Evaluation and Measurement: Some Dilemmas for Health Education

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Abstract: Seven dilemmas of evaluation and measurement posed by the nature of health education are presented, together with suggestions for their resolution. These include the dilemmas of: 1) rigor of experimental design vs significance or program adaptability; 2) internal validity or "true" effectiveness vs external validity or feasibility; 3) experimental vs placebo effects; 4) effectiveness vs economy of scale; 5) risk vs payoff; 6) measurement of long-term vs short-term outcomes; and 7) threshold vs diminishing-return levels of expenditure on health education. Emphasis is placed on the need to develop a more cumulative data base through standardization of measures, replication of experiments in different settings, and better documentation, reporting, and diffusion of experiences in practice. (Am. J. Public Health 67:155–161, 1977)

The purpose of this paper is to identify some problems peculiar to health education and emphasize the needs for research and evaluation distinct to health education where the research methods and evaluation results in related fields of behavioral sciences, marketing, education, epidemiology, and so forth, are not directly or fully applicable. Seven dilemmas of this nature will be discussed.

1. The Dilemma of Rigor vs. Significance

One problem that makes it imperative to develop a *cumulative* body of literature based on actual programmatic experiences in health education is that the implementation of programs in living communities and institutions presents administrative problems and opportunities to which the creative health educator must adapt his strategies and methods. Scientific rigor requires the strict adherence to a protocol which specifies the experimental educational treatment in procedural detail. The educational treatment is supposed to be the *independent* variable, meaning that it should not be subject to, or dependent upon, events which follow or result from the implementation of the program. The attempt to maintain such rigorously defined protocols often results in sterile, perfunctory, or routinized educational performance which is not sufficiently adapted to emerging circumstances to be significant in its impact. Thus, we end up sometimes with rigorously defined but trivial interventions, and other times with significant interventions that are too vaguely defined to be replicated.

What we know, then, is that health education works if it is sufficiently adapted to the problem, the population, and the circumstances in which it is implemented. What we do not know is how to describe those crucial adaptations.

How do we get off the horns of this dilemma? I believe there are four ways we can deal with this problem: one requires more complex experimental designs, a second requires more complex statistical analysis, a third requires more detailed documentation and reporting of procedures, and a fourth requires more replication and attention to the cumulative building of the theoretical and research literature in this field. I have described some of these proposals in detail in other places, so will only summarize them here and cite the more detailed references.

(a) Factorial designs

Most evaluations of health education programs have employed rather primative pre-experimental and quasi-experimental designs; those that have utilized more rigorous experimental and quasi-experimental designs have usually had only one experimental and one control group with no provision for variations in the experimental treatment.[1] The recognition of the need for adaptations of the educational treatment at different points in the implementation of a program can be accommodated in advance by the sequential assignment of subjects to cells in a randomized factorial design.[2, 3] If the size of the available population and the total time available for experimental programming are known in advance, a

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schedule of programmatic variations can be established at the outset without necessarily knowing exactly what the educational variations will be. Each phase of the program could have its own experimental and control groups, or the control group could be accumulated during one period of the program if there is not systematic bias in the order in which subjects are available for exposure to education.

(b) Analytic solutions

Even with more simplistic evaluation designs, we could make better use of statistical methods for sorting out the variable effects of variations in educational treatments during a program.[2-4] Computers are making such methods more accessible.

(c) Documentation and reporting

Even without factorial designs and adequate data for more detailed analysis of variable program effects, the adaptations and variations in health education interventions could at least be better documented during the program and more explicitly described in published reports. This would allow better understanding of the process of program development as well as the specific elements of health education to which results might be attributed.

