CHAPTER 5
HOW IT COULD BE: THREE STORIES

The purpose of these stories is to suggest how curriculum reform could proceed using the ideas laid out in the preceding chapters. Written from the perspective of a time a decade or so in the future, they tell how three quite different school districts went about creating new designs for their K-12 curricula. The Palladio Unified, Edmond Halley, and Lewis & Clark Regional school districts don't actually exist, except in our imagination, so we can purport to know everything about them and exactly what transpired. The stories in this chapter are most directly about the science, mathematics, and technology components of the curriculum, but much of the account is relevant to other subjects and to the entire curriculum as well.

Never mind that these stories are made up. The intent here is to provoke fresh thinking about how we can get beyond marginal change in curriculum, not to prescribe a sure cure for current curriculum ills. Although in each case the reform process is presented as a series of steps, in the real world of schools, things happen in parallel and in loops. Stepwise presentation merely makes it possible to consider and describe the components of curriculum reform. As in architectural design, curriculum design draws as much on the spirit of art as on the spirit of engineering, and hence it inevitably involves compromise between form and function, between respect for the past and an eye for the future, between intellectual integrity and political reality.

Knowledgeable readers will recognize that these tales make no effort to deal with any number of serious impediments to the realization of reform in K-12 education. The tales focus narrowly on the process of K-12 curriculum design writ large—not on turning a curriculum design into an actual curriculum and not on operating a curriculum once it is place. In fact, of course, little of that can possibly happen unless the conditions listed in Chapter 3's Setting the Stage section are realized: consensus on

the need for reform, well-developed and evaluated curriculum blocks, better prepared teachers and administrators, supportive policies, and adequate resources.

These three stories simply assume that those matters have been dealt with satisfactorily. Reality may turn out otherwise. In any case, it is not the purpose of this volume or these stories to propose solutions to the many problems that beset American K-12 education. Rather, it is to think about how it may be possible in the future to actually go about the business of designing the entire K-12 curriculum as a whole in terms of specified learning goals. The approaches described here do not constitute Project 2061 endorsements of best practices, or even portray the full range of possibilities. They do raise issues that any real design enterprise will have to address.

FOREWORD

We are in the future looking back. In undertaking to create new curriculum designs, the three school districts had begun a decade earlier with one crucial advantage in common: sustained purposefulness. The district leaders seemed to know that major curriculum reform couldn't simply be mandated from the top down, the bottom up, or the outside in. They realized that first there had to be a widely shared desire for change among the administrators, teachers, parents, and citizens who ultimately would have to approve of undertaking any serious design effort, participate in the design process, and then see to its implementation. They knew that impeding change is vastly easier than effecting it. So the districts were willing to invest, in their various ways, the time necessary to secure the involvement and support of key individuals and groups.

But desire for curriculum change, no matter how widespread, will not itself ensure the creation of effective designs. Indeed, designs cobbled together in a hurry by unprepared designers are very likely to result in curricula that are worse than the ones they replace. So the districts also took the time necessary to build a capability for curriculum design and change.

Fortunately, building capability and building support go hand in hand. Rather than start out by talking about the need for grand changes in the curriculum and proposing radically new possibilities, each of the three districts first examined its entire curriculum in light of accepted content and structural standards, identified its strengths and weaknesses, and reported its findings regularly to the entire faculty, school board, and community. Each such study took several years because it dug into the details and because the participants had to learn how to carry out sophisticated analyses. As the study reports appeared,

more and more interested parties were drawn into thoughtful and informed discussions of what the curricula were actually like and what about them most needed attention.

How the districts went about that work varied according to their size, circumstances, and traditions, but all three drew heavily on their state frameworks and nationally accepted goals statements. In the context of science literacy, these included Project 2061's *Science for All Americans* and *Benchmarks for Science Literacy;* the National Research Council's *National Science Education Standards;* the content standards produced by the National Council of Teachers of Mathematics, International Technology Education Association, and the National Council for the Social Studies; and similar documents in other subject areas. Moreover, as time and money permitted, representatives attended appropriate conferences and visited other districts that were said to have outstanding curricula or that were experimenting with novel curriculum components. During those same years, professional curriculum-materials developers invented a large number of diverse curriculum blocks that were field tested, revised, and fully analyzed in a national computerized database.

Even as the curriculum studies proceeded, teachers in each of the three districts were making small improvements in parts of their district's curriculum. They tried out new teaching techniques and time arrangements, sampled alternative teaching materials, introduced some new content and, although it was harder to do, eliminated some topics, even some previously untouchable ones. With some material eliminated, they worked on how to use the extra time to teach better some important ideas that students had not learned well before. Teachers kept records on what innovations they tested and shared their findings with one another. In short, the districts followed many of the suggestions found in Part III of this book on how to get started toward long-term curriculum reform.

Because of their participation in these activities carried out over an extended time, a large proportion of the teachers and administrators in the districts became knowledgeable about curriculum-design issues, possibilities, and limitations. Further, a strong consensus developed on the need for a major curriculum transformation and a strong sense of what direction that transformation ought to take. The faculty deepened its understanding of curriculum architecture and became skilled in the use of computer-based tools for curriculum design and resource analysis. During those years, newly hired teachers were assigned to serve as apprentice members of the various curriculum committees and study groups, so that their continuing professional development was linked from the outset to reform activities.

