

ATO ASI Series

Advanced Science Institutes Series

Series presenting the results of activities sponsored by the NATO Science Committee, which aims at the dissemination of advanced scientific and technological knowledge, with a view to strengthening links between scientific communities.

Series is published by an international board of publishers in conjunction with NATO Scientific Affairs Division

Life Sciences Plenum Publishing Corporation
Physics London and New York

Mathematical and Kluwer Academic Publishers
Physical Sciences Dordrecht, Boston and London

Behavioural and
Social Sciences
Applied Sciences

Computer and Springer-Verlag
Systems Sciences Berlin Heidelberg New York
Ecological Sciences London Paris Tokyo Hong Kong
Cell Biology Barcelona Budapest

Global Environmental
Change

NATO-PCO DATABASE

An electronic index to the NATO ASI Series provides full bibliographical references (with keywords and/or abstracts) to more than 30 000 contributions from international scientists published in all sections of the NATO ASI Series. Access to the NATO-PCO DATABASE compiled by the NATO Publication Coordination Office is possible in two ways:

via online FILE 128 (NATO-PCO DATABASE) hosted by ESRIN,
via Galileo Galilei, I-00044 Frascati, Italy.

via CD-ROM "NATO Science & Technology Disk" with user-friendly retrieval software in English, French and German (© WTV GmbH and DATAWARE Technologies Inc. 1989).

The CD-ROM can be ordered through any member of the Board of Publishers or through NATO-PCO, Overijse, Belgium.



Series F: Computer and Systems Sciences Vol. 95

Comprehensive Systems Design: A New Educational Technology

Edited by

Charles M. Reigeluth

Instructional Systems Technology Department, Indiana University,
School of Education, W. W. Wright Education Building, 3rd and Jordan,
Bloomington, Indiana 47405, USA

Bela H. Banathy

International Systems Institute and Saybrook Graduate School,
25781 Morse Drive, Carmel, California 93923, USA

Jeannette R. Olson

Instructional Systems Technology Department, Indiana University,
School of Education, W. W. Wright Education Building, 3rd and Jordan,
Bloomington, Indiana 47405, USA



1993

Springer-Verlag

Berlin Heidelberg New York London Paris Tokyo
Hong Kong Barcelona Budapest

Published in cooperation with NATO Scientific Affairs Division

Principles of Educational Systems Design¹

Charles M. Reigeluth

Indiana University, Bloomington, IN 47405, U.S.A.

Abstract: A year prior to the NATO workshop described in this book, the first Asilomar Systems Conference was held (in 1989). One of the focuses of that conference was how to bring about systemic change of our current educational system. This paper describes the author's view of the results of those discussions: a stakeholder approach to educational systems design. It describes 15 activities that appear to enhance the success of system design efforts, and it identifies what appear to be the most important principles or guidelines for successfully carrying out each activity.

Keywords: Educational systems design, systemic restructuring, change process, stakeholder approach, parallel system approach.

Introduction

There is widespread recognition that *fundamental change* is needed in education. Since "A Nation at Risk" was released in 1983, over 150 reports have called for fundamental change rather than the traditional, piecemeal, "tinkering at the edges" approach to educational improvement (Perelman, 1987; 1988). Prominent trade magazines have devoted special issues to the topic (*Phi Delta Kappa*, December 1989 and January 1990; *Educational Leadership*, February 1988 and April 1990). Teachers' unions are advocating and experimenting with fundamental change (Futrell, 1989; Shanker, 1988; 1990; Watts & McClure, 1990). The American Association of School Administrators endorses fundamental, systemic change (Rhodes, 1988). The National Governors' Association is committed to such an approach to educational improvement (Cohen, 1988). And the United States Department of Education has established a national research and development center and a New American Schools program to further such an approach. Therefore, there is wide recognition that fundamental redesign of educational systems is necessary.

But fundamental change is far more difficult than piecemeal "add-ons." Fundamental change is *systemic*, in that a change in one aspect of the system requires changes in other aspects for it to be most successful (Banathy, 1988). This means that virtually all aspects of the

current educational system are likely to be changed, including the use of human resources (eg. the roles of administrators, teachers, assistants, and students), material resources (eg. space/classrooms, instructional materials, and advanced technology), and time (eg. grade levels, periods in the day, hours of operation, and days of operation). Therefore, there are many constituencies that must "buy in" to any fundamental changes, which greatly complicates the process for bringing about such change.

