

Distinguishing Between Applied Research and Practice

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Behavior-analytic research is often viewed along a basic–applied continuum of research goals and methods. The applied portion of this continuum has evolved in ways that combine applied research and service delivery. Although these two facets of applied behavior analysis should be closely related, more clearly distinguishing between them, particularly in how we conceptualize and conduct applied research, may enhance the continuing development of each. This differentiation may improve the recruitment and training of graduate students.

Key words: basic research, applied research, applied behavior analysis, graduate training

Evolution of Applied Behavior Analysis

Applied behavior analysis was formalized in the 1960s with the efforts of a relatively small number of researchers to determine if the basic principles of operant conditioning could be used to solve behavioral problems in everyday situations. Although these attempts were practical in focus, the style of analysis was often experimental, perhaps in part because many of the researchers were experienced in basic animal research. Early reports of this work were scattered among professional journals in clinical psychology, psychiatry, and child development. However, edited volumes by Krasner and Ullman (1965), Ullman and Krasner (1965), Ulrich, Stachnik, and Mabry (1966), and Neuringer and Michael (1970) helped to identify and encourage the nascent discipline.

If there was an official announcement of the birth of applied behavior analysis, it was the publication in 1968 of the *Journal of Applied Behavior Analysis (JABA)* by the Society for the

Experimental Analysis of Behavior, which had been established in 1957 to publish the *Journal of the Experimental Analysis of Behavior (JEAB)*. The definition of the new specialty was described in a seminal article in the first issue, “Some Current Dimensions of Applied Behavior Analysis” by Baer, Wolf, and Risley (1968). Its placement in the premier issue, the authors’ reputations, and the influence of their academic department at the University of Kansas insured the article substantial and enduring impact (it has been certified as a citation classic by the *Social Science Citation Index*).

The article defined a set of terms germane to the conception of applied behavior analysis. The definition differentiated the new journal from its older sister publication, *JEAB*. What emerged was a definition of applied behavior analysis as a particular style of analysis, differing in certain ways from the style of analysis practiced in animal laboratories. Baer et al. discussed the definition of seven terms:

The evaluation of a study which purports to be an applied behavior analysis is somewhat different than the evaluation of a similar laboratory analysis. Obviously, the study must be *applied, behavioral, and analytic*; in addition, it should be *technological, conceptually systematic, and effective*, and it should display some generality. These terms are explored below and compared to the criteria often stated for the evaluation of behavioral research which, though analytic, is not applied. (1968, p. 92)

The authors approached the discussion in terms of the challenge of evaluating

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whether a candidate study would qualify as an applied behavior analysis, especially in contrast to a nonapplied analytical effort. In considering the defining features of an applied behavior-analytic study, the paper conveyed a certain model of applied behavior analysis as a field of research.

Over the ensuing years, there have been many assessments of the evolution of applied behavior-analytic research as represented by *JABA* and other applied behavioral journals (Hayes, Rincover, & Solnick, 1980). For example, some have noted that the goal of much applied behavioral research seems to be to demonstrate a new technique or a new application of an existing technique (Birnbrauer, 1979; Hayes et al., 1980). Studies designed primarily to analyze an intervention procedure or treatment effect or to replicate a prior study are less common (Hayes et al., 1980) and seem more likely to be rejected or given secondary status by being categorized as a report instead of an article (Birnbrauer, 1979).

In pursuit of the interest in demonstrating a practical capability, an overriding consideration observed in applied journals is delivering a behavior-change service that can solve an applied problem, not just in general but typically in the immediate circumstance presented by each study. Demonstrating a capability to solve a problem sometimes takes precedence over more experimental objectives such as learning about the etiology of the behavior, elucidating sources of control, or understanding the contribution of component variables (Birnbrauer, 1979; Deitz, 1982; Hayes et al., 1980; Michael, 1980; Pierce & Epling, 1980).

The applied context seems to dominate not only the research agenda but often how it is pursued. Research methods are sometimes subservient to the project's compatibility with the demands of the applied situation. Thus, studies typically use subjects, behavior, and settings presented by the applied problem (Hayes et al., 1980). Although such decisions may be appropriate in

many cases, the pervasiveness of this tendency suggests a narrower view of research interests and methodological options than may be necessary. The priority of the applied context may therefore discourage studies using subjects not indigenous to the applied setting, target behavior selected for experimental rather than applied purposes, or analogue settings that offer a higher degree of control than might otherwise be available.