The decade of focused preparation in our three districts was carried out in the spirit

of exploration and learning, and it engaged students, parents, and concerned citizens in all of their cultural, ethnic, economic, and occupational diversity. In none of the districts was total harmony realized among the educators or within the community, but enough agreement eventually emerged—after some give and take on one aspect or another—to warrant moving from piecemeal improvements and cautious experimentation to systematic, comprehensive curriculum redesign. For more on what happened, we turn to each of our three districts: Palladio Unified, Edmund Halley, and Lewis & Clark Regional.

Palladio Unified School District

Palladio Unified School District is located in a very large, heavily populated urban area. Its student population has changed dramatically over the decades, largely reflecting the waves of migration that have passed through the city, and its financial health has mirrored the ups and downs of the region's industrial base. Currently, African-American, Hispanic (mostly Central American and Caribbean), and Asian-American (mostly Southeast Asian) students make up most of the Palladio student body, although the overall proportion of those minorities in the city itself is considerably less. More than a third of the students come from working-poor and under-employed families. In spite of federal aid and state equalization funds, the school district is unable to secure the financial resources it feels it needs to put it on a par with the school systems in the surrounding suburbs—or, more critically, to reach the ambitious goals it has set for itself.

Nevertheless, this is not a school district in disarray. In its century and a half, it has faced severe challenges time and again, enjoyed its share of successes, survived its failures, and believes that such is its fate. Palladio Unified exists in a very political city that never hesitates to criticize its institutions, a city that is often at odds with the state and the courts over school matters. Yet surveys show that a substantial majority of parents and citizens believe the schools are making headway in the face of the city's current challenges. One reason may be that because they live in a city of neighborhoods (some of which were formerly villages bordering the city proper that were incorporated into the city against opposition that has never entirely subsided), parents and citizens focus more on *their* particular schools than on "the system," and they do not think that criticism (or even praise) of the school system as a whole has much to do with them.

Because of that attitude, and because the district's rather rapid turnover of superintendents and school-board members has made it difficult to create and sustain a strong central bureaucracy in any case, Palladio has never become strongly centralized.

Thus, the district's name not withstanding, creating a single districtwide curriculum has never been in the cards for Palladio Unified. With regard to this curriculum-design undertaking, everyone understood that the role of the central administration and board was to set directions, provide incentives for action, distribute resources fairly, monitor progress, and take care of legal and financial oversight.

Settling on a Process

In a series of joint meetings in various sections of the city, the Palladio school board suggested to teachers, principals, and parents that after nearly a decade of making worthwhile but piecemeal improvements in the curriculum, a more thorough and coherent curriculum was in order. As increasingly close attention had been paid to specific learning goals, it had become more and more evident that students were not learning well. Moreover, the faculty now had the ability to design a curriculum. This board declaration was neither surprising nor unwelcome. It was followed by a series of hearings with representatives of the teachers' and principals' organizations, the city's political and business leaders, and the general public. The aim was to ensure enough political support to effectively carry out a major curriculum-design effort.

The district plan of action that emerged had these main features:

- Although there was strong support among teachers, principals, and parents for making curriculum changes on a larger scale than before, relatively few of them believed it was desirable to create an entirely new curriculum. Thus, the leaders provided for two parallel lines of action: (1) to carry out a major redesign of the existing curriculum *school by school* along traditional lines for one set of schools and (2) to create an entirely new, highly innovative K-12 curriculum for another set of schools. Each school could decide for itself which line to participate in. Teachers were given the option of transferring to other schools, so they could participate in the design undertaking of interest to them.
- Each school would have a budget to underwrite its curriculum-design work and would be free to go about that work however it wished—as long as it was making reasonable headway, as judged by an advisory panel established by the school superintendent. However, since much could be gained from collaborating with others, some additional funds would be made available to encourage schools to form voluntary groups to share in the task.
- To ensure that this design freedom would not result in ineffective curricula, whether traditional or new, the school superintendent would submit for board

approval a single set of essential learning goals that had to be met at various assessment checkpoints. Acceptable designs would have to demonstrate that they would enable students to meet district standards of accomplishment. Moreover, the common checkpoints would provide some assurance that students from several lower schools could be successful in the higher grade school they fed into. (It was recognized that students who changed schools at years between the checkpoints, however, could encounter some mismatch.)

Conceptualizing a Design

It followed from the decision to proceed on two separate tracks that two design concepts would be needed, one for the "major redesign along traditional lines" majority and one for the "essentially new design" minority. Some individuals realized that although this dual approach could be seen as giving up on any chance of ever achieving district unity, it could also be seen as a clever alternative strategy to the usual one of transforming an entire district from scratch. Those people also believed that if a more radical design actually turned out in practice to outperform the other, then a second set of schools in the district could replicate it, and later a third set, and so on until the entire district had been transformed—all without ever requiring the reluctant majority to make the change.

Traditional curriculum. As work got under way, it turned out that few of the elementary and middle schools wanted to work in total isolation and so groups of schools gradually formed partnerships. Some groups were composed of schools of the same grade ranges, some of schools of adjoining grade ranges. A consensus soon emerged to the effect that "traditional" meant only that the curriculum in any one elementary or middle school would be organized by the usual subjects and disciplines and in uniform time configurations, and that all students in that school would experience the same curriculum. Otherwise, school independence would prevail: external similarity, internal diversity. As this concept played out in the high schools, each school decided to remain a traditional comprehensive high school, but, for the first time in anyone's memory, each would design its entire curriculum—four years and all subjects—simultaneously and would do so without having to match the other schools.

