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ABSTRACT

When implementing an innovation, a multitude of components interact to change not only the users, but the innovation as well. This guide explains the concept of innovation configurations, or adaptations made in innovations during implementation. After presenting and discussing past research on innovation changes, the report outlines a five step procedure for identifying these changes. A one year study testing these steps is described. The report concludes with a discussion of problems arising in implementation and evaluation of an innovation, including evaluator subjectivity, degree of change in the individual or innovation, and the complete alteration of the innovation. (CJ)

Innovation Configurations:

Analyzing the Adaptations of Innovations

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Change is a major characteristic of our modern world and the replacement of old ways of doing things with new methods is a common sight in all institutions and organizations which wish to keep pace with society. Schools and colleges are no exception to this and most have sampled innovation products and processes in attempts to solve the problem of how to best educate their students. Unfortunately, it has often been discovered that many sophisticated and well-researched educational "innovations" do not significantly improve student performance.

When the outcome of a change effort is measured and the conclusion is that there is "no significant difference" in performance, the innovation naturally takes the brunt of the blame. However, research on the implementation of innovations at the Texas Research and Development Center suggests that the innovation may not always be at fault. It is clear that educational innovations can become changed significantly during implementation and their operational forms often bear little resemblance to the theoretical models for their developers.

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In this paper the concept of innovation configurations is introduced to describe the adaptations made in innovations during implementation. A procedure for identifying configurations is suggested and research and evaluation studies utilizing this procedure are referred to. The paper concludes with discussion of issues that surface with understanding of the concept and implications for evaluators, developers and facilitators.

Background

Over the past several years, the *innovation* has been the subject of much research in the field of education. Researchers first made an effort to define the term as it is used in education and to describe the characteristics of an innovation. Later, implementation of the innovation became a focus of study, and it was noted that innovations can become changed during the process. Most recently innovation research has centered around learning how to measure and evaluate the effects of implementation.

Innovation Characteristics

Exacly what is an innovation? Many researchers have approached this question. In their important review of knowledge-utilization studies, Rogers and Shoemaker (1971) offered the following definition of the term *innovation*:

> An *innovation* is an idea, practice, or object perceived as new by an individual. It matters little, so far as human behavior is concerned, whether or not an idea is "objectively" new as measured by the lapse of time since its first use or discovery. It is the perceived or subjective newness of the idea for the individual that determine his reaction to it. If the idea seems new to the individual, it is an innovation(p. 19).

In an effort to describe innovations, Rogers and Shoemaker proposed a set of *perceived* attributes which represent five distinct innovation characteristics. These were extrapolated from the authors' review of past studies: (1) relative advantage, (2) compatibility, (3) complexity, (4) trialability, and (5) observability.

A more extensive list of innovation dimensions was proposed by Zaltman and Lin (1971). Their twenty dimensions relate the importance of change to the participants and the outcome of adoption. Their list includes such dimensions as cost (both financial and social), efficiency, perceived work, structural radicalness, divisibility of innovation practice, and susceptibility to successive modifications.

Continuing the effort to describe the characteristics of innovations, Chin and Downey (1973) developed a set of definitions relative to the type of *change* that is produced. They identified four different approaches: (1) change in terms of relationships to goals of the system, (2) change as any substantive difference in the client system, (3) change by some theoretical model, and (4) change in a methodological process of a system.

The Effects of Implementation on the Innovation

There is now increased awareness that change is a process, not an event. Only recently have researchers, policy makers, and practitioners all become more aware that implementation is a key phase in the change process (Berman, McLaughlin, Bass, Pauly & Zellman, 1977). Also, evaluators are discovering that what is being implemented must be assessed directly (Hall & Loucks, 1977). If it is not, there is the danger of trying to measure a change that has not occurred. Charter and Jones (1973) referred to such situtations as "nonevents".

During the course of implementation, a multitude of variables interact to change not only the users, but the innovation as well. Different conceptual perspectives and terminologies have been proposed to describe an innovation as it undergoes change during implementation. Agarwala-Rogers, Rogers and Wills (1977) have proposed that the term *re-invention* be used to represent the "degree to which an innovation is changed in the process of implementation (p. V)."

Probably the best known recent study that has identified innovation adaptation is that published in several volumes by the Rand Corporation (Berman & McLaughlin, 1975). The authors report on their extensive analysis of policy and system practice relative to the implementation of federal change agent projects. A key concept from the research is that of *mutual adaptation*, which is defined as "an organizational process in which an innovative plan is developed and modified in light of the realities of the institutional setting, and in which the organization changes to meet the requirements of the innovative project" (Greenwood, Mann & McLaughlin, p. 31, 1975).

Emrick, Peterson, and Agarwala-Rogers (1977) viewed the innovation as a key variable when they evaluated the National Diffusion Network. As have others, they concluded that:

> There is a trend for adopters (56%) to begin implementing only selected aspects of the innovation rather than the entire innovation. At the same time, adopters will modify methods and materials in what they believe are reasonable ways, so as to make the innovation more consistent or compatible with local conditions (p. 116-8).

Emrick, et al. point out that most of the modifications are viewed as small by the adopters, with less than 20% reporting large changes, although in one site "the re-invention process was so complete that the innovation had been renamed and the staff insisted that they were not now adopting the developer's project, but had their own innovation (p. 119)."

Sikorski, Turnbull, Thorn and Bell (1976) also recognized the consequences of implementation for the innovation. Supporting the notion that change in the innovation is inevitable, they discuss how this can be dealt with:

> Recognizing that adaptation may be an inevitable part of the change process, we believe that some change strategies should be geared directly to *adaptive modification* of innovations. This

> could take place in two ways: (1) the development process could include attention to an innovation's susceptibility to adaptive modification, and (2) implementation assistance could help users make systematic adaptations of innovations.
>
> During development, the mechanism of field testing offers one opportunity to find out how users might need to modify an innovation but to yield this information a field test would have to be fairly sustained--unlike the prevalent approach of giving users a brief experience with the innovation.
>
> When users are implementing an innovation, the people assisting them might work for systematic adaptation rather than replication of a model. In a rough way, each site could evaluate an innovation iteratively--beginning to implement it, observing the results, modifying either the innovation or the implementation strategy, observing the new results and so on. Too much evaluation can strangle an innovation, of course, but technical assistance might offer simple methods of gathering and analyzing such information in order to make continuous improvements in the innovation (p. 19).