Furthermore, the overriding criterion for the effectiveness or success of applied research often seems to be the extent to which the results ameliorate the presenting problem. Obtaining a large effect seems important (Baer, 1977; Parsonson & Baer, 1986). This can mean that studies reporting clear but modest effects are less likely to be published, even though such effects may be important in understanding a certain type of behavior. A desire for large effects can also discourage efforts to establish good control over extraneous variables and attempts to conduct analytical studies that examine the contributions of component variables whose separate effects might be relatively small.

Finally, some have expressed concern that the relation of intervention procedures to underlying behavioral principles is sometimes made on a nominal basis guided by topographical similarities (Birnbrauer, 1979; Hayes et al., 1980; Michael, 1980). That is, procedures may sometimes be described as embodying certain basic principles of conditioning because the operations take the same form as the referenced principles.

Whether these features are problematic may depend on one's conception of what applied behavior-analytic research literature should look like (e.g., see Baer, 1981). However, it may be important to consider how they influence the pursuit of still other characteristics of the discipline. For example, there are a number of possible costs of emphasizing the demonstration of new techniques or applications. These in-

clude a failure to develop an adequate understanding of the etiology and maintenance of important behavior, a shortage of analyses describing how complex procedures actually work (or why they do not), and the lack of a thematic style in the literature. Although there may be large areas of research that address a certain problem or method, the studies collectively may fall short of providing a complete and integrated picture of the nature of the problem or the mechanisms of its solution. These tendencies have been observed in the applied literature (Birnbauer, 1979; Deitz, 1982; Hayes et al., 1980; Michael, 1980).

Giving the applied priority of context over research methods can also be costly. Measurement procedures sometimes seem to accommodate the constraints often associated with applied circumstances, such as limitations on observing target behavior. One result is the frequent use of problematic measurement procedures such as interval recording (Kelly, 1977). (A number of studies have emphasized the shortcomings of interval recording; e.g., see Powell, Martindale, & Kulp, 1975; Powell & Rockinson, 1978; Repp, Roberts, Slack, Repp, & Berkler, 1976.) Compromises in experimental control and design may be settled in favor of the dictates of the applied situation. For instance, the modal number of days in baseline phases in *JABA* articles from 1968 through 1976 has been reported to be between 3 and 4 (Huitema, 1986), too brief to achieve the objectives of the steady-state strategy, which is at the heart of within-subject comparisons.

The above assessments and concerns suffer the inevitable constraints of summarizing broad areas of research and may be countered with notable exceptions. There is no attempt here to provide a comprehensive review of the characteristics of the applied behavioral literature, the overall quality of the literature as a research enterprise, or the value of its service achievements. Furthermore, this is a diverse literature

whose origins are not limited to the traditions of *JABA*. Nevertheless, it may be argued that to the degree that the problematic characteristics described above are present, they limit the effectiveness of the literature in explaining human behavior and offering a consistently effective technology for ameliorating problems.

Given that these concerns have been discussed by various authors over the past two decades, it is reasonable to wonder about the influences that maintain some of the applied research practices that might be considered problematic. Although early guidance and exemplars may have played some role, they cannot be held responsible for so much behavior over such a long period. Speculation about the contingencies at work might start with the reinforcers gained by helping in a direct and immediate way those serving as subjects in applied research. Many who conduct applied research probably chose careers focusing on applied issues because they enjoy working with certain populations or in certain settings. Indeed, many who conduct applied research are employed in service settings and are therefore likely to be greatly influenced by the service contingencies of such settings. Conceptualizing a study that requires a comparatively contrived setting or nonindigenous subjects is probably less likely for such individuals than a study whose objectives include ameliorating a presenting problem.

More broadly, conducting research aimed at creating effects of obvious practical value is likely to contact societally mediated reinforcers beyond the research setting. Proposing to have developed a solution for a behavioral problem often leads to professionally and personally powerful reinforcers. Although conducting a component analysis as part of a long-term research program may augment a procedure's eventual effectiveness, publishing a study that shows that it is possible to ameliorate a behavioral problem, particularly if an effective procedure has

not been previously published, is likely to be especially reinforcing.