New curriculum. Here the challenge was somewhat different. The teachers, principals, and parents agreed to create a curriculum design more or less from scratch and to approach it from the start as a K-12 undertaking. The design concept they finally

settled on was a variation on the theme of diversity. Instead of the school-by-school curriculum diversity their colleagues sought, they had instructional diversity in mind. They argued that since different students generally respond differently to different ways of teaching, and different kinds of content are better taught by some instructional approaches than others, the curriculum should be designed to incorporate a variety of ways of organizing subject matter, partitioning time, and formatting instruction.

But replacing the existing curriculum with a hodgepodge was not what anyone had in mind. Unconstrained diversity would almost certainly end up as chaos and lead nowhere. So the design groups eventually adopted a core-plus-late-diversification model. The core curriculum would be designed to be completed by the end of the 10th grade, leaving students free during their last two years to enroll in one of several special schools. These schools, which might be housed together but run independently, would be two years long, but affiliated with a community college to make available three- and four-year programs. To start with, the options would include a science and engineering school, a performing-arts school, and a health-sciences school, each of which would be open to both vocationally oriented and college-bound students who had come successfully through the new ten-year curriculum.

Selecting Curriculum Blocks

The job of deciding what kinds of curriculum blocks would be eligible for selection in designing the Palladio Unified's curricula turned out to be relatively easy. Most of the schools involved found it expedient to form groups and share the burden (and risk). And the group that set out to create an entirely new curriculum necessarily had to share in specifying criteria, given the schools' commitment to unity. But what made the job so manageable was less the sharing of the labor than the nature of the decisions that had been made earlier.

Goal specification. Everyone engaged in the design process was aware of the board decisions with regard to goals, and few contested them. The board had made it clear that, although it had adopted some goals for operations, such as reducing the district's dropout rate, the paramount goals were to be learning goals—namely, what students were to be expected to know and be able to do at various stages of their schooling. For guidance on what those learning goals would be, the board had officially adopted the current state framework, which, it noted, was said to be consistent with the national standards in the various school subjects.

Like many such documents, however, the state framework was cast in terms that were too general for the purposes of curriculum design. It is not easy to derive specific goal statements from general ones, but fortunately that had already been accomplished in most of the subject areas. In natural science, for example, the CD-ROM *Resources for Science Literacy: Professional Development* (a tool well known to the Palladio teachers) contained a computer utility that identified the "fundamental understandings and skills" statements of the National Research Council and the "benchmarks" of Project 2061 that corresponded to the content recommendations found in the frameworks of each of the states that had issued them. With the greater specificity of these nationally accepted goals, the job of selecting learning goals was essentially complete. The more formidable task lay ahead—understanding the goals deeply enough to use them thoughtfully in the design process.

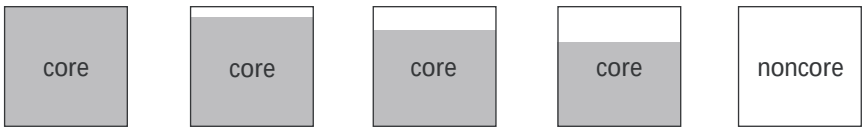
Constraint specification. Limits on what the Palladio Unified curriculum could be like came from near and far: the community, the state, the nation. It was recognized that such constraints might have the authority of law, such as the number of days of school, or they might be matters of local custom and finance (for example, limits on field trips). The superintendent was responsible for seeing that design teams were informed about the constraints—the number was really very small—and for checking the draft designs to make sure the constraints were dealt with properly. In the traditional-curriculum case, the main constraints involved decisions to limit the curriculum to discipline-based courses and to require uniform time arrangements. In the new-curriculum case, they involved the requirements that a variety of instructional formats be used and that the curriculum as a whole have several different alternative specializations in the last two years of high school.

Block selection rules. With the goals and constraints identified and understood, the school groups formulated two selection rules to be applied as follows:

- Both groups—the blocks selected had to target all of the learning goals specified for each of the chosen grade ranges—K-2, 3-5, 6-8, and 9-12.
- The traditional-curriculum group—all blocks had to be discipline or subject based, to be a semester or year in length, and to have the same time configuration. Grades K-8 had to contain only core blocks, but grades 9-12 could include up to 30 percent elective blocks.
- The new-curriculum group—starting with grades 3-5, every grade range had to include at least one seminar block and one project block. Blocks could vary in length from one quarter to three years and have any time configuration. Core

blocks would be distributed so that they would account for all of grades K-2, about 90 percent of grades 3-5, 80 percent of grades 6-8, and 70 percent of grades 9-10. Grades 11-12 (and in some cases 11-13 or 11-14) would be entirely noncore, as determined by the affiliated high school and community college. Grade by grade, the final K-10 configuration would be the same in every participating school.

The proportion of core and noncore can be represented like this:



Completing the Design

Palladio Unified's curriculum design efforts had unexpected results. The group that sought school-by-school curriculum independence realized substantial unity after all, and the unity-committed group had some trouble getting there. It went like this.

The traditionalists. In principle, each school could go its own way as long as its final design could be shown to meet the district-set learning goals and honor the agreed-upon commitment to standard school disciplines and uniform time frames. But by its nature, such a loose design concept does not provide much actual guidance to the teachers, administrators, and parents at a given school when it comes to choosing blocks to build a curriculum. In this case, what happened was that each of those individuals at each school who wanted to have a hand in formulating the curriculum began browsing the curriculum-block database looking for "interesting" blocks for consideration.

