for one of the simulations and provided performance assessments and other assessment techniques.

I cannot specify the ratio of CRI's willingness to take advantage of research and evaluation studies to its failure to take advantage. CRI asserts that it made productive use of a good deal of university research, particularly from Indiana. Whatever the ratio, the larger point is that the pressures on any developer and disseminator to create its innovation in a timely fashion and to train teachers and students to use the innovation in everyday classrooms may be at odds with the interests of and constraints on university researchers. The result is that at least some opportunities for mutual enrichment are likely to be lost.

It seems to me that this situation is inevitable. There is a natural tension between university researchers and an organization like CRI devoted to development and dissemination. Developer/disseminators follow one agenda; researchers, another. On the one hand, the university researchers value and protect their objectivity, strive to produce research of general value, are more interested in basic principles of learning than in the success of a particular intervention, and want to follow the evidence wherever it leads. They do not see themselves as obligated to further the day to day operations of the organization that is responsible for the innovation. On the other hand, the main goal of the developer-disseminator is to develop and disseminate useful educational innovations. For them, research is useful to the extent that it can improve the innovation and tell a positive story. As they see it, university research may be abstract and irrelevant, and researchers may spend more time talking and writing than accomplishing anything concrete.

I sympathize with both views. Unfettered research focusing on basic issues, particularly when conducted in educational settings, can be of enormous value. As argued earlier, research of this type can indeed provide very useful ideas and tools. At the same time, developer-disseminators are obligated to develop and disseminate as effectively as they can, and they usually know how to do this better than do university researchers. The tension is real and appropriate. Some ways to ameliorate it are discussed below.

It is hard for a foundation to be a matchmaker and therapist. The Russell Sage Foundation played a major role in initiating contact between CRI and the research groups, in attempting to get the groups to collaborate, and in mediating disputes. There was a fair amount of negotiating, persuading, wheedling, suggesting, handholding and other attempts to facilitate. This is a bold undertaking, very different from the practice of many foundations. As has been seen, the effort was only partially successful.

Why? Perhaps there was some lack of clarity about the goals of the collaboration. Were the universities to provide an objective, outside evaluation of program effectiveness? Were they supposed to develop general ideas about how the program worked? But more importantly, there is, as has been argued, a natural tension between the goals of a developer-disseminator and those of researchers. Probably the groups spoke different languages, and the cultures clashed.

Under these conditions, it is hard for a foundation to serve as a matchmaker and therapist. But Mellon/RSF should be applauded for making a valiant and skillful attempt. There were good things—indeed, many good things—that came out of the collaboration, and the foundations deserve some credit for them. But more importantly, the foundations deserve credit for attempting to create a difficult cohabitation (marriage is too strong a word) from which something might be learned about the conditions necessary for establishing a productive collaboration.

How to produce collaboration between yin and yang. Effective collaboration between the groups may be possible to achieve under certain conditions. First, both sides might benefit from agreeing that some other group should do any necessary summative evaluation. This may immediately remove one possible bone of contention. Any information the collaborating researchers provide is intended to improve the innovation, not to pass

judgement on it. Second, the researchers need to understand and value the developer-disseminator's struggle to accomplish something concrete and beneficial in the often unreceptive and unmovable world of education, and to appreciate the resulting impatience with the pace and process of academic research. Third, the developer-disseminator needs to understand that independent research really can lead to improvement of the innovation, even if the process leads to delay. Under these conditions, it will surely be easy to achieve the best of both possible worlds, namely researchers whose work can benefit from attention to concrete outcomes and practical goals, and developer-disseminators whose perspective can be enriched by a measure of academic objectivity and thoughtfulness.

Well, maybe the best of both possible worlds is not clearly in sight. These suggestions are surely insufficient. The first (no summative evaluation by yin of yang) seems useful and even practical, but the others, involving as they do benevolent understanding, may not be sturdy enough to power the effort. What we really need is further study of the nature and conditions of useful collaborations around large-scale educational endeavors.

Dissemination

CRI shows what it takes to disseminate effectively and widely. The CRI approach to dissemination is comprehensive, organized, and relentless. CRI works with systems from districts to states, offers institutes around the country, aggressively seeks new clients, publishes a newsletter and other forms of publicity, engages in fund-raising, and in general markets its "product" with great intensity. The use of business imagery is of course deliberate. CRI's origins are in the business world, from which it has taken much that is valuable. CRI shows what it really takes to disseminate in the real world of imperfect educational systems: focus, organization, political and economic sophistication (and connections), and single-minded dedication to the task of publicizing the innovation, getting systems to try it, and supporting its use.

The stress on extensive dissemination has a downside, namely a tendency to push the product to the detriment of pointing out its limitations or improving it. But any form of dissemination is imperfect, and CRI has many strengths that enable it to succeed where others could not.⁴⁸

Ethnic variation in the US is not a significant barrier to dissemination. CRI reports little difficulty in using its simulations with diverse groups across the country. CRI builds diversity into the simulations in such a way as to include and respect people from different groups. But it does not seem necessary to modify the fundamental characteristics of the simulation so as to accommodate the needs of different ethnic groups.

Sustainability

Sustainability requires a multi-level approach. CRI shows that to succeed, dissemination must entail a massive effort on many levels. A similarly complex effort is necessary to promote the sustainability of the innovation. To make sure that the innovation endures, it is necessary to influence superintendents and principals, work with units as large

as states and districts, train trainers of teachers, and secure long-term funding. Again, an independent organization like CRI seems more suited to this task than does a university.

Large-scale change in teacher practices is difficult. At the same time as it demonstrates its potential, the CRI experience suggests that not every district is interested in reform and that professional development fails to produce long-term change in more teachers than it helps. Of course the percentage of failures will depend on many factors, including the effectiveness of CRI efforts, the duration of training, the follow-up efforts of the district, and the abilities and characteristics of the current population of teachers. But the bottom line is that change is very hard indeed, despite extensive efforts of well equipped and designed organizations like CRI.

Teaching teachers to do the tough stuff is tough. CRI simulations have great potential for promoting student learning. Indeed, to some extent, the simulations can work reasonably well even when the teacher's role is minimal. But they can work even better when teachers who have insight into students' learning provide active coaching and other forms of stimulation. For this to happen, teachers need to be motivated and well trained. They need to think independently and have the ability to use the simulations in novel ways. It is easy to sit the students in front of the computer monitor; it is hard to help them make good use of the simulation.

There are reports that some teachers are not dedicated to learning to use CRI in sophisticated ways and are not interested in working in collegial groups. (The same is true of many other innovations.) They want to learn only very specific methods of teaching, rather than stimulating variations on the activity. They encourage the students to achieve immediate solutions of the sort required by a standard test, rather than to reflect on what they are doing. The result is that although benefiting from CRI, students do not learn as much problem solving as they could. Yes, the simulation itself is effective, but it could be made even more powerful by skilled and dedicated teachers.

Why do teachers not do a better job at helping students benefit from the simulation? No doubt there are many reasons. The working conditions, including pay, for many teachers are abominable. Many teachers have little time or energy for anything but the minimum needed to get through each day. Some teachers may not be talented enough to learn what needs to be learned to implement CRI effectively. And CRI professional development may not be as good as it could be.