(d) Replication and diffusion

Finally, even with better designs, improved analyses, and more concrete reporting, we will remain on the horns of the dilemma of rigor vs. significance unless we can convince practitioners and administrators that our improvements in rigor have indeed made our results more rather than less significant to them. Convincing practitioners will require that results hold up in more than one evaluation, and this will require replication. But even with replicated results we have a persistent "town and gown" problem in this field. Practitioners and administrators are frequently either unequipped or disinclined to consume and use the research literature. The literature itself is partly at fault for having been written often without practitioners as participants or even as the intended audience. It has also lacked cohesiveness as a body of literature, partly because there has been so little replication. The result of this eclectic and noncumulative character of the literature is that the practitioner flounders in a sea of print without unifying concepts or theories. Greater efforts at theory-building from replicated results, more rigorous training of practitioners in the translation of research and theory, and more continuing education and dissemination of results from evaluation are needed.[5]

2. *The Dilemma of Internal vs. External Validity*

A special case of the dilemma of rigor vs. significance is the methodological problem of experimental control in community or clinical settings. Internal validity is the degree to which we can say with certainty that the results observed after the program are attributable to the program or educational treatment. External validity is the degree to which such results can be expected to recur in other places or at other times. This is sometimes called generalizability. The dilemma is that the harder we strive for internal validity, the more we usually sacrifice external validity; and the more we strive for external validity, the harder it is to maintain internal validity or experimental controls.

What we know is that internal validity is more important when the primary purpose of the evaluation is to determine the efficacy or the "true" effectiveness of a health education method or program design, whereas external validity is more important when the purpose of the evaluation is to demonstrate the feasibility and practical effectiveness of the method or program under actual community or clinical circumstances. What is not known is how and to what degree to sacrifice one type of validity for the other.

The way out of this dilemma would seem to be the development of a set of decision rules for use in striking the right balance between internal and external validity on the one hand, and resources and circumstances on the other. I have recently proposed a set of hierarchies of optional designs for maximizing either internal or external validity with a minimum sacrifice of the other and with economy and practicability in mind.[6, 7]

3. *The Dilemma of Experimental vs. Placebo Effects*

Medical researchers go to great lengths to remove from their experimental evaluations the element of effect attributable to the faith or confidence the patient has in the treatment. Ironically, this is the very effect that health education attempts to enhance through increased patient participation and informed consent. When we remove the placebo effect from a health education strategy, we have a rather sterile and uninteresting intervention. I have been inclined, in the face of this dilemma, to define health education as an "organized placebo."

The same dilemma is posed by the behavioral science counterparts of the placebo effect. These are the "Hawthorne Effect"—change in performance attributable to the attention paid to subjects in an experiment—and the "social desirability effect" change or response bias attributable to being observed and wanting to do the "right" thing. These are precisely the effects that participative and normative strategies in health education attempt to mobilize. A well designed health education program would add to the informational component: 1) an attempt to increase the patient's or consumer's belief in the efficacy of the treatment or preventive measure (placebo effect),[8] 2) an attempt to increase the patient's or consumer's perception of having his own problems or needs addressed (Hawthorne effect),[9] and 3) an attempt to increase the patient's or consumer's perception that the recommended health practice is socially acceptable and sanctioned (social desirability effect).[10]

What we know is that these elements are important components of health education which have motivating and reinforcing effects. What is not known is the degree to which and the ways in which health information interacts with these social psychological forces.[11]

4. The Dilemma of Effectiveness vs. Economy of Scale

By aggregating, standardizing, and formalizing health education, we can achieve economies of scale at the expense of some effectiveness at the individual level. The cost per unit of production per patient educated, or per message disseminated can be reduced through aggregation. The goal in educational innovation is to design standardized materials, methods, and procedures that can be produced or implemented on a larger scale (therefore at lower unit prices) without sacrificing a proportionate amount of effectiveness inherent in more individualized, personalized, and flexible methods and procedures.

The usual form of the economy of scale curve is illustrated in Figure 1. The vertical axis represents the cost per unit of education. The horizontal axis represents various ways of increasing the scale of educational production, all three of which usually result in reduced effectiveness in terms of behavioral change achieved. Effectiveness is not represented in Figure 1 except as it is negatively correlated with aggregation of educational inputs.