Gradually the pool of such candidate blocks began to grow and "selling" began. The proponent of a particular block would try to persuade colleagues that it was better than any of its alternatives in the pool. As the elimination of candidate blocks proceeded, the configuration problem came to the fore: In each school the blocks had to fit together, but blocks selected individually, however popular, would not necessarily do so. In fact, some blocks often introduced large helpings of unwanted redundancy and left sets of learning goals unattended.

It made sense, therefore, to see what other comparable schools in the district were coming up with. Indeed, even earlier, informal exchanges had begun to take place (often

to find allies for certain blocks), but the need to share ideas on the configuration problem increased the frequency of such exchanges. Knowledge of solutions worked out in one school quickly spread throughout the district and often influenced decisions made at other schools. The result of these informal exchanges was that the designs finally adopted by the schools (of similar grade range) were more alike than different, but each school could point to some differences that set it apart. Moreover, consultation between schools at different grade levels (often to join forces in support of blocks that related well to other blocks being adopted in higher or lower grade ranges) led to more K-12 continuity in the end than might have been expected. The board approved all the variants.

The avant-garde. This smaller group necessarily had to work more formally, since it was committed to K-12 unity from the start. Recall, however, that the unity sought was mostly structural—emphasis on a common core of studies that met all district-specified learning goals by the end of the 10th grade and a single pattern of instructionally diverse blocks (project and seminar blocks as well as traditional courses). That left open such matters as (1) the proportion of project and seminar blocks in each grade range, (2) how the blocks would be configured, (3) what the balance would be between discipline-based and integrated blocks, and (4) how much variety in time frames would be permitted.

A steering committee elected by the teachers identified six issues for further study before beginning to search for curriculum blocks. Teachers and administrators could participate in the study of as many issues as they wished, but by common agreement had to contribute to at least one. The six study groups, each of which had participants from every grade level, focused on the use of (1) time, (2) content variety, (3) instructional variety, (4) student differences, (5) K-12 articulation, and (6) the nature of the non-core. The purpose was to further clarify the design concept—unity with variety—by trying, as it were, to complete a floor plan before furnishing the rooms, with the understanding that subsequent decisions on furnishings might require changes in the basic plan.

Some participants attended formal sessions, others studied the topic and submitted their ideas to e-mail files that had been established for each of the study issues. Consensus was not quickly reached within each topic, and it turned out that decisions reached on one issue were not always compatible with those reached on other issues. But with time, the differences within and between study groups were reduced, and the steering committee then appointed a small subcommittee to come up with a plan that would incorporate as many ideas as possible from the study groups and yet end up with a coherent overall design.

By that time, the process had taken the better part of an academic year. Only then did actual block selection begin. A large K-12 design team representing the multiple groups worked through the summer and proposed a complete set of blocks that it believed met the criteria, fit the plan, and was interesting. Not all individuals and groups agreed, and they offered substitutions, arguing why this or that block was a better bet than one of those proposed by the design team. In two months, with an adjustment here and there, enough agreement existed to send the design to the school board for approval. Because the design was radically different from the existing curriculum and from the design adopted by the traditionalist group (whose plan was quickly approved by the board), it took the rest of the school year to secure sufficient public support to enable the board to give its official approval.

That was the easy part. Everyone understood that implementation would be difficult, especially because the district would have to accommodate two very different designs. Planning for their implementation would have to be no less thoughtful and thorough than the design effort itself. It took a summer and another school year to work out the details of the process, and then three more years to institute the changes. It took that long for many reasons, the chief one being that no new blocks were introduced without suitable teacher preparation in using them.

Interestingly, by the time the two designs were in place, enough of the teachers and administrators in the traditionalist group—and essentially all of the newly hired teachers—had opted for the avant-garde approach to justify starting another such track. That happened about every three or four years, so that within about 15 years of undertaking the design effort, the original minority avant-garde had become the new majority traditionalists in the district. What appears to have happened is reform by co-option and attrition. Instead of trying to make radical changes in the entire system at once, the district ended up changing the curriculum by gradual substitution.

EDMOND HALLEY SCHOOL DISTRICT

The Edmond Halley School District encompasses a single suburban city of moderate size and prosperity. The district maintained a generally good reputation as it grew with the community after World War II, with few scandals, high graduation rates and elite-college admissions rates, and winning basketball teams. When the city population stabilized demographically, so did the school population. The annual turnover of students, teachers, and administrators is relatively low compared to national norms. But when

the decade of reform began, the age distribution of teachers was such that many would retire before the new curriculum design would be implemented.

Halley (with many fewer schools than Palladio) sees itself as a unified entity conceptually and operationally, not as an aggregation of nearly independent schools. The hierarchy of authority is clear and generally accepted in principle, if not in every instance. Ideas, concerns, and information flow up, policies down. Committees—standing and ad hoc—are where the action is. Because committees are accorded the time and other resources they need to do their work and are usually paid attention to, teachers and citizens do not mind serving on them.