This article does not address the question as to what kinds of changes are needed or what our new educational system should be like. That question has been addressed elsewhere (Leonard, 1968; Reigeluth, 1987). Rather it addresses the question as to how to bring about fundamental change of our current educational system. It describes a *process* for designing a new educational system.

Three considerations impact on the nature of the process for fundamental change. First, at this point in time, there is no new model (representing fundamental systemic change) that has been field tested, debugged, and proven effective. Therefore, a process to implement fundamental change must be a process to **invent**, debug, and continuously improve a new system, not just adopt one. Second, if a fundamentally different educational system is to be successful, all the key players must be content with their new roles: students, teachers, administrators, policy makers, and parents. Therefore, the change process must be one that results in **shared ownership** of the new system. Third, since fundamental change entails new roles for the key players, the process must be one that effects substantial professional development to the point of **changing people's mind-sets** about education.

Given these three considerations, one can analyze the pros and cons of two fundamentally different approaches to educational systems design: the expert approach and the stakeholder approach. The **expert approach** entails one or a few creative experts in educational systems design engaging in a systems design process to plan all aspects of a new system. Then the new system must be "marketed" to school districts and/or state education departments, stakeholders must be informed and allowed to "buy in" or opt out, personnel must be retrained for their new roles, facilities must be reconfigured, and new learning resources must be procured. Finally, the original designer(s) must work with the personnel to debug and continuously improve the system. The disadvantages of this approach are that the experts may not be familiar enough with local needs and conditions, and that local stakeholders may not "buy in" to the new system and will likely feel less ownership and commitment.

The **stakeholder approach** is much more collaborative, requiring representatives of all stakeholder groups in a local school district to work together on a design team. The team must receive training in educational systems design so that they can effectively engage in a systems design process to plan all aspects of a new system. Access to outside expertise and resources are very helpful to the process. All stakeholders should constantly be kept informed by their representatives and allowed to "buy in" or opt out. Then personnel must be retrained for their

¹This paper was published in the *International Journal of Educational Research* and (with minor changes) is reprinted here with permission of the publisher, Pergamon Press.

new roles, facilities must be reconfigured, and new learning resources must be procured. Finally, the design team must work with all personnel to debug and continuously improve the system. The disadvantage of this approach is that the members of the design team may lack, and may not be willing or able to acquire, the mind-set and systems design expertise needed to break out of the current paradigm and successfully plan a viable alternative.

This paper reports on a process for implementing the **stakeholder approach** to educational systems design.

Overview

One year prior to the NATO Workshop reported in this book, there was a meeting of many of the same people in the same place (Asilomar Conference Center in Monterey, California). The participants were primarily people who had been involved in helping to bring about fundamental change in public schools using the stakeholder approach. They were from different regions of the United States and Canada and included representatives from three regional educational laboratories funded by the U.S. Department of Education: the Far West, the Mid-Continental, and the Northeast and Islands. They met for five days of intensive work sessions to synthesize their collective experience and wisdom into a common knowledge base about the process for fundamental change in education. What follows here is my view of the results of that "Asilomar Conference" effort. Please keep in mind that my view may not overlap completely with the views of other participants in the conference.

Discussions at the Asilomar Conference centered around two points of view for the change process: that of stakeholders inside a school district and that of an outside facilitator. This article describes a change process from the perspective of an **insider** using the stakeholder approach.

In the discussions, it became evident that there were certain activities that should be performed, and that in many cases there was an order for performing them. But it was also evident that a set of steps was not sufficient to successfully guide the process. On the contrary, it appeared to me that a set of **principles** or guidelines represented the most important knowledge about the change process, and that the steps just helped to indicate when the various principles might best be used. Accordingly, the following change process is a set of principles organized according to a series of ordered activities. But it should be kept in mind that even those ordered activities do not represent a linear order. Rather they are iterative. Some activities need to be done simultaneously, and it is often beneficial to revisit earlier activities at a later point in the process (Banathy, 1984). It should also be kept in mind that these principles, although based on participants' experiences, are offered here as hypotheses that remain to be rigorously tested.

Given those qualifications, the following is an outline of the activities under which the principles of educational systems design are nested:

1. Assess the readiness of the community.
2. Get an outside facilitator.
3. Get a commitment from all stakeholder groups.
4. Select an approach for the change effort.
5. Select participants for the coordinating council and design teams.
6. Prepare the participants.
7. Relate with nonparticipants.
8. Find common values and analyze learner and societal needs.
9. Develop core ideas and goals.
10. Develop an image, and design a system of functions.
11. Design enabling systems.
12. Analyze the feasibility.
13. Plan the implementation.
14. Implement the design.
15. Document/market the system.