This suggestion to look closely at just how an innovation is being implemented has been pursued by evaluators who are faced with assessing innovation effects in real world settings.

Evaluating Implementation

It can no longer simply be assumed that an innovation is in use in an unaltered form just because it is supposed to be. In their evaluation studies of Follow Through Models, Stallings and Kaskowitz (1974) were among the first to establish a set of procedures to verify that an innovation was actually in use before collecting evaluation study data. In their study, innovation developers were surveyed for descriptions of what the innovation should look like in use. The presence of these characteristics in study classrooms was then documented.

Evans and Scheffler (1974) also concentrated on the innovation and how it was being implemented when they evaluated the Individually Prescribed Instruction (IPI) mathematics program. In their work they attempted to assess which of eleven developer-identified innovation categories were in use at each study school. They discovered that not only did the degree of implementation of the innovation (i.e., the number of categories observed) vary among schools, but that there were even differences in the categories.

The problems of how to measure the degree of implementation of an innovation are just beginning to be understood. Gephart (1976) has identified several classes of measurement problems and more recently Owens and Haenn (1977) have developed a clear summary of the difficulties. The latter authors also provide illustrations of how they have handled the problems in their evaluation of Experience-Based Career Education (EBCE).

In a study of what they call "program residuals", Mitroff and Boston (1977) looked at the use of innovations in a large urban school system after implementation support under Title I of ESEA had ended. They developed a procedure involving survey forms, questionnaires, and personal interviews to discover how and if innovations were being used a year after the end of implementation support.

Fullan and Pomfret (1977) have addressed many of the issues related to measuring the innovation as a variable in the change process. They point out the complexity of understanding and measuring the changes in an innovation during implementation:

> One of the most complex and important issues regarding the formation of research instruments concerns the two perspectives of fidelity and adaptation. It may be that the fidelity perspective with consequent specific instruments, is most applicable when studying the implementation of prepackaged, relatively explicit innovations. This approach is more questionable when innovations are at the early stages of development and use. Whichever perspective one uses, it is advisable to view the measurement of the implementation as a "snapshot" of what users are actually doing with respect to the innovation at one point in time. It is important to consider that the nature of innovations in use may transform over time and that we need measurements to detect these changes in further specification, redefinition, or development (p. 367).

Emrick, et al. (1977) came to a similar conclusion about the time factor in their NDN evaluation:

> The sample of adopters studied by observation or survey in this evaluation showed the implementation process to be very complex and uneven, which means that estimates of actual diffusion

> will vary considerably, depending upon when assessments are made. Also, actual implementation appears to be so gradual and cumulative that early assessments of diffusion will probably underestimate the phenomenon (p. 119-120).

Fullan and Pomfret conclude:

> The main implication of this discussion is that researchers and practitioners in change situations should be oriented to addressing continuously the program explicitness and degree of complexity of educational innovations that they are attempting to use (p. 371).

PAEI Research

In an attempt to develop better understanding of the change process, the Procedures for Adopting Educational Innovations (PAEI) Program of the University of Texas Research and Development Center for Teacher Education is studying innovation implementation in schools and colleges. Although elsewhere extensive study has been made of innovations from the point of view of dissemination and the adoption-decision, much less is known about innovations from the point of view of their actual functioning at adopting sites. Thus, PAEI research has focused on innovation implementation at the user level.

The conceptual basis for the PAEI research is the Concerns-Based Adoption Model (CBAM) (Hall, Wallace & Dossett, 1973). In the CBAM, the *individual* and the *innovation* are the frame of reference from which the change process is described. The individual and the innovation have been the cornerstones for PAEI research as well.

Two critical dimensions for describing innovation implementation from the individual perspective have been identified in the CBAM and researched in the PAEI Program. These dimensions are Stages of Concern About the Innovation (Hall & Rutherford, 1976) and Levels of Use of the Innovation (Hall, Loucks, Rutherford & Newlove, 1975). Procedures for assessing these dimensions have been developed and a series of cross sectional and longitudinal studies have been conducted, which have initially verified the existence of seven Stages of Concern and eight Levels of Use.

The Stages of Concern dimension deals with how users (usually teachers) feel about an innovation from the time they first become aware of it until they have mastered it. It has been discovered that users are first concerned about how an innovation will affect them personally. Later concerns shift to how to complete the tasks related to using the innovation. Finally, users become concerned with the impact of the innovation on pupils.

The Levels of Use dimension operationally defines the various states of user behavior, that is, exactly what a user is doing with an innovation. The levels begin with complete nonuse of an innovation and move to orientation about it. Preparation is the next step, followed by mechanical use. Eventually, use of an innovation becomes stabilized and routine. At this point, users may begin to refine their use of the innovation. Later they may integrate their refinements with their colleagues. Lastly users may reach a point where they reevaluate the use of an innovation and begin to seek major modifications in it.

It was while conducting Stages of Concern and Levels of Use studies involving more than 800 teachers and professors that it became glaringly apparent to PAEI researchers that a single innovation is seldom operationalized in the same way at different field sites and in different classrooms. Indeed, it was discovered that no two individuals were using exactly the same form of the innovation being studied, nor did they agree on the same operational definitions. While sometimes the adapted forms of the innovation were only slightly different from each other, at other times the innovation was almost unrecognizable.