In any event, it is easier to get a district to adopt an innovation than it is to help teachers to use it well. Accomplishing this requires meeting two challenges. The first is CRI's: it needs to develop increasingly effective methods of professional development linked directly to the innovation. Teachers need help in learning how to use CRI as such. CRI has of course devoted considerable resources, time, and energy to this ongoing effort. The second challenge is for school districts, and the public at large, to make a long-term commitment to nurturing and supporting teachers. Although the first challenge is difficult enough, and indeed is the Achilles heel of many who seek to introduce innovative educational practices, the second challenge is a question of public policy and goes well beyond what an organization like CRI can be expected to (or can) provide.

Educators must navigate the larger political landscape. A large national issue, like the demand for testing, clearly influences the possibility of disseminating and sustaining the reform. For example, the current stress on accountability and testing leads some schools to reject CRI because they want to spend their money on teaching to the tests. CRI attempts to counter the argument by claiming that its program is aligned with various standards (of course everyone says that!) and that use of the program will lead not only to enthusiastic and meaningful learning (CRI's main goal) but to test-score improvement as well (as demonstrated by research). The argument appears convincing but some feel they cannot accept it because of the national pressure towards narrow forms of accountability. In any event, an innovation does not succeed on its merits alone; it is evaluated in the context of larger issues and pressures.

Corporate support is wonderful but not everyone can get it. CRI activities are supported by contracts with schools and by external fund raising, which seems to be aided by CRI's extensive connections to the corporate world. Yet corporate support is a blessing not easy to come by. Significant educational innovations require large-scale and sustained funding to assure their success and continuation. Presumably the provision of such funding is primarily the responsibility of government, national and local.

Don't scale up too quickly. CRI claims that they benefited from several years' work on perfecting the innovation before attempting to disseminate it widely. This would seem prudent.

Technology should be simple. CRI made a judgement that its simulations should be relatively simple. State of the art programs tend to be impractical for everyday educational practice.

Yet what is complex today is simple tomorrow. On the other hand, this approach may limit the program's effectiveness by causing it to aim too low. The CRI simulations could be criticized for not being very interactive. The response could be that real interactivity may be too complex to develop and to run with current computers. But in the world of computers, the definition of simplicity keeps shifting towards the complex. Even schools with limited funds can now obtain extremely powerful computers, so that what seemed complex yesterday is almost trivial today. Hence, more seriously interactive simulations are now possible. This means that innovators have to walk a fine line between accommodating to current limitations in the attempt to be practical and anticipating possibilities in the near future.

Fostering Communities of Learners

The Fostering Communities of Learners (FCL) project began in the late 1980's under the direction of Ann Brown and Joe Campione. The Mellon Foundation first funded the development of FCL classrooms in 1992. In 1994, it funded a major expansion of the project, Reinventing Communities of Learners,⁴⁹ a distributed consortium of researchers including John Bransford, Susan Goldman and Ted Hasselbring (Vanderbilt University), Ed Haertel (Stanford University), Milbrey McLaughlin and Joan Talbert (Stanford University), and Lee Shulman (Stanford University) and Judy Shulman (WestEd). Later, the funding shifted to an expansion of FCL work at Vanderbilt, in conjunction with other members of the FCL consortium.

What is FCL?

I describe the initial FCL work in Berkeley, the operations of the research consortium, and later developments in Nashville.

Context and Goals

After beginning their careers as experimental psychologists, Brown and Campione turned their attention to problems of education, particularly in regard to disadvantaged students in inner city schools. Influenced by the work of Mike Cole, and believing that the educational system often poorly serves these students despite their considerable intellectual potential, Brown and Campione took as their goal "... creating, sustaining, and expanding learning communities in urban schools."⁵⁰ Their focus was the learning community, the substance and culture of schooling, not after-school programs or computer simulations. Developing such communities required creating "a theoretical base for the design of tomorrow's learning environments,"⁵¹ and this was one of Brown and Campione's major activities for several years.

After the initial FCL schools in California had demonstrated a fair amount of success, Brown and Campione created a consortium of researchers distributed over geographical location to work on a large-scale "design experiment," in which researchers would work "...collaboratively both to embark on a major reform project and simultaneously to study and understand it as it evolves."⁵² Individual research efforts were to focus on assessment and evaluation (Haertel), "generative learning units" (Bransford), professional development (Shulman and Shulman), and social context for change (McLaughlin and Talbert). Eventually, the focus of FCL efforts shifted to the Nashville area, where several consortium members joined in undertaking various FCL activities. The project, and the rest of the educational world, suffered a major loss with the untimely and tragic death of Ann Brown in 1999.

Core Principles

The major goal of FCL is to disseminate core principles, not the surface procedures of the educational program. Although individual FCL classrooms may differ, all must share basic characteristics.⁵³

- ◆ Learning is active, strategic, self-motivated and purposive. Children need to engage in meaningful learning, and gradually learn to reflect on, obtain insight into, and control it.
- ◆ Children come to school with different interests and abilities and learn at different rates. Students differ in the extent to which they are ripe for new learning in different areas. The classroom is therefore a place where different people have different levels of expertise (and ignorance). “Everyone is expert at something; nobody, not even the classroom teacher, knows it all [so that] everyone is simultaneously an expert, a researcher, a learner, and a teacher.”⁵⁴ FCL aims to respond to and encourage this diversity while at the same time to assure that all learn the “basics.”
- ◆ Learning must involve deep conceptual content knowledge. This takes a long time to achieve, requires effort, and pushes students to the limit of their capabilities.
- ◆ Learning and teaching depend heavily on creating, sustaining, and expanding community. Because expertise is distributed across students and teachers, FCL involves several techniques designed to enable children and teachers to work together as learners. Everyone is interdependent. All take the responsibility to enhance their own understanding and that of others. This interdependence “...promotes responsibility, respect, and a sense of personal and group identity.”⁵⁵
- ◆ Each FCL classroom must implement the principles in line with local interests and needs. There is no single, “correct” FCL classroom. Teachers must use core principles to develop classrooms appropriate to their own interests and experience and to their students’ developmental status.

Basic Prototype

The essence of an FCL classroom is that students are active members of a community of active learners. To foster such a community, teachers employ several pedagogical techniques, perhaps the most important of which is “jigsaw teaching.” This entails asking small groups of students first to acquire expertise in a particular subtopic of a larger theme, and after a period of learning to put together knowledge of the sub-topics (the pieces of the jigsaw) to achieve a general understanding of the larger theme (the puzzle as a whole).

Jigsaw teaching requires several steps. First, the designer of an FCL classroom—a researcher/developer, a teacher—collaborates with subject matter specialists to choose broad age-appropriate themes for study, which are then broken down into subtopics. For example, a portion of the sixth grade FCL environmental/biology program covers “changing populations.” Subtopics of this theme might include extinction, endangered species, assisted populations, and the like.

The teacher then divides students into research groups, each of which works collaboratively to develop expertise in one subtopic. Students assume considerable responsibility for directing their own learning and are permitted to “major” within their subtopic, choosing an area of study in line with their interests. Students also engage in long-term, large-scale projects to demonstrate their expertise. Within the changing populations theme, students might major in such topics as global warming, contagious diseases, or

adopting an endangered species. Choice of a major in turn might inspire projects such as building a biosphere, or creating a futuristic animal. Although traditional competencies such as reading, writing, and verbal expression play an essential role in these projects, students also develop higher-order thinking skills such as self-monitoring and reflection.