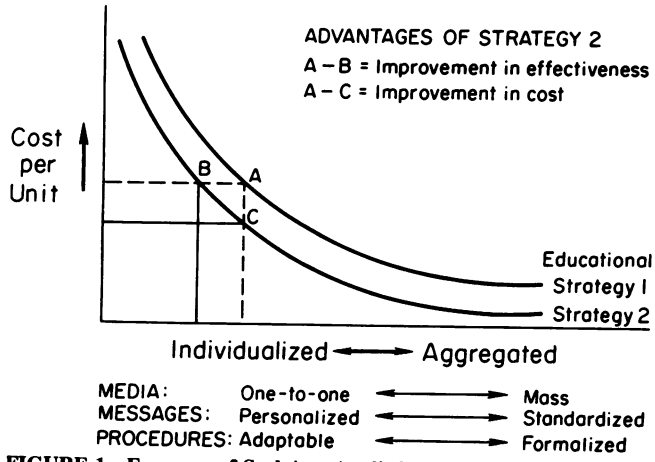

FIGURE 1—Economy of Scale* as Applied to Health Education Program Components.

***Source: Partially adapted from Oettinger AG, Zapol N: Will information technologies help learning? *Teachers College Record* 74:5–54, September 1972.**

(a) Aggregating patients

An example of an educational innovation with adults that achieved this kind of economy of scale was group discussion-decision methods, first demonstrated in nutrition education by Lewin,[12] later in breast cancer self-examination by Bond,[13] and recently in reducing emergency room utilization and dependency of asthmatics.[14] The beauty of this innovation was that it achieved economy of scale through aggregation while *increasing* rather than decreasing effectiveness. The group, if properly constituted and guided, proved to be more powerful as an agent of change in health behavior than the individualized exhortations from doctors and nurses. It was also more effective than similarly aggregated education delivered through lectures.

(b) Types of education personnel

Another example of an educational innovation that might fit the curve of Figure 1 for educational strategy 2, relative to the curve for educational strategy 1, is the introduction of indigenous health education aides to carry out health education (strategy 2) in place of health professionals (strategy 1). The cost would be lower at any level of aggregation (A-C), and the effectiveness might be improved at any level of cost (A-B) because the indigenous aide would be able to communicate more personalized messages.[15] For example, Cuskey and Premkumar demonstrated that a medium-sized drug treatment center serving about 1,000 addicts could save up to $100,000 annually if ex-addict counselors were used in place of professional counselors with graduate level training.[16] Even better than paid indigenous workers for some educational purposes are patients themselves as counselors, recruiters, or reinforcers of other patients. Andrew Fisher has experimentally demonstrated that family planning patients given post-cards to pass on to friends achieve recruitment rates at approximately one-third the cost per new appointment in comparison with the next most cost-effective method.[17] Another study demonstrated the cost-effectiveness of a clerk in the emergency room assigned to call and remind patients of their return appointments.[18] Any strategy successful in reducing broken appointments must have considerable appeal to hospital administrators, and to staff concerned with continuity of care.

(c) Technologies

Other educational technologies that might be expected to meet the criteria of a cost-effective innovation as defined by the difference between the two curves in Figure 1 are programmed instruction and cable television. Teaching machines, or "computer-assisted education," as one kind of programmed instruction, can achieve an economy of scale in production while preserving the effectiveness of personalized and adaptable messages and procedures. The marketing problems associated with these technologies, unfortunately, have not yet allowed the unit cost to be low enough to achieve the promised economies of scale.[19, 20]

The tendency for some hospital administrators to invest in expensive hardware rather than salaries of educational personnel has been based on the sincere but misguided assumption that audiovisual technology is as effective educationally as it is slick. As concluded by Campeau from her extensive and scholarly review of experimental studies evaluating audiovisual media in adult education:

> "What is most impressive about the formidable body of literature surveyed for this review is that it shows that instructional media are being used extensively, under many diverse conditions, and that enormous amounts of money are being spent for the installation of very expensive equipment. All indications are that decisions as to which audiovisual to purchase, install, and use have been based on administrative and organizational requirements and on considerations of cost, availability, and user preference, not on *evidence of instructional effectiveness* . . ." (p. 31)[21]

The use of expensive hardware in patient education can be approached on the same purchasing basis as other overpriced medical hardware such as kidney dialysis units, viz.

the regionalization of resources. Health education centers could be established to serve several hospitals and clinics through the pooling of their resources. Under these circumstances a total decrease in training time and in provider-patient ratios for all of the hospitals can be translated into cost savings to the system.[22] This situation obtains when computer-assisted instruction (CAI) or other specialized educational resources can be used for the education and training of professionals as well as patients whose special learning needs cannot be met by routine clinical procedures. Similar experience with CAI in schools has led to essentially the same conclusions.[23]

(d) Variety in approach to patients

Another aspect of the economy of scale dilemma is that what works for some patients does not work for all. The educational strategy, medium or message that achieves compliance in some patients may yield noncompliance in others. As with prescribing drugs, there are differential dose responses and side effects with patient education. This poses a specific set of problems for evaluation of patient education programs,[1-3] and it calls for a degree of sophistication in educational planning not to be expected of every doctor and nurse. It is generally recommended, therefore, that the person assigned overall responsibility for educational planning be one with graduate training, preferably in health education or adult education. As with expensive hardware, this often requires the sharing of a specialist on a regional or multi-hospital basis.

In addition to the principle of "different strokes for different folks," patient education programming also calls for shifting emphasis and technique within a patient group or population over time. These principles can be seen in terms of benefits in programs requiring the sustained cooperation of patients. An example is illustrated in Figure 2, where Atwater demonstrated the sequential benefits of different educational approaches during three phases of a venereal disease clinic program over a two-year period.[24] The benefits of each educational strategy can be noted both in the absolute number of patients appearing at the clinic and in the composition of the patient population. The change in interviewing policy was a change from an investigative approach in which patients were asked for the identification of their sexual contacts to an approach in which patients were encouraged to take the responsibility of getting their contacts under treatment. The change in the male/female ratio of patients as a result of this change in educational approach is most notable.

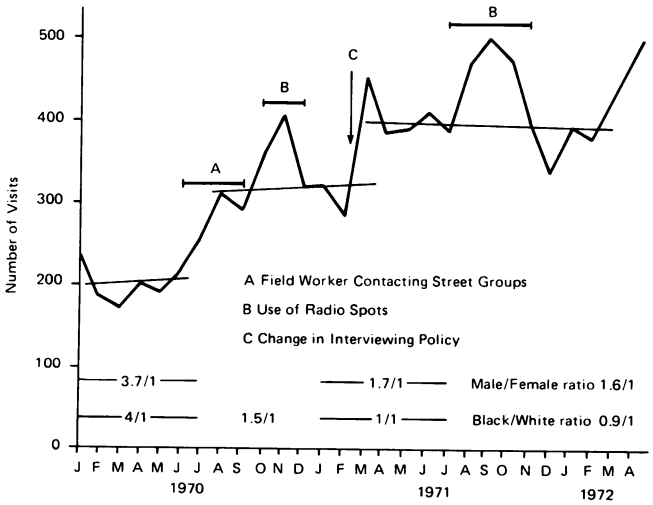

FIGURE 2—Visits to a Venereal Disease Clinic by Month, 1970–1972, Health Department, New Haven, CT.

Source: Reproduced with permission of the author and publisher from Atwater, J. B.: Adapting the venereal disease clinic to today's problem. *Am. J. Public Health* 64:433–437, May 1974.