It is clear from PAEI studies and other innovation research that there is a need for conceptualizing and measuring the changes made in an innovation during implementation. The concept of *innovation configurations* has been developed to meet this need and to provide a framework for the discussion of the issues brought to light by previous research and evaluation efforts.

Innovation Configurations, The Idea

The developer* of an innovation usually has a "model" form or forms of the innovation in mind. Whether specified as such or not, this model will contain certain key characteristics or components that are essential to the innovation.

As the innovation is disseminated and the developer's model is translated into practice in different classrooms, it may be unrecognizable. At the very least, one or more components may be "adjusted" to fit local needs. In a study of team teaching at the Texas R&D Center, for instance, the size of the team, the number of grade levels, what was planned as a team, and team member instructional responsibilities were all components that varied across sites. A similar study of instructional modules, the components of objectives, packaging, instructor role, and alternative enabling activities were all identified as dimensions along which the innovation varied. At different sites, different components may be adapted in different ways. Thus, any one innovation can be said to have several different operational forms or *innovation configurations*.

Innovation configurations are the operational patterns of the innovation that result from selection and use of different innovation component variations. The components will be different for different innovations, but will generally include characteristics of the innovation such as materials and role and style of the user and clients. Each component can be varied or adapted. How the

*In this paper the term developer is used throughout to refer to the individual or group that originally conceived an innovation. The specific job function of a developer is immaterial in this instance.

component variations are selected, how they are organized, and the way they are used by the actors result in different operational forms of the innovation or different innovation configurations.

The key to identifying innovation configurations is to first determine the components and the component variations that describe the innovation in use. The degree of specificity and the complexity needed is best determined by considering the use to be made of the information. An innovation developer may emphasize ten components while a practitioner may consolidate these to three or four. Further, the innovation developer may, and often does, tolerate less variation within each component than the practitioner.

A Procedure for Determining Innovation Configurations

Developing a procedure for determining configurations began almost serendipitously as PAEI Program staff were solving a Level of Use interviewing problem. Levels of Use interviewers were having difficulty determining whether subjects were in fact using the innovation in question. The interview subjects would say they were, but their description of what they were doing would not fit with the interviewer's general impression of what the innovation was supposed to be.

The first solution used by the program staff was to develop a set of innovation characteristics or components based on the developer's descriptions. The Levels of Use interviewers would then make the use/nonuse decision based on whether the interviewee used a significant number of the components on the list. As the research evolved, however, it became increasingly obvious that there was more to determining whether the innovation was in use. There were variations in the components which had to be documented as well. It was found that an innovation configuration pattern could be developed for each user by identifying the component variations they were using. Several configuration studies have since been conducted by PAEI staff and colleagues and the procedure for analyzing configurations has become more elaborate.

Presently, the procedure for determining innovation configurations includes five steps. This procedure is not meant to be the *sina qua non* of innovation configuration measurement, rather it is one way that has been found useful and that in many aspects parallels the work of Evans and Scheffler (1974) and Owens and Haenn (1977).

The five-step process for determining configurations is outlined in the flowchart in Figure 1. The steps are:

1. *Interviewing developers and facilitators for essential components.* The first step in the innovation configuration identification process is to determine what the innovation is "supposed" to look like in practice. When there is a developer apart from the change facilitator(s), the developer must be queried for the essential components of the innovation. Often actual interviewing is impractical or impossible since the innovation could have been developed at a distant school district or research and development agency, it could be the product of a publishing company, or it could be the ideas of a particular individual that are outlined in a book. Thus, it may be necessary to review whatever descriptive material is available in books, pamphlets, and teachers' manuals to determine the "developer's" components of the innovation.

Those responsible for facilitating use of the innovation on-site (e.g., curriculum coordinators, deans, principals) will have their own ideas about essential components of the innovation and what will be emphasized during implementation. Previous experience interviewing facilitators (and developers, when available) has indicated three questions to be most useful:

(a) What would you observe when the innovation is operational?

(b) What would people be doing?

(c) What are the critical components of the innovation?

Previous experience also indicates that it is often difficult for developers and facilitators to answer these questions. This may be due to a tendency to think in terms of "what" the innovation is, rather than "how" it should be used.

This first step results in a preliminary set of key components of the innovation with some suggested variations. For example, facilitators might require teachers of an individualized program to use specific program materials and regroup children once a week. Thus, two components of this program are materials and grouping. Use of different materials than those specified would be a variation of the materials component. The daily regrouping of children would be a variation of the grouping component.

2. *Interviewing and observing a small sample of users for variations.* For this step a small (e.g., N=10 to 20) sample of users is selected that is estimated to represent a wide variety in use of the innovation. Facilitators and building administrators may be good judges of where variations exist. The interviews conducted and observations made should deliberately be very broad and open-ended in order to find extreme variations. An interviewer might ask for a general description of how the innovation is used. If the components named by the developers/facilitators are not described, the interviewer should probe the user for information about each component. Observations should also be broad-based. An ethnographic methodology is suggested: every innovation-related action taken and comment made by the user is written down, as is a description of the physical elements present in the setting that relate to the innovation. These notes can later be formalized into a written report.

To follow the same example of an individualized program, teachers may have described their use of the innovation by talking about the tests and record-keeping systems used. These become additional components. Some teachers may use teacher-made tests while others may use program-developed tests. These are two possible variations under the component of testing. Observations also contribute to the list of components and variations. For example, teachers could be observed using a textbook, which becomes another variation under the facilitator's nominated component of materials. As a result of this step, more components may be added to the list and more variations can be identified under each component.

3. *Developing interview questions and interviewing*. As a result of steps 1 and 2, a tentative list of components and component variations is developed. In step 3 interview questions are developed to probe users about each of these components. Using the same example, some interview questions for the individualized program might be:

(1) What materials do you use?

(2) How often do you regroup children?

(3) What tests do you use?

(4) How do you keep records?