Each research group becomes an expert on only one-fifth of the information, but all the students must eventually master knowledge about the entire theme. To this end, each group teaches what it knows to the rest of the classroom when all the subtopics (the “jigsaw pieces”) are combined. Such distributed expertise creates a close-knit community in which students share the knowledge they “own” to ensure that the entire classroom comprehends the overall theme. Discussion is the key to sharing knowledge in an FCL classroom, giving each student the opportunity to take on the roles of teacher and learner.

Variants

Various sites in Nashville attempted to incorporate FCL principles into local schools. In some cases, the FCL principles were incorporated into Schools for Thinking, another reform effort in which the Bransford group was involved. But the effort has not evolved sufficiently to produce clear variants.

Operational Structure

Brown and Campione established the original FCL classrooms in the Berkeley-Oakland area. The researchers worked intensively with a few teachers at the elementary level to develop all aspects of the classroom, from stimulating intellectual activities to pedagogical techniques. Other members of the consortium in the Stanford-San Francisco area were not able to do extensive work in the prototype FCL classrooms, because they were few in number. Members of the consortium therefore conducted their research in a variety of other locations, and in fact sometimes worked with teachers whose students were much older than those in the core FCL classrooms. Thus, the Shulmans tended to work with middle and high school students.

Meanwhile, the Bransford group attempted to set up FCL classrooms in Nashville where they could develop their “generative learning units.” Gradually, the number of FCL classrooms increased and other members of the consortium began to collaborate with the Nashville researchers. Over time, the Nashville group, aided by other members of the consortium, devoted increasing attention to issues of assessment, dissemination, and sustainability.

Dissemination and professional development

Brown and Campione’s major focus was the development and investigation of the basic FCL prototype. Their work did not include extensive dissemination. Shulman and Shulman developed a model for a pre-service teacher education course, and also some in-service experiences for teachers interested in FCL. But it seems fair to say that none of their efforts, nor those of other California investigators, involved large-scale dissemination.

In attempting to implement FCL in the classroom, the Nashville group found that "... although we knew the theory of FCL, our knowledge was really a set of isolated facts."⁵⁶ Apparently, the ability to talk and write intelligently about the principles and to "understand" them on a theoretical level does not necessarily indicate the kind of knowledge needed to use the principles in the classroom.

The proposed solution was to engage novice teachers in a form of learning by doing, namely Generative Learning Units (GLUs). These are technology-based activities, often employing video, that promote active learning and help students acquire deep principles, engage in metacognition, and think in flexible ways. The idea was that teachers would begin by acting as students, trying to solve the problems posed by the GLUs and thus experience FCL from the students' point of view. Then the teachers would reflect on the pedagogical principles underlying the activities. In this way, the GLUs serve as "anchors for teacher professional development,"⁵⁷ by illustrating how FCL principles can be used to guide teaching. Then teachers can use GLUs as "starter units" to implement FCL in a concrete way.

The Nashville project also developed "performance support tools"—multimedia technology designed to support teachers who are attempting to learn FCL. The tools show visual examples of classroom events and serve as a basis for discussion about implementing FCL principles, like reciprocal teaching.

The Nashville group discovered that the GLUs were not effective for various reasons. Teachers tried to implement them rigidly instead of using them to learn general principles of FCL; teachers did not have enough time to reflect on what they were doing; and the GLUs did not fit well with the existing curriculum.

As a result, the Nashville group shifted focus from curriculum development to "... supporting teachers' understanding of student understanding and how to assess it to inform instructional decision making."⁵⁸ One of the most powerful methods for doing this stemmed from the work with Haertel and involved teachers in the design of assessment techniques for understanding student learning. Now their efforts deal with helping teachers understand student learning of a variety of contents at many different grades and age levels. "...[S]tudent understanding in content areas serves as the focus of collaborative inquiry [for teachers]. Professional development involves teachers reflecting on observations of students in their classrooms, engaging in dialogue with each other as they attempt to make sense of their observations, and developing awareness of their own learning processes as a professional community."⁵⁹

The Nashville group has also used a short film and a radio show to explain FCL and educational reform generally to the public at large, which influences important decisions about implementation of FCL in the public schools.

Research and evaluation

Basic FCL principles and activities. Brown and Campione devoted considerable energy to developing and elaborating the basic principles and practices of FCL in several

prototype classrooms. The researchers engaged in extensive theoretical work, reevaluating such notions as reciprocal teaching, and also expanded the curriculum to cover a variety of topics suitable for the age range from Pre-Kindergarten to eighth grade. These new materials and activities included Literacy for Preschool, Kindergarten and First grade; Environmental science/biology units from second to sixth grades; Social studies units on Native American/California history; Interdisciplinary units on Plagues and Peoples, for sixth and seventh grades through eighth and ninth grades.

Evaluation. Haertel and associates, particularly Steven Athanases, planned to engage in several very different types of evaluation, including the ways in which teachers implemented the FCL program and employed core principles, the kind of learning outcomes students achieved, and the benefits that teachers perceived themselves to receive from the program. In the end, the evaluation research focused most heavily on the development of assessment methods designed to measure student thinking, on teachers' actual use of assessment, and on the effects of assessment on instruction.

Several principles guided the evaluation research and development. One is that "...curriculum, instruction, and assessment are mutually supportive..."⁶⁰ Innovative curriculum work can lead to or involve equally innovative assessments, and sound assessment can guide instruction. A second principle is the desirability of "collaborative construction of assessments with teachers."⁶¹ The researchers feel that the development of assessments benefits from teacher input. Also, the experience of creating assessments improves teachers' understanding of student learning and thinking.

One outcome of the project is a usable set of assessment tools. These not only provide qualitative and quantitative measures of critical thinking and understanding (for example comprehension of themes in literature), but also help students understand the goals of instruction and reflect on what they learn. Another outcome is "assessment literacy"—that is, teachers who understand purposes of assessment and who can use it intelligently to further their educational goals.

Individual teachers implementing FCL. Shulman and Shulman performed intensive ethnographic case studies designed to reveal how both novice and veteran teachers at various grade levels learn to implement FCL principles despite various obstacles.⁶² Comparison of cases revealed positive outcomes when teachers were predisposed to think in FCL-like ways, and when teachers worked together to form "critical friendships," treating their curriculum as "community property" to be discussed in a group forum with supportive peers.⁶³ The research showed that critical friendships are indeed beneficial, especially for novice teachers; however, these friendships require time and effort to develop and maintain, and care needs to be taken that they not alienate the larger community of teachers within the school. The research showed that teachers encountered difficulty when they had the responsibility for creating their own FCL curriculum units (on top of their normal classroom work!) and when other FCL classrooms were not readily available for observation and practice. District and school policies that ran counter to FCL principles also created problems for teachers.

Contexts for teacher development. McLaughlin and Talbert investigated "learning community as a context for teachers' development and change."⁶⁴ They examined FCL as a

“core case,” but also studied learning communities in schools that were attempting to implement different, although related models of educational reform. Through interviews, observations and other methods, McLaughlin and Talbert attempted “... to identify and understand the variety of organizational arrangements that can be the occasion for teachers’ learning and professional growth...”⁶⁵ in some 15 schools. They examined how teachers and administrators in an innovating school learn to interact with one another, promote creative work, struggle with difficult issues of implementation, and in general attempt to create a collaborative professional community that can assure the long-term success of the innovation.