The following is a discussion of hypothesized principles of educational systems design for each of these activities.

1. Assess the Readiness of the Community

There are some preconditions in a community which are essential for a fundamental change effort to be successful. For example, a poor relationship between the teachers' association and the district administration would make it almost impossible to have the kind of collaboration and trust necessary for a fundamental change effort to succeed. Furthermore, fundamental change is risky business, especially for administrators and school board members, who don't have tenure. Therefore, the top administrators and a majority of the school board members have to believe firmly in the need for fundamental change.

Teachers are on the front lines of the educational system. Corporate restructuring has recognized the importance of the "front-line" employees and has proceeded to invest much greater responsibility and decision-making authority in them. Whoever the personnel will be in the new system, they must "buy in" to the new system, and they must understand the new paradigm on which it is based. This leaves two alternatives: replace current people with new people who possess those qualities (if you can find them) or "retool" the people who are already there (if they are willing). From a practical point of view, **replacing** the current people is very difficult and expensive (if not, in many cases, next to impossible). And chances are

slim of finding replacements who are any better in terms of understanding and buying in to a new--as yet nonexistent--system. For **retooling** the current people, it is very helpful for the impetus for fundamental change to come from the teachers, and therefore for the change process to be led by one or more teachers. Furthermore, it is important for those teachers to be ones who are highly respected in the district and community. The process is not very likely to be successful if it is led by "oddball" teachers or by an administrator.

Similarly, the change process is far more likely to be successful if there is grass-roots community support for fundamental change. The support of respected parents, business leaders, and community leaders can provide the political support necessary for the school board, the administrators, and the teachers to feel they have a mandate to try something bold, or even radical.

In sum, a basic principle is:

- 1.1 Don't undertake the restructuring effort unless conditions are highly favorable.
 - There is a good relationship between teachers and the administration.
 - There is strong support for fundamental change from the top administrators and school board.
 - Some respected teachers are interested in leading the effort.
 - Some respected parents and business leaders are interested in supporting the effort.

2. Get an Outside Facilitator

Fundamental change is very difficult to bring about. In our current educational system, we are used to thinking in terms of win-lose situations, rather than win-win situations. Trust is essential for the change processes to be successful. A neutral outsider who can earn the trust of all participants can play an essential role in mediating the resolution of conflicts and in building trust among the participants.

Furthermore, the process of fundamental change is, among other things, a design process. Since there are no ready-made solutions, the first communities to change are going to need to invent their own solution. But the participants do not have any experience or training in designing a new educational system. While the leadership for the change effort needs to come from within the district, the effort will be much more likely to succeed if there is also a design-process facilitator from outside.

Therefore, additional principles are:

- 2.1 Select an outside facilitator who is an expert in the educational systems design process and whom all stakeholder groups trust.
 - Make sure the facilitator has no ulterior motives or predetermined solutions.
 - Make sure the facilitator has no favoritism towards any stakeholder groups.

- 2.2 Assign that expert the role of facilitator / consultant, not leader, of the process.

3. Get Commitments from All Stakeholder Groups

There are many stakeholder groups which have an interest in any changes that are made to our educational institutions, including students, parents, teachers, administrators, policy makers, and business and community leaders. The more of these groups which are strongly committed to fundamental change, the greater are the chances of a successful effort (all else being equal).

Perhaps the greatest incentive for commitment from each of these groups is a dissatisfaction with the current system. Therefore, one of the first activities you should undertake is to build dissatisfaction with the status quo. However, you must exercise great caution here, because such efforts could be divisive and build animosity and resistance to your change efforts. Therefore, you should probably first build dissatisfaction among those who have the greatest vested interest and responsibility for the current system: the central administration. Then, with their permission (or, better yet, at their request), proceed to other stakeholders: board members, building administrators, teachers, parents, students, and community and business leaders.

But building commitment entails more than building dissatisfaction with the current system. That alone can be negative, unless it is channeled in positive ways, such as providing a mandate for action and a commitment to provide necessary resources to take action. Given the importance of support from all the stakeholder groups, such action should likely be to form a collaborative design team with representation from every stakeholder group.