Since the possibility exists that there are more components of the innovation than have come to light in steps 1 and 2, the specific probes should be followed up by an open-ended question such as, "Are there other things about your use of the innovation that I haven't asked you about?"

Interviews are then conducted with a large sample or all of the persons involved in the study. The interviews should be taped or notes should be taken about use of each of the components of the innovation.

4. *Constructing a component checklist*. Resulting from the preceding steps are a list of innovation components and a set of variations within each component. These can be formulated into a checklist. Using the same example, a part of a

checklist for the individualized program might be:

Materials

_____ Uses program materials

_____ Uses a textbook

_____ Uses teacher-made materials

_____ Uses a combination of materials

Record-Keeping

_____ Keeps records on program card

_____ Keeps records on teacher-made chart

_____ Keeps records in record book

This checklist may be completed by the interviewers for each user of an innovation or they may be filled out directly by the users. When the checklists are completed, the different operational forms of the innovation being studied will be evident.

5. *Locating dominant innovation configuration patterns.* One useful aspect of the configuration concept is that the various operational forms of a given innovation can usually be reduced to a manageable set of dominant innovation configurations. To do this, each variation for each component on the checklist is given a number, e.g.:

Materials

__1__ Uses program materials

__2__ Uses a textbook

__3__ Uses teacher-made materials

__4__ Uses combination of materials

Record-Keeping

__1__ Keeps records on program card

__2__ Keeps records on teacher-made chart

3 Keeps records in record book

Each user is then assigned a code number containing as many digit places as they are components in the innovation. Each digit place corresponds to a specific component. The number in that place refers to the variation of the component that was used. For the two-component checklist above, the user with code 2-3 uses a textbook and keeps records in a record book. Each code represents an operational innovation configuration. Users with like codes can be grouped together.

Obviously, the more components an innovation has and the more variations there are within the components, the more possible innovation configurations there will be. If an innovation is complex, it may be necessary to further condense groups of users. To do this, judgements must be made about the importance of each component variation. Some variations can be collapsed while others may need to be kept discrete, depending on the ultimate use of the data. For example, if "grouping" were a component, "small flexible groups" and "small stable groups," two variations, might be combined into "small groups." Some components might be eliminated. Another example, in the checklist above, *how* a teacher keeps records might not be important, but that records are kept at all might be *very* important. In this reduction process some detail is lost, but the gain is a manageable number of innovation configurations which will account for a large number of classrooms. The next section describes a research study where such an innovation configuration checklist was developed and data reduction was accomplished using this procedure.

Configurations of a Math Curriculum

A full year study designed to develop a procedure for identifying configurations was conducted utilizing a criterion-referenced mathematics curriculum for kindergarten through grade eight. Nineteen schools and 168 teachers participated in the study.

Program developers, who were also district facilitators, gave three basic requirements for teachers of the program: teach the objectives, test the objectives, and keep records according to the objectives. When teachers talked about the program they typically described the materials they used and their grouping patterns. Figure 2 shows the checklist that resulted from steps 1-4 of the configuration identification procedure. Figure 3 describes the eight configurations that resulted from the checklist analysis in step 5. Subsequent analysis led to a revised innovation configuration checklist which can be completed by teachers (see Figure 4). This checklist has proven useful for district and staff development purposes.

Several issues surfaced while this study was underway. Since it was exploratory and conducted by outside researchers, the developers and users contributed equally to nominating items for the checklist. If the developer's perspective had been emphasized, user variation in materials and grouping would not have been included, since only the objectives, tests and record-keeping components were important to the developers. Checklist construction is obviously subjective and is influenced by the intended purpose as well as the perspective of the person constructing it. The point during the implementation process at which the data for steps 1-3 is collected can also have a bearing on checklist construction.

The reduction of checklist data to determine dominant patterns can also be rather subjective. Just how different component variations are combined or eliminated to make the resulting data more manageable will depend greatly on who is doing the work and for what purpose. To reduce the math program data, three components were emphasized which seemed, at least to the program staff, to represent the essence of what teachers were doing differently across the district. Some variations of these components were combined into single categories. For example, for the "materials" component, "textbook only" and "textbook emphasized" were considered as single variation. Very different combinations and reductions may have resulted if teachers or district facilitators had been involved in the process.

A similar procedure was used by Susan Heck at the Southwest Educational Development Laboratory (1977) to determine the operational configurations of a parent training package designed to teach low-income parents certain essential parenting skills. Reidy and Hord (1978) also determined operational configurations for a mathematics skills achievement monitoring program in Fitchburg, Massachusetts. They also found differences in learning outcomes that could be associated with different innovation configurations.

Implications and Discussion

Configuration Continuum

As has been seen, any one innovation can be and usually is operationalized in many different forms. How different are these operational forms from the developers' model(s)? When has an innovation been adapted so much during implementation that it is no longer the same innovation? To answer these and other questions, it may be useful to consider the various configurations of an innovation as lying on a continuum. One such continuum is illustrated in Figure 5. In this figure the innovation is a car. Configuration components could include a number of doors, engine, interior styling, etc. At the far right of the continuum lies the *Developer's Model*. The developer may restrict the model to one tightly defined operational form (e.g., four-door Ford), or the developer may allow for some variation (e.g., four door GM products are o.k.), or perhaps even encourage user adaptation of innovation components (e.g., Continental Mark

IV and VW bugs are appropriate also). However, most developers will reach a point beyond which the adaptations made to their innovation will not be acceptable. Beyond this point on the configuration continuum, the *point of drastic mutation*, the developer will not accept what is being used as the innovation.

The point of drastic mutation naturally varies from innovation to innovation since some developers require a stricter adherence to their model than others do. Users and facilitators often have their own ideas about when an innovation has been adapted too much and they may determine different points of drastic mutation. Figure 5 represents a case where the innovation developer is relatively conservative in specifying what constitutes use of the innovation [see Innovation Developer's Point (IDP)], while the change facilitators and staff developers [see Change Facilitator's Point (CFP)] were more liberal in determining acceptable configurations, and users were still more liberal [see User's Point (UP)]. Other relative positions could have been drawn. For example, users or change facilitators may set more rigorous standards than the developers (nothing but Honda Civics).