Creating contexts for teacher development. As part of their research effort, Shulman and Shulman created pre-service and in-service experiences to help teachers cope with the demands of implementing FCL in their classrooms. These interventions ranged from a pre-service course taught as part of the Stanford Teacher Education program, to professional development efforts involving novice and veteran teachers within the schools. As a result of this experience, Shulman and Shulman offer several recommendations for creating FCL support programs. They need to revolve around “hands-on” experiences in a classroom. Extensive mentoring is required from other teachers, and professional communities fostering critical friendships need to be established to support ongoing innovation. Introduction of FCL concepts needs to be gradual, giving teachers time to assimilate and reflect on basic ideas and core issues, like the nature of student learning. The heavy emphasis on classroom discussion means that teachers need to learn dialogue techniques that can be used to engage in meaningful conversations with their students. Teachers also need to maintain an awareness of school institutional norms that can become obstacles in adopting the FCL principles.

Teacher development in the larger context. McLaughlin and Talbert also investigated how teacher learning communities are affected by the larger social context of school policies, community demands, state requirements, professional organizations, and the like. The investigators eventually extended their research to Nashville, where they collaborated with the Bransford group. This impressive body of work offers some important lessons about dissemination and sustainability that I will discuss below.

What can be learned from FCL?

Of the three Literacy projects, FCL is only one that deals with mainstream schooling and professional development across many grade levels. It offers several lessons.

Relations among research, theory and practice

Theory really does help. The core principles of FCL contribute an inspiring vision of education as well as sound ideas that can be used in understanding teaching, learning, and assessment. They also provide guidelines for an exciting pedagogy. FCL principles elaborate in a productive way on the progressive vision of education rooted in Dewey⁶⁶ and “social constructivists” like Vygotsky. Teachers working on FCL are inspired and enlightened by ideas about distributed learning, the nature of understanding, metacognition, dynamic assessment, jigsaw techniques, reciprocal teaching, cross-talk, and many others

But consider various limitations of core principles.

Core principles provide only a guide to innovation. McLaughlin and Talbert's work confirms, as I have shown before, that theoretical principles are not by themselves sufficient to produce educational innovations. Rather, the theory may produce suggested practices, observation of which in turn helps to refine the theory, which in turn may result in modifications of the innovation. Researchers are not the only contributors to the process: practitioners may offer both theoretical insights and practical suggestions. In an interview, Campione suggested that teachers working on FCL could be "magical" and that sometimes children too made important contributions to the design of activities. The process of creating innovations may be considered "...reform generation and learning in which participating practitioners are co-inventors, with researchers, of theory-in-practice."⁶⁷

A rich core is difficult to understand and implement. As mentioned earlier, when working with classrooms in Nashville, Bransford, Goldman, and Hasselbring found that they themselves experienced difficulty in understanding and implementing the core FCL principles. It is striking and noteworthy that these eminent researchers and theorists, at least one of whom (Bransford) had over the years enjoyed considerable interaction with Brown and Campione, experience this kind of difficulty. To us, it raises basic issues about the nature of theoretical principles and their application to the context of education.

Why is it so hard to understand the core principles of FCL and translate them for classroom use? Are the principles themselves impossible to understand, overly vague, or lacking in substance? I think not. They are based on a rich tradition of theorizing and a considerable body of evidence. And at least some classroom examples establish the existence theorem that the principles can be applied successfully.

The problem appears to be the inherent difficulty of connecting two kinds of knowledge, theoretical and practical. The FCL core principles are generalities. But devising successful methods for teaching children in a classroom requires combining these "nomothetic" ideas with rich practical knowledge. Ideas about metacognition or jigsaw methods need to be combined with understanding how to deal with children's motives, personalities, interests, and the ways they interact in groups. Researchers can understand the general theory and pedagogical method, but their training and life experience do not necessarily create a rich supply of practical knowledge about children and classrooms.

If researchers struggle with applying the principles, how likely is it that teachers relatively unsophisticated in psychological theory and varying in background, ability, style, and interests will understand the principles and apply them well? Teachers (and other practitioners) often possess considerable practical knowledge about students and classrooms but lack the theoretical sophistication of the researcher. For them too, combining theoretical and practical knowledge presents many difficulties. One of them involves constructing an understanding that is both true to the theory and personally relevant. The concept of "metacognition" means one thing to a cognitive psychologist but to be useful in the classroom perhaps needs to take a somewhat different form in the mind of a teacher. Thus, teachers too need to struggle with understanding and applying the principles. But the task is not necessarily harder for them than for researchers; it is just different.

Perhaps Vygotsky's theory⁶⁸ of "spontaneous" (or "everyday") and "scientific" (or "organized") knowledge can illuminate the task faced by researchers and teachers. In Vygotsky's view, "scientific" knowledge—like the FCL core principles—is organized, explicit, conscious, general, and hierarchically organized knowledge of the sort that is taught by formal education. Everyday knowledge, by contrast, is "saturated with experience"⁶⁹ and "... strong in what concerns the situational, empirical, and practical."⁷⁰ To achieve a rich understanding, one needs to synthesize the two types of knowledge. Scientific knowledge helps to organize the intuitions of spontaneous knowledge, and at the same time, spontaneous knowledge provides "body and vitality" to scientific knowledge. Real understanding then combines the sophistication of the theorist with the practical wisdom of the teacher.

In brief, basic principles are hard to implement in the classroom because they need to be combined with practitioner's knowledge in order to accommodate the realities of children in classrooms and the individualities of teachers.

No psychology and pedagogy without content. FCL is primarily a psychological and pedagogical innovation. At its core are ideas about students' thinking and methods for promoting it in the classroom. At the same time, Brown and Campione stressed that to thrive, thinking needs to feed upon rich subject matter: "... awareness of the deep principles of academic disciplines should enable us to design intellectual practices for the young that are stepping stones to mature understanding..."⁷¹ FCL did indeed develop several exciting "intellectual practices" or what might be called "curricula," particularly in biological science. Also, Brown and Campione devoted considerable effort to the creation of "developmental corridors"—rich curricula extending over many years of schooling.

Nevertheless, FCL was not successful in developing enough rich curriculum that could be used by teachers interested in the core ideas. Why? To be sure, limited funding was one obstacle, but does not appear to have been the main difficulty. It seems highly unlikely that innovators whose base is in psychology and pedagogy possess sufficient content knowledge to develop the variety of curricula required to meet the needs of students throughout the grade levels, or even from Kindergarten to sixth or eighth grades. Developing rich intellectual practices does indeed demand an "awareness of the deep principles of academic disciplines." But most psychologists don't have this awareness, or enough of it. It is even more unlikely that practicing teachers can develop the necessary curricula, if only because of limited time and energy.

In brief, basic principles of FCL cannot operate independently of rich content. But psychological and educational researchers cannot produce that rich content on their own. An innovation of the magnitude of FCL requires extensive contributions by what are sometimes called subject matter experts, particularly those possessing the magic required for developing exciting curricular materials. An attempt to develop a comprehensive curriculum needs to involve those who understand subject matter deeply.