Some features of applied research literature may result from convenience compared to apparent alternatives. For example, brief phases are generally less troublesome than long ones. Similarly, it is easier to tolerate excessive variability in the hope that large effects will make findings clear than to search out the sources of variability and control them, especially when there are barriers to modifying applied settings for experimental purposes. The familiarity of certain practices such as interval recording may also prompt decisions to use them in spite of documented weaknesses. When convenience and familiarity are not subservient to the effects of thorough research training in graduate school, the many choices involved in conceptualizing and conducting a study may not always lead to analytical clarity and strength. Under such conditions, decisions about the research features of applied studies (e.g., measurement procedures, experimental design and control) may sometimes yield to practical limitations and service-oriented emphases imposed by some applied settings.

APPLIED RESEARCH VERSUS SERVICE

Consequences For Applied Research

This brief summary of the evolution of applied behavior-analytic research and some of its characteristics suggests that it has operated under certain constraints, whether imposed by early traditions or by the contingencies under which applied researchers work. Applied behavior analysis evolved as a blend of applied research and service delivery. This amalgam may be useful in many instances, especially when the objective of a project is to ameliorate a specific behavioral problem. As a way of conducting applied science, however, this traditional model may result in less than adequate experimental pursuit of applied questions in the behavior-analytic research enterprise. It

may even burden service delivery with unnecessary research obligations. The result may be areas or types of applied research that are deficient or even absent.

Some of the missing research agenda might be addressed by expanded basic research interests. There has been increased attention in the basic research literature over the last couple of decades to questions that specifically concern human behavior (Buskist & Miller, 1982; Hyten & Reilly, 1992; Johnston, 1983). Some of these research themes have not been well integrated with nonhuman research (Perone, 1985a), and some topics have not realized the potential that might be anticipated. For instance, attention to social phenomena (e.g., Hake & Olivera, 1978) has yet to blossom into an identifiable and multifaceted area of basic research (Cherek, 1995; Schmitt, 1995; Sherburne & Buskist, 1995). However, some areas are showing steady growth and integration. Experimental interest in verbal behavior has increased considerably (reflected by the evolution of *The Analysis of Verbal Behavior* from newsletter to journal status), and the burgeoning stimulus equivalence literature (see Sidman, 1994) seems to be realizing its potential to be an integral part of the basic literature while extending to a wide range of basic and applied research issues.

What remains underdeveloped in behavior-analytic research is what in other natural sciences is categorized as applied science. Applied science may be defined as experimental research that is connected to basic research through its experimental style and a basis in fundamental principles, directly driven by applied issues and problems, but not compromised by the practical limitations or the immediate service interests of applied settings. The traditional conception of applied behavioral research seems to be shortchanging the larger research agenda of behavior analysis by failing to adequately encourage this type of experimentation. Although we can point to a large and, in some ways,

well-developed applied research literature, it may not adequately serve the functions necessary to complete a scientific continuum connecting basic research to applied practice.

Because much applied behavioral research is overly permeated with service considerations, the considerable size of the applied literature may suggest more than it can actually deliver. Although this literature is indeed applied, behavioral, and experimental, its substance may not yet reveal the benefits of a fully developed applied science, one guided by questions from both laboratory and field and nurtured by adherence to the thematic and explanatory styles characteristic of basic research (see Johnston & Pennypacker, 1993, chap. 3). Although there are some areas of study that constitute an exception (e.g., Sidman, 1994), the dearth of studies representing a systematic, science-oriented approach to questions with direct applied implications creates a gap between basic research interests and the service-oriented focus of the present applied literature. This breach has been one of the central concerns of writers who have examined our research enterprise (Birnbauer, 1979; Hayes et al., 1980; Malott, 1992; Michael, 1980; Pennypacker, 1981; Perone, 1985b; Poling, Picker, Gossett, Hall-Johnson, & Holbrook, 1981). What must we do to strengthen applied behavioral research and thereby improve its effectiveness, as well as that of our applied service efforts?

Technology Versus Craft

Although some basic researchers may rebel at this contention, basic research in any science is typically justified by a history of contributions to the culture through the technological benefits it has spawned. More explicitly, societal (i.e., financial) support of a science depends on the science's promise to provide an eventual record of delivering technological solutions that solve practical problems and make

life easier. Although much scientific behavior may be reinforced by the joy of discovery, society is likely to continue supporting a well-developed, modern science only to the extent that its promises are eventually fulfilled by discoveries that facilitate solutions to society's problems. Thus, even though we may say that the goal of a basic science is to discover orderly and general relations among phenomena, the associated applied science must use these discoveries to develop effective technologies, which then must be usefully disseminated.