Settling on a Process

After extensive consultation with all the various stakeholders in the community, Halley's board of education selected a task force of teachers, administrators, and citizens to take the lead in creating a districtwide curriculum design, hired a curriculum-design consultant, and assigned support staff to the task force. This activity paralleled how the same board would have proceeded if it had been planning to build a new school. The task force's charter spelled out what the task force was to deliver and provided a budget, timetable, and enough procedural details to begin to work. Directives given to the task force by the school board included, in addition to oversight and monitoring provisions, these conditions:

- The design process would be made explicit and adhered to faithfully. If at any point it seemed to make sense to alter the process, changes would be negotiated with the groups involved in the process.
- Representatives of all stakeholder groups would have a part in the design process, and, although the school board had the final say by law, no participating group would have de facto control. The process would be open to public scrutiny at all times, even at the cost of slowing things down.
- Sufficient time and money would be made available in that such a politically sensitive and conceptually difficult task could not be done cheaply or in haste without great risk of failure.

Conceptualizing a Design

The school board was well aware that behind every interesting design (as in our earlier examples of the Panama Canal, the *Whole Earth Catalog,* or the Cannes Film Festival) there is an interesting idea. Thus the first step in the process was for the design task force to come back to the school board with a proposed design concept—not an actual

design—that would capture the imagination of educators and the community alike. The concept would be backed up by a cogent rationale, aimed at leading quickly to consensus. However, no further steps would be taken until a solid consensus was reached.

Because of the understandings gained during previous efforts in the district, it did not take long to reach consensus on some basic propositions. Ideas were drawn from personal experience, the reform literature, conferences, and consultants. The result was a design concept that emphasized coherence both in the development of students' understanding and in the thematic topics that organized study. The task force believed that the concept made sense as a whole, across the grades from kindergarten to high-school graduation and across the various subjects.

Reaching agreement on the importance of developmental coherence was relatively easy because participants in the design process believed that most of the significant ideas specified in their goals, had to be learned progressively over time. The Edmond Halley teachers were familiar with the growth-of-understanding strand maps found in the *Atlas of Science Literacy* and believed that it was possible, taking into account the findings of cognitive research along with the logical connections among ideas, to sequence concepts and their precursors across grade ranges. (Indeed, many of the district's science, mathematics, and technology teachers had long been looking to those strand maps for clues on improving coherence in their own teaching.) The design concept simply called for the developmental sequence and connections in the new curriculum to be explicit enough that responsibilities could be assigned and progress monitored.

Reaching agreement on thematic coherence was much more difficult because the idea was less clear than that of developmental sequencing, and because there were so many attractive possibilities. Eventually, after much districtwide discussion, the task force adopted "exploration" as the dominant theme for the Edmond Halley curriculum. The theme was meant to further the design of a curriculum that would engage students in investigating different aspects of the world and human existence from different perspectives: humanistic, scientific, economic, aesthetic, vocational. The curriculum would be characterized by the spirit of inquiry as manifested in different subject-matter areas and would build on children's natural curiosity about themselves and the world and its things and events. The curriculum would draw on the basic disciplines and fields.

The task force made clear in describing the design concept that the curriculum should be designed to do more than simply preserve students' curiosity and inquisitive behavior. It should also help them channel their curiosity so that they could explore their biological, physical and cultural surroundings more and more effectively as they matured and could

continue to do so as adults. The arts, humanities, and sciences each have their own traditions, and students should experience exploration in each of those domains, not to become competent practitioners in them but to understand the nature of inquiry in each. The task force argued that the curriculum should engage students in exploring the kinds of explanations given by different disciplines, groups, and cultures, and at different times in history, for why things are the way they are. The exploration theme was also taken to mean that the curriculum should give students opportunities to probe the different occupations—not only the "professions"— and what it would take educationally to enter them.

The idea of exploration was intended to imply certain limitations and demands. For one thing, "exploration" implies a level of understanding well short of "mastery." The curriculum should, for instance, enable students to explore aspects of scientific inquiry (or artistic expression) without expecting them to master the art of conducting actual scientific investigations (or becoming skilled in art). As the task force pointed out, the demand implied by exploration in science is that students develop the basic mathematical and language skills as early as possible, for without them they will be severely handicapped when it comes to participating meaningfully in the exploration of any of the domains of human thought and action.

Selecting Curriculum Blocks

Moving from general propositions to concrete specifications was not a matter of simple logic for the task force. It was important for the process used to be interactive and unhurried, making it possible to examine a wide range of suggestions thoughtfully, make arguments and counterarguments, negotiate trade-offs, and build further consensus. Cross-subject, cross-grade curriculum committees and subcommittees were established at every school in the district to support the task force, and representatives of each set met regularly—in person and on-line—to present ideas, argue their merits, bargain, and assess progress.

The journey from design concept to design specifications was complete when the committees and subcommittees had managed to reach a strong districtwide consensus that was then approved by the task force and accepted by the school board. Hence an up-or-down vote between competing designs was never needed. Perhaps that happened in part because everyone understood that agreeing on design specifications was not the end of the line, that there were further stages to go through during which the specifications could be revisited and then, if they were not leading to an acceptable kind of design, revised. The task of establishing selection criteria for blocks was divided into two

parts, one to focus on learning outcomes and one to look at the other properties a satisfactory curriculum would need. The results of these efforts are summarized below:

Goal specification. The task force concluded that it wanted the new curriculum to reach two broad curricular goals, one pertaining to all students and one serving the needs of some students. The all-student goal would be a common core that all students would be expected to learn; the other goal would be to offer to some students learning opportunities that go beyond the common core. The all-student, or core, part of the curriculum would include studies focusing on achieving literacy in the arts, humanities, science, technology, and mathematics. In the early grades, the core studies would emphasize developing the basic language and mathematical competencies needed to enable students to make continuous progress in them, while at the same time whetting their appetite for exploring the subjects further in the later grades and beyond. The responsibility for developmental and thematic coherence was to rest with the core curriculum, which (unlike the elective curriculum), had to be designed as a whole and linked to an explicit set of specific learning goals.