But no content without psychology and pedagogy. The Nashville group reported that teachers tended to apply the GLUs in mechanical ways. They took a "curriculum" that ironically was intended to illustrate key FCL principles, and "did it" without thinking deeply about student learning or principles of pedagogy. It is widely reported that many teachers

prefer doing concrete things in the classroom to thinking about how and why one does them. Clearly, content alone is not sufficient, just as psychological and pedagogical principles cannot stand on their own.

The theory must expand in response to educational needs. The Nashville group points out that FCL's original theory of child learning and classroom practice needed to expand in order to deal with issues arising in the course of the innovation effort. Thus, as the group's focus shifted to teachers' understanding and "ownership" of FCL principles, a need arose for a theory of adult learning and organizational change. This is perhaps another example of how the implementation of an innovation deriving from theory may lead to further developments in theory.

The richness and expansion of the theory can be a mixed blessing. The principles of FCL can be useful in a variety of educational settings, ranging from preschool to the university. The principles suggest ways of dealing with more important issues—curriculum across the grades, teacher training, devising institutional support for teacher practice and development, among other things—than a single project can possibly handle. FCL researchers were unable to implement all that their theory suggested could and should be done.

Evaluation

Construction of assessments helped teachers understand the essence of the curriculum. The Nashville group, along with Haertel, engaged teachers in constructing assessment methods for their classrooms. The effort was a big success on two counts. For one thing, it resulted in practical classroom assessments that influenced instruction. But more importantly, the collaborative activity helped teachers understand what is most important for students to learn in a given activity—in short, the goals of the curriculum. Thus, constructing assessments helps teachers to develop ideas about student learning and to clarify teaching goals.

Coordination among researchers

FCL was an extraordinarily complex undertaking that provides many lessons about the structure, process, and conditions of collaborative research. The members of the distributed consortium all report that the collaboration was both a failure and great success. Although the structure and conditions for collaboration were not ideal, the individual researchers all learned a great deal from the task and from each other, produced some remarkable results, and in the end were more closely inter-linked than in the beginning. For example, the Nashville group reports that their professional development activities very definitely benefited not only from the original FCL approach of Brown and Campione, but also from the assessment work of Haertel, the embedded community theory of McLaughlin and Talbert, and the case study approach of Shulman and Shulman.

Several lessons emerge from this experience.

Don't try to do too much too soon. Probably FCL attempted to scale up too early, before its founders felt that the core principles were sufficiently elaborated and before

enough successful FCL classrooms had been established. The result was that too much needed to be done during the course of the project. In addition to strengthening the core classrooms, there was a need to develop several additional “alpha sites.” There was also a scramble to create “developmental corridors” and other forms of curriculum. As mentioned earlier, the investigators’ imagination outstripped their operational capacity. This is probably a common academic disability. We let our good ideas lead us into more than we can manage. Perhaps less is more.

How to ensure productive collaboration. At the outset, the FCL distributed consortium or “... Center consisted of a set of four ‘independent’ grants geared to working on the problems associated with spreading educational innovations from their initial research sites to the wider community... As the proposals were written and reviewed independently, there needed to be a mechanism for strengthening the interactive collaborative component of the Center activities, the ‘synergy’ that would make the Center more than the sum of the separate parts.”⁷² As the project progressed, there was a shortage of classrooms embodying FCL practice, so that researchers ended up working with children at different grade levels and hence did not always share a common experience with FCL. The consortium also lacked clear arrangements for coordination of their efforts.

As mentioned earlier, the members of the group certainly did important work and eventually did strengthen the synergy of the consortium. But perhaps some conditions could have supported an earlier emergence of the gestalt. Here are some possibilities.

- ◆ A project of this sort needs multiple “alpha sites,” each reasonably firmly established. This allows a consortium, particularly one distributed over space, to share common experiences with the innovation. To be sure, variation is to be encouraged, but some common experience is essential. Ideally, members of a consortium, even if scattered in different locations and universities, should each be involved in the operation of a local site and have extensive contacts with teachers there.
- ◆ Collaboration needs to revolve around a commitment to shared goals. As pointed out earlier, academic researchers tend to think of their individual goals rather than the common good. The FCL group took some time to arrive at common understandings and shared goals. The structuring of a distributed consortium needs to promote such understanding and goals from the outset. Indeed, FCL principles can be useful for this purpose.
- ◆ A consortium needs to have reasonably clear responsibilities, leadership, and rules for collaboration. No doubt some flexibility can facilitate accommodation to unanticipated events, and some duplication may be desirable. But overlap needs to be kept to a minimum, and members need to know how their expertise will contribute to the consortium.
- ◆ Groups should have members with different levels of experience and expertise. Successful innovation does not demand that every member of the group be a world-class expert. More important are commitment and shared goals.

- ◆ Technology is useful, but nothing beats face-to-face contact to make collaboration happen. Video conferencing can be effective, especially when it leads people to plan ahead and take turns. E-mail is essential. But researchers need to have personal contact with one another. Ample travel budgets are therefore crucial if the consortium is distributed across space. Members of the consortium report that collaboration across distance is difficult, but not impossible.

You never know what might happen when you fund good people. In the end, there is a good deal to be said for talent and commitment. Despite whatever difficulties FCL encountered or entailed, when good people—that is, both talented and committed to the improvement of education—get together (or more or less together) to work on a problem, something useful may emerge. Despite the fact that the structure of the collaboration may not have been optimal, the investigators all became engaged in the issues, felt they learned a great deal, emerged from the process different (and wiser) than when they entered it, and in fact produced valuable results. The foundations recouped their investment.

Sustainability

Teachers' minds are one key to scale and sustainability. A reform like FCL involves ideas more than it does materials. Dissemination and sustainability require more than widely scattering the form of the reform. It might be possible to get teachers to say that they are doing FCL or even to appear to engage in some of its practices. But statements of belief (“I am doing FCL in my classroom” or “I am a constructivist”) and imitation of the surface routines of an innovation do not indicate that a reform has been effectively implemented. Instead, teachers need to assimilate the basic principles of the innovation, using them to think about learning and to plan instruction.

The experience of the Nashville group illustrates the importance of this point. Their original plan was to develop activities (the GLUs) designed to help teachers learn general principles of FCL. The teachers then tended to employ the activities in a mechanical fashion, failing to learn the principles they were designed to teach. The Nashville group's response was to relegate the GLUs to secondary status and instead to develop a variety of techniques designed to help teachers construct personal understandings of FCL principles. One method, influenced by the research of Shulman and Shulman, is to help teachers learn to analyze cases that raise important issues about learning and teaching. Another method, developed in collaboration with Haertel's group, is to involve teachers in the development of assessment techniques, a process that helps them to think about the meaning of student performance, the goals of assessment, and different forms of assessment useful for their teaching styles, students, and classrooms.⁷³

In brief, a key aspect of both dissemination and sustainability is helping teachers to develop personally relevant understandings of the basic principles and methods of the innovation. Another way of saying this is that an innovation can be considered successful to the extent that teachers choose to keep its basic ideas and methods. For the teachers to keep the innovation, its developers need to give it away.

How can we help to produce and support thinking teachers?

Teachers need to work in communities of learners. Teachers seldom get the chance to talk about their work with other teachers; they usually spend their days almost exclusively in the company of children. Yet, according to McLaughlin and Talbert, teachers need to think and learn about teaching the way they want their students to think and learn about their content—by working with peers to construct personally meaningful understandings that can guide and then sustain their action.