5. *The Dilemma of Risk vs. Payoff*

Another way of viewing the implications of Figures 1 and 2 is to consider that there may be optimum times in the life history of a given health problem or program when spending for specific kinds of educational inputs will minimize risk and maximize payoff. Referring back to Figure 1, as educational methods become more aggregated they tend to minimize risks while usually also minimizing payoff. More individualized methods increase the risks of loss because they are more expensive, but they also increase the possibility of benefits to the extent that they are usually more effective. The timing of investments in one educational method vs. another should follow the same decision rules governing priority setting in other areas of administration.

During the early phases of a new program, the people most likely to respond are those who are already motivated to adopt the recommended health practice. During this phase, low unit-cost measures such as written materials (pamphlets, etc.) are effective enough. As the program moves through the at-risk population to increasingly "hard to reach" and high-risk groups, more expensive educational methods such as counseling sessions and home visits may be justified. The extra cost to reach one high-risk patient will be offset in most cost-benefit computations by the greater benefit accruing from behavioral change in a high-risk as contrasted with a low-risk patient. In economic terms, the marginal utility of behavioral change is greater in high-risk than in low-risk populations.

6. *The Dilemma of Long vs Short-term Evaluation*

Most of the benefits of health education are time-dependent. These raise problems of behavioral change that must be taken into account in assessing program effectiveness and benefits. Most of these have to do with the timing of measurement of outcomes following the educational inputs. Some effects of health education are immediate and temporary, others are slower in developing but longer lasting. These variations and others are illustrated in Figure 3.

(a) Delay of Impact

The first curve (A) illustrates the error that would be made in underestimating the impact of an educational pro-

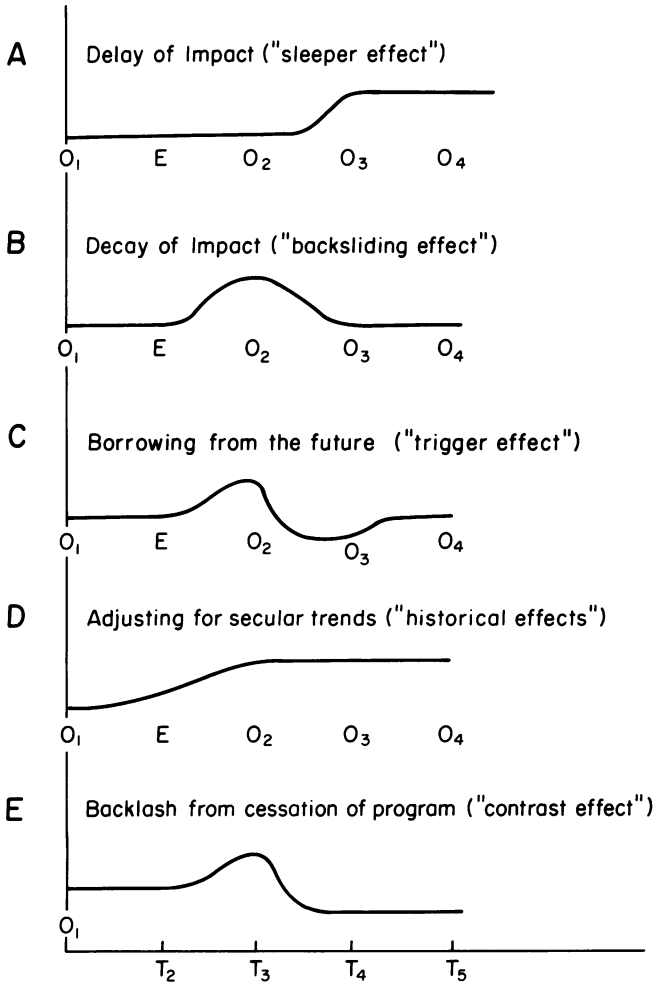

FIGURE 3—Points of Observation Relative to Different Educational Inputs.

gram if the effect were measured as the difference between observation 1 before the program and observation 2 after the program ($O_2 - O_1$). The so-called "sleeper effect" in much behavior change occurs when the audience must go through a process of attitude change between the educational exposure and the actual change in behavior that yields the health benefits. This effect might also be found where an immediate behavioral change requires additional time before its benefits can be detected in health or administrative terms.

