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ABSTRACT

Categories of educational research and development (R&D) effort are distinguished to guide formulation of an educational R&D program addressing communication skills instruction in the elementary schools. It is postulated that all legitimate educational R&D efforts directed toward upgrading the effects of education on a learner population fall under the general headings "instructional domain specificity," "instructional program effectiveness," and "instructional program efficiency." The necessary subheadings, or categories of educational R&D effort, are postulated to be "criterion specification" and "entry skills" for specificity; "instructional path" and "level of explication" for effectiveness; and "application," "cost return," and "support" for efficiency. Categories of effort are described and illustrated, using communication skills exemplars where possible. Preliminary views on the educational R&D program are presented in flowchart form. The position is taken that such programs will neither be adequately planned nor adequately funded until they permit and require decisions regarding later steps to be contingent on earlier progress. (Author)

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COMMUNICATION SKILLS: CATEGORIES OF EDUCATIONAL R&D EFFORT

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Categories of educational R&D effort are distinguished to guide formulation of an educational R&D program addressing Communication Skills instruction in the elementary schools. It is postulated that all legitimate educational R&D efforts directed toward upgrading the effects of education on a learner population classify under the general headings instructional domain specificity, instructional program effectiveness, and instructional program efficiency. The necessary subheadings, or categories of educational R&D effort, are postulated to be criterion specification and entry skills for specificity, instructional path and level of explication for effectiveness, and application, cost-return, and support for efficiency. Categories of effort are described and illustrated, using Communication Skills exemplars where possible. Preliminary views on the educational R&D program which categories imply are presented in flowchart form. The position is taken that such programs will neither be adequately planned nor adequately funded until they permit and require decisions regarding later steps to be contingent on earlier progress. It is contended that the program sketched has this potential.

COMMUNICATION SKILLS: CATEGORIES OF EDUCATIONAL R&D EFFORT

The tendency is growing to formalize planning techniques underlying formulation and execution of broad, long-term educational R&D programs. The trend--evident in applications of Convergence, Delphi, and other techniques--is commendable because it reflects an ability to develop explicit, public frames of reference which permit planning toward production of sound, comprehensive courses of action. While the planning procedures set forth in this paper are advocated as more apt to formulating work in the Communication Skills domain than alternative contemporary planning routines, these procedures share with alternative routines many of the same ends and some of the same means. In particular, they share a goal of producing plans that can be expected to grow sounder because they are public and are sufficiently explicit to warrant critical review and attract unequivocal amendment.

Two recent Technical Notes--TN-1-70-5 and TN-1-70-6--seek to formulate facets of an educational R&D program referencing to Communication Skills instruction in the elementary grades. The earlier papers are necessary roots; this paper presents the tree within which such roots and others of a comprehensive program classify. The resulting taxonomy of educational R&D efforts then is translated into a preliminary sketch, in flowchart form, of a comprehensive educational R&D program for Communication Skills.

Categories of Effort

Entry learner population. Learner characteristics underlying entry into an instructional program may be defined in terms of skills, maturation, chronological age, or other factors. Current practice in the schools is to split an age-defined learner population into general and special education populations on the basis that state-defined minimal levels of certain skills and categories of maturation condition classification into the general education population. The program to be sketched contemplates further differentiation of the general population--particularly on the basis of entry skills levels. However, for present purposes, the notions of age-defined entry into the schools and classification into general and special education populations based on levels of skill and maturation will be accepted. The learner population of interest will be that of the general education category.

If age-grade-defined entry into contemplated instruction were taken as occurring well beyond kindergarten, then a long-term educational R&D program could hope to influence entry characteristics of the population by operating on its prior history in the schools. For present purposes, the onset of the kindergarten year will be taken as point of entry for the learner population. Current social organization and educational organization tends to preclude execution of effective educational R&D programs referencing to the preschool history of a learner population.

Thus, there is a pragmatic basis for asserting that educational R&D programs should not contemplate operating extensively at the preschool level at this time. If, provisionally, we accept this view, then, provisionally, it follows that the learner population is given to educational R&D efforts and that entry characteristics of the learner population are fixed. While the question is one we would expect to reopen, the program to be sketched assumes a kindergarten level, general education category, entry learner population whose relevant characteristics are fixed.

