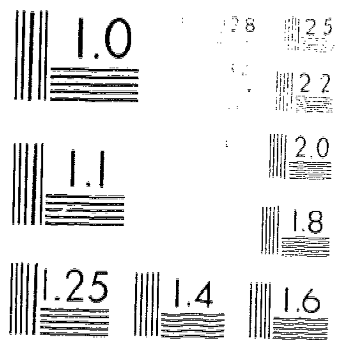
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AUTHOR Schwen, Thomas M.

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ABSTRACT

An attempt to establish criteria to judge scholarly activities in the field of educational technology focused on skills of inquiry, a process which includes problem definition, hypothesis formation, and hypothesis verification. To be judged adequate such inquiry should be: (1) publicly verifiable; (2) disciplined; (3) generalizable; (4) based on a conceptual structure or theoretical framework; (5) directed towards the extension of knowledge; (6) a demonstration of a comprehensive search; (7) a creative exploration; and (8) sensible. This report describes the need for such criteria, defines each criterion, and explains the implications for adopting the set of criteria. (EMH)

PROFESSIONAL SCHOLARSHIP IN EDUCATIONAL TECHNOLOGY: CRITERIA FOR JUDGING INQUIRY

By

Thomas M. Schwen

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Thomas M. Schwen is the Director of Development and Special Projects, Audio-Visual Center and Associate Professor of Education at Indiana University.

Address: Audio-Visual Center
Student Services Building, Room 235
Indiana University
Bloomington, Indiana 47401

PROFESSIONAL SCHOLARSHIP IN EDUCATIONAL TECHNOLOGY: CRITERIA FOR JUDGING INQUIRY

Introduction

As a professional field such as educational technology alternates between evolution and revolution; it is, occasionally, necessary to re-examine some of the basic assumptions which guide its development. This article, commissioned by ERIC and AV Communication Review (AVCR), is directed to the publication criteria which are used to judge scholarly activity in educational technology.

In recent years with the advent of more specialized roles in Educational Technology as well as Education at large there appears to be some confusion over publication standards that are appropriate for a scholarly journal such as AVCR. In recent correspondence with the Division for Instructional Development* of AECT the author has found a wide range of opinions regarding what should constitute the nature of research, development, and what has constituted the nature of previous publication policies. The responses ranged from requests for normative data based surveys of media utilization to the observation that the practic of development was not a suitable topic for "the only American journal to focus exclusively on research in our field."

Some of the confusion regarding the concepts of research, development, and practice seems to be a matter of how many functions one argues, are being performed. Baker (1973) reviewed the various positions regarding research and development that have been taken in recent years. The review showed some have argued that conclusion inquiry and decision oriented inquiry subsume the distinction between research and development. Others have argued that the process of information flow is the most salient

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*The author informally polled the approximately 400 members for their opinions regarding the problems of publishing in conjunction with their Instructional Development activities. Unfortunately, space does not permit the opportunity to thank each of the respondents.

discriminating factor. For example, linear, interactionalist, and cyclic formulations have been designed to model the information relationships between research, development, and practice.

The position taken here is that the classic concepts of roles and functions can be applied to distinguish research, development, and practice. Adapting the work of Gideonse (1968) it can be argued that there are three professional roles being performed. These roles can be characterized by different expectations, contexts, and particularly outcomes. 1) Practitioners in educational institutions are expected to deal with the buzzing, blooming confusion of the real world and control the variables that lead to knowledge, skills, attitudes, etc., in their students. 2) Educational researchers, on the other hand, deal with the confusion of uncertain theoretical understandings and move toward the discovery of new knowledge. This knowledge is appropriately tied to educational problems, but the outcomes are valued for their reduction of uncertainty, not necessarily for their immediate utility. 3) Developers (including many education technologists) occupy a middle ground. They are constrained by immediate problems, but, unlike practitioners, their efforts are more directed by scientific replicable processes which result in pragmatic outcomes. On the other hand, unlike researchers, the developers' most important criterion for success is the immediate utility of the processes or products they invent.

