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ABSTRACT

This paper is a summary of a much longer evaluation report. It contains a discussion of a number of issues in curriculum development and implementation. Eight NSF-supported summer implementation projects focusing on the two programs, Engineering Concepts Curriculum Project, the Man-Made World (TMMW) and Technology People-Environment (TPE) were evaluated and the findings of this external evaluation are presented. The evaluation plan is described. A curricular policy system is presented in flow-chart form. The study had two major purposes; 1) to address the policy problems of the cost-effectiveness of investment by the National Science Foundation in the development and dissemination of the curricular products of a development group, Engineering Concept Curriculum Project (ECCP); and 2) to explore in a preliminary way the general problem of the means, if any, by which potentially fundamental curriculum changes take place in a national school system. (Author/EB)

Introducing Teachers to a New Curriculum

AN EVALUATION OF THE SUMMER 1975 ECCP IMPLEMENTATION PROGRAM

Department of Secondary Education
University of Illinois at Urbana-Champaign

December, 1975

INTRODUCING TEACHERS TO A NEW CURRICULUM

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This paper is a summary of a much longer evaluation report which should not be published inasmuch as commitments of confidentiality were given to personnel in the projects studied. There are, however, a number of generalized issues in curriculm development and implementation addressed in this study which merit discussion and with this goal in mind we have edited the attached summary and concluding chapters from our original final report to the National Science Foundation to make our research available for limited discussion. We trust that readers can accept the limitations that necessitate this abridgment.

Ian Westbury

Owen Gaede

A SUMMARY OF THE STUDY

This report presents the findings of an external evaluation of eight NSF-Supported summer implementation projects focussing on the two programs of the Engineering Concepts Curriculm Project, The Man-Made World (TMMW) and Technology-People-Environment (TPE). The study addressed a number of different questions:

* How effective were the particular projects in achieving goals of the NSF Triple-I program?
* Using the results of this evaluation, what guidelines for project and participant selection might be suggested to increase the probability of project success?
* If the projects observed in summer 1975 are treated as generally representative of past projects and problems, does any basis emerge for understanding some of the problems seemingly associated with the implementation of TMMW, a major curriculum development undertaking of NSF, but a program that, at this point, is apparently not widely adopted?

Evaluation Plan

This study is seen as a part of a larger project, an analysis of the experience of one cohort of teachers with two programs which make, because of content and pedagogy, unusual and complex demands both on teachers and schools. However, this study was a discrete undertaking inasmuch as it had as its primary focus understanding and evaluation of the eight TMMW-TPE Triple-I projects supported by NSF during summer 1975. This narrower purpose would serve to provide a foundation for a planned larger undertaking in that

it offers a basis for an analysis of the variety of initial exposure to TMMW-TPE offered the cohort.

An explanatory model or a series of assumptions about school district and individual curricular decision making forms the foundation for this study. The model assumes that only teachers with certain characteristics interest themselves in a new program; that some of these teachers, as a result of a project experience, decide to implement; and that where this initial implementation is successful, a school district might adopt--but that district adoption will be constrained by predictable characteristics of the district, and that successful adoption will be a function of support for that district both from within and without.

The primary goal of this study was to explicate this model as it bore on TMMW/TPE and explore what role summer project activity might play in the dissemination and adoption process. Time limitations imposed severe constraints on the full exploration of variables associated with this model and only project participants were investigated. Questionnaires were given participants probing:

The source of their information about TMMW/TPE.

The use of the programs in their school districts.

Their educational and experiental backgrounds.

Their demographic characteristics.

Their commitment to teaching and view of their work.

Their responses to their project experience.

In addition, site visits were conducted at all projects and, in the course of these visits, interviews were conducted with all project directors to explore their perceptions of the nature of their implementation activity.

Dependent Variables

Three dependent variables were explored:

The overall effectiveness of a project qua project qua project.

The perception of participants had for use next year of TMMW/TPE.

This last criterion is, of course, totally unsatisfactory inasmuch as most often plans for program use are made prior to attendance at a given project. As such this criterion reflects prior penetration rather than a specific project effect. Clearly, if use-as-a-result-of-a-project-experience is to be used as an ultimate criterion of project success, follow-up studies of a single year cohort is required. Nevertheless, to the extent that prior decision-making can be regarded as an indicator of the impaction success of locally-originated implementation programming--and all of the projects observed should be seen in this way--this criterion can serve, when used in conjunction with the narrower criteria, as a basis for evaluation of local program success, as a basis for diagnostic evaluation of the appropriateness of the kind of programming observed, and for assessment of probable short-term impaction of that program in a local region or target system.