It follows, therefore, that the overarching goal of our science is to learn enough about behavior to support the development of a technology as impressive as those engendered by other natural sciences. The technologies of engineering and medicine are familiar examples. In fact, they are so familiar that it might be easy to underappreciate their effectiveness. Yet, people routinely bet their lives on how thoroughly applied researchers have investigated the application of the laws of fluid dynamics to aircraft design or on how well medical researchers understand the effects of drugs on disease processes.

What are the characteristics of these technologies that make them so effective? Their scientific foundation is the obvious source of their power, of course, but other features are important as well. If their characteristics are transposed into a definition of a behavioral technology based on a natural science, it takes the following form:

Behavioral technology refers to behavior change procedures whose mechanisms have been established by experimental analysis in the terms of the natural science of behavior and for which applied empirical evaluation has established reliable and general effects. (Johnston, 1993c, p. 333)

Within the phrases of this definition lies a conception of applied behavioral research that differs from that represented by much of our applied literature. For instance, the definition distinguishes procedures that are effective

for reasons that are unknown or only suspected from those that work for reasons that have been identified through an experimental history. It says that a procedure is ready for inclusion in a behavioral technology only when the variables that make it effective have been identified through experimental analysis. In other words, it suggests that it is the understanding of the mechanism of a procedure's action, rather than its apparent effectiveness, that qualifies it as technology.

Accomplishing this requires not just component analysis, but a focus on understanding the nature of the behavioral problem and the contributions of past and current environments. This approach to developing technology begins not with a tentative intervention to be tested, but with experimental pursuit of variables whose understanding will suggest procedural solutions to the problem. The emphasis in the early stages of a research program is more on experimental analysis than on delivering a product.

This paper cannot fully delineate the features of this stage of applied research; they are considered in greater detail in Johnston (1993c). However, the following questions suggest the scope of this preliminary, experimental effort.

- (a) What is the nature of the problem?
- (b) What are the goals of behavior change?
- (c) What kinds of behavior are of interest?
- (d) What are their controlling variables?
- (e) What are the relevant principles and procedures?

The experimentally derived answers to these questions eventually lead to tentative procedures that have some promise. However, this definition requires that further development and testing also be distinctly analytic, as opposed to service oriented. The questions now become:

- (a) What are the procedure's effects?
- (b) What are the components and their effects?
- (c) How do the components produce their effects?
- (d) How can the procedure be improved?

Although these two sets of questions may seem routine to applied researchers, their summary nature may hide the implied experimental agendas necessary to answer them in a scientific style. For example, determining the nature of the behavioral problem may often involve not only reviewing the literature, interviewing interested parties, and judging the embedded contingencies but also collecting descriptive data, intervening experimentally to evaluate the function of existing variables, or even conducting experiments under controlled conditions to learn more about how certain kinds of behavior work. In the case of the research concerning breast self-examination described below (Pennypacker & Iwata, 1990), the full dimensions of the behavioral challenge were not clear until a number of experiments had been conducted.

Throughout this experimental process, the definition requires that the analysis be in the terms of the natural science of behavior. This is not just an insistence on correct use of scientific terminology but on reaching an understanding of how the basic laws of behavior are involved in a problem and its solution. Although such research sometimes may appear fairly nonapplied compared to existing applied literature, it usually will fall well short of constituting basic research (see Pennypacker & Iwata, 1990). These studies usually will be driven more or less explicitly by the applied problem, which is customarily a primary consideration in categorizing experimentation as applied rather than basic in focus.

The definition's emphasis on conducting analysis in terms of the science identifies a critical feature of a natural-science-based technology. It insures

that the technology is firmly rooted in a scientific understanding of the phenomena involved. It is this feature that distinguishes technology from craft; both may work, even consistently, but only with science-based technology is there a sound basis for understanding why. The experimental effort to attain that understanding is what makes technology as effective as the science will permit, which is usually more effective than mere craft.

Finally, the definition adds a second empirical process procedures must undergo. After an experimental literature has led to the development of a procedure shown to be effective, it must be evaluated under increasingly realistic applied conditions and be shown to have reliable and general effects. This will not be the first occasion for using target subjects, behavior, and setting, nor will the procedure's effects be unknown. At this point, however, there should be no important analytical questions remaining, only the need to assess the procedure's effectiveness under highly realistic conditions. The primary focus at this point is to learn how routine application might modulate effects that are already well established.