It is postulated that all legitimate educational R&D efforts directed toward upgrading the effects of education on the learner population classify under the general headings of instructional domain specificity, instructional program effectiveness, and instructional program efficiency.

Instructional domain specificity. The degree to which any instructional domain is specified is postulated to be jointly determined by: a) how aptly the criterion specifications for the program's terminal skills are stated, and b) how well the program's entry skills match those of an entry learner population. Domain specificity is important because effectiveness and efficiency of an instructional program necessarily will be deficient if the instructional domain is not clearly bounded. The evaluation of criterion specification models references empirically to the community that directs administration of given instruction and supports that directive. Educational R&D personnel postulate terminal skills and estimate their relevant dimensions and required levels after studying an apparent community requirement; thereafter, some form of community evaluation of the postulated criterion model is solicited. The evaluation of entry skills characteristics of instruction references empirically to the learner population whose entry characteristics establish the lower bound of the instructional domain. It is contended that any educational R&D program must take establishment of instructional domain specificity as a first order of business and that all conceivable efforts to establish specificity will classify under one of the subheadings of criterion specification and entry skills.

Instructional program effectiveness. The degree to which any specifically-bounded instructional domain yields an effective instructional program is postulated to be jointly determined by: a) how well the program instructional path bridges from entry to terminal skills, and b) how well the level of explication of the instructional path matches population skills brought to instruction at any point in path negotiation. The evaluation of instructional path characteristics references to state-of-the-art skills development models which in turn reference to known maturational characteristics of children. The evaluation of level of explication of the instructional path references to the learner population. Education R&D efforts to date have dealt more implicitly than explicitly with the level of explication facet of instructional program effectiveness; it is contended that such efforts should treat both classes of effectiveness factors straightforwardly during program formulation and that all conceivable efforts to achieve effectiveness will classify under one of the subheadings of instructional path and level of explication.

Instructional program efficiency. The degree to which any effectively-designed instructional program is efficient is postulated to be jointly determined by: a) application efficiency--how well the instructional program produced and employed in the classroom matches design specifications for an effective program, b) cost-return efficiency--how efficiently the available educational resources are used (or how design-efficient the expenditure of posited educational resources expended in a certain way would be in light of empirical findings), where it is given that the program is application efficient, and c) support efficiency--how well the available resources match the design-efficient educational resource requirement, where application efficiency and cost-return efficiency for available resource expenditures are not at issue.

Given that an effective program design exists, then instruction will be application efficient if: a) the instructional product is consonant with that design, and b) instruction is not distorted during its administration in the classroom. Given application efficiency, then instruction will be cost-return efficient if costs associated with realizing targeted return are the lowest that can be obtained in light of state-of-the-art for pedagogical science. Given application and cost-return efficiency, then instruction is support efficient if community support matches a minimal cost identified through exploitation of state-of-the-art for pedagogical science. Educational R&D efforts to date have dealt more implicitly than explicitly with instructional program efficiency factors; it is contended that such efforts should treat all classes of efficiency factors straightforwardly during program formulation and that all conceivable efforts to achieve efficiency will classify under one of the subheadings of application efficiency, cost-return efficiency, and support efficiency.

Categories of Effort vs. Alternative Taxonomies

The postulated taxonomy assumes that all legitimate educational R&D efforts referencing to school-controlled instruction will classify under one of two subheadings of instructional domain specificity, one of two subheadings of instructional program effectiveness, or one of three subheadings of instructional program efficiency. If this is so, then it is necessary to show how such customary rubrics as evaluation and teacher training find their loci in the taxonomy.

The present scheme assumes that one evaluates instructional effects or trains teachers to administer instruction to establish or promote efficiency or to do both. Thus, an evaluation program keys terminally to behaviors reflected in criterion specification and at all interim points keys to a previously negotiated segment of the instructional path. It does so because evaluation programs are needed to establish application efficiency and to promote cost-return efficiency. Teacher training may be required to promote application efficiency. We cut the matter somewhat differently than is customary because evaluation and teacher-training schemes become meaningful only when referenced to specified facets of a grand design to achieve instructional treatments that are tied to a specified domain and are effective and efficient.