The task force sought authoritative content recommendations, having no intention of taking on the formidable job of deciding what would be most important for everyone to learn. This proved easy to do because the task-force members had been using the relevant documents in their own subject areas over the years. Recommendations were forwarded to the school board in every subject area. For science literacy they recommended that the core curriculum aim at all of the growth-of-understanding goals in *Benchmarks for Science Literacy.* These goals were adopted formally by the Edmond Halley school board and then forwarded to and approved by the state. There was now a clear understanding up and down the line that any curriculum design satisfactorily serving those benchmarks would meet national, state, and local content standards in science, mathematics, and technology (and similarly in other academic areas).

Constraint specification. Inevitably, the curriculum design had to accommodate some constraints. There were rules and regulations set by the school board and state law covering such matters as the budget for instruction-related expenditures, the length of the school year and day and its permissible subdivisions, and the assignment of teaching responsibilities. Because of its commitment to coherence, the task force set a severe constraint with regard to the division of time between the core curriculum and the curriculum electives. It believed that the existing curriculum was too much of a hodgepodge—students were free to choose unwisely and could end up being inadequately

prepared for either work or college and lacking basic literacy in the arts, humanities, or sciences. Yet the task force also wanted enough flexibility in the curriculum to enable students to follow their interests and talents beyond the core, and it believed that the right kind of curriculum ought to enable all students to meet the core learning goals by the end of the 11th grade. So the task force indicated that, except for the senior year of high school, no more than a quarter of the time available could be devoted to electives.

Selection Rules. With goals and constraints in mind, the task force developed specific requirements for a design. Chief among them were the following:

- Because the district had already adopted variable scheduling, curriculum blocks could be a semester or one to three years in length, and they could meet two, three, or five times a week, and each meeting could be one or two periods long. However, the final array of blocks would be required to form a pattern that students and teachers could follow easily.
- The exploration theme would be addressed by having a mix of discipline-related and integrated issue-related blocks, with some of each being in project format.
- To ensure that coherent understandings would result, at least one capstone block cutting across the arts, humanities, and sciences should be introduced at the end of the middle grades and again by the end of the 11th grade to review and organize the studies of the previous three or four years.
- To ensure that the design would be developmentally coherent with regard to science, mathematics, and technology, the core blocks selected for each grade range (K-2, 3-5, 6-8, and 9-12) would collectively target all benchmarks for that range.

Completing the Design

In principle, many different assemblies of curriculum blocks could meet the design criteria, but there was no reason to believe that all possibilities would be equally acceptable. Thus, as happens in nearly all design situations, the participants thought it important to consider a number of alternative designs.

Three districtwide design teams were appointed to propose separate designs. They were helped in this task by a curriculum-design consultant who gave the teams descriptions of curricula developed in other school districts that might meet many or all of the district criteria, and by examining a database of curriculum models. Each team was free to base its design entirely on an existing model or on a modification of an existing model, or to create one from scratch.

All three teams chose to adopt the same curriculum model—but each team modified it somewhat differently. The main part of their work then became the search for an appropriate arrangement of curriculum blocks. Each used a computer program to identify candidate blocks, to investigate and compare them, to assist in placing them, and to track how well the developing array satisfied targeted goals and necessary constraints. In making choices, each team had to trade some goals off in favor of others.

The three alternative designs were submitted to the task force responsible for overseeing the entire design process and making a final recommendation to the Edmond Halley school board. It had taken a long time to reach that point, and the work involved a very large number of people, but that is what is to be expected in important and politically difficult design undertakings. (For example, the design board for the United Nations headquarters in New York City met 45 times and considered 86 design concepts before reaching a final decision.) The new curriculum was coming into being in a way that would make its eventual adoption and successful implementation less problematic, even though it could be considered quite radical compared to the curricula of the 1990s and earlier. But there was still more work to be done.

The Edmond Halley task force studied the three competing designs. It debated the issues associated with them, including equity, cost, risks, possible side effects, manageability, adherence to state policy and legal requirements, and more. As it happened, however, the committee did not recommend any one of the designs as submitted. Rather, it made some trade-offs among them and settled on a compromise design that incorporated complementary features of each. The final design included required blocks and optional ones (selected from the three submissions) at each grade-range level, giving schools the authority to make some choices.

Lewis & Clark Regional School District

Meriwether Lewis and William Clark are adjoining rural counties. At one time, each had its own independent school system, but as academic demands increased and the local economies languished, the citizens decided that it made sense to pool their limited resources, even at the cost of local pride. The counties formed a single K-12 school district, aptly named the Lewis & Clark Regional School District. Not surprisingly, the merger raised difficult legal and political issues—such as how taxes would be levied fairly, where the one high school that would serve both counties would be located, what the makeup of the new board would be, which county superintendent would head up the joint system—as well as strictly educational ones.