Thus, depending on the role group, there may be a difference in opinion about whether a certain configuration of the innovation does or does not represent an acceptable operational form. Rather than there being one "point" of drastic mutation, there is a zone or area of drastic mutation. Within this area there is disagreement about what constitutes use of the innovation. The more conservative or liberal one role group is in setting their decision point relative to another, the larger area of disagreement.

Another way of approaching this question is in terms of fidelity of implementation. The following definition of fidelity has been suggested by R. Wallace (personal correspondence, 1977):

$$\text{Purity of implementation} = \frac{\text{Number of components observed}}{\text{Number of components in developer's model}}$$

With this education, a user implementing an operational form of an innovation identical to the developer's model (e.g., four-door Ford) would have a fidelity value of one. Users who have altered or adapted so many components that their form of the innovation lies beyond the area of drastic mutation (e.g., helicopter) would have a fidelity value of zero.

Unfortunately, everyone may not describe the innovation using the same components. In the continuous-progress mathematics curriculum studied, the developers emphasized the objectives and testing in describing the innovation while the teachers described the innovation in terms of materials and record-keeping systems. With most innovations, there is not sufficient specificity about components to absolutely determine when the point of drastic mutation has been reached or when the fidelity value equals zero. This problem could be corrected if more care were taken to accurately describe innovation components and limits to component variations.

Present implementation practice implicitly places a great deal of responsibility on the user for determining the configuration that is operationalized "behind the classroom door." In many cases, developers and change facilitators do not make clear the minimum operational essentials (critical components) of an innovation. Users freely adapt the innovation with little or no knowledge of the potential consequences. Who should determine how much and which variations are allowable (i.e., valid)? It seems clear that this determination should be made or at least anticipated prior to the time of implementation.

Describing Innovation Components

Change facilitators and evaluators would have an easier time in determining if certain innovation configurations constitute valid use of an innovation if innovation components were more accurately described. Perhaps innovations should be described in terms of "critical components", a core of components which must be present for the innovation to be in use, and "related components", peripheral components that are of secondary importance.

It is now common to use altogether different components to describe different innovations. In theory, though after, configuration components have been identified for a large number of innovations, it may be possible to develop a set of generic configuration components. Some thinking has already been done in this direction. Leithwood (1978) has identified eight "dimensions" for describing school curriculum. These begin with the "platform" or a system of assumptions used as a basis to decide what to include in the curriculum. Other dimensions include such things as objectives, teaching strategies, and learning experience.

Change in the Individual vs. Change in the Innovation

The concept of innovation configurations describes the innovation as it is changed during implementation. But how much people-change and how much innovation-change is appropriate in a given situation?

Different combinations of people-change and innovation-change are represented in Figure 6. These representations are illustrative of how the innovation configuration continuum can be contrasted with what is happening to innovation users. In Case A, the innovation is implemented in a user system where the developer's model was closely adhered to and the user made large changes. In Case B, there is some change to both the innovation and to the user, while in Case C, the user changes very little and the innovation is changed a great deal. Case D represents a case where the innovation is changed beyond the point of drastic mutation and the user does not change at all.

There are alternate interpretations of these cases but the point to be emphasized is that change facilitators are responsible for determining explicitly or implicitly how much user change and innovation change will be accepted.

Depending on the goal of the change effort, a greatly modified form of the innovation may be appropriate. In another case, the users may already be doing approximately what the developer's model requires so that the implementation period will be short and the developer's model will be implemented with little change. However, it should be noted that the Rand Implementation Study (Berman, McLaughlin, Bass, Pauly & Zellman, 1977), concludes that small changes in the user are less likely to be long lasting.

In an earlier Rand study report Berman and McLaughlin, (1975) found that "mutual adaptation" was the most successful change strategy. Mutual adaptation is represented in Figure 6 by Case B; the user changes some and the innovation is changed some. Although this may have been the most successful implementation strategy across federal change agent projects, with some innovations mutual adaptation could result in mutations that are drastic enough to create less effective innovation configurations. If the critical components of an innovation must be closely adhered to in order to get validated learning outcomes, then perhaps mutual adaptation would not be the most appropriate strategy.

Innovation Implementation and Evaluation

Perhaps the innovation implementation process should vary depending on the complexity of the innovation and how close to the developer's model the implemented configurations should be. If closeness to the developer's model is sought or the innovation is complex, more implementation facilitating activities will be necessary as will a longer implementation period.

The more change an innovation represents from present practice, the longer the implementation period will probably have to be. And, if the developers have not clarified the critical components of an innovation, some implementation resources may be needed to clarify just what innovation configuration is to be implemented.

Often it appears that developers will specify the implementation requirements (e.g., the number of microscopes and time periods), but not include an operational description of what will be observed and what people will actually be doing when the innovation is in use. This results in a greater potential for user confusion about what is expected and more deviation from the developer's model.

Two elementary science curricula, Elementary Science Study (ESS) and Science A Process Approach (SAPA), can be used to illustrate this point:

> ESS appears to be an example of an innovation in science which has a variety of developer configurations and a great deal of latitude for modification of the related components to meet site-specific needs. On the other hand, SAPA, because of its hierarchial approach within and between grade levels, could be viewed as having a less variable original configuration and a more restricted set of related components, (Roberts, personal correspondence, 1977).

So, an implementation strategy for SAPA should emphasize the importance of adhering closely to the objectives and hierarchy while an ESS implementation strategy should emphasize diversity (e.g., user creativity) in use of the innovation materials.

As has been noted, innovation components are often not accurately described. This raises some important implications for implementation. It appears that when the developer is not clear in describing an innovation or when change facilitators do not communicate effectively, users are more apt to implement an unusual configuration. If, however, the implementation process is well designed and well articulated and is consistent with the developer's model, semantic and operational confusion is less likely to occur.