(b) Decay of Impact

Curve 4B illustrates the error in underestimating benefits that might be made if comparative measures were taken only at time 4 or time 5; or in overestimating impact if observations at time 3 were taken as permanent. The backsliding effect is not uncommon with behavioral changes that are complex, such as smoking cessation, diet changes, and complicated drug regimens.

(c) Borrowing from the Future

Some educational effects are really only triggers to behavior that would have changed eventually anyway. In such cases, the educational program can be regarded as hastening the inevitable. There may be real benefits to be realized from getting earlier action, as with early diagnosis of cancer symptoms, earlier treatment of infections or injuries, earlier prenatal care, and so forth. But it might be an error of overestimation of benefits from some health actions if the observations are taken only at O_1 and O_2. The gains at O_2 may be offset at O_3, so that the net long-term gain is zero. This phenomenon is most notable in some mass media campaigns designed to recruit new patients to a screening clinic or a family planning clinic.* The gains immediately after the broadcasts turn out to be patients who would have appeared within a few months anyway. This effect can be seen following the radio broadcasts in Atwater's data on the V.D. clinic (Figure 2).

(d) Adjusting for Secular Trends

One of the most important purposes served by having a control group in the evaluation of program impact is that the apparent gains following the program can be partitioned into gains resulting from the program and gains that were occurring as part of general trends or extraneous events. Curve 4D applies to an "experimental group" of patients exposed to an educational intervention of some kind. If there were another curve for a control group of patients not exposed to the education, it would probably be parallel to 4D, because the gains were actually developing and heading toward the O_2 level *before* the educational intervention. In this case the error without adjustment for secular trends would be one of overestimating the benefits of the program.[25]

The secular trend, however, could be negative (downward sloping curve prior to or simultaneous with the health education program). In this case, the error would be a false-negative underestimation of the program's impact. In every case, a careful plotting of trend lines or the use of a control group not exposed to the program is essential to the accurate estimation of the true benefits of a program.

(e) Contrast Effect

Another dilemma posed by short-term evaluation is illustrated by graph E in Figure 3 where premature termination of the educational treatment may induce a contrast that demoralizes or embitters the experimental group, causing a backlash, a defiant reduction or reversal of the behavior advocated. Self-care programs,[14] smoking and diet programs,[15] and family planning programs[26] have experienced contrast effects when the educational activities were insufficiently developed, creating expectations that were not met.

*This effect may obtain also when the clinic has difficulty handling and providing adequate service to the new influx of patients. Dissatisfied patients may give negative impressions of the clinic to other potential patients.

7. *The Dilemma of How much to Spend on Health Education.*

Evaluation should lead eventually to knowing how much to budget. In the meantime, the decision tends to be made in a variety of ways, but the most common way is probably the least rational: budgeting from left-over funds. The alternatives to residual funding for health education require either assumptions or research data. Until we accumulate more specific data, assumptions based on theory and experience must suffice. The alternative criteria for deciding how much to spend on health education are as follows:

(a) Cost-benefit Analysis

When cost-benefit ratios can be computed comparably for health education and alternative intervention or control mechanisms such as surgery, long-term medication, hospitalization and the like, we will be compelled to budget accordingly. We are so far from having adequate data to compute comparable ratios that there will be few applications of this criterion as an administrative decision tool for the near future.[4] Even then, it will apply primarily to public programs and institutions, not to proprietary hospitals,[27] or voluntary health agencies.