Results

The stage of prior penetration of awareness of TMMW/TPE more than any other factor seemed to effect project success as defined in terms of any of the above criteria. When penetration is defined in terms of a phasic model that uses terms such as initial awareness, initial use, trial and implementation, match between the target system state and the form of a project's program seems to account for most of the variation between projects in success. Unsuccessful projects recruited participants who had different concerns that those of the project's staff and different readiness to attend to a project's programs. Successful projects seemed to optimize matches between the readiness states of the target systems and participant selection

and programming. Two programs were judged unsuccessful using an intuitive sum of the above criteria, two more judged only moderately successful, and four were judged successful. Of the 198 participants, 65 participated in unsuccessful projects, 50 in moderately successful projects and 85 in successful projects. Using the strict criterion of implementation of either TMMW or TPE in 1975-76, 7 percent of participants in unsuccessful projects were implementers, 16 percent in the moderately successful projects, and 40 percent in the successful projects. If we intuitively assign weightings that derive from assessments of successful programming, it would appear that a significant proportion of the resources devoted to ECCP implementation in 1975 were spent ineffectively.

Within these broad findings about success, the following variables appear to account for the perceptions of individual participants of the salience of TMMW/TPE to them and their statement about their plans for use of either program:

A press on the part of their districts for use of the programs.

Age and experience--with more experienced teachers being more interested in the programs than less experienced teachers.

Subject background--social studies teachers were not adopters and were not positive towards their experiences.

Investment in and satisfaction with teaching as a career.

Commitment to a given school system that is, however, modulated by characteristics suggesting cosmopolitaness--number of graduate schools attended, initial information about programs and projects being gained from printed sources, etc.

Either an intrinsic interest in the programs or school-based press for use.

Overall, it would appear that, if implementation is the goal of the summer project program, only two projects, with limited targeted systems, played a significant part in an active local implementation system. Two played a part in a successful awareness-generating system, one (first-year) program might promise success in an awareness system provided that appropriate subsequent

activity took place, and three projects promised little (one continuing, two initial). The unsuccessful projects showed little promise in optimizing the interactions between their participants, clienteles, and the conditions identified as being prerequisites for systemic impaction. These projects did not have the characteristics associated with either "infection" of a target system or support for developing awareness or implementation.

Implications

It did not appear that either NSF guidelines for project selection or NSF administration of those guidelines was effective in producing projects judged as successful. Indeed, if the projects observed can be judged as representative, it appeared as if NSF policy bore little relationship to events on the ground. Successful project directors had all made long term commitments to implementation programs and used NSF programs as a necessary fiscal aid to their programming rather than as a support for their endeavor.

Indeed it would appear that, apart from funding, NSF implementation programming has played only a limited part in optimizing the conditions for effective trial implementation of TMMW. This suggests that the agency's policies may need to be re-thought, particularly as they bear on implementation of curricula which have the characteristics of TMMW, i.e., curricula in areas which have no existing place in the conventional high school program. Existing policy seems to be framed within a model which is designed to maximize the dissemination of updated versions of traditional curricula areas through the school system and is, to this extent, predicated on the availability of significant human and institutional resources which can be turned to slightly different purposes by the addition of marginal resources to the school system by a national agency. This condition is not met in the case

of a curriculum such as TMMW and, as a result, when traditional cost-effectiveness criteria are used, the program must be judged cost-ineffective. This fact, when added to programming that has probably produced projects of the varied quality observed in Summer 1975, raises the possibility that implementation programming for curricula such as TMMW must be re-conceived. The projects judged successful had only 80 participants (approximately) and only two (one of the other projects was essentially a national awareness project, the other was a regional awareness project) were achieving significant local awareness and implementation. Even widespread regional implementation requires more successful local impaction than observed this summer. If these findings also held for prior years, the relative lack of implementation success of TMMW becomes understandable and should not, the study suggests, be judged to reflect an evaluation by the schools of the curriculum itself. New implementation programs would seem to be required, programs that are built on a more complete understanding of implementation at the local level and on the systemic implications of local decision-making for the curriculum policy system. This task seems to require conceptualization of projects as components, both of information systems and teacher training systems--a distinction which seemed ambiguous in the projects observed--and an understanding of the interactions between programs of one or both of these implied kinds and systemic impaction.

CONCLUSIONS AND IMPLICATIONS

This study had two grand purposes: (1) to address the policy problem of the cost-effectiveness of investment by the National Science Foundation in the development and dissemination of the curricular products of a development group, ECCP; and (2) to explore in a preliminary way the general problem of the means, if any, by which potentially fundamental curriculum change takes place in a national school system. Inevitably, of course, these purposes were and are intermingled: an assessment of the cost effectiveness of the ECCP development presumes, ultimately, that one can evaluate a set of given strategies as in principle appropriate (or inappropriate) to the problem. To make that judgment one needs a conception of the means by which a given kind of change might take place in the schools or might be supported by a given policy thrust.