The central argument of this article is that underlying the professional roles is one function: that function is inquiry.* The point is not to make the definition of inquiry so broad that it includes all the activities in all professional roles, but to assert that inquiry is the single function that integrates all three roles. Inquiry is seen as a formal function that

*The term inquiry is utilized here because it appears to enjoy a broader and more inclusive meaning than 'research.' Also, it helps to clarify the distinction between the role of research and the function of inquiry.

may take different forms with different goals, constraints, role perceptions, etc.; however, the current definitions and commonly held criteria for judging inquiry are inclusive and applicable to inquiry associated with any of the professional roles educational technologists assume. If accommodations for role in publishing are to be made they may be directed to more precise communication between professionals who serve in editorial functions and those who are engaged in the various roles.

Some Definitions

Educational Inquiry is defined as a process which includes problem formation, hypothesis formation, and hypothesis verification. Further, the process is restricted to the domain of planning, implementing, and evaluation of the management-of-learning process. This definition has been adapted from E. Steiner Maccia (1976) and Hoban (1965). The classical processes of inquiry have been utilized in a definition by Maccia. In regard to domain, Hoban has argued that the management of learning problem subsumes the so-called teaching-learning process, the term utilized by Maccia.

The classic process distinctions have formal counterparts across many disciplines or fields of study. For example, the definition of a problem can occur in a symbolic mathematical form or in a Fruedian expression describing the psychic disability of a child, etc. In all cases the problem sets out a question which a professional community of scholars has not resolved. The hypothesis formation process is a process wherein tentative solutions to the problems are posed in a manner consistent with the modus operandi of the discipline or profession. The hypothesis verification process includes the formal disciplined resolution of the problem in a manner that enables other scholars to incorporate that solution in subsequent explorations of the same or similar problems.

The restriction in domain is a characteristic of a profession. In the same manner that medicine draws on the 'mother' disciplines of chemistry, biology, etc., to create a form of knowledge peculiar to its sphere of professional interests, education, also, draws on many disciplines and specific methodologies to create a unique body of knowledge that bears on educational problems. The terminology in this definition was deliberately chosen to incorporate philosophic as well as empirical inquiry.

The goals of educational inquiry are understanding and prediction (precision)*. This almost axiomatic definition has been restated by Dubin (1976) for an applied field. Following Bergman (1957) he argues that understanding results from a knowledge of the process or dynamics of a theory. Prediction results from investigation of the outcomes of a theory. The distinction is in part a matter of the level of description one uses. In inquiry directed toward understanding the professional focuses on the abstract relationships or generalizations that constitute a logical explanation of the reality being explained. In inquiry directed toward prediction of a professional focuses on the less abstract empirical laws which have been derived from the theory. The empirical laws are applied when the measures of one set of theoretical variables are utilized to predict the measures of another set. Dubin argues that these dual goals are evident in theory building that is 'applied' or 'basic.' He also argues these two goals are coordinate in that knowledge cannot be advanced without both goals being pursued.

Argyis (1976) has argued that professionals in an applied field often exhibit a predisposition toward the goal of prediction in inquiry with the consequent stagnation of understanding of theoretical processes.

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*The terms prediction and precision will be considered equivalent for the purposes of this discussion. Precision is more useful in contexts such as discussions of inquiry directed to improving professional practice.

In other words, a theory that permits a reasonable level of prediction is not brought under examination. For example, it could be argued that the use of individual differences theories for prediction of academic success have enjoyed 'sufficient' success thereby curtailing the development of new theoretical formulations of individual differences and school learning. In essence, Argyis argued that the constraints of professional roles act to preclude the advance of knowledge. Argyis' observation appears to be useful in evaluating inquiry in educational technology, as well. For example, understanding of the mastery model has not substantially improved since the original formulations of Carroll (1963) and Bloom (1968). Subsequent exploration has been largely oriented toward improving the precision of the methodology (e.g., Block, 1971).