In sum, additional principles are:

- 3.1 Get commitments from all stakeholder groups to make fundamental changes in the educational system.
 - Get a mandate from all stakeholders to take action by forming a design team. This includes endorsements from the school board, the superintendent, the building administrators, the teachers' association, the parent-teacher association (PTA), business leaders, and community leaders.
 - Get a strong resource commitment from the administration and school board to act on the recommendations of the design team. You may also need to get a resource commitment from the business community.

4. Select an Approach for the Change Effort

There are two different approaches that can be used in a fundamental change effort: whole-district and parallel-system. The **whole-district** approach entails changing the entire district

at once. On the other hand, the **parallel-system** approach entails allowing teachers who want a change to design and implement a separate school or schools in the district and a separate administrative system for the school(s), while giving teachers who do not want to change the option of continuing with "business as usual."

The whole-district approach has the disadvantage that teachers and parents who don't want to change are likely to sabotage, or at least water down, the change effort. It is also likely to take much longer to design and implement. Furthermore, the resulting schools in the district would be more likely to be quite similar to each other than if different design teams were designing different schools for the district. This last problem could be mitigated by the way the whole-district approach is implemented.

The parallel-system approach has the disadvantage that the new system might be viewed with hostility, or at least benign neglect, by the people who have elected not to be a part of it. Hence, fundamental change would be less likely to occur in the rest of the district. However, it is possible that the whole district could buy into the notion of the parallel system as a trail-blazing experiment which, if successful, would be followed by a fixed timetable for the rest of the district to switch over, one school at a time, to the new system. One expectation of this approach is that the advantages of the new system for both students and teachers would lead both groups to want to switch over in roughly equal proportions. However, if there were to be an imbalance, strife would almost certainly result, either with teachers who are reluctant to switch over being forced to by parental demand, or with parents who are reluctant to switch over being forced to by teacher action.

Perhaps the decision as to which approach to use should be made largely on the basis of the proportion of teachers and parents in a district who are favorably disposed to fundamental change. If it is higher than a certain amount, then perhaps the whole-district approach would have the best results in the long run; but below that amount, the parallel-system approach might be best. My hunch is that the parallel-system approach will usually be better because it will be quicker, less stressful for teachers and parents who don't want to change, and less risky for administrators and board members to implement. But this is an empirical question that needs to be tested.

In sum, additional principles are:

- 4.1 Use the whole-district approach if most teachers, parents, and other stakeholders in the district are favorably disposed to fundamental reform.
- 4.2 Use the parallel-system approach if a sizable number of stakeholders in the district are resistant to fundamental reform.

5. Select Participants for the Coordinating Council and Design Teams

For the **parallel-system approach** it is wise to have both a coordinating council and design team(s). The **coordinating council** is a district-wide group whose purpose is to give a district- and community-wide identity to the redesign effort. The council should represent all stakeholders, should have as many nonschool as school representatives, and should be empowered by the school board to make administrative decisions regarding all redesign efforts. Depending on the size of the school district and community, the council should be comprised of 25 to 40 people who are selected because they have the respect and trust of their respective stakeholder groups (constituents), or because they are members of the design team(s). The council members should all be involved in pyramid groups with their respective stakeholders, both to inform them and to be informed by them. (In pyramid groups, each member meets with a certain group of constituents to pass information to them and to get input from them. Then each member of that group meets with another group of constituents to do the same, and so on until all interested people are involved.) The coordinating council should engage in activities 6 - 9, whereas the design team(s) should focus mainly on 10 - 15, with the coordinating council providing support and watching to ensure that the district-wide values, needs, and goals are being addressed.

Each **design team** should be a school-based group whose purpose is to design a new school within the district. The selection of the participants is a crucial activity. Lack of representation of a stakeholder group could lead that group to mistrust and eventually resist (or even sabotage) the change effort. Furthermore, the design team is likely to have a difficult time reaching consensus on any fundamental changes unless the participants are open-minded, collaboration-oriented people who share a strong dissatisfaction with the current system.

Literature on group process has found that group dynamics change notably when group size exceeds about 15 people. This has important implications for design team size, as well as school size. Given that literature on school size also shows clear advantages for smaller schools (Gregory & Smith, 1987), it seems likely that the new schools in a parallel system should be comprised of a maximum of about 10 teachers and minimum of about 5. This would allow *all* the teachers who will comprise a new school to be on the design team for their school, along with a representative from each of the other stakeholder groups. This is particularly important, because the purpose of the design effort is not only to create a blueprint for a new school, but also to create an appropriate change of mind-set about schooling in the people who will staff the new school.