This two-fold concern shaped the form of this study and its conclusions. Chapter 3 sought to explore the policy parameters associated with the success of summer projects that had as their goal the introduction of teachers the ECCP materials, using immediate adoption of the programs as the criterion. Chapter 4 sought to explore some of the factors that seem to be associated with adoption by single teachers of TMMW. Not surprisingly, the conclusions of these two analyses were complementary. The existence of the program in a given LEA was fundamental to implementation success defined in the narrow terms we have been using; however, the analysis of the factors associated with individual adoption decisions makes its own contribution by pulling out again some of the other factors that appeared in the project patterns: adopting teachers seem to be more invested in teaching than their project peers, they are less likely to be local in their career orientation, they tend to have attended more institutions for in-service education, and they tend to have more educational experiences than their peers.

This seems to represent an intuitively satisfying picture of the teachers one would expect to see adopting a program such as TMMW. When we add, as we did in Chapter 3, factors like subject background, the picture becomes even more satisfying. But what does this picture mean? for understanding of the implementation process in general? for our understanding of implementation of ECCP? for policy?

These questions are disturbing. Even if we leave aside the technical problems of our analysis, we must face two fundamental difficulties. All of the teachers we studied were in the information field of TMMW; all were interested enough in the project to attend the project. Some attended because of pressure of some kind or other from their district to prepare for use of the curricula, others attended because the presence of the programs in their environment made them curious about what TMMW/TPE might be, others attended because they were interested--and we cannot account for this curiosity, yet in the case of districts or communities which had had no possibility of prior information about the programs, this group becomes critical. They are, to use the epidemiological analogy that is being increasingly used to explore dissemination of new ideas, potential infecting agents.

The second difficulty is equally disturbing. The criterion in all of our analyses was, as we have emphasized again and again, an implementation-next-year decision. But as we have said, such a criterion confounds an entering factor with a project-outcome factor and with an institutional feasability factor. A more valid criterion for a project effect requires that we explore implementation when all participants have had an equal chance to implement: but this is not a realistic state; institutional factors, local press, the quality of follow-up and later support by project personnel all effect in

clear ways the real possibility, and thus the probability of implementation.

An additional problem associated with any usable criterion must also affect the task of assessment. Does offering either TMMW or TPE as an elective represent implementation of these curricula? Thus, we can grant that any use of the curricula represents a legitimate use by the schools of an idea that has been offered the schools, but still wonder how important the problem-solving, multi-disciplinary view of engineering concepts implicit in the programs is in an assessment of implementation success.

Again this last concern is imponderable. Wirt and Quick (1975) suggest that

> national curriculum projects serve a vitally important planning function in education. By this we do not mean planning in the deductive sense of developing an agenda of future activities from an assumed set of end objectives. Rather, we mean planning in the inductive sense of thinking about needed improvements in the substantive quality of education, considering what is possible to do, and preparing for the future by producing new curricula. The net effect of supporting curriculum development over a period of years is the production of a body of curriculum resources that piece by piece are not only technological aids to educational improvement but are in total an educational plan. During the development process both the individual curricula and the emergent plan become the subject of public scrutiny through the channels of the curriculum policy system. The widespread deliberations about new curricula or curricular ideas, even when they do not lead to a decision not to adopt become as important for bringing about educational improvement as actual adoption of the new curriculum products produced (p. 50).

Yes ~~and no~~! Some plans can be exploited as ideas. Others require demonstrations for a real assessment of their utility and significance, and it is at least part of the purpose of a dissemination program of the kind we observed this summer to establish demonstration sites.

This leads us to the most vexing question any study of this kind must face. We can put the problem in terms suggested by one project director. His goal was the creation of awareness in his region and saw one major dis-

function being associated with this goal--he sought widespread adoption as part of his dissemination program and he achieved it in discrete sites in this region, but he achieved beginning major impaction in only one site. He believed he could have achieved such impaction in one or two major centers in his region, say in St. Louis and Decatur, but he wondered what such a pattern means. "So Decatur and St. Louis are using TMMW." How can resources on the scale necessary to achieve impaction in these two sites be provided to achieve implementation in Peoria, Indianapolis, Rockford, Quincy and Chicago. And even if implementation occurred in these sites what would that mean? The ECCP programs make major demands on the curricular structures of the conventional school; they make major demands on the capabilities of teachers. Even if we assume that a self-sustaining state were reached in Peoria, St. Louis, Decatur, etc., would the programs diffuse further without further active support by a sponsoring agency? Inasmuch as such a state has not been achieved outside perhaps the Tampa region, we do not know; and what is happening there has not been systematically evaluated. There appear to be no precedents to guide even thoughtful reflection on this problem. Clearly the time frames required to reach such a potential state excede any that have been used to date in curriculum implementation program. As Wirt and Quick (1975) have noted