Inquiry in Educational Technology is defined as all educational inquiry, associated with the planning, implementing, and or evaluation of the management of learning process, which employs a systematic technological process. The significant addition to the previous definitions is the phrase, systematic technological process. Following authors such as Finn (1960), Hoban (1965), and Heinich (1970) it is argued that an appropriate definition of educational technology must include reference to a systematic process. That is, technology defined with hardware or software attributes is too transitory to build useful philosophic distinctions and, therefore, too restrictive. Many current definitions of technological processes may be found in development models (e.g., Davies & Schwen, 1972) or message design models (e.g., Fleming & Levie, in press). These models all have the common attributes of, a) disciplined analysis of: problem, context, constraints, learners and task; and, b) disciplined synthesis involving: the design of replicable forms of instruction and formative and summative evaluation. It is true that professional practice quite often involves the use of 'media' hardware and software. This author would argue that a formal definition of educational technology may not be bound by attributes of hardware and software.

Inquiry in Instructional Development and Inquiry in Educational Technology will be treated as coordinate terms for the purposes of this discussion. If the reader were to include media attributes in the definition of Inquiry in Educational Technology, Inquiry in Instructional Development would be the superordinate term because inquiry that incorporated a technological process without media hardware or software would constitute a more comprehensive logical set.

Implications Following From the Definitions

An important assumption held in respect to this article is that AVCR should publish inquiry that advances the profession of educational technology.

The definitions allow for a middle ground between those professionals who would restrict publication in the professional journal to 'empirical' inquiry directed to theoretical understandings and those professionals who would seek sophisticated reports of development or practitioner role activities. To restrict publication to empirical studies directed toward understanding or prediction is to operate with a definition of inquiry that is too narrow or restrictive. For example, there are many questions of philosophy that professionals in educational technology will need to address. A reasonable outlet for that type of inquiry is the professional journal. On the other hand, to publish sophisticated development or practitioner role activities as inquiry is to be unduly repetitive regarding commonly understood generalizations and facts or commonly utilized methodologies.

The use of the rather broad definition of Inquiry in Educational Technology opens the journal to a broader range of topics than the current editorial policies would seem to permit. For example, an educational technologist/developer could develop a so-called auto-tutorial class. Associated with the systematic technological analysis used in the design of the class; a management system employing student tutors could be utilized for remedial purposes. Inquiry which explored the effectiveness of various tutorial procedures, even if the procedures excluded 'media' developed for the class, would be an appropriate topic for publication under the proposed definition. Of course, the example could be expanded by excluding the auto-tutorial aspect. The class could be traditional in the sense that media would not be used. By the definition, if a systematic technological process were employed, inquiry could be conducted that would not exceed the logical reach of the definition.

The Criteria for Judging Scholarly Products*

It is not sufficient to define inquiry and expect reasonable publication practices and procedures to be deduced. In this section, some of the classical criteria which characterize adequate inquiry will be reviewed. These criteria will be submitted as a partial list to be debated, expanded, or modified by those who judge the adequacy of scholarly endeavors in our profession. This restatement of classic criteria is intended as a stimulant toward the re-examination of basic assumptions alluded to in the opening paragraph of this article.

I. Inquiry in Educational Technology should be publicly verifiable. Professionals in educational technology have the obligation that all

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*The author wishes to acknowledge his colleagues on the Commission on Doctoral Study, School of Education, Indiana University, particularly A. Stafford Clayton, who led the committee in developing an earlier version of these criteria. Those criteria appeared in a report entitled, Report of the Commission of Doctoral Study (undated 1975).

professionals do to describe their scholarly activities in a manner which permits the referent community of scholars to: 1) examine the basic plan or design that has been used; 2) replicate the processes that have been employed; and, 3) accept or reject the outcomes that have been developed. Empirical and historiographic inquiry may be particularly enhanced by the media often used in this profession. An unusual opportunity to preserve the data or treatments exists. However, it would appear that our documentation procedures are lacking. For example, most empirical studies are impossible to replicate because mediated treatments are unavailable. An archival library is needed for the field. An interim solution has been developed by Merrill (1965). He provided access to the treatments in his several sequencing studies by placing the original work on microfiche with a national documentation center.