If more than 10 teachers in a district are interested, then several separate schools should be designed, each by a separate design team. Preferably, each of those schools will become a "school within a school" so that teachers will not have to be moved from one school building to another and so that parents will not be forced to choose between their neighborhood school and

the kind of school they think will be best for their child (new or old). Then all design teams should collaborate on the design of an administrative system to govern and support them.

In contrast, for the **whole-district approach**, all teachers in all schools will be changing to the new system, but not all the teachers can be on the design team, for that would make it unwieldy. In this case, to get broader representation and participation, it might be advisable for the design team to have several working groups, each chaired by a member of the design team. Rather than each working group designing a whole new system just for its members, each would work on one aspect of the new system (e.g., design one subsystem) and the design team would orchestrate the efforts. Pyramid groups should also be used with this approach.

In sum, there are several principles that are important regardless of which approach is used, but some will also vary depending on approach.

- 5.1 All stakeholder groups should be represented on all councils / teams / groups: parents, administrators, board members, teachers, students, business leaders, community service agency leaders.
- 5.2 All design team members must be viewed as of equal status in the design effort.
- 5.3 Only enthusiastic volunteers should comprise the design team. No teachers should be required or even pressured to participate.

For the parallel-system approach:

- 5.4 The coordinating council should be comprised of highly respected opinion leaders in the district and community.
- 5.5 Each design team should be small (about 15 people).
- 5.6 Each design team should select a leader who is an opinion leader among the teachers in the district, has good interpersonal and group-process skills, and is highly motivated to redesign the system.
- 5.7 Each "New School" should be small (about 6-10 teachers), and all of its future teachers should be on the design team. This results in essential buy-in, as well as in-service professional development.
- 5.8 If possible, have more than one, but no more than about three, design teams working independently. Having more than one will increase the chances and speed of finding a good model for the new schools. More than three would likely be too expensive and too difficult for an outside facilitator to support.
- 5.9 The coordinating council and pyramid groups should be used to get the rest of the district to view the design teams as trail blazers for them to eventually follow once the best trail is found and there is evidence as to how much better it is than the "road more traveled."

For the whole-district approach:

- 5.4 The design team should be comprised of highly respected opinion leaders in the district / community.

- 5.5 The design team should select a leader who is an opinion leader among the teachers in the district.
- 5.6 Working groups should be formed to do most of the detailed design work.
- 5.7 Each working group should be small (about 15 people).
- 5.8 Pyramid groups should be formed to involve all interested stakeholders.

6. Prepare the Participants

The fundamental change process is first and foremost a systems design process. But the participants on the design team will be people who have no experience or training in systems design. It is very difficult to break out of the prevailing mind-set--the prevailing paradigm--to design a completely new, complex, human-activity system. Therefore, the design team participants (and coordinating council and working group participants) should receive some training for this novel task. Given such training, the design team will be prepared to design its own design process, or at least modify a generic design process for its particular needs and conditions. It will also be prepared to set criteria to judge the quality of any designs it creates.

Hence, additional principles are:

- 6.1 All members of the design team (and coordinating council and working groups) must receive training in the design process, including:
 - Paradigm shifts.
 - Systemic view.
 - Needs-based approach (societal and learner needs).
 - Levels of design, starting with the learning-experience level (Banathy, 1991).
- 6.2 The design team should design its own design process.
- 6.3 The design team should develop criteria to evaluate its design (the new system).

7. Relate with Nonparticipants

Regardless of whether you use a whole-system approach or a parallel-system approach, many stakeholders (teachers, parents, administrators, students, policy makers, business leaders, community service people) will not be directly involved in the effort. But many of those same people can do much to sabotage the effort if they start feeling threatened, left out, or dissatisfied with the direction that the effort is going. Therefore, the following principles are important to keep in mind:

- 7.1 All teachers in the district should be assured that none of them will be forced to change.

- 7.2 All stakeholders in the district must view the effort as designing and testing a prototype that could work anywhere in the district. The fundamental change effort must not be viewed as creating another "alternative school."
- 7.3 The design team must constantly share its thinking with all other stakeholders in the district, at each and every stage of its process, and solicit input from them. This should be done throughout the change process, not just at one point in time. Pyramid groups are an excellent vehicle for doing this.