> Our analysis has shown that the products of national curriculum projects require a substantially longer time to spread broadly into education than the rate at which societal goals for education shift. Factors of delay include the more than five years required to develop a new curriculum, the five year life-cycle of the book in the schools that places an upper limit on rates of adoption, and the more than ten years required for the content of nationally developed curricula to seep into the basal programs of commercial publishers. (p. 49)

Does our experience offer any basis for a commentary of this task, assuming that what we have been suggesting above describes in crude outline the conditions necessary before major impaction of a program like TMMW/TPE can be regarded as realistic?

Quick and Wirt (1975) (See Figure 5.1) suggest that the curricular policy system includes as resource components:

money for services
products
personnel, and
information

as resource-providing institutions:

commercial publishing houses
colleges of education
other university departments and
curriculum development centers

and as regulating institutions:

national testing organizations
state adoption boards
teacher certification
school accreditation.

What happens when we look at the implementation program we saw in ways suggested by this structure and the time and commitment frames suggested by Wirt and Quick's analysis of the complexity of the implementation task?

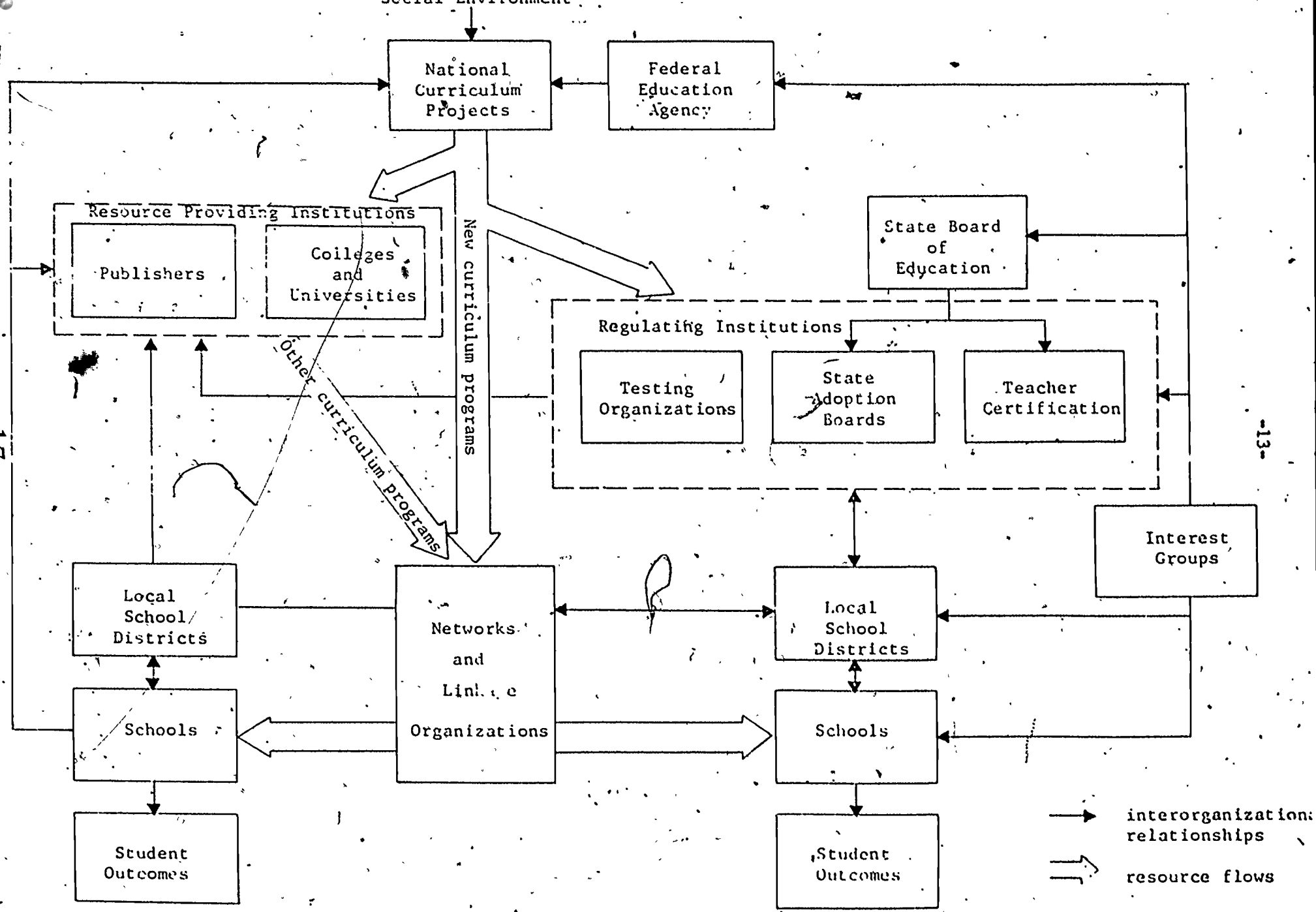
First, time (or rather time-on-the-implementation-task) is clearly associated with even intial penetration of TMMW. The projects that had