Illustration of Categories of Effort

The taxonomy will be illustrated using exemplars from the Communication Skills domain. The illustrative learner population will be children who enter the public schools at the kindergarten level and exit from that portion of Communication Skills instruction of present interest at the end of Grade 6. Thus, entry skills will be defined on "five year olds of a general education population." The setting of terminal skills criterion levels is a thornier question. However, the question is not one that necessarily requires further work to resolve. For example, it would be adequate for present purposes to define criterion performance in terms of levels achieved by 50th (fiftieth) percentile present-day twelve year olds, with the community requiring that effective application-efficient and cost-return-efficient instruction yield 5th (fifth) percentile future twelve year olds who achieve criterion performance. Such a requirement would imply a community willingness to invest more than is currently invested in Communication Skills instruction for the population if it turned out that effective instruction that was application and cost-return efficient alone could not close the gap between present and desired educational effects.

The descriptive propositions to be presented might be viewed as points of departure--or as preludial to more-definitive points of departure--for planning efforts that will produce definitive components of the contemplated educational R&D program. Such propositions will either have to be accepted or else deleted, replaced, or refined. For any category of effort (or program component), planning objectives are to produce a set of propositions that are exhaustive and acceptable.

A. Instructional Domain Specificity

1. Criterion Specification

Preliminary criterion specification for a contemplated Communication Skills instructional program occurs in TN-1-70-5 under the headings of primary and secondary terminal skills, exclusions, program characteristics, real-time reception of communications, generation of communications, and persuasion. The nature of such propositions is illustrated here using propositions classifying under the first two of these headings.

a. Primary and Secondary Terminal Skills.

(1) The primary terminal skills of Communication Skills instruction are real-time reception of communications and generation of communications.

(2) A secondary terminal skill of Communication Skills instruction is persuasion. An exemplar is instruction in debating.

b. Exclusions.

(1) While other instructional programs may be charged with securing in the child a long-term storage of certain contents employed in enroute and criterion tasks, content learning in the sense of long-term storage is not a part of Communication Skills instruction except insofar as such learning contributes directly to the terminal skills of such instruction.

(2) The real-time provision for reception precludes placing a delayed response load on the receiver; while delayed responses may characterize reception requirements for other terminal skills of elementary schools education, they do not characterize those for Communication Skills reception.

2. Entry Skills

Preliminary specification of entry skills for the contemplated instructional program also occurs in TN-1-70-5. The headings under which propositions classify are language skills, perceptual-motor skills, conceptual skills, and behavior predispositions. Both those relevant entry skills that general education category children may be expected to possess at different levels and those minimal skills levels used to classify children into special or general education population are reflected in the preliminary sketch of entry skills. Illustrative propositions classifying under the first two headings are the following:

a. Language Skills.

(1) Spoken-language entry skills to which Communication Skills instruction will reference classify under production and reception categories.

(2) Learner population will classify into subpopulations on the basis of mother tongue. Hence, if only one language of instruction is used, then entry skills evaluation by mother tongue is indicated.

(3) Spoken-language skills levels will vary within a mother-tongue-defined subpopulation. Hence, if the within-subpopulation variation in entry skills performance is appreciable, then the field of entry points into Communication Skills instruction will be at least two-dimensional; these dimensions will be subpopulation and entry skills level.

B. Perceptual-Motor Skills.

(1) Entry into Communication Skills instruction presumes certain levels of visual and auditory acuity. Children whose vision and hearing fall below these levels and cannot quickly be corrected to exceed these levels classify in a special education population.

(2) Entry into such instruction presumes certain levels of visual and auditory discrimination. Children whose visual and auditory discrimination fall below these levels and cannot quickly be corrected to exceed these levels classify in a special education population.

B. Instructional Program Effectiveness

1. Instructional Path

The domain specified through explication of entry and criterion skills, the instructional path consists of flowchart component skills reflecting the anatomy of effective intervening instruction. Posited component skills of a contemplated Communication Skills program are enumerated in TN-1-70-5. A subset of these component skills belong to an Oral Reading portion of the Communication Skills program. Component skills of this subset were sequenced in TN-1-70-6 to provide an initially-posited view of the instructional path for Oral Reading. (Different subpopulations and entry skills levels could necessitate use of different path segments at the outset of instruction. Whether all members of the population eventually share one path remains to be determined.)

2. Level of Explication

Instructional path specification occurs at a gross or outline level of explication. Even at the path level of explication, it is conceivable that component skills elements and the sequencing of these elements might vary with learner (or subpopulation) characteristics. If that is not true, then surely it will be true that the level of explication of effective instruction will vary with learner (or subpopulation) characteristics.