8. Find Common Values and Analyze Learner and Societal Needs

The purpose of an educational system is to meet the needs of society and its individual members. An educational system is a subsystem--a part of a larger system--of society. Like all subsystems, the educational system must meet the needs of the larger system of which it is a part, or the larger system will act to change it or replace it. And it must deal with the conditions of the larger society or it will not be able to perform its functions. Over the past 25 years, our educational system has gotten steadily worse in spite of greatly increased real expenditures on education (Perelman, 1987). As we have evolved into an information society, the needs of society have changed in ways that render our educational system inadequate to meet those needs. Therefore, any effort to redesign the system should begin with a careful analysis of the ways society is changing and is likely to change in the future as we get deeper into the information age (Banathy, 1991). And we should then explore the educational implications of those changes. Those implications should be couched in the form of educational needs of individual learners, as well as those of the society as a whole.

Furthermore, any design for a new system of education will be based on values. Different values will naturally lead to different features for the system. Therefore, to achieve consensus on the nature of the new system, the design team members must first achieve consensus on their related values.

The following principles reflect these considerations:

- 8.1 Design team members should share a great dissatisfaction with the status quo in their schools.
- 8.2 Design team members should explore and share their own values regarding such things as:
- Their own experiences as a student.
 - How they would like to learn.
 - Their personal goals and motivations in becoming an educator or in becoming involved in this educational design effort.

8.3 Design team members should arrive at a common view of:

- Societal needs to be met by their new system.
- Learner needs for an information society, to be met by their new system.

9. Develop Core Ideas and Goals

Once common values and learner and societal needs have been identified, the next activity is to identify core ideas and goals that implement them. Core ideas are fundamental characteristics of the new system, and goals are what the new system should accomplish. These core ideas and goals will in turn provide the basis for developing an image of the new system (discussed next). For examples of core ideas and goals, see Banathy (1991). In sum:

- 9.1 A unifying set of core ideas and goals should be developed, based on present and future needs of society and learners.

10. Develop an Image, and Design a System of Functions

Core ideas and goals provide the basis for developing an image of the new system. The image is similar to the core ideas, except that it is more complete, detailed, and systemic. It is systemic in the sense that all the major functions of the system and their interrelationships have been conceived in such a way as to work together well as a system.

A major obstacle to this activity is the difficulty, especially for those closest to the current system, of "breaking set" with the current system, of breaking out of the current paradigm and envisioning alternatives. One of the most effective ways to overcome this obstacle is to discuss a variety of alternative images or paradigms, such as the one-room school house, my "third-wave" system (Reigeluth, 1987; 1991), or Leonard's (1968) image. In doing so, it is advisable to start by envisioning the kinds of learning experiences that the new system should support, then envisioning the kinds of instructional support necessary to implement those learning experiences, then envisioning the kinds of administrative support needed, and finally envisioning the kinds of governance (district and state policy support) needed (Banathy, 1991). And the envisioning on the learning-experience level should be based heavily on the values, needs (societal and learner), and core ideas and goals from Activities 8 and 9.

The following principles are based on these ideas:

- 10.1 The design team members should be exposed to alternative educational systems to "break set" with the current system.
- Read about alternatives.
 - Listen to credible outsiders.

- 10.2 The design team should initiate imaging at the learning experience level after careful consideration of how learning occurs, and gradually progress to the instructional, administrative, and governance levels.
- Write stories about "a day in the life."
- 10.3 The design team should use the needs-based approach for envisioning the new system.
- Work from societal and learner needs, based on changes in society.
- 10.4 Design a system of functions which is the first "model" (or blueprint) of the future educational system (Banathy, 1991; Checkland, 1981).
- Work from societal and learner needs, and the image.

11. Design Enabling Systems

Once the image has been developed and the design of the system of functions has been accomplished, progressively more detail can be worked out for the system functions by designing the enabling systems (Ackoff, 1981). The image gives a holistic, systemic view that helps to keep the design of each subsystem on track, so that each subsystem will work well with all of the other subsystems.

The following are some principles or guidelines to keep in mind:

- 11.1 Start at the learning experience level, and gradually progress to the instructional and administrative levels.
- 11.2 Using an "ends-to-means" approach, gradually work out more and more details for the enabling systems/subsystems--that is, details for the system that will guide the carrying out of the functions.
- 11.3 Throughout the design process, focus on interactions and interrelationships among people and among system components.
- 11.4 Be sure to design a separate administrative system for the new system.