Some Further Characteristics

It may be difficult to appreciate what an applied research literature would look like if it was consistent with this definition of technology. It requires imagining literatures that presently exist only in the form of limited or incomplete examples. The program of research chronicled by Pennypacker and Iwata (1990) concerning the development of a technology for teaching breast self-examination provides a fairly good example of this approach. Although this research program was unusual because it involved only a single group of researchers, it exemplifies some of the characteristics of this approach to technological development.

The research program shows a thematic approach to identifying and learning about the many variables nec-

essary to building an effective breast self-examination technology. Early studies probed in different directions to identify the topographical characteristics of lumps in breast tissue, the requirements for physical models of breasts, and the psychophysics of manual palpation. These studies led to a further series of studies that focused on techniques of palpation, the analysis of topographical components of palpation and search pattern, and the features and materials of client training procedures. Additional studies focused on testing the emerging self-examination procedures under increasingly realistic conditions. The technology was not offered for dissemination until years of research had shaped and justified every facet of it, and it remains the state of the art in breast self-examination (Pennypacker & Iwata, 1990).

Of course, a single example cannot convey the range of a fully developed applied science. Although much of this literature would, as in this example, address the development of particular technologies, a significant portion would be only indirectly motivated by the need for specific applied techniques. Instead, these more general studies would be conducted to improve our understanding of how the basic laws of conditioning are involved in certain kinds of behavior under certain field conditions. It is some of these investigations that would encroach on the uncertain boundary between basic and applied science. A research program that addresses social behavior might be an example of this less practically directed type of applied research.

In light of the present applied literature, some might find this approach to be excessively experimental and laborious, too far removed from the immediate need to address an applied problem. In fact, many applied studies consistent with the proposed perspective would indeed be distinctly analytical in their focus. The goal of research designed to support and develop technology should be to learn enough

about the problem and its applied context to bring the strengths of the basic science, both substantively and methodologically, to bear on resolving the applied problem. In general, applied researchers should not be asked to solve practical problems in any immediate or local sense but to learn enough to permit practitioners to solve problems consistently under the varied conditions they may encounter.

The recommended focus does not dictate any particular emphasis in the selection of subjects and settings. Both analogue and actual subjects and settings would occur in such literatures. The choice would be based on the requirements of each study, instead of allowing the features of the applied context to take precedence over methodological needs. For example, Pennypacker's research program used college women, older women recruited from the community, and physicians as subjects. Research settings included different laboratory environments as well as a range of contrived and uncontrived applied settings. Each study was given the circumstances necessary to answer its guiding question, even if a highly contrived circumstance resulted (Pennypacker & Iwata, 1990).

Some readers may also infer from this description an overly formal or structured applied research process. It is important to appreciate, however, that such literatures would develop naturally from the interdependent and overlapping efforts of multiple researchers. Nevertheless, a literature developing in the manner proposed here might be more thematic than the existing applied literature. Because studies usually would be driven by an array of analytical questions associated with a problem, there might be more organization or direction to research on a topic than we are now accustomed to, even with independent researchers involved. Studies would more often be constructed to pursue certain questions, rather than to take advantage of access to a population or setting. This focus on accumulating the information nec-

essary to build an effective and general behavior-change capability would replace a tendency to demonstrate that capability in particular instances without the guidance of a well-developed experimental literature.

Finally, some may be concerned about our ability to discover enough about particular kinds of target behavior and circumstances to fashion a technology that is comparable to those of engineering or medicine, even over the long term. Achievement of such capabilities in specific areas will overcome such doubts, but it may help to separate the problem of developing technological capability from the problem of delivering it. The availability of an effective technology of treating self-injurious behavior in mentally retarded individuals, for instance, does not abrogate the challenge of getting the technology properly applied in individual cases. It might be presumed, however, that solving the first challenge will aid in solving the second. Not only will the requirements for service delivery be fully revealed only when the technology is fully developed, but the ability to show the power of the technology may also help to engineer the resources necessary to assure its proper application.