One component skill of oral reading is letter-sound rules. Only recently has the phonic rules basis for learning how to read been made satisfactorily explicit. Even so, many children have learned to read well over the years; these children inevitably reach a point in instruction wherein they are able to decode novel rule words of the language to speech. In such instances, we infer that the child induces the letter-sound and morphophonemic rules underlying performing well on such tasks. It seems tenable that the level of explication characterizing effective instruction should vary with learner characteristics; in practice, this signifies that instruction should reach a level of explication consonant with taking 5th (fifth) percentile achievers to criterion performance, with provisions made to cause higher-level achievers to skip certain elaborative portions of the instruction. That is, path would be secondarily defined on level of achievement or rate of achievement. (Perhaps classification into achievement subpopulations could be based on prior rates of individuals, computed on an appreciable segment of a common instructional path. There is no reason why reclassification should not occur periodically, since rate of achievement is known to vary over time as a function of a wide range of factors.)

C. Instructional Program Efficiency

1. Application Efficiency

The efficiency with which an effective instructional design is applied is determined by the actions of two different sets of personnel: a) those charged with developing the instructional program in consonance with provisions of the effective instructional design, and b) the classroom teaching staff charged with administering the program produced by an instructional development staff. Accordingly, we distinguish between D-application efficiency, referencing to actions of an instructional development staff, and C-application efficiency, referencing to a classroom teaching staff.

a. D-Application Efficiency.

The first point at which application can stray from design provisions for effective instruction is during development of instruction. Development operations exist primarily to exploit pedagogical science to optimize cost-return efficiency of the instructional product. Design specifications say very much less than could be said about pedagogical techniques useful to reaching cost-return efficient instruction. Thus, application of an effective instructional design involves a good deal more than simply reading the design through a development operation and then printing up output as an instruction product. The instructional program produced will be D-application efficient if, while appreciably embellishing its effective instructional design to serve pedagogical ends, the development staff conforms without exception to instructional path and level of explication provisions of the design.

b. C-Application Efficiency.

A teaching staff will use specified equipment while administering the instructional product to a sample of the learner population in a classroom or alternative specified learning situation. The teaching staff may conform or not to either the design specifications reflected in the instructional product or to the pedagogical techniques reflected in the product. If the teaching staff does not violate design specifications reflected in the product, then the instruction manifests C-application efficiency in Sense A; if staff does not violate pedagogical techniques reflected in the product, then the instruction manifests C-application efficiency in Sense B. While we will wish to distinguish these senses of application efficiency in the classroom, we cannot hope to evaluate cost-return efficiency straightforwardly unless classroom application is efficient in both senses--that is, C(A,B)-application efficient. Teaching staffs may perhaps wear teaching and research hats. In the classroom they must wear the teaching hat, which we define to mean that they must take no liberties with the product's instructional path, level of path explication, or level and form of pedagogical explication. Undoubtedly, some teachers in a research role can provide valuable feedback to educational R&D efforts to improve the cost-return efficiency of the product. However, the two functions must be kept separate if the objective is to produce unequivocal information on cost-return efficiency of an instructional program.

2. Cost-Return Efficiency

Given that the design of instruction is effective, the product reflects the design, and classroom application is efficient, it remains to determine how best to employ available or potential educational resources to insure that members of the learner population (or subpopulations thereof) reach terminal skills criterion levels at a cost in dollars and learner time that is minimal in light of state-of-the-art for pedagogical science. While we cannot really calculate what the minimum costs should be at any point in time, the matter can be approached on a diminishing-returns-of-effort basis. If repeated attempts to improve cost-return efficiency over time and R&D dollars yields a negatively-accelerated increasing function that is approaching an asymptotic value, then it is tenable that the effort either is badly staffed or approaching state-of-the-art. If the latter, then only significant breakthroughs in pedagogical science will "blast the cost-return function into a new orbit." By way of analogy, the hydrodynamics state-of-the-art before the 1950s was such that submerged speed for submarines was approaching asymptote in a negatively-accelerated increasing manner; R&D costs were achieving progressively smaller returns in increased submerged speed. The Albacore submarine hull design reflected a breakthrough in the science of hydrodynamics. In consequence, it again became profitable to expend R&D efforts appreciably to improve submerged speed of submarines. However poorly we might rate pedagogical science, it seems probable that educational R&D is much further below asymptote than was submarine R&D before the appearance of the hydrodynamics findings underlying the Albacore hull design. What clearly is needed is an educational R&D commitment to a systematic effort to optimize cost-return efficiency in light of state-of-the-art for pedagogical science. A good place to begin would be the Communication Skills domain.