II. Inquiry in Educational Technology should be disciplined. Disciplin as a criterion is advanced in place of and in contrast to the often stated concept, systematic inquiry. Cronbach and Suppes (1969) made the point when they suggested that inquiry in practice is not always ordered or systematic, either in regard to procedures or in the creation of a new subdiscipline or field. The quality that does characterize excellence in inquiry is the style of the investigation. Inquiry is disciplined in the sense that: the problem is described with precision; the assumptions and the boundaries of the inquiry are carefully delineated; the report of the design or plan is explicitly focused on logical consistent outcomes; and the outcomes are set forth in language or syntax that is descriptive, coherent and concise. It is unfortunate that the criterion has been misapplied to the preliminary procedures of inquiry, since for this reason students of the profession as well as in other fields seem to carry a perception of inquiry that is formal, empirical, rational and mechanistic.

The rich, speculative, creative, frustrating and insightful early stages of most inquiry is, perhaps, distorted by the systematic formality of the final report. It may be appropriate to speculate that this perception of the inquirer has been responsible for forming the collective pattern that many authors decry, e.g., Snow and Clark (1976), Levie & Dickie (1973), etc. Departing from this narrow model of quantitative empirical inquiry could conceivably advance the field as much as increased sophistication of methodology. Of course, logical, historic and philosophic forms of inquiry should be encouraged, not for the sake of expanding the forms, but to facilitate integrated advances in knowledge.

III. Inquiry in Educational Technology should be directed toward generalizability. The concept is one of intent rather than absolute state. At a general level, this concept is not advanced with the premise that all inquiry will discover new or novel rules, principles, or facts, but with the expectation that deviations from commonly understood generalizations or understandings are to be carefully reported. In other words, the complexities of inquiry generally preclude the uncovering of substantial new knowledge, whether in just one or in a number of studies. Generalizability of knowledge may be achieved through continuous effort across a series of studies; therefore, individual reports must be evaluated in a well defined context.

On a technical level, there have been a number of advancements in the concept of validity that should have substantial influence on inquiry in our field. Campbell's and Stanley's (1966) well-known contribution on the methodology of quasi-experimental design and on internal and external validity has been augmented by more recent contributions such as Snow (1974), Cook and Campbell (1976), and the most recent AVCR-ERIC commissioned paper by Snow and Clark (1975), which reviews inquiry in our field. Including decision theory within this context is especially valuable for those professionals who are primarily concerned with precision. For example, Schwen (1973) has argued that the application of decision theory constitutes a logical extension of the formal analysis function in instructional development. It is a means of using empirical data to logically analyze the consequences of extending a technological treatment to other samples or individuals. Decision theory, therefore, constitutes a useful extension of the external validity concept in the prediction of behavior.

IV. Inquiry in Educational Technology should be incorporated with a conceptual structure or theoretical framework. Excellent inquiry cannot occur in an intellectual void. All scientific advances, even revolutionary advances (Kuhn, 1970), are based on the accumulation of past theoretical understandings. In an applied field as well as in a "classic discipline," a quality of excellent inquiry is that it focuses on theoretical or conceptual problems, and not exclusively on day to day tasks or symptomatic indices of fundamental problems. The predisposition of a professional field such as educational technology to engage inquiry directed toward prediction makes this criterion all the more relevant. Educational technologists must continually return to the field's cumulative knowledge, as well as to the disciplines, to define professional problems in increasingly precise theoretical terms. Ultimately, new theoretical understandings as well as increased precision will be a product of this willingness to question traditional definitions of problems.

V. Inquiry in Educational Technology should be directed toward an extension of knowledge. As noted above, additions to knowledge are seldom dramatic. New knowledge is seldom clearly disparate from previous understandings. In most instances of inquiry it would be optimistic to

e than a subtle refinement of current knowledge or a definition
elationship between previously discontinuous categories of
Also, as Heinich (1970) and Maccia (1976) have observed, the
educational inquiry are unique to educational problems. That
owledge gained from educational inquiry is more than an extension
ogy or other disciplines. It follows that accumulated knowledge
onal technology is discrete from the 'mother' disciplines.
the problem definition may be influenced by the classical
of scholarship, however, the definition of the problem and
ed extension of knowledge must be defended from the context of
al problems.