12. Analyze the Feasibility

At this point, the new system has been designed--a model has been created. This model should be an "ideal", that has not been constrained by particular barriers and obstacles that might exist in the district/community (Banathy, 1991). Experience has shown that this approach almost always results in a superior change, because many barriers and obstacles that were initially thought to be insurmountable in fact end up being surmountable. However, it then becomes necessary to identify any and all barriers and obstacles, find out which ones are presently surmountable, which ones may be surmountable at some time in the future, and which ones are

not likely ever to be surmountable. Often, rather than being a black-or-white issue, there are tradeoffs to be made. And resource needs must be identified.

Therefore, the following are useful principles to keep in mind:

- 12.1 The design team should identify barriers and obstacles, along with alternative solutions for each.
- 12.2 It should identify tradeoffs/compromises that might have to be made.
- 12.3 It should identify resource needs for the transition process.
- 12.4 It should identify incentives and rewards for engaging in the fundamental change effort.

13. Plan the Implementation

Once you have arrived at a feasible model for the new educational system, its implementation should be planned. Implementation is a difficult and expensive process, even though the new system, once implemented, will likely be more cost-effective than the current system. Therefore, a master plan should be created in considerable detail to guide the implementation effort, and that plan should be approved by all stakeholder groups, especially those invested with authority and resources in the district/community.

But a master plan is not enough. Those who will be doing the work need a support network, for there will inevitably be times of disappointment as well as times of elation, there will be failures as well as successes on the road to implementation. And the implementors will need training to help them implement the new system, especially wherever new roles for personnel are called for. Implementation planning should also include any redesign of facilities and procurement of new equipment and other resources called for by the model of the new system.

In sum:

- 13.1 A master plan for action should be developed in considerable detail, and appropriate approvals should be obtained.
- 13.2 Coalitions and support networks should be built.
- 13.3 Plans should be made for training personnel who will fill new roles called for by the model.
- 13.4 Plans should be made for any redesigning and remodelling of facilities called for by the new model.
- 13.5 Plans should be made for procuring and installing any resources and equipment called for by the new model.
- 13.6 Sufficient time and money must be provided for all these activities.

14. Implement the Design

At this point the major remaining activity is to carry out the implementation plan and work the bugs out of the new system. However, the proverbial cup isn't at the lip yet, and there is still plenty of room for a slip. In one district I've worked with, a few parents got "up in arms" because they wanted their children to learn the same way they had learned. And there will inevitably be many problems that need to be ironed out, no matter how well conceived your model is. Time and resources need to be allocated to working out such problems. Some functions and subsystems may need to be redesigned. The design team should remain active, but in a trouble-shooting mode.

The following are some principles to consider:

- 14.1 You should only accept students whose parents volunteer them to attend the new school.
- 14.2 Trouble shooting, problem solving, and redesign should be continuous. The design team should meet frequently to discuss problems and "fine tune" the new system.
- 14.3 Don't expect things to work well at first. Allow at least three years of operation before conducting any summative evaluation.

15. Document / Market the System

So, now your work is done? Not quite. If you are using the parallel-system approach, this fundamental change effort is but the first step in getting the district to change. It is important to show other teachers how much better the quality of work life is in the new system, and to show other parents how much better their kids' education will be in the new system. Neither teachers nor parents should be forced to change; but, if the new system is working better than the old, you have a moral obligation to share what you have learned. And whether you are using the parallel-system approach or the whole-system approach, it is important to show other districts/communities the advantages of the new system and share with them the process you found most helpful. The following principles are relevant:

- 15.1 Use a broad range of measures, including traditional tests as well as nontraditional assessments of:
 - thinking skills and learning strategies
 - attitudes toward learning and school
 - emotional/psychological development
 - social development
 - moral/ethical development
 - development of creativity.

- 15.2 Share the process, experiences, and results with other stakeholders, especially teachers, and with other districts/communities.

Summary

It is well recognized that fundamental change is needed in education. What we don't know is what the new system should be like. Therefore, the traditional change model of disseminating and implementing an innovation (e.g., Rogers, 1983) is inadequate to the task. We must focus more on the process of change--as a design process--than on the products of change--ready-made solutions (new educational systems). Although the expert approach may work, perhaps we need a change model in which the users of the innovation (the stakeholders) are also the designers of the innovation.

In this article, I have presented a tentative model for a fundamental change process using the stakeholder approach. The model is based largely on the experiences of people well versed in systems design. But much work is needed to test and improve this process model. Furthermore, it seems likely that, as new systems are designed and implemented, the optimal process may change. On a scale ranging from pure invention by the users on one extreme to pure adoption of someone else's invention on the other, the optimal position may well gradually shift from close to the pure invention side to moderately close to the pure adoption side (adoption with slight modifications) over the next decade.