3. Support Efficiency

Support efficiency is a badly understaffed area of educational R&D effort although entirely legitimate to such operations. Such operations need to face the possibility that we will find, when all else has been optimized consonant with state-of-the-art, that support resources are inadequate to insure that program objectives will be met. Such resources may fall shy of the mark because of insufficiency in <u>magnitude</u> or because they are inefficiently <u>allocated</u> in light of real or potential options available concerning how they might be spent. It seems tenable that a variety of hypotheses are worth evaluating under the support efficiency heading. We present one such hypothesis to illustrate the domain of such efforts.

With the possible exception of the first-generation immigrant European poor who long ago contributed appreciably to the population of poor people in this country, children of the lower classes seem on the average to have fared less well in American education than their counterparts in higher classes, whatever the instruction. We need ask why this is so. And we need be open to the response that it is so because instructional program support efficiency is unacceptable for such children. This is not to say that such children attract a smaller per capita investment in tax dollars than do children of the more affluent--although this may be true more often than we would like. Neither is it to say that such children attract less committed or prepared teaching staffs than do children of the more affluent--although this also may be true in many instances. One proposition worth entertaining is that contemporary schools are less charged with <u>teaching</u> the child than with presenting him with <u>well-critiqued home study assignments</u>.

It is frequently contended that affluent parents on the average assume supervisor-coach rules to a greater extent than do lower class parents. If this is so and if it is relevant, then two kinds of solution suggest themselves: a) At an appreciable increase in tax dollar support to the schools, the need for home study can be removed from educational requirements imposed on children of the lower classes--or from those imposed on all children, or from those imposed on all children whose parents are unwilling to engage in the supervisor-coach activity that makes a home study program profitable. b) At a smaller increased cost in tax dollar support but an appreciably increased cost in community effort, community programs under school control can be identified, evaluated, and put into effect.

It is probable that effective application and cost-return efficient instruction will entail either dollar or community effort expenditures not now anticipated by the community if the result is to be across the board support efficient instruction. Disjointed pilot efforts to identify programs to ameliorate the home study problem, if indeed the problem exists, should give way to systematic educational R&D efforts: a) to identify and specify the range of viable options for programs centered in both school and community but probably school-controlled, and b) to determine the relative cost-return characteristics of these programs. (Whether the postulated problem is home study or some other, what we pursue is an affirmative response to the complaint that it is not enough to say that schools need more or different support. If they do, what form should it take and at what cost in tax dollars and community effort?)

Form of the Educational R&D Program

Foregoing remarks tend to imply a chain of planning and execution activities referenced to production of a Communication Skills instructional program whose domain specificity and program effectiveness and efficiency are consonant with various states-of-the-art. A preliminary sketch of the educational R&D program implied by these remarks is contained in Figures 1 and 2. Figure 2 simply is a continuation of Figure 1.

While it would be premature to cost activities identified in the flowcharts of Figures 1 and 2, the following rules of thumb apply:

1) Point of departure (POD) planning activities will cost very little.

2) Definitive planning (DP) activities following up on POD activities will be more costly but will tend not to be appreciably expensive in light of ultimate overall program costs.

3) Execution (EX) activities referencing to definitive plans will use the bulk of program resources.