Teachers need supportive communities, both in and outside of their schools, in which they can collaborate with other committed individuals to facilitate their work and develop as professionals. Shulman and Shulman show that such communities can help individual teachers as they attempt to introduce FCL into their classrooms. The McLaughlin and Talbert research details the forms that these communities may take and the conditions that facilitate their operation. For one thing, they need to rest on a firm organizational base. The district or other relevant social organization (school, state education department) needs to provide teachers with time to collaborate, appropriate materials and resources, freedom to develop new methods of applying the principles and to use non-standard curriculum materials, policies supporting their innovative activities, and regular opportunities for professional development. Second, these communities cannot long exist as a minority of the teachers in a school. The majority of teachers need to learn that the reform is valuable and should become a regular part of the curriculum and school culture. Unless this is done, the reform must constantly be supported from the outside, which almost guarantees failure.

But sustainability involves more than communities of learners.

Politics and values again. The FCL program in Nashville was buffeted by local politics. The school administration that had supported FCL and SFT efforts was replaced by one advocating a back to basics approach and narrow forms of accountability. Presumably this shift revolved around value conflicts about the goals of education, such as the relative importance of basic facts as opposed to critical thinking. And later still, the school administration became enamoured of lesson study. These seismic shifts in educational policy at high levels clearly affect the sustainability of any innovative program. In response to events such as these, the FCL group participated in debates on accountability and redoubled their involvement with professional development. They were forced out of their comfort zone to develop political strategies too: they communicated with and attempted to influence the views of board members and the public, and supported various teacher initiatives.

If politics impinge so powerfully on the success of innovations, as is clearly the case, to what extent should the researcher/developer be expected to engage in political activity in order to sustain the innovation?

Section 3. Conclusions and recommendations

This section draws upon my reviews of all projects to discuss general lessons learned concerning educational research, practice, and sustainability. The section concludes with advice to psychological researchers and to foundations.

Lessons Learned

The projects offer many lessons, beginning with:

The sheer magnitude of it all

The three projects engaged in an incredible amount and variety of work.

- ◆ They have created conceptual frameworks, materials, curricula, goals, standards, pedagogical methods, cultures, videos, radio shows, simulations, mazes and mythical entities.
- ◆ They have reinvented, refined, changed, morphed, expanded, contracted, enhanced, degraded and (in the developer's view) interfered with the prototype innovation.
- ◆ They have searched for or invented methods to assess achievement, processes of learning, butterflies, performance, teacher behavior, cooperation, and the quality of simulations.
- ◆ They have conducted basic research on thinking, problem solving, beliefs, learning, teaching, social interaction, and behavior.
- ◆ They have engaged in advertising, selling, marketing, speaking, writing, networking, lobbying, conferencing, and producing propaganda and newsletters.
- ◆ They have conducted institutes for teachers, principals, specialists, superintendents, and parents; have created and nurtured communities of teacher-learners; have created college distance learning courses; and have worked with school boards and politicians.

And this of course is only a partial list. Clearly the scope of the work has been huge. Undertaking and sustaining an educational innovation is a massive and time-consuming endeavor.

The importance of research consortia

Research consortia are essential. The enterprise of educational innovation is so vast that it clearly requires the sustained efforts of many people with different skills. This was the message of a National Research Council Report.⁷⁴ The experience of the Mellon Literacy Project reinforces the idea.

Research consortia can work. The Mellon experience shows that research consortia can work, particularly when they are organized around a common goal, have open leadership, accept diversity, foster creative independence, and consist of talented and dedicated

individuals. At the same time, there is a great deal that we need to learn about the creation, care, feeding, and mental health of research consortia.

Universities may not provide an ideal institutional base for research consortia.

Research consortia involved in educational innovation can benefit a great deal from university connections. Universities provide talented people and resources like libraries and computers. Universities can benefit a great deal from consortia that provide exciting research opportunities for faculty and students. At the same time, universities may not provide an ideal institutional base for research consortia of this type. One reason is that universities stress individual research accomplishment as opposed to collaboration. A second is that they tend to place less value on “applied” research than on “basic” research. Third, they probably should not be in the business of dissemination. And finally, they tend to distance themselves from political activity (except of course to further their own goals), community action, and the like.⁷⁵ Yet collaboration, applied research, dissemination, and community involvement are all crucial for consortia involved in large-scale educational reform.

Psychological insights

All of the projects use psychology in one way or another. First it is necessary to be clear about what it is.

The projects employ psychology, not merely cognitive science. The projects attempt to understand and deal with student motivation, personality, identity, social interaction, ethical judgements and values, academic achievement, development, and culture, as well as learning and thinking. The discipline that attempts to deal with the full range of these topics is called psychology, not cognitive science.

Psychology can make many different kinds of contributions to the endeavor. The projects use psychology in many different ways. Psychology provides ideas and tools. It can:

- ◆ inspire core principles and a vision of educational goals
- ◆ suggest teaching methods
- ◆ provide a framework for developing new materials and activities
- ◆ lead to deeper understanding of teaching and of students’ learning and thinking
- ◆ offer an understanding of what should be assessed and evaluated
- ◆ provide methods for assessment and evaluation
- ◆ help teachers understand children’s learning and thinking
- ◆ help teachers understand their own teaching

But psychology can play only a limited role. Sound psychological principles do not ensure the development of successful materials, activities and curricula. As William James said, "...you make a great, a very great mistake, if you think that psychology, being the science of the mind's laws, is something from which you can deduce definite programmes and schemes and methods of instruction for immediate schoolroom use."⁷⁶ Deduction from theory is not sufficient; creativity, magic, and deep knowledge of content are required. Live pedagogical feedback—suggestions from teachers, other practitioners, and children—can inform development of the innovation. The idea of applying psychology to practice does not capture the complexity of the process.

Even a broad psychological perspective is incomplete. Just as cognitive science has a limited perspective, inadequate for understanding education and improving it, so does psychology. It does not attempt to deal with many issues crucial to education, such as the social structure of schools or the larger economic and political systems that shape everyday educational practice. The understanding of education must draw upon many intellectual perspectives.

Psychology can benefit from engagement in the development of innovations. Any interesting innovation in education may produce unanticipated results that current theories and methods cannot easily assimilate. Successful education is very much an open-ended process producing surprises and disequilibrium for child and researcher alike. Engagement in educational reform and involvement in the real world of classrooms and after-school clubs can suggest fundamental questions of psychology and lead to important basic research.

Evaluating Evaluation

The first lesson is well known but bears restating:

Evaluation serves different purposes and uses different methods. The projects used "formative" evaluation to help develop and improve the innovation. Another kind of evaluation focused on student "outcomes" such as grades, and another on key aspects of learning, like problem-solving. "Summative evaluation" was used to determine program success. The work of all projects was based on the assumption that different types of evaluation require different methods. The projects were particularly inventive in developing a variety of evaluation methods, from tests to field notes. "Basic research" sometimes paved the way to new methods of evaluation.

There's no way around it: Independent summative evaluation is required. Developers and advocates of an innovation tend to resist large-scale summative evaluation, partly because it cannot easily, or maybe never fully, capture the essence of rich and enthusiastic learning in a complex setting, and partly because it may not show them to be as successful as they think they are. But their resistance is hopeless. It is necessary for the public and for educational agencies to ask for an evaluation of the innovation's success.