high level of awareness associated with them had all been actively engaged in implementation activity for several years. As important, all of these projects were directed by personnel who had attempted more or less systematically to operate on their systems. Both awareness of this need to impact and sufficient time to achieve impaction seem to be necessary conditions for success defined in this way. As important, the intensity of impact in a given locale seems to be strongly associated with the scale of the target area. One project focussed on a single city and saturation awareness, after five or so years, seemed to be the outcome. Other projects focussed on broader regions and achieved significant, but weaker impact.

Second, engagement in and with the system appears strongly associated with success. We have already noticed that given our perspective the source of an original systemic infection must be regarded as random. It seems clear, however, that subsequent activity and subsequent impact entails reaching less committed teachers and an institutional press on those teachers seems necessary for their active engagement with these curricula. The stages between these points seem classical (initial interest, awareness, trial, evaluation, implementation) and follow, in rough outline the stages suggested by observers of the "adoption" process such as Coleman et al. (1966). Each movement between these stages requires its own strategies and active support by a facilitaing agent and agency. When we reflect on the seven sites we observed, four seemed to have a sense of this task and three had little or no awareness.

Only in one site, however, did the organizational context of the project activity seem to support the awareness of the project staff of their tasks--and that commitment seemed personal rather than institutional. In most sites ECCP

Figure 5.1 The Curricula Policy System



From Wirt and Quick, 1975

implementation activity was an add-on activity, a soft money venture without significant or monetary support from the institution itself.

This last factor seems critical. Six sites were vested in schools of engineering or science: in one beginning site significant monetary support had been given for equipment purchase, in two others significant long-run personal support had been given by deans and the like, but the sustenance of primary missions in a period of budgetary stress in one of these sites was beginning to require the diversion of resources away from the ECCP implementation program. This problem in a school of engineering is understandable inasmuch as teacher education cannot be regarded as a primary mission of such a school. The problem is that in this site, and in the other engineering-science sites we investigated, no successful efforts had been made to transfer responsibility for the ECCP program to the school of education, the logical site and source of long-term support for school-oriented programming. It would seem that the very presence of a successful ECCP program in a school of engineering should be regarded as fortuitous.

NSF funding policies seem to bear some responsibility for these problems. A decision to vest a project in a school of engineering would seem to raise the possibility of the personnel in that school neither understanding the needs of teachers nor the needs of the adoption system. To offer summer-focussed funding only would seem to pose the problem that, where there was likely little understanding of the need for long-term follow-up, activity would simply be summer-focussed. To continue funding education-focussed activity in a school of engineering on a basically soft-money basis without a requirement that the school demonstrate commitment by the allocation of local resources or significant incorporation of school of education faculty raises the danger of the

termination of a whole implementation program long before implementation is self-sustaining.

To return to the terms of the Wirt-Quick model, it would seem that one of the problems that ECCP implementation programs have faced is a failure in resources provision: personnel with an understanding of and commitment to the tasks associated with implementation have not been found in significant numbers, funding for the long run servicing of implementation programs has not been provided, transfers of information and personnel have not been effected between those sites which have been the prime sources of initial personnel resources and interest to those sites which would seem to have the resources, fiscal, human, informational, for longer-run commitment to the programs.