Inquiry in Educational Technology should demonstrate a comprehensive
ne definition of a specific instrumental problem of practice is,
, insufficient to merit its consideration by a community of
The instrumental problem is and should be a representation of
nresolved logical problem. The classic search of the literature
er of functions, the most crucial of which is to relate the
problem to the larger context of educational issues which it
. The inquiry must ultimately stand on the merits of this
logical problem. No amount of methodological or logical
ion can compensate for an ill-defined problem statement or a
loped contextual formulation of the problem. In educational
as in all professional fields, the unresolved logical problem
ated to professional problems in a meaningful fashion.
a problem that attempts to speak to an extremely broad set of
es or instances such as the development of a theory of learning
tter left to the appropriate discipline. On the other hand, a
ch is wholly instrumental or pragmatic has been too narrowly

defined. A properly defined problem stands on both the common pragmatic foundation of professional experience in the field, and the unique set of accumulated knowledge.

VII. Inquiry in Educational Technology should demonstrate creative exploration. In many instances a "discovery" in inquiry is a reordering or reformulation of understandings. In these cases the "discovery" may create a different perspective or insight regarding theoretical understandings, or regarding precision in practice, or both. The question is not whether the discovery incorporates new or novel elements. A contribution is measured by the potential effect on the professional community. A creative "discovery" modifies the previous definition of the related educational problem in a manner that must be considered in future inquiry.

VIII. Inquiry in Educational Technology must make sense. This criterion is offered as an extension of the Versteken concept popularized by Winch (1958) and others (Gibson, 1960). This concept was originally discussed in the context of social theories as a means of distinguishing between inquiry which revealed a "sympathetic understanding" of the phenomena being investigated, and inquiry which treated problems mechanistically. The sympathetic understanding was deemed necessary to develop the subtle, humane understandings that were fundamental to the problems being explored, such as a sociological description of gang warfare. Versteken was to be achieved by an inquirer who lived as a participant in the events. An inquirer who merely relied on observations as an "outsider," was thought to produce sterile or insensitive understandings of the phenomena. This criterion seems relevant to an applied field such as Educational Technology as well. It's not a matter of all professionals 'living in' the practical problems, although, that could be appropriate training for a career as a researcher. What is required for sensitive and intelligent description of educational problems is an involvement or participation in the management of learning process that forces the inquirer to periodically attend to the assumptions, the analytic perspective, and the methodologies that have altered or destroyed the reality being modeled.

Insert Table 1
about here

Implications

These criteria have been developed with the explicit intention that they could be used to judge inquiry in Educational Technology. However, there are two important qualifications: first, not all inquiry suitable for consideration by educational technologists will meet all of the criteria. These criteria are intended to serve as an ideal. It is quite possible that excellence in one aspect of inquiry will need to be weighed against an adequate or questionable quality of another aspect. These are the decisions that editorial boards must weigh. Prospective authors have the responsibility to make explicit the strengths as well as weaknesses in the processes and products of their inquiry. Second, the criteria are not exhaustive, further clarification and modification of the criteria and consequent editorial policy would be expected. The criteria cut across a number of different philosophic issues. It is inevitable that the positions taken here will need to be modified by subsequent inquiry.

To further illustrate the utility of the criteria a series of exemplars and false exemplars have been created to facilitate use in editorial decision making.

Extensive descriptive evaluations documenting the installation of a technological innovation, or development project, etc., are often false exemplars. Evaluations often are verifiable, disciplined, creative, and sensible. However, they are not often linked to conceptual or theoretical structures, anchored by a comprehensive search, oriented toward an extension of knowledge, or generalizable. This state of affairs is often a matter of role constraints and planning. Schwen, Keller, et al (1974) developed a case study of a development project that posed a number of questions about the installation of a Human Geography class. The case study served the professional needs of the client system but because a theoretical problem was not posed nor new methodology developed, the criteria, extension of knowledge, linkage with a theoretical structure, or generalizability were not met. The case could have been developed to meet these criteria. The case involved the mastery model and there were some innovative methodological patterns used. A report focusing on the theoretical understandings of the mastery model, modifications of mastery methodology, or both could have resulted in a case study worthy of consideration by an editorial board.