In the turmoil of striving for the compromises and trade-offs needed to make the merger possible, a realization grew that this was an excellent time to rethink the curriculum, since, in more settled times, change of any significance had always seemed beyond reach. It dawned on the two communities that cost-effectiveness was not the only reason for the merger, maybe not even the most compelling reason. What finally became widely accepted, especially among parents in the two counties, was that the crisis before them was educational: their children were being left behind in the new world of global competition driven by advances in science and technology because they were not being educated for such a world.

With funding from the National Science Foundation's Rural Systemic Initiatives program and the loan of some corporate executives and technical personnel, a working design committee was commissioned to design a curriculum that would prepare the school district's graduates to realize their full potential and be the match of their peers nationwide. The design committee was encouraged to consult widely beyond the counties' boundaries, but to keep firmly in mind the geographical, cultural, and economic realities of life within the counties.

Settling on a Process

One of the first realities to be faced was that people were widely spread out and getting together for frequent meetings was very difficult. For that reason, the first decision on process was that the curriculum committee would consist of teachers, parents, and citizens in equal numbers from both counties but would hold its meetings in a relatively small area where the counties abut. The committee would meet as often as it needed to make progress, and it would report to the community at least once a month, with each report to be followed by public responses to questions and comments.

The participation of teachers was to be more organized. Since every school in both counties had computers, agreement was easily reached to link them with a server dedicated to the design challenge (upgrading some of the computers, as necessary). This necessitated hiring full-time computer specialists, but the school boards knew that that was an investment long overdue anyway. With the two-county computer network in place (and not to be used for instruction), schools could communicate easily with each other and with the curriculum committee and could access outside ideas and information by means of the Internet (or its 21st century equivalent). Moreover, the school board members could follow the discourse as it took place, reducing the need for the committee to make frequent and detailed reports to them.

The plan was for the committee to proceed one phase at a time. It would do some work, present its ideas on the dedicated network, consider the responses, revise the ideas as necessary, present the revised ideas, consider the responses, and so on until enough agreement had been reached to enable the committee to move on to the next step. In other words, most of the initiatives would come from the committee, but those teachers and administrators who wished to do so would be able to influence the outcomes on a daily basis. And neither the committee or the teachers could get too far without public input. The new single school board had to approve the key decisions.

Conceptualizing a Design

No one doubted that, given the opportunity, children in the two counties were perfectly able to learn the science and mathematics that children anywhere could learn. What the school boards and curriculum committees did doubt was their ability to attract the quality of teachers and to offer the array of courses needed to provide such an opportunity. Geographical remoteness and financial circumstances made it hard to recruit outstanding teachers, and the small population of students in the upper grades, along with the ever-present financial limits, made on-site course variety unrealistic.

Facing these realities, but unwilling to give in to them, the committee proposed a curriculum concept that (with modifications along the line) was rather quickly subscribed to by teachers, students, parents, citizens, and the school board even before all of the details of the merger had been hammered out. The concept had three facets:

- In each major subject area, students would individually be held to the attainment of national or state standards, whichever was, in each area, higher.
- The skill to be developed above all others would be the ability to engage in independent learning.
- State-of-the-art information and communications technology would support the curriculum.

Briefly, the argument for this high-tech curriculum design ran something like this: Without challenging external learning goals, it would be too easy to settle for whatever locally defined goals that could easily be met. Moreover, since valid computerized tests keyed to state and national standards were known to exist, it would be easy to monitor the progress of each student. If, in the process of acquiring a comprehensive base of knowledge, students learned to be competent learners, they would then be in a strong position for the rest of their lives to go as far beyond the standards as the times and their interests urged. By depending heavily on the use of modern computer and

communications technologies to build that base of knowledge, students would enhance their developing learning skills and gain the technical facility needed to make good educational use of the information highway.

Calculations indicated that purchasing, installing, maintaining, and updating the requisite technologies (including laptop computers), paying line charges, and training teachers and students in their use would be much less costly than what it would cost to attract teachers from the best universities and to run small classes of academic subjects. There were four basic assumptions behind the calculations: (1) help in underwriting the capital costs would be forthcoming from government and industry; (2) much of the training on the use of the computer system, and some of the maintenance, would be carried out by middle-school and high-school students; (3) many of the current teachers could be converted from "tellers" into learning guides, and preference would be given in future hiring to those teachers best prepared to help students learn to learn; and (4) there were outstanding curriculum blocks available—outstanding in their focus on learning goals specified in national and state standards—that were technology intensive and explicitly designed to foster independent learning skills.

Selecting Curriculum Blocks

Curriculum design proceeded straightforwardly from the design concept: assemble blocks, preferably high-technology, to create a curriculum that would enable students to reach challenging learning goals while becoming independent and technologically proficient learners.

Goal specification. As noted at the beginning of this story, the Lewis & Clark counties embarked on this adventure only after a decade of working in one way and another to improve the curriculum at hand. Part of that decade-long effort engaged teachers, administrators, and some interested parents and other citizens in becoming familiar with authoritative statements of learning goals in various fields, including the science, mathematics, and technology education standards. Because *Benchmarks for Science Literacy* (in its successive editions) substantially overlaps all of those and the state's framework in those subjects as well, and because *Resources for Science Literacy* (in its successive editions) provides a convenient way to move back and forth among them, the learning goals specified in *Benchmarks* were adopted without modification.