We have assumed that it is possible to talk of a self-sustaining implementation site. No such site exists of course. Training, however routine it might be, is a necessary part of the sustenance of any implementation or use activity, and to sustain implementation or use in a significant number of sites, the training requirements are considerable. It is inconceivable that a national agency with a finite budget should expect, or be expected, to support the training demands of Chicago and Peoria and Decatur and St. Louis and Rockford and Indianapolis. That task must be undertaken routinely by existing training institutions to be conceivable, must be undertaken over long periods of time, and, to be cost effective, must be seen as a part of existing training structures. No site we saw had begun to face that problem; annual funding made even the continuing existence of a summer project activity problematic, institutional cost-sharing had not been secured to ease the burden on the national agency, existing training (and incentive for

training) structures had only in one case been co-opted. Given the long haul that must be presumed to be a prerequisite of even a demonstration-focussed intervention, these failures seem foolish. We would argue that guidelines and programming must address this problem. The task of resource provision must be borne by more than the agency alone, if not in the beginning of an implementation, certainly over the longer run. Given a finite allotment of implementation resources by NSF it would seem as important to concentrate on the total task of impaction on the curriculum policy system (at least in a demonstration and trial mode) with the goal of securing the beginnings at least a self-sustaining implementation as it would to continue funding summer activity. This is, of course, implicit in the school systems project category of the overall program we investigated, but it was not evident on the ground. And intuition and experience would suggest that the problems we have identified in the eight projects we explored are found in many systems projects. They seem no less ad hoc, no more systematically planful than do the projects we observed.

All of the remarks we have been making to this point imply a failure of NSF programming to address the tasks we see associated with ECCP implementation, problems which are potentially endemic to many of the second and third generation projects in the NSF curriculum development program. Resource components, resource provision and regulation have not been addressed with sufficient care and purpose for us to believe that the potential of TMMW has been shown the schools.

But this is a judgment based more on speculation than evidence. Equally fundamental problems appear to lurk in the structures which produced the mismatches we observed between project types and the "needs" of the clienteles

and systems from which participants emerged. All of the participants we observed were interested to some degree in TMMW/TPE. But the form of this interest varied widely, and systematically. This variation was not reflected systematically in the character of the programs we saw.

We suggest that a project can be conceptualized as functioning in two quite different ways: it can be seen as a component of an information system or a component of a training system. Let us spend some time with this distinction.

A decision to consider a program, to test a curriculum proposal experimentally, presumes knowledge of a possibility. A project such as the State University national leadership project was an example primarily of an intensive information dissemination activity: ready participants were given an opportunity to work through TPE, explore their questions about the program and its components in an interactive mileiu, and so shape their understanding of what the developers thought TPE might be. The participants at this project were familiar with TMMW and, to a higher degree than elsewhere, they secured their information about both the project and the program from print sources. They were ready in some sense for an intensive communication experience. The first SU project (a regional project) had some of these same qualities, but there the group of participants were more localite in their orientation and had learned about the program from regionally pitched, person-dependent channels. These projects secured adoptions from committed, interested (or perhaps intrigued) teachers but they did not secure implementation. As the director of the SU project asserted again and again, he was focussing his intentions on and had begun to achieve awareness of TMMW/TPE, <u>not</u> implementation. He was beginning to build (or had built) an information field

not an implementation system. In this system implementation became a process that was initiated and sustained by local forces or by the reception in the schools, themselves, of the programs. (Training in the sense that we will use that term below was a component of the US program, of course. We are ideal-typifying rather than describing.)

If we conceptualize projects as structures of a certain type within an information system two consequences seem to follow. On the one hand we must ask what part a project as a subsystem of a special kind plays in the total system, for what ends it is maximally useful, and under what conditions it plays its optimal role as a maximizer of information flow of what range of types to its audiences. On the other hand, we must explore the relationship between information and implementation. Basically it is this last kind of concern which lies behind the preliminary analysis outlined in Chapter 4 where we sought to discern characteristics of teachers who responded positively to prior awareness of the potential for them of TMMW. Not surprisingly we found that those who characteristics would suggest that they were potentially most receptive to the implementation implications of information about possible new programs planned to use those programs. That this is tautological finding is, of course, only a small part of this problem.

If we turn this kind of conceptualization of the nature of the projects we observed to more explicitly practical, evaluative purposes, some clear bases for judgments of projects seem to emerge. Thus, if we take the least successful of the projects, it would seem that we can account for their problems largely in these terms. They reflect mismatches between information needs and readinesses and modalities; the programming at Central State University constituted overload, the programming at Western State University was

mistargetted: the group wanted basic information but received meta-information, i.e., information about how more basic information might be transmitted. The project at Central City University was mistargetted inasmuch as the implementation or an adoption readiness of the system required a different audience. Atlantic University offered information to a group that was, in some senses, relatively unwilling or unable to use it. The messages of the Atlantic project were, to some extent, poorly pitched inasmuch as the group had little readiness to hear of new "elective" science courses (the region was experiencing budgetry retrenchment) and perhaps little predisposition to attempt innovation.