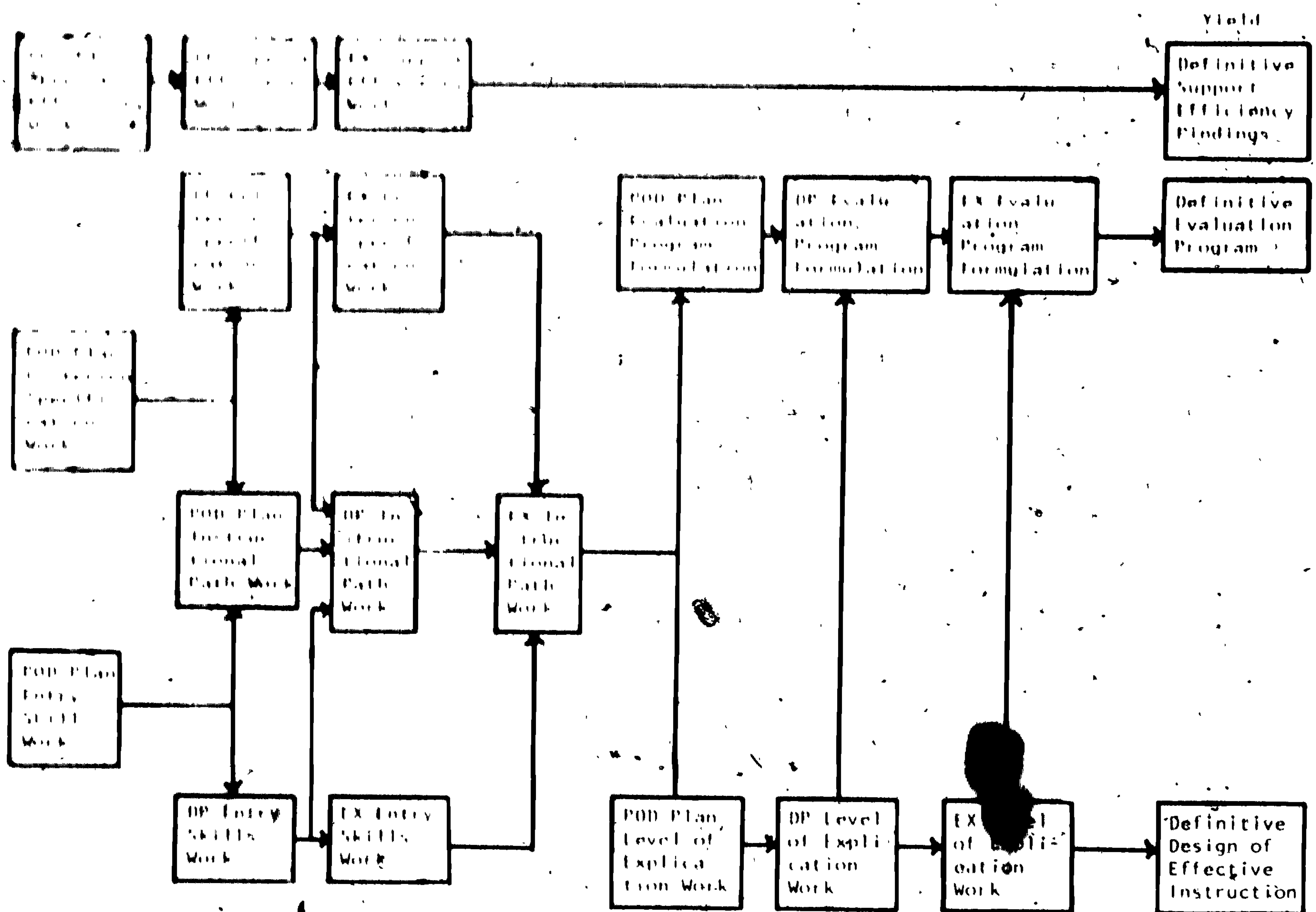
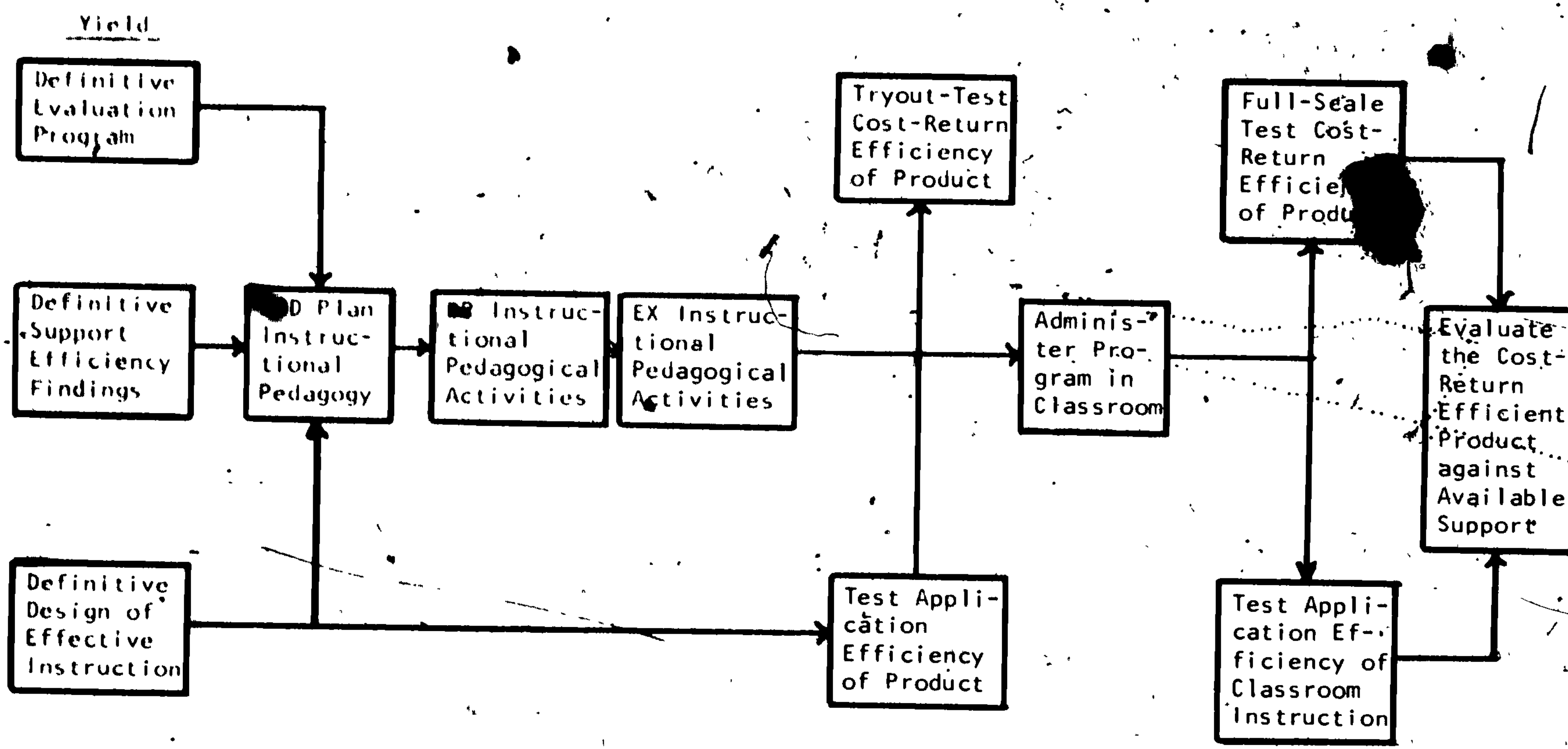