Data based summaries of technological services, summaries of development projects, year-end reports, etc., are generally false exemplars. Many developmental organizations, Audio-Visual Centers, etc., prepare sophisticated reports of their service activities. Most of this documentation would not be appropriate for consideration in AVCR. Although these reports obviously serve a useful function, they do not tend to address theoretical or conceptual questions, relate to the literature on educational technology, extend theoretical knowledge, or permit generalizability. Many adaptations could be devised to accomplish useful inquiry. For example, theoretical questions concerning the nature of service organizations could be posed, e.g., following Bennis (1963); systematic comparisons or extensive empirical case studies using the data from service reports could be used to advance the precision or theory of educational technology organizations. Of course, all of the criteria would need to be applied to efforts of this kind.

The current statement and restatements of development and message design models are for the most part false exemplars. While these exercises may serve useful functions for instructional purposes, most discussions do not constitute an extension of knowledge or creative exploration. Also, they are seldom integrated with conceptual or theoretical structures, disciplined, or derived from comprehensive searches of literature. It is interesting to note that even the first attempts to develop models were weak on the criterion of verification. There are few, if any, published reports (including case studies) that have focused on explicit demonstration of a model as the central problem of the study. Appropriate inquiry and publication in this formally unexplored area would be appropriate. Ellson's (1972) review of six studies demonstrating dramatic improvements in learning or efficiency outcomes was an interesting example. He has recently assembled twenty additional case studies (personal correspondence), e.g., Markle (1967) which, also, demonstrated unusual improvements as the result of systematic design process. This type of inquiry can be defended on the basis of the criteria. The Ellson review was disciplined, and the summary of case studies technique developed was effectively employed to develop generalizable and verifiable findings. There was a relationship developed with the traditional fields of scholarship. The exploration of the topic was reasonably comprehensive and the treatment and conclusions seemed to make intuitive good sense.

The development of new techniques, methods of analysis, technological treatments, etc., will be the subject of inquiry in educational technology for many generations to come. For example, the recent interest in multidimensional scaling (Subkoviak 1975) could be the subject of inquiry across many different professional roles in Educational Technology. Film producers could use the methodology to analyze responses to films that elicit affective responses. Many film makers have been concerned about the incongruity between their intuitive reactions to 'powerful' films and the absence of effects demonstrated with conventional methodologies such as Likert scales. The multidimensional scaling methodology, which has been used in marketing research for several years, has the advantage of utilizing non-metric data and small numbers of subjects. It, also, seems quite sensitive to subjects' perceptions of concrete objects. In addition, the methodology could be used to assess client reactions to technological services, structural perceptions of cognitive content, etc. The point is that inquiry of this type, although primarily focused on increased precision in practice, could meet the previously stated criteria.

Some of the criteria, when applied to precision oriented inquiry, should be weighted or treated differently. The criteria, verifiability, discipline, and creative exploration would be treated similarly in inquiry directed to precision and in inquiry directed to understanding. However, the criteria, comprehensive search, generalizability, integration with a conceptual structure, extension of knowledge, and sensibility may be applied to prediction oriented inquiry in a different fashion. For example, there may be a different emphasis on the criterion of a relationship to a conceptual or theoretical structure and comprehensive search. It would be important to link the inquiry to the appropriate methodological or closely related substantive literature. The inquiry may not necessarily be linked to theoretical or conceptual understandings in education inquiry at large. This is not to say that this is a desired state of affairs. It is, simply, that predictive problems in a profession have a context or integrity that is closer to pragmatic operations of day to day problems. The theory is not being explored. An application of the theory is what may be new or novel. The search and linkage with the theoretical literature would tend to be more abbreviated and concentrated on methodological problems. Of course, professionals will need to be encouraged to reexamine their theoretical assumptions if Argyris' (1976) prophesy of theoretical stagnation is to be avoided.

The criterion extension of knowledge follows logically from the discussion above. The new knowledge in inquiry directed toward prediction will be of an applied nature. That is, the professional community will tend to add to its precision in practice by means of this type of inquiry. It should, therefore, be evaluated from this point of view by professionals who are expert in day to day professional problems.