Constraint specification. To purchase and maintain the advanced computer system that the new consolidated district would rely on, the district would have to forego hiring

top-flight content specialists for every classroom in the upper grades (even if they could be attracted in sufficient numbers, which was itself doubtful). As a consequence, the new curriculum could not include courses that required such teachers. Similarly, blocks that required special facilities, such as laboratories for each of the sciences, would not be eligible. Instead, the new high school would have one large project room for science that could be used by individuals and small groups for hands-on activities associated with their studies. It would also house a reference library of textbooks, from easy to advanced, in science and mathematics subjects. However, no textbook adoptions would be made, nor would any course be offered that required all students to have the same textbook.

Finally, block selection would minimize establishing a rigid sequence of courses, especially after 8th grade, since students would be permitted to pass courses by examination and in any order. Indeed, no courses as such would be required, though students could form study groups to explore together (with a faculty guide) any of the required subject areas. For that purpose, the faculty would identify interesting and goals-relevant blocks that it would be willing to lead, given enough student demand. Also, students themselves—individually and as small groups—would be free to browse the database of curriculum blocks to find ones for consideration by the faculty that would move them toward their personal learning goals, as well as those set by the combined school district.

Selection rules. Translated into practical terms, the criteria for assembling the Lewis & Clark K-12 curriculum became:

- Every block for grades K-2 and grades 3-5 had to be rich in benchmarks and be teachable in an ordinary elementary school with a generalist teacher. The blocks for grades 6-8 could either each have some provision for independent study, or have among them some that did not include independent study and some that were entirely independent study. The high-school curriculum would consist largely of a pool of independent-study blocks.
- There had to be one common block in high school (taken in parallel with whatever science, mathematics, and technology students were studying individually or in small groups) that dealt with the nature of the scientific enterprise. It could be any length, from a semester to two years, provided it met for a total of at least 180 class hours.
- The curriculum had to include some “teaching blocks” that would prepare middle-school and high-school students to share in some of the teaching of reading and computation skills in the lower grades. Priority would be given to blocks focusing on the use of calculators, computers, and networks.

- Increasingly from kindergarten through graduation (which could come anytime after a student had passed the requisite examinations), curriculum blocks had to be technology dependent. That could include the entire array of electronic and print media, but not conventional textbooks alone. Blocks could be selected that referred to standard textbooks, but not blocks built around a single, required textbook. Preference would be given to blocks referring to trade books and articles available in an ordinary school library or that could be obtained by loan from a distant library or on-line.
- Since specified learning outcomes were the basis for progress, all blocks had to contain appropriate evaluation instruments and procedures. That was considered crucial, since students would be expected to monitor their own learning and teachers would be expected to monitor how well students were able to do so.

Completing the Design

Because of the limited transfer of students among elementary schools in this region, there was no special interest in having all of the elementary schools end up with the same array of blocks in their curricula. The board approved, nevertheless, having all students take the same tests at the checkpoints, and basing the tests on the district's specified learning goals rather than on the individual school curricula. It was also agreed that each student's passage from 5th grade to 6th grade and from 8th grade to 9th grade would depend upon the student demonstrating the technology skills that would be required in the middle and high schools, respectively.

Each county had just one middle school, and the committee's task was to come up with a curriculum that would make up for any lapses in the earlier grades and prepare students for the one high school serving both counties. They looked for blocks that would help students make the transition from dependent to independent learners. Most of the blocks were designed around small-group instruction, with some individual study, and only a few were in the form of whole-class instruction.

For several reasons, the high-school curriculum was more difficult to formulate. For one thing, the two schools had formerly been rivals, at least in sports. What was more important was that neither had had much experience with goals-directed instruction, independent study, or advanced technologies. And the new high school with adequate space and wiring did not yet exist—though there was the chance to opt for a school to match the curriculum, rather than the reverse.

The combined faculties finally decided to move cautiously by creating the curriculum over a five-year period. During the first year, they worked out the 9th-grade curriculum

and installed it in the second year (all other students in year two took the traditional curriculum, more or less). On the basis of that experience, the 10th-grade curriculum was designed in year two and instituted in year three, and so forth. It turned out that as faculty and students gained experience and confidence, and with substantial faculty turnover due to retirements, the transition was completed in four years. An interesting consequence was that the design process—students and faculty consulting in one year on the composition, within limits, of the curriculum for the following year—survived and became a permanent feature of the Lewis & Clark high school curriculum.

AFTERWORD

The three stories above constitute a brief look at the process of designing a curriculum by assembling components according to agreed-upon selection rules, not a description of what the curricula of the Palladio Unified, Edmond Halley, and Lewis & Clark Regional school districts would have turned out to be—or what modifications of them would have resulted from monitoring how they worked. Perhaps a central point to be made is that different school districts can approach the design challenge in quite different ways administratively even while following good design practice and drawing on the same pool of possible curriculum elements. The stories also suggest—even though they skip over the final designs of each of the three districts—that it is possible to create very different curricula to serve a common set of learning goals.

Before such stories can become a reality, the requisite curriculum blocks and the computerized curriculum-design system will have to be created (all design challenges in their own right). Perhaps the promise of a new age of curriculum design and development suggested here is enough to motivate us individually and as a nation to get busy on those tasks and design our own nonfictional curricula.

In our three stories, the school districts were remarkably fortunate in being granted ten years to get ready for curriculum reform. Although in reality, none of their design endeavors would have run as smoothly as portrayed here, virtually free of personality clashes and disagreements, even their idealized success could hardly have been contemplated without that decade of preparation. What would they have done in that decade of grace? Part III describes some of the essential strategies of how to get started.