(b) Cost-effectiveness

Unlike cost-benefit data, the prospects for generating comparable cost-effectiveness ratios for different combinations or amounts of health education and other program components are very real. The difference is that specific outcomes can be identified for cost-effectiveness analysis, whereas the outcomes for cost-benefit analysis are largely conjectural. Cost-effectiveness data will be equally applicable to public and private programs or institutions. Care must be taken, however, in generalization of cost-effectiveness estimates from one situation to another, or one population to another.

(c) Threshold Spending

The minimum that should be spent on health education for a specific purpose is the amount required to achieve that purpose. While this may seem tautological, it is a tragic fact of much health education funding that the budget is below the minimum required to obtain a desired effect. Parrish notes a similar phenomenon in marketing, where "massive amounts of advertising dollars are wasted on budgets that are well below minimum effective levels of spending."[28] With health education, as with advertising, a threshold level of input is required before a difference in behavior is perceptible. It is not necessarily true that anything is better than nothing. If the "anything" is insufficient to achieve a desired effect, it may be wasted and, worse, may place health education in disrepute. A "critical mass" is required before a reaction can be expected.

From the first three criteria, decisions about the minimum amount to spend can be made. Cost-benefit estimates can tell you whether *anything* should be spent on a given educational program. If the ratio of potential benefits to costs is not greater than one, then nothing should be spent, strictly speaking. Cost-effectiveness ratios enable one to compare the costs of two or more methods in achieving the same outcome. Then, depending on how much of that outcome is needed, the threshold level of spending might be obtained directly from the cost-effectiveness measure by multiplication.

(d) Saturation Spending and the Point of Diminishing Returns

The maximum to be budgeted for a specific health education purpose should be based on data concerning the point of diminishing returns for further inputs. We are beginning to get an understanding of the point of diminishing returns in some program areas.[29] It has always been clear that quality in educational programming was more important than quantity, but we have seldom tried to determine how much was too much of a good thing, probably because we have seldom had resources enough even to reach threshold levels. The range within which decisions on variable amounts of spending should be made is the range between the threshold level and the point of diminishing returns.

(e) Booster Spending

We are sometimes guilty of claiming too much for health education, as we do when we give the impression that educational effects are usually permanent. In fact, we know a great deal about learning curves and memory curves, and the process of forgetting and backsliding. We know that reinforcement is as important to education as booster shots are to sustained immunization. Thus, after reaching the saturation level of spending, we should allow a period of time to elapse before introducing an additional expenditure on education for the same population. At the point when the behavioral changes achieved begin to deteriorate, booster spending on reinforcement or new educational methods may be necessary.[30] It is a mistake also to assume that educational effects are highly generalizable to related but distinct health behaviors. The evidence appears to indicate the need for highly targeted health messages addressed to very specific behaviors rather than more general classes of health behavior.[31]

Summary

This survey of the state of evaluation and measurement in health education has attempted to summarize what we know and what we don't know in relation to the major decisions facing administrators and practitioners today. First of all there are some fundamental dilemmas to be reconciled. These are posed by the peculiar characteristics of health education that make it resistant to some of the standard applications of research procedures. Second, there are some problems in measuring outcomes of health education that require policy decisions on whether benefits are to be expected to accrue rapidly or slowly, temporarily or permanently, in the general population or in high-risk groups, and in what relationship to the economy. Finally, there are questions to which administrators and practitioners must address themselves in the absence of an adequate data base. These particularly concern the decisions that must be made on how much to expend for various health education efforts. Health educa-

tion need not be regarded as a bottomless pit, but neither can it be expected to accomplish much without adequate, timely and well-directed support. Further evaluation is needed specifically to determine the threshold level, the point of diminishing returns and the saturation level for various programs.

Some of the dilemmas facing health education today cannot be resolved simply by trying harder to measure and evaluate. Some will not yield to quantitative and deductive solutions until they undergo a more thorough conceptual and inductive analysis to clarify the theoretical and experiential basis for much of what passes as health education practice.

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