Successful projects were much more successful in optimizing the match between the needs of participants and their programming. Southern City recruited a population who needed as much information about TPE as they could secure because their systems were pressing for use. Far West University had in some sense perfected its communicative capabilities vis-a-vis its group of interest with the result that there was little channel noise in that system and, as a result of prior activity in the region, considerable readiness on the part of participants for the messages.

The notion of "readiness" invokes, of course, conceptions of information systems as educative agencies, i.e., agencies which move the cognitive or affective states of participants towards either real or created needs. Within education or training systems the changes that are the goals of the system are seen as taking place because of the characteristics of the system itself, not as a result of independent actions, primarily outside the system, undertaken by the student--although, of course, some readiness to enter instruction is required for success.

If we apply this kind of a model to the projects we observed a different set of sorting categories and evaluative foci emerge: we would attribute outcomes to the training system itself, to its match with the readinesses and capabilities of participants, its quality and efficiency as an instructional system. Context is, of course, important but it becomes in a sense peripheral to the primary focus of the analysis--it becomes a means by which participants are recruited and a source of some of the barriers that will interfere with implementation of learnings acquired in a project. As such, an instructional or educational conception of a project is a complement to a view of a project as a component in an information system..

A more or less standard set of descriptive and evaluative categories emerges from a model of this kind, and not all of the areas suggested by the model have been explored in this analysis. One such area in particular troubled us and inasmuch as the kinds of programs we saw were, to some extent, a response to NSF policy, some discussion is perhaps warranted.

Clearly the engineering concepts of the ECCP programs are not well understood by teachers, most of whom have a basic science background. One project director saw this problem most clearly from the first days of his contact with participants and spoke to us at length about his concern over the inabilities of teachers to think quantitatively, the hallmark, he thought, of the engineer's mind. He focussed much of his attention on this problem and although he was somewhat unsuccessful in communicating the idea of quantification to his participants he was surely correct in his assumption that unless teachers understood engineering concepts they would not be able to teach these concepts effectively. The difficulties that the teachers would have with this program

as a result of their cognitive problems would surely lead to a degradation of the conceptual structure of the program, itself only one manifestation of the larger domain of engineering concepts. We should note that we saw aspects of this problem manifesting themselves again and again: at one project much time was spent on an airport landing pattern activity, and it seemed as if the only participant who had a firm grasp on the problem (a model of a real world problem) was a teacher who was an air force reserve air traffic controller. At another time it seemed to us that it was a retired naval engineer participant who had the clearest capacity for moving readily with the ECCP materials and taking them further: he understood the lab equipment and seemed most able to see its potential and, perhaps, realize its possibilities.

We saw, however, far too little attention being given to this problem area in the course of the summer. Indeed to the extent that projects followed the increasingly widely understood prescription for inservice that teachers should experience the activities that were to offer their students, there seemed to be less attention to the problem of underlying theoretical or conceptual learning. Nowhere, given this point of view, did there seem to be an appropriate attention to engineering concepts. Given this, we wonder what the experience of teachers with the program in their schools might bring and how they might be buffeted by the demands of their students and their settings.

It can well be answered that we are positing an unrealistic criterion for a summer project and we recognize this. But, in conceding this, we come back to the analysis (derived from the work of Wirt and Quick) that we offered above. We can grant the limitations of a summer project format but still ask and expect that an implementation program in an area that is as problematic as this one engage the resource providing system more extensively than has this

program. The only site at which this engagement (in the aspect that we are exploring here) appears to have taken place was at Southern City University where a master's program addressing engineering concepts had been developed for teachers. Yet, the enrollments in this program are small (currently approximately 20) in proportion to the needs even of the Southern City region. Some attention to this problem would seem to be a necessary part of the planning for the development of an implementation system designed to make a systemic impact even for demonstration purposes. And, in another vein, one cannot but speculate on the implications of the cognitive inadequacies we are presuming for the long run use patterns of TMMW in the schools. Teaching is a complex cognitive act: teachers, as Lortie (1974) has noted, develop much of their cognitive capability in the course of their own school experience with the college experience serving to hone that experience rather than replace it. What happens when teachers do not have the cognitive capabilities that effective teaching requires?

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The thrust of our argument in this report has been to suggest that, if this summer's ECCP implementation program was representative of the programming of previous summers, it cannot be said that the ECCP implementation program has been effective, that some at least of the seeming problems of the program are understandable and begin at the point of initial dissemination. When the problems that the schools, themselves, experience when they seek to implement radically new programs, and when the tributions of ECCP itself are added to the picture (a function of the program's history), an explanation of the program's fragmentary success emerges very clearly. An approach to systemic impaction has not been seriously undertaken and such activity as there has been cannot

be regarded as conceptually cost-effective. The $3 m. devoted to this effort have not been well spent.