Yield
Definitive Support Efficiency Findings
POD Plan Evaluation Program Formulation
DP Evaluation, Program Formulation
EX Evaluation Program Formulation
Definitive Evaluation Program
POD Plan Instructional Path Work
DP Instructional Path Work
EX Instructional Path Work
POD Plan Entry Skill Work
DP Entry Skills Work
EX Entry Skills Work
POD Plan, Level of Explication Work
DP Level of Explication Work
Work
Definitive Design of Effective Instruction

FIGURE 2

An Educational R&D Program for Communication Skills:
From Yields Underlying Instructional Development to Terminal Yield



Such a scheme is both honest and realistic in that it invites progressive funding at an accelerating level as the level of definitiveness of planning increases. At a POD planning level, staff assert that they may have the beginnings of a useful program; if supporting documents lead a funder to concur, then more definitive planning is funded. If more definitive planning reveals feasible execution activities which promise to yield returns consonant with the investment in R&D dollars, then and only then need the funder commit himself to the appreciable support levels that execution of comprehensive plans will probably entail. Moreover, the scheme is consonant with generating criteria during planning activities which, if concurred with by the funder, could serve as an unequivocal basis for periodic outside evaluation of progress during the life of an expensive execution activity.

The planning and funding of R&D programs addressing complex military systems long ago began to feature phased contingent responses; the systems that educational R&D would identify, develop, and install are no less complex; moreover, they are potentially sufficiently expensive to warrant the view that they will neither be adequately planned nor adequately funded until they clearly permit and require decisions on later steps always to be contingent on earlier progress. The taxonomy of educational R&D efforts and the sketch of a program addressing Communication Skills presented above address the goal of making such contingencies explicit.

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