Should complex innovations which require the use of many critical components be implemented all at once or should they be phased into operation? The trauma of change will likely be reduced with a phasing strategy. There is, however, a chance that the developer's model may become lost in the gray area created by the initial use of a less demanding configuration.

In another part of the PARI/CBAM research, evaluators have been encouraged to check for the use or nonuse of an innovation before measuring outcomes (Hall & Loucks, 1977). The concept of innovation configurations suggests that evaluators may need to document carefully which critical and related components are being used. The effects obtained from drastically mutated forms of an innovation are likely to be different and may be less desirable than those obtained with the developer's model. Evaluators and developers could run empirical tests on different configurations using planned variations to determine which components and combinations of components create the most effective configurations for meeting the objectives of the innovation.

Conclusion

Change is seldom easy. Most people are reluctant to abandon tried-and-true methods for new ways if they are not certain that the new ways will be beneficial in the long run. Schools and colleges are no exception to this and many are now shying away from educational innovations because they have discovered that after the trauma of implementation is over there is usually no significant improvement in student performance. It is clear now, however, that the innovation cannot always be blamed for this since it is often drastically altered during implementation. It is no longer safe to assume, as most people involved with educational innovations always have, that a pure form of an innovation has been implemented just because the decision to do so has been made.

If the impact of educational innovations are to be evaluated fairly, it must be determined just how they are adapted during implementation. The concept of <u>innovation configurations</u> deals with this problem and provides a simple but precise method for determining how the operational forms of an innovation differ from the model(s) of the developer.

Figure 1

A procedure for identifying innovation configurations.

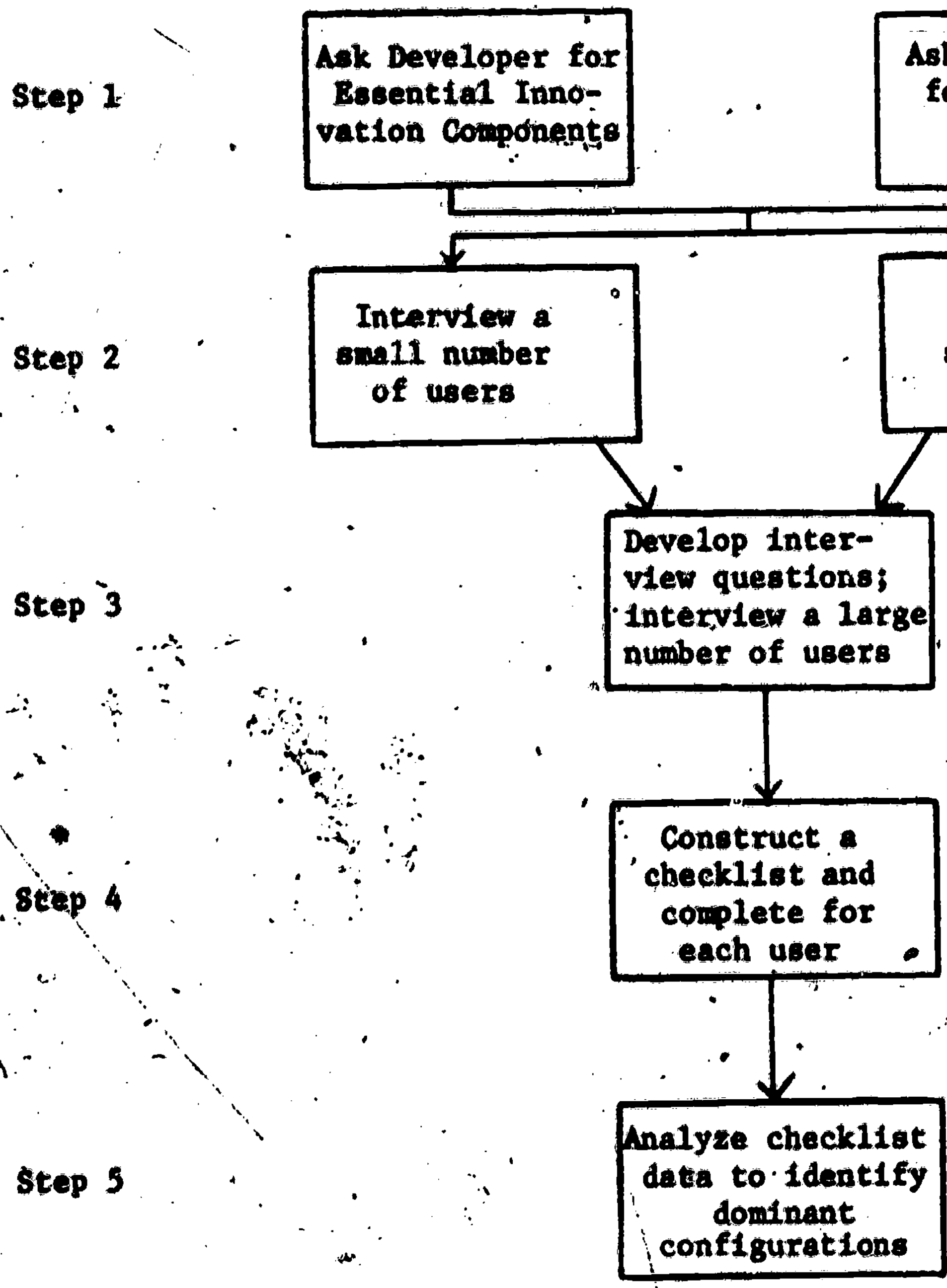


Figure 2

Original innovation configuration checklist for math curriculum study.