IMPLICATIONS FOR BEHAVIOR ANALYSIS

Applied Research Versus Applied Service

One of the strengths of this conception of applied behavior-analytic research is that it may aid in resolving one of the most serious and long-standing problems in our conception and practice of applied behavior analysis. When Birnbrauer (1979) identified this problem, it was already well entrenched in the accepted definition of applied behavior analysis. The problem is that we have excessively intermingled applied research and service delivery interests in our applied literature, to the detriment of each.

There are inherent conflicts between

the requirements of applied research and the application of research findings for purely practical purposes. Research requires a certain degree of experimental control, enough to reveal the relation between the independent and dependent variables. The price of control, however, is a degree of artificiality in the experimental circumstances that would be required to investigate an applied issue.

On the other hand, applying technology for service purposes requires compliance with the needs of the applied situation. The price here is a lack of control over those factors that yield clear answers to experimental questions. In other words, each is often an inherently limited occasion for accomplishing the other.

The traditional conception of applied behavior analysis as simultaneously serving both interests may prevent us from doing either as well as we could. The requirements that every applied study simultaneously (a) use subjects and settings common to the applied problem, (b) produce effects that are large enough to resolve the immediate problem, and (c) examine the applied generality of the procedure often precludes the sound, analytical research necessary to develop true technologies. Furthermore, bringing the intrusive and burdensome requirements of research methods to routine service delivery may complicate this work as well.

It is applied research that suffers the most, however, because we intend our applied literature to describe experimental efforts that can each serve as effective behavior-change procedures. Although our interventions are often markedly more effective than those of other fields of psychology, they are only modestly effective by practical criteria. The shortfall between practical needs and technological prowess often prevents practitioners from being able to solve practical problems without approaching their work as a quasi-experiment. As a result, we must teach practitioners that the full panoply of mea-

surement and design procedures is a necessary part of service delivery because these experimental safeguards are often required to address the shortcomings of interventions. In effect, by failing to do the necessary experimentation in the first place, we are often forced to do it in the guise of practice.

The alternative approach recommended here involves making a greater separation between applied research and practice. As with other applied natural sciences, it is basic and applied research that should be viewed as closely related enterprises, often indistinguishable near their shared boundary. They should differ only in the rationale that guides experimental questions, not in thematic or methodological style. The priority of applied research is answering with the full power of science questions that focus on building technological capability. This should be done by trying to understand human behavior and its practical circumstances and by using that understanding to develop ways of exerting useful control over it. This kind of applied research should be thematic, with the goal of filling the gap between the basic science and the needs of practitioners. The choice of subjects, behavior, setting, and preparation should be subservient to experimental questions, not to the applied circumstances in which problems must eventually be solved. It is this priority, for example, that encouraged Pennypacker and his colleagues to conduct a number of studies concerning lump detection under laboratory conditions (Adams et al., 1976; Bloom, Criswell, Pennypacker, Catania, & Adams, 1982).

In contrast, the priority of applied practice is to deliver an effective service, not to answer experimental questions. The only questions practitioners should routinely face concern assessment of the presenting problem, selection of appropriate procedures from available technology, adaptation of procedures to local circumstances, administration of procedures consistent with the technology's requirements,

and tracking of the results. With a mature technology, interventions should take on a quasi-experimental style only when expected or desired effects are not obtained, which would be far less often than is now customary.

In other words, as in the application of engineering and medical technologies, practice is generally not an occasion for discovering, understanding, or explaining in a scientific sense. Although individual practitioners may gain from experience in these ways, such knowledge is quite different than that obtained by researchers and cannot substitute for applied research. It is a mistake to view the circumstances of service delivery as accommodating the applied research agenda on a systematic basis.

Graduate Selection and Training

The distinction outlined here between applied research and service delivery implies a new approach to selecting and training graduate students, especially those with applied interests. At present, behavior analysts seem to distinguish between basic and applied mainly when making reference to student interests and training programs. The proposed perspective toward applied behavior analysis changes the primary distinction to research versus service, with research interests further subdivided into basic and applied.

In other words, the applied nature of students' career interests should be less important than knowing whether they intend research or service careers. Applied researchers should be science oriented in their career interests. To bridge the gap between the potential of the basic science and the needs of practitioners, they should have command of both basic and applied research literatures. They should have a thorough understanding of experimental methods because of the challenge of having to satisfy the inherent conflicts between experimental needs and applied problems. Above all, they should think

like researchers when considering applied problems.