My hope is that this tentative process model will provide a useful springboard, if not foundation, for further development of powerful process models for the fundamental change of our educational system.

References

1. Ackoff, R.L.: *Creating the Corporate Future*. New York: John Wiley & Sons 1981
2. Banathy, B.H.: *Design in the context of human activity systems*. San Francisco: International Systems Institute 1984
3. Banathy, B.H.: *Systems inquiry in education*. *Systems Practice*, 1 (2), 193-212 (1988)
4. Banathy, B.H.: *Educational Systems Design: A Journey to Create the Future*. Englewood Cliffs, NJ: Educational Technology Publications 1991
5. Checkland, P.: *System Thinking, System Practice*. New York: John Wiley & Sons 1981
6. Cohen, M.: *Restructuring the education system: Agenda for the 1990's*. Washington, D.C. National Governors' Association 1988
7. Gregory, T.B., & Smith, G.R.: *High Schools as Communities: The Small School Reconsidered*. Bloomington, IN: Phi Delta Kappa Educational Foundation 1987
8. utrell, M.H.: *Mission not accomplished: Education reform in retrospect*. *Phi Delta Kappan*, 71 (1), 8-14 (1989)
9. Leonard, G.: *Education and Ecstasy*. New York: Delacorte 1968
10. Perelman, L.J.: *Technology and Transformation of the Schools*. Alexandria, VA: National School Boards Association 1987

11. Perelman, L.J.: Restructuring the system is the solution. *Phi Delta Kappan*, 70 (1), 20-24 (1988)
12. Reigeluth, C.M.: The search for meaningful reform: A third-wave educational system. *Journal of Instructional Development*, 10 (4), 3-14 (1987)
13. Reigeluth, C.M.: In B.H. Banathy (ed.), *Educational Systems Design: A Journey to Create the Future*. Englewood Cliffs, NJ: Educational Technology Publications 1990
14. Rhodes, L.A.: We have met the system - and it is us! *Phi Delta Kappan*, 70 (1), 28-30 (1988)
15. Rogers, E.M.: *Diffusion of Innovations*. (3rd ed.). New York: The Free Press 1983
16. Shanker, A.: Reforming the reform movement. *Educational Administration Quarterly*, 24(4), 366-373 (1988).
17. Shanker, A.: The end of the traditional model of schooling - and a proposal for using incentives to restructure our public schools. *Phi Delta Kappan*, 71 (5), 345-357 (1990)
18. Watts, G.D., & McClure, R.M.: Expanding the contract to revolutionize school renewal. *Phi Delta Kappan*, 71 (10), 765-774 (1990)

Structuring the Program of the NATO Advanced Research Workshop: An Architecture of Decision-Oriented Disciplined Inquiry

Bela H. Banathy

International Systems Institute and Saybrook Graduate School, 25781 Morse Drive, Carmel, CA 93923, U.S.A.

Abstract: Conclusion-oriented disciplined inquiry—the domain of the scientific disciplines—is concerned with generating knowledge about what *is* and describing it. Decision-oriented disciplined inquiry focuses on the use of knowledge for making decisions about what *should be*. Systems design is a decision-oriented inquiry. It creates a model of a future system. An architecture for selecting methods of systems design and carrying out design is introduced in the paper. The architecture also provides a framework for the organization of the workshop.

Keywords: Systems design, design architecture, disciplined inquiry, conclusion-oriented disciplined inquiry, decision-oriented disciplined inquiry, designing the design inquiry, systems inquiry.

Introduction

In this paper an architecture is presented which offers a framework for organizing the approaches / strategies / methods for conducting any disciplined inquiry. The architecture was proposed for use at the NATO advanced research workshop as a framework for organizing our own inquiry. The paper has four parts.

In Part One, decision-oriented disciplined inquiry (DODI) is defined in the larger context of disciplined inquiry and is juxtaposed with conclusion-oriented disciplined inquiry (CODI). Design is defined as one mode of DODI. From this discussion emerges the rationale for the use of an architecture for DODI. In Part Two, I introduce the use of the architecture I developed earlier in conducting design inquiry in the context of designing human activity systems.

In Part Three, the architecture is used in the planning of design inquiry itself, and this mode of use is demonstrated in the context of a specific situational application. In Part Four, I propose to use the architecture for the organization of our own inquiry. The first three parts help to set the stage for approaching Part Four.