Teacher I.D. ________

School I.D. ________

Grade ________

FOR EACH OF THE FIVE DIMENSIONS BELOW, CHECK THE ONE THAT MOST CLOSELY DESCRIBES THE TEACHER. IF NONE DESCRIBE THE TEACHER, USE THE SPACE ON PAGE 2 UNDER THE APPROPRIATE DIMENSION TO DESCRIBE THE SITUATION IN DETAIL.

1. Instructional resources used

____ Program materials only

____ Textbook only

____ Textbook emphasized, Program materials supplemental

____ Program materials emphasized, textbook supplemental

____ Enriched combination, including such sources as games, manipulative materials, learning centers, etc., as well as the above

____ Unknown

____ Other -- describe on page 2

2. Grouping patterns

____ Large group within heterogeneous classroom: whole class or two large groups

____ Large group within homogeneous classroom: whole class or two large groups

____ Small stable groups

____ Small flexible groups

____ Unknown

____ Other -- describe on page 2

3. Program objectives used largely in sequence as guide for instruction

____ yes ____ No ____ Unknown ____ Other -- describe on page 2

4. Kind of testing

____ Posttest on objectives (either program-supplied or teacher-made) and cluster test (either program-supplied or teacher-made)

____ Cluster test only (either program-supplied or teacher-made)

____ Teacher observation only

____ Unknown

____ Other -- describe on page 2

5. Test utilization

____ Test results determine what is to be taught next to each individual

____ Group goes on if most pass test; stragglers are given special attention

____ Group goes on if most pass test; those who fail are not attended to

____ Unknown

____ Other -- describe on page 2

Figure 3

Innovation configurations for a math curriculum.

Commonalities: All configuration patterns have the following elements in common:

Objectives:	Program objectives are taught
Testing:	Students are evaluated on their achievement of program objectives
Record Keeping:	Teachers record achievement or non-achievement of program objectives immediately after evaluation occurs

Configuration Patterns:

A (N = 11)	Materials:	Program materials emphasized
	Grouping:	Large group(s) within homogeneous classroom
	Test Use:	Group goes on if most pass test, attention to stragglers
B (N = 34)	Materials:	Enriched combination
	Grouping:	Large group(s) within homogeneous classroom
	Test Use:	Group goes on if most pass test, attention to stragglers
C (N = 16)	Materials:	Enriched combination
	Grouping:	Small flexible groups
	Test Use:	Test results determine next steps for individual
D (N = 14)	Materials:	Enriched combination
	Grouping:	Individualized
	Test Use:	Test results determine next steps for individual
E (N = 8)	Materials:	Program materials emphasized
	Grouping:	Individualized
	Test Use:	Test results determine next steps for individuals
F (N = 6)	Materials:	Textbook emphasized
	Grouping:	Large group(s) within homogeneous classroom
	Test Use:	Group goes on if most pass test, attention to stragglers
G (N = 5)	Materials:	Enriched combination
	Grouping:	Large group(s) within homogeneous classroom
	Test Use:	Group goes on if most pass test, stragglers not attended to
H (N = 5)	Materials:	Program materials emphasized
	Grouping:	Large group(s) within heterogeneous classroom
	Test Use:	Group goes on if most pass test, attention to stragglers

Figure 4

Revised innovation configuration checklist for math curriculum study.

I.D. (Last 4 digits of SS#) _____ _____ _____ _____

Please check one choice under each of the five categories below that is the most descriptive of your math instruction.

1. Instructional resources used:

_____ Program materials (i.e., packets, worksheets) only
_____ Textbook(s) only
_____ Textbook(s) emphasized, program materials supplemental
_____ Program materials emphasized, textbook(s) supplemental
_____ Combination of text(s) and/or program materials with teacher-made materials and games
_____ Large variety of text(s), program materials, games, teacher-made materials, manipulatives, centers, labs, etc.

2. Grouping patterns:

_____ Teach whole class or two groups in a class with children ranging in abilities (i.e., heterogeneous)
_____ Teach whole class or two groups in a class with children of generally the same abilities (i.e., homogeneous)
_____ Teach 3 or more small groups that are fairly stable--the children in each group seldom move to a different group
_____ Teach 3 or more small groups that change continually--the children frequently move to a different group.
_____ Teach individuals only, no grouping

3. Clusters of objectives:

_____ Use program clusters largely in sequence as a framework for instruction
_____ Use program clusters largely out of sequence
_____ Do not use program clusters

4. Objectives:

_____ Use program objectives largely in sequence within the clusters
_____ Use objectives largely out of sequence
_____ Do not use program objectives

5. Kind of testing:

_____ Use posttest on objectives (either program-supplied or teacher-made) and cluster test (either program-supplied or teacher-made)
_____ Use cluster test (either program-supplied or teacher-made) only
_____ Use posttest on objectives (either program-supplied or teacher-made) only
_____ Use teacher judgement only
_____ Varies widely using posttests, cluster tests and/or teacher judgement