Although practitioners should have a good command of the basic literature, it is the applied literature with which they must be most familiar. They also should have a considerable array of applied skills, which will require extensive training in field settings. It also follows that those planning careers in service delivery need not be highly trained as researchers. Even more important, they should not be encouraged to view research as part of their career obligations. Nor should their training and professional experiences lead them to believe that research is the sole or even the primary basis for defining their professional worth.

This will be a controversial point for those who have grown up with the scientist-practitioner model of graduate training and practice in psychology (see Barlow, Hayes, & Nelson, 1984, for a brief history). Applied behavior analysis seems to have adopted uncritically this approach to graduate training, in spite of its controversial and waning application in clinical psychology. This paper cannot consider the embedded issues, but it is easy to point out that the model is exemplified in the careers of relatively few individuals. Not only do attempts to be equally well trained and effective as both scientist and practitioner run afoul of conflicting contingencies, but individual interests seem to match the model's requirements only infrequently (Malott, 1992, takes a similar position).

In contrast, the professional model of practitioner training seems to be well established in those fields in which technology is highly developed (e.g., engineering and medicine). Although some individuals may be interested in and able to pursue true scientist-practitioner careers, they are the exception. The recommended approach to developing and applying behavioral technology suggests that a professional model of graduate training may be better preparation for most individuals who are planning service careers. This

model might also improve our approach to training students who are working toward a bachelor's degree.

The Challenge of Disciplinary Change

The perspective proposed here may be controversial because it deviates from the practice-dominated approach to applied research that is represented in applied literature. The recommended view encourages us to go beyond traditional prescriptions and consider a style of applied research shared by the natural sciences. Effective behavioral technology will result from addressing analytical questions about human behavior and its applied circumstances in a style that provides a relatively complete picture of the variables that must be accommodated in intervention techniques for them to be consistently effective. Focusing on the development of interventions without this underlying information may limit the potential of behavioral technology. Although the necessary applied research agenda is more thematic and analytical than that to which we are accustomed, it may be the best way to acquire the knowledge necessary to make our procedures as effective and consistent as the science will allow.

Some may argue that although our technology may be underdeveloped by some criteria, it is at least better than that offered by other human service fields. This position implies that behavior analysis need not change its style of applied research because it is doing well enough as is. In considering this argument, it should be remembered that the standards of a science and technology are at the heart of how disciplines are defined. Behavior analysis has always set itself apart from other areas of psychological research on the basis of the kinds of questions asked and how they are answered. Behavior analysts maintain that their success in both research and service is testimony to the superiority of their approach. The present argument is that

the discipline can improve its pursuit and delivery of effective technology. It is difficult to know exactly how much improvement is possible, however, without improving how the applied research agenda is approached. Behavior analysts often make an analogous point when wondering about how much the behavior of individual organisms can be changed.

This perspective toward applied research may also be disputed because some may be uninterested in conducting the kind of research it requires. Each person chooses his or her own research career, of course. The discipline, however, is defined by the collective effects of these individual decisions on its literatures. It might be useful to consider how to influence the decision making of individual investigators such that the collective research output has the desired characteristics. For instance, how can graduate training experiences lead new applied researchers to conduct the style of research encouraged here? How can the existing applied research cadre be encouraged to focus on addressing analytical questions rather than demonstrating a procedure's potential? How can those who plan a career providing behavioral services be taught that professional excellence and accomplishment do not require conducting research?

Some may insist that our ability to control the relevant variables in service delivery environments is inevitably so limited that it is pointless to strive toward a technology as effective as that of engineering or medicine. Even though there are limitations in practice, however, it does not reduce the value of applying an improved technology. Indeed, such constraints make it all the more important to improve behavioral technology so as to minimize the constraints of service settings. Furthermore, the more thorough our understanding of how to manage behavior, the better our understanding of what is needed in order to be maximally effective. And the more effective behavior analysis can show its technology to be,

the more control over service settings may be attainable.

Finally, it could be suggested that behavior is sufficiently different or complex compared to other phenomena that behavior analysis may never be able to learn enough about it to create technologies as effective as those of the other natural sciences. This might be true. There are certainly present limits on the applicability and effectiveness of behavioral technology, and these should be acknowledged. However, the ultimate possibilities of a science and technology of behavior have yet to be exhausted. The present proposal may facilitate progress toward any limits.

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