On the other hand, complex learning is hard to evaluate, and it is not fair for evaluators to employ trivial methods to do the job. The insights of the developers and users of the innovation may assist evaluators in developing appropriate summative evaluation

procedures. Further, the evaluation has to be as “independent” as possible—a requirement that may not appeal to the developer and advocates of the innovation. Perhaps something like an educational “consumer’s report” is needed. In-house evaluation is less than ideal.

For teachers, evaluation needs to serve the purposes of instruction. The work of the Vanderbilt group confirms that teachers want to assess—a better term than evaluate—student learning primarily in order to guide instruction. Cognitively informed teacher assessment can help to ensure that innovations succeed.

We’ll never know exactly why the innovation works. Educational environments—innovations, classrooms, schools, after-school clubs, along with the students and adults in them—are enormously complex and always in flux. Under these conditions, it is virtually impossible to isolate the “factors” or “variables” responsible for an innovation’s “success.” Indeed, the idea of success itself is complex. Innovations seem to “work” in some ways with some teachers and some students but not with others. Perhaps we need to settle for the fuzzy judgement that on the whole, this innovation seems to do a better job and is more appealing—on various grounds, including outcome scores, teacher preference, financial considerations, and values—than another educational activity.

Dissemination as marketing

Get the word out. Dissemination is getting out the good word. It can be thought of as marketing. It needs to be conducted in a highly organized and disciplined way, as CRI has so ably demonstrated. Most researchers do not have much familiarity with work of this type.

Marketing ideas is very difficult. The essence of all of the Literacy projects’ innovations is not so much a thing—a piece of curriculum, a simulation, or a maze—as it is a set of ideas about teaching and learning. Dissemination of the innovation is therefore the marketing of ideas. It is not easy to convey complex ideas of the types underlying the Literacy projects. The level of public discourse about education in this country is not inspiring. Consequently, in trying to reach a wide audience, disseminators may fall into the trap of diluting the message. “Scaling up” an innovation may make it hard to insure the integrity of the ideas underlying it.

Three faces of sustainability

Sustainability presupposes flexibility and depends most heavily upon political factors and professional development.

Sustainability requires flexibility. Insistence on exact replication of an innovation is a hopeless strategy. Innovations must be adapted to local conditions. Some degree of morphing is not only necessary, but also desirable. Developers and advocates must be willing to give away the innovation in order for others to accept it.

You can’t get away from politics (in two senses). Political factors in the broad sense—testing policies, priorities embedded in the federal budget, availability and extent of state and local funding, guidelines for teacher certification, union rules, the values of the citizenry, and the like—all have more of an impact on the sustainability of an innovation than

does research evidence or foundation recommendations. Many innovations die despite formal or informal evidence of their success. The problem is not creating innovations but keeping them alive (in suitably morphed form).

If political factors are so crucial, then those involved in educational reform need to engage in political activity. The issue is not simply developing and implementing an effective curriculum, but building the “civic capacity”⁷⁷ to sustain the work over a long period of time. Researchers committed to implementing and sustaining an innovation need to lobby school boards, attempt to influence the public’s values and beliefs, shape legislation, and the like.

Sustainability is in the mind of the user. Complex educational innovations are sets of ideas. For innovations to be effective, practitioners have to assimilate and employ these ideas. At the same time that it requires political support, sustainability ultimately resides in the minds of practitioners. In recognition of this fact, the Vanderbilt group now focuses on teacher education as the key to sustaining FCL. Similarly, the leaders of CRI have come to believe that teachers’ appreciation of poor children’s learning potential is crucial to their simulation’s success.

Helping practitioners to assimilate the ideas is a complex process. As McLaughlin and Talbert point out, teachers need to work with and receive support from like-minded peers in their local schools. This kind of learning community cannot flourish unless it is embedded within a larger supportive context of school policies and practices.

The goal of learning communities and other forms of professional development is to help practitioners to come to a practical understanding of the innovation’s core principles and procedures. Practitioners need to create a personal understanding of the innovation’s core principles. The principles cannot simply be told; practitioners need to construct them, just as children need to construct their own understandings of what is taught in school. In the end, practitioners’ understanding may be somewhat different from psychologists’. But that is a necessary consequence of giving away psychology to those who need to use it.

As William James put it: “Psychology is a science, and teaching is an art; and sciences never generate arts directly out of themselves. An intermediary inventive mind must make the application, by using its originality.”⁷⁸ The core principles of an innovation need to get assimilated into practitioners’ intermediary inventive minds so that they can make the practical application in their own ways over the long term.

Whoever said it would be easy? Several of the researchers commented on the difficulty of professional development. Successful practitioners need to be creative, dedicated, and thoughtful. Unfortunately, these qualities are in short supply and hard to teach. Perhaps there are real limits on the success of professional development in the case of a complex innovation. But why should it be surprising that something as worthwhile as helping practitioners to develop inventive minds is hard to do, hard to persuade others to do, and hence seldom done effectively?

Advice to (psychological) researchers

Get out there

Whoever you are—educational psychologist, developmental psychologist, measurement expert, educational researcher, and especially cognitive scientist!—get out into the world of classrooms, schools, after-school clubs, and daycare centers. It's exciting. It will improve your research.

Learn psychology (and some other things)

If you do venture out there, you can't specialize too much in one branch of psychology. The realities of education force you to deal with the "whole child" (and teacher too). You will need to learn many things besides the narrow field that defines your psychological specialty and leads to tenure. You may even have to steel yourself to learn some sociology, economics, and political science.

Get help

You can't do everything. Educational innovation is too complex for any one person to handle. Practitioners and students may have interesting ideas and perspectives. Listen to them.

Don't exaggerate the importance of what you do

You have a lot to contribute but remember that your piece of the action is small. Many people and institutions influence the development and implementation of an innovation more than you do even if your theory is brilliant and your evidence impeccable.

Give away your ideas

Psychological ideas are so important that you should not polish them to perfection but instead should give them away to undergo reconstruction and use by the intermediary inventive minds you are trying to help.

Act!

If you are really interested in change, you will have to do some form of political activity. You will have to abandon academic objectivity and take a stand. You will have to prod principals, work with school boards, try to influence parents, or even campaign for (or against) someone. This is not an extra curricular activity but a key part of your work on the innovation. Isn't doing some form of good why you got into the field in the first place?

Advice to foundations

Support innovative educational activity

Support large-scale educational innovations, particularly when they are creative, offbeat, and unlikely to receive funding by government agencies that seem to favor the conventional. Don't demand that the innovation have a firm scientific base at the outset. Many important innovations do not derive from "science."

Support long-term, comprehensive efforts

Large-scale innovation involves many components, including development and refinement of the innovation, evaluation, research, dissemination, and professional development. Work in all of these areas takes time. Ten to 15 years is a more reasonable time frame for innovation projects than 3 to 5 years. Foundations should re-think the length of their commitments

Explore new institutional arrangements for innovation projects

Universities are not the ideal institutional base for innovation projects. Foundations should explore other possibilities, including the kinds of networks described by a recent National Research Council report.⁷⁹ Complex institutional arrangements need to be devised to support activities like research, evaluation, dissemination, and professional development, all of which are necessary to the effort but differ from one another in fundamental ways. Indeed, some of these activities need to have a degree of independence from the rest, particularly evaluation and dissemination. Foundations may help to put together complex consortia involving universities, businesses, school districts, independent research agencies, and the like.