6. The use of test results:

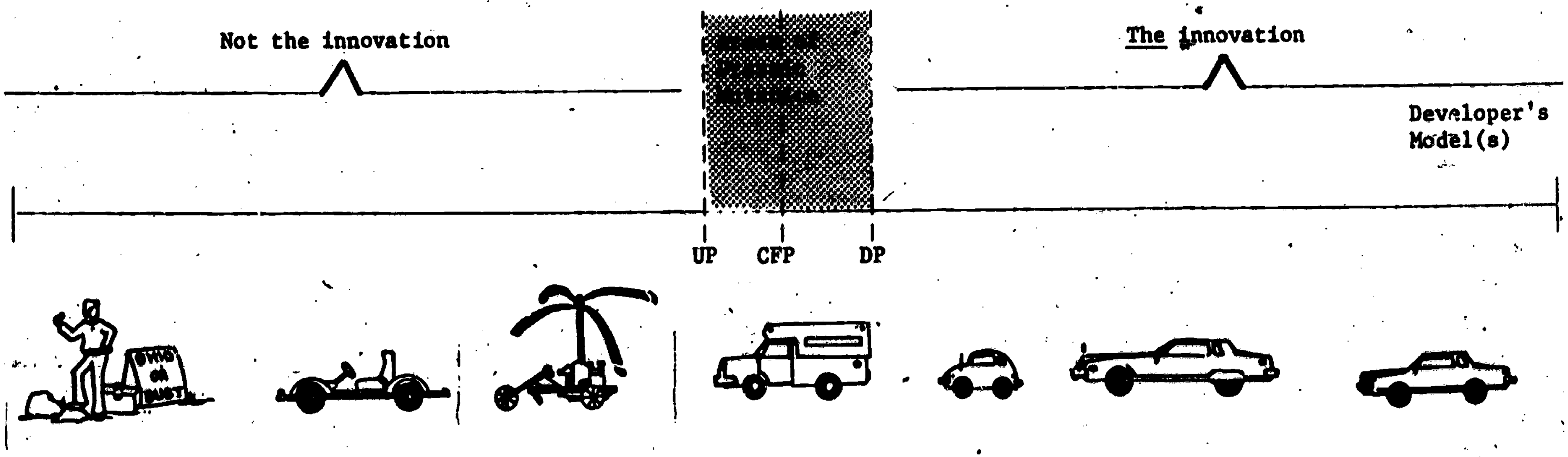
_____ Each individual child is assigned work or activity depending on the results of the test given
_____ When most of the group passes a test the group goes on; those who fail are given special attention
_____ When most of the group passes a test the group goes on; those who fail will have another chance to learn later due to the spiral nature of the curriculum
_____ What is done with test results depends on the objectives being taught

THERE OTHER SIGNIFICANT FEATURES OF YOUR MATH PROGRAM THAT WE HAVE NOT INCLUDED? (Please describe on back of this page)

Figure 5

Configuration Continuum

Using "Car" as the Innovation



Points of Drastic Mutation

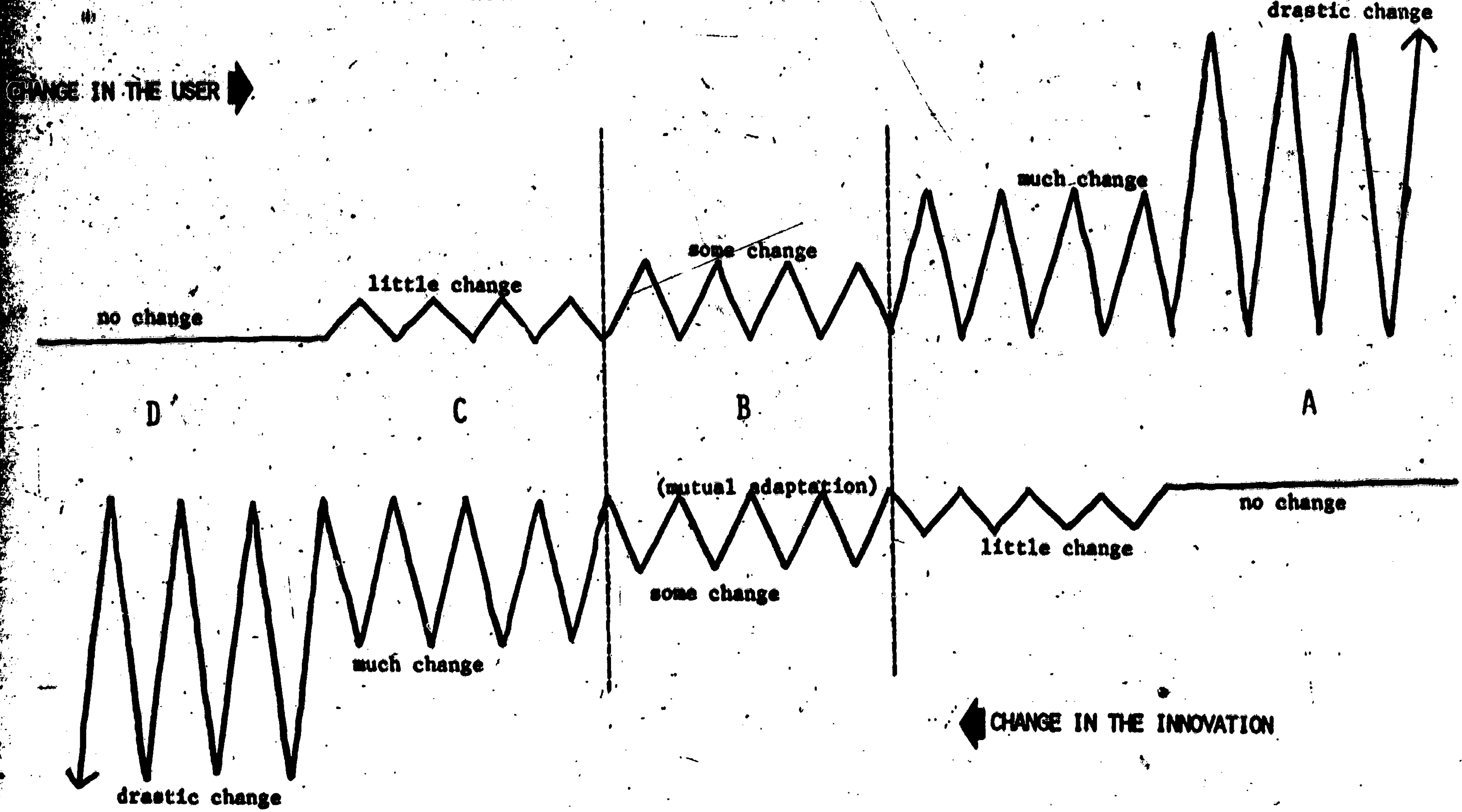
UP -- User's Point

CFP -- Change Facilitator's Point

DP -- Developer's Point

FIGURE 6

CHANGE IN THE USER AND CHANGE IN THE INNOVATION



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