This conclusion is important both for an assessment of the future of ECCP and for its implications for planning of implementation of other programs like TMMW and TPE (although we must note that the problems facing TPE implementation seem less awesome than those confronting TMMW, if only because it has few competitors for its potential niche in the curriculum, a niche that all recognize needs attention). SUNY (1975) and Wirt and Quick (1975) have both noticed a marked difference between the original development programs that initiated the curriculum movement of the 'sixties and the programs that have come, and are coming, to fruition in the 'seventies. These newer programs (and TMMW is perhaps the prototype) do not have a natural place in the social system that is the curriculum of the American high school. The danger is that they will experience the same implementation difficulties that TMMW has suffered and that important, perhaps crucial curricular resources, will not be seen or evaluated by the schools. The root of the problem will be, we suggest, the implementation system inasmuch as it will not support in an appropriate way the development. If they are to be successful, these projects need a new kind of implementation system; one built upon a careful analysis and evaluation (more fundamental than that offered here) of the successes and failure of the existing system. Perhaps we can conclude this report with some reflections on this problem.

In the years after the intial movement of NSF into secondary school curriculum development an implementation system haltingly emerged to make available to the schools the products of development (NSF, 1975). This

system has evolved, of course, since its initiation in the mid-'fifties, but its essential characteristics have remained constant: it was and is a system designed to feed information and training into the existing institutions that constitute the curriculum of the secondary school. It was, and is, a system designed to update work done within existing subjects; it was not and is not a system designed to change those subjects in other than evolutionary ways. Summer institutes, academic year institutes, inservice institutes and the like are settings designed both to move information about what might be done more quickly to teachers and to instruct teachers in the ways and means associated with new programs. Spin-offs of all kinds have occurred: there have been changes in the practices of publishers and regulatory agencies, changes in the patterns of teacher education and the like--but all of these changes must be seen as firmly embedded in the characteristics and forms of functioning of the existing service delivery system than is the school. All of the programs, and the responses of the educational system to these programs, must be seen as epiphenomenal inasmuch as they reflect the forms and the needs of the system. Programming has been most effective when it has most closely matched needs in the system, or in parts of the system; when it has provided resources of information, programs and funds which permit the school system to actualize its own agendas.

Numerous criticisms can be made about the details of the functioning of existing mechanisms for program implementation, but we would argue that in the main the programs have achieved, and are achieving, their purposes (McKinney and Westbury, 1975; Wirt and Quick, 1975). The problem from our point of view rests with these purposes. They assume a more or less steady

state, they assume physics and mathematics; they assume an existing institutional capability which can be impacted by essentially marginal investments in innovative mechanisms--investments which are successful in their achieving their intents to the extent that they do, in fact, match existing systemically-derived needs. Where that match does not exist (as in, say, elementary school focussed programming) success becomes more problematic.

This argument foreshadows our conclusion. To achieve even successful demonstration of the curricular potential (or the educational utility) of new programs (e.g. TMMW), new institutions must be created; existing institutions and existing channels cannot do the job. They cannot assume existing systemic investments in resources, nor can they draw upon the influence and capabilities of the existing system. One consequence is seemingly prodigous expenditures for small gains inasmuch as there is only limited potential for multiplier effects. The programming we observed did not seem to recognize this problem and relied for its success on random responses of individuals and institutions. This is to be expected, of course, in the beginnings of any programming that has the potential of fundamental social change. But of systematic trail of a randomly emerging possibility is a legitimate goal of a national agency (and this is moot politically but not moot in principle), then purposive movement towards programming that produces (probabilistically) predictable outcomes must be initiated. Such outcomes are not emerging, seemingly, from the existing programs. We may be forgiven perhaps--what follows is special pleading--for suggesting that such programming will not emerge full-blown from the heads of planners but instead will come about as programming responds both to planning that acknowledges problems head on and

to incrementally successful social inventions that emerge in the marketplace. The goal, given a commitment to new forms, is new social institutions, and each such institution must be properly seen as an invention. Such responsiveness will only emerge as an agency interacts reflectively with the marketplace that exists in the multiple systems that make up the nation's school system. And this conviction brings us back to our study: three of the projects, Far West University, State University, and Southern City, seem to show what can be achieved by random individuals working in randomly occurring sites: the task of the planner and the program manager is to make such occurrences less random. It is probably unfair to suggest that these successes were occurring in spite of existing policy rather than as a result of those policies--but something close to this was said by many of the people we talked with this summer.

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