Support both development and research

Development and research go hand in hand, so foundations should not be rigid in defining curriculum development and research and should not limit support to one or the other. To develop curriculum, the innovator may have to conduct research. To conduct research, the researcher may have to develop new activities.

Support field based research

Education can benefit from at least some research that operates within classrooms or other natural settings and employs a variety of methods, including observation, interview, and case study. Again, federal funding seems to favor more conventional approaches.

Support research on collaboration

Little is known about collaboration in complex research consortia or how to promote it.

Support and investigate professional development

Many good innovations have died because did not know how to use them properly. Professional development and support of teachers is a key to successful innovation. Yet little is known about practitioners' thinking and learning and sound methods of professional development. Support research on these topics as well as extensive programs of professional development.

Try to influence the body politic

Political factors in the broad sense exert enormous power over attempts at educational reform. Foundations committed to educational innovation need to influence the political process in one way or another. At the very least, foundations can fund programs that attempt to understand and educate the public perception of educational issues. Perhaps other forms of political activity in support of educational innovation are possible as well.

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Endnotes

¹ Rudenstine (1988)

² Ibid, p. 43

³ Ibid, p. 44

⁴ Ibid, p. 43

⁵ Ibid, p. 44

⁶ Bruner, Smith, & Smith (1992), p. 23

⁷ Ibid, p. 2

⁸ Ibid, p. 4

⁹ Ibid, p. 4

¹⁰ Ibid, p. 6

¹¹ Ibid, p. 6

¹² National Research Council (1999b)

¹³ National Research Council (1999a)

¹⁴ Bransford, Brown, & Cocking (1998)

¹⁵ Cole (1996); Nicolopoulou & Cole (1993)

¹⁶ Cole (1996)

¹⁷ Nicolopoulou & Cole (1993), P. 283.

¹⁸ Nicolopoulou & Cole (1993), P. 294.

¹⁹ Cole (1994)

²⁰ <http://129.171.53.1/blantonw/5th DCIhse/>

²¹ <http://www.uclinks.org/>

²² Ito, McDermott, & Greeno (2001)

²³ Cole (1996), P. 318.

²⁴ Cole (1996)

²⁵ Cole (2001), p. 8

²⁶ Ed Haertel's phrase

²⁷ Blanton (1997)

²⁸ Briefly, the simulations are:

The Chelsea Bank: students take on the role of teller and customer service representative in a commercial bank

The Court Square Community Bank: students take on the role of a vice president at the bank

The Alicia Leary Progress Foundation: students take on the role of the executive director of a foundation charged with promoting community development

The Community Clinic: students take on the various roles of a patient's primary care team in a clinic

The Starr Medical Center, Part I: students take on the role of a nurse in a medical and intensive care unit

The Starr Medical Center, Part II: students take on the role of a hospital administrator

The Riverview Hotel: students take on the role of hotel manager

RioTech Solutions: students take on the role of project director for technology consulting

The Green Mountain Paper Company: students take on the role of plant manager of a paper mill

The River City News: students take on the role of managing editor at a newspaper

The Sports Network: students take on the role of managing director at a sports entertainment network

²⁹ Bernard, L. & Lacovara, M. (personal communication, September 24, 1999)

³⁰ Ferrari, Taylor, & VanLehn, (1999)

³¹ Jeong, Taylor, & Chi (In press)

³² Taylor & Chi (2001)

³³ McQuaide, Leinhardt & Stainton (1999)

³⁴ Leinhardt & McQuaide (1999)

³⁵ Duffy, Farr, Greene, & Mikulecky (1996)

³⁶ Farr (Undated)

³⁷ (1) Thinking/decision making; (2) interpersonal development; (3) English language arts: reading; (4) English language arts: writing; (5) English language arts: listening and speaking; (6) mathematics; (7) science and social studies; and (8) world of work.

³⁸ Duffy, Farr, Greene, & Mikulecky (1998)

³⁹ Duffy, Farr, Greene, & Mikulecky (1996)

⁴⁰ Duffy, Farr, Greene, & Mikulecky (2001)

⁴¹ Duffy, Farr, Greene, & Mikulecky (1996)

⁴² Duffy, Farr, Greene, & Mikulecky (1998)

⁴³ Connor (1999)

⁴⁴ Duffy, Farr, Greene, & Mikulecky (2001)

⁴⁵ Duffy, Farr, Greene, & Mikulecky (1998)

⁴⁶ Ibid

⁴⁷ Ibid

⁴⁸ It is interesting that at one point, Teachers College rejected the opportunity to become involved with the operations of CRI. This was probably a wise decision. It does not seem that any university has the structure or personnel to succeed at doing what CRI does so well.

⁴⁹ I ignore the acronym for this project, RCA, along with the acronyms for several of the individual projects within it, like Haertel's ECL (Evaluating Communities of Learners), and in the interest of simplicity refer to the whole kit and caboodle, and each of its parts, as FCL.

⁵⁰ Brown & Campione (1994), p. 1

⁵¹ Ibid, p. 1.

⁵² Ibid, p. 1.

⁵³ These underwent revision as the project developed. I present here the initial list as described in the Brown and Campione 1994 proposal.

⁵⁴ Brown & Campione (1994), p. 6.

⁵⁵ Ibid, p. 6.

⁵⁶ Bransford, Goldman, & Hasselbring (1999), p. 4

⁵⁷ Ibid, p. ii

⁵⁸ Ibid, p. 18.

⁵⁹ Zech, Gause-Vega, Bray, Secules, & Goldman (2000), P. 208.

⁶⁰ Haertel (1997), p. 1

⁶¹ Ibid, p. 1.

⁶² Shulman & Shulman (1994)

⁶³ Meyer & Atchinstein (1999)

⁶⁴ McLaughlin & Talbert (1994), p. 5

⁶⁵ Ibid, p. 6

⁶⁶ See the discussion of Dewey in Brown (1992).

⁶⁷ Stokes, Sato, McLaughlin & Talbert (1997), p. 18

⁶⁸ Vygotsky (1986)

⁶⁹ Ibid, p. 193.

⁷⁰ Ibid, p. 194.

⁷¹ Brown & Campione (1996), P. 306.

⁷² Brown & Campione (undated), P. 1.

⁷³ Here is a different approach to the same goal: In my experience, it is very difficult for teachers to understand and use the core principles, or even to want to understand and use the core principles, unless they first engage in specific teaching activities made possible by the innovation. Thus, to understand the principles of FCL, at least some teachers may first have to act out specific FCL activities, even without a great deal of thought and even in a rote fashion. After observing that the activities are not difficult (or at least not impossible to do) and even seem work, teachers then have an interest in understanding principles that may underlie them. (Some teachers may benefit in a similar manner from following scripts.) Behavior may need to lead thought; rote activity may have to precede a “constructivist” approach.

⁷⁴ National Research Council (1999b)

⁷⁵ Of course, there are exceptions, like land grant universities and some professional schools.

⁷⁶ James (1958), P. 23

⁷⁷ Henig, Hula, Orr, & Pedescleaux, (1999)

⁷⁸ James (1958) pp. 23-24

⁷⁹ National Research Council (1999b)