The treatment of the remaining criteria, generalizability, and intuitive good sense are quite important and most distinct from application in inquiry directed toward understanding. The inquiry must make sense to the mature practicing technologists in the field before it should be published. It must make sense in respect to the body of subtle and intuitive understandings that accrue in professional practice over time. It must make sense in that it appears to offer the possibility of refining, improving, or modifying current practice. This criterion should not be used as an argument to retain the status quo. The criterion is advanced in conjunction with the assertion that mature, informal, and intuitive understandings are as useful as formal criteria in judging scholarly activity of this type.

Finally, the criterion of generalizability must be applied with care. There may be times when no formal attempt to generalize would be in order. For example, a case study may demonstrate a new technological process or application of a theoretical concept in such a dramatic fashion that it would be worthy of consideration by an editorial board. More typically, there will be complex trade offs between internal validity and external validity to be considered. These trade offs have been discussed more completely in other sources (Snow, 1974), (Cook & Campbell, 1976). A few elaborations will be advanced here. In a profession with inquiry directed toward precision field studies will often be submitted. The inevitable threats to internal validity must be carefully detailed by the author and weighed by the editorial boards. Incomplete discussions of the threats to internal validity would be reason for rejecting a publication. The issues of sampling and design will be perrenial problems with the consequent compromises having implications for external validity. Of course, external validity will be of utmost concern in inquiry directed toward improved precision; quite often designs will be so constructed as to maximize external validity while investing "sufficient" efforts toward internal validity. With this emphasis on external validity and improved prediction the special topic of utility takes on added importance. The conventional practices of describing the probability of type I and type II errors in experimental designs and then moving on to inferences regarding the relationships between and among independent and dependent variables is, clearly, not sufficient. This could be appropriate for inquiry directed toward understanding theoretical relationships but in inquiry where increased prediction is the intent, further analysis is essential. It will be necessary for scholars to estimate the magnitude and scope of their observed effects on subsequent practice. For example, Sego (1974) reported a significant aptitude-treatment interaction between college students' level of cognitive style and two types of programmed instruction materials. Sego extended the analysis of data by utilizing the Neyman-Johnson technique for estimating the region of the interaction. The analysis of the interaction indicated that less than two percent of the population would improve their learning by differential use of the sets of programmed instruction materials. In other words, it appeared as if only two percent of subsequent students using both sets of programmed instruction materials would do better than using either one of the sets alone. This analysis substantially altered the conclusions Sego advanced. He advised the professional community of scholars that his findings may suggest interesting and potentially useful theoretical relationships; however, he also suggested that immediate improvements in learning would probably not be justified by the additional expense of developing and producing similar materials. The Sego example is the exception rather than the rule in educational inquiry. More often than not significant ratios, t-tests, multiple Rs, etc., are reported without reference to the magnitude of the relationships between independent and dependent variables. Conclusions are drawn without reference to the amount of variance that has been accounted for by the experimentors' interventions. Our journals tend to be full of 'significant' but not important findings.

Concluding Remarks

This article has been primarily directed toward judging inquiry that is subsumed by the scientific goal of prediction. The classic distinction between prediction in inquiry and inquiry directed toward increased understanding has been exaggerated so as to clarify the issued of judging inquiry by practicing professionals. The distinction is one of emphasis rather than exclusive orientation. At times practitioners could and should move to the laboratory to resolve practical and theoretical problems. In such cases their scholarly activities should be judged accordingly. Quite often, however, practitioners may be expected to engage in inquiry that will improve their precision in practice. This type of inquiry should be judged by the same criteria that would be used for other forms of inquiry. However, the application of the criteria may be weighted or adjusted to reflect the purpose of inquiry.

1. Is the inquiry publicly verifiable?

2. Is the inquiry disciplined?

3. Are the results of the inquiry generalizable?

   a. Is the inquiry internally valid or consistent?

   b. Is the inquiry externally valid or applicable?

4. Is the inquiry integrated with a conceptual structure or theoretical framework?

5. Is the inquiry directed toward an extension of knowledge?

6. Is the inquiry derived from a comprehensive search?

7. Does the inquiry demonstrate creative exploration?

8. Does the inquiry make intuitive good sense?

TABLE 1. A Summary of the Criteria for Judging Inquiry in Educational Technology.

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