R E P O R T   R E S U M E S

ED 012 256   SP 000 873

A THEORETICAL MODEL FOR RESEARCH IN EDUCATION.
BY- ARMSTRONG, JENNY R.

PUB DATE 17 FEB 67

EDRS PRICE MF-$0.09 HC-$0.40 10P.

DESCRIPTORS- CONTROL GROUPS, CURRICULUM RESEARCH, *EDUCATIONAL RESEARCH, INSTRUCTIONAL DESIGN, LEARNING, *MODELS, *RESEARCH METHODOLOGY, NEW YORK CITY

THE FAILURE OF EDUCATIONAL RESEARCH TO CONTRIBUTE LARGE CONSISTENT BODIES OF KNOWLEDGE ABOUT THE EDUCATIONAL PROCESS HAS BEEN DUE TO FIVE MAJOR FACTORS--(1) FAULTY EXPERIMENTAL DESIGN, (2) FAILURE TO CONSIDER ALL OF THE MAJOR INPUT ELEMENTS OF THE EDUCATIONAL PROCESS, (3) FAILURE TO MAKE MEANINGFUL COMPARISONS (FOR EXAMPLE THE CONTROL GROUP IS NOT AN APPROPRIATE CONTROL FOR THE TREATMENT VARIABLE), (4) CONFOUNDING OF VARIABLES, (FOR EXAMPLE DEDUCTIVE APPROACH WITH CONCRETE MATERIALS AS OPPOSED TO INDUCTIVE APPROACH WITHOUT CONCRETE MATERIALS), AND (5) FAILURE TO RESEARCH OVERLAP BETWEEN HIGHER ORDER INPUT AND OUTPUT VARIABLES. TO COMBAT THESE FAILURES A THEORECTICAL MODEL FOR RESEARCH WHICH DETAILS THE FOUR MAJOR INPUT ELEMENTS (CURRICULUM, INSTRUCTION, TEACHER, AND LEARNER) AND OUTPUT (LEARNING) ELEMENTS OF THE EDUCATIONAL PROCESS IS PRESENTED. IN ADDITION, A GENERAL DESIGN AND LAYOUT FOR CLASSROOM RESEARCH WHICH INVOLVES (1) A STRATIFIED RANDOM SAMPLING OF BOTH TEACHER AND PUPIL POPULATIONS, (2) THE RANDOM ASSIGNING OF TEACHERS AND PUPILS TO THE FOUR ELEMENTS, AND (3) THE DESIGNATION OF SOME PHASE OF LEARNING AS THE DEPENDENT VARIABLE IS BRIEFLY OUTLINED. THIS PAPER WAS PRESENTED AT THE ANNUAL MEETING OF THE AMERICAN EDUCATIONAL RESEARCH ASSOCIATION (NEW YORK, FEBRUARY 17, 1967). (LC)

2/14/67
A9

A THEORETICAL MODEL FOR RESEARCH IN EDUCATION

by

Jenny R. Armstrong

(A paper presented at the annual meeting of the American Educational Research Association - February 17, 1967.)

Introduction. The purpose of this paper is to discuss a general model for research in Education. Although research in Education began some 69 years ago with the early survey studies of Rice (1897), there has been a meager amount of consistent educational information and knowledge accumulated.

To a large extent, the failure of educational research to contribute large consistent bodies of knowledge about the educational process has been faulty experimental design (Campbell and Stanley, 1963). There are, however, several other factors which directly relate to this problem. The four factors which will be discussed here are: 1) failure to consider all of the major input elements of the educational process; 2) failure to make meaningful comparisons; 3) failure to make comparisons which are not confounded; and 4) failure to research the higher order input and output areas.

Failure to Consider All of the Major Input Elements. One of the factors which is directly related to the minimum informational output of educational research is the failure of researchers to consider all of the major input elements of the educational process. What is proposed, here, is that there are four major input elements in the educational process which must be considered if one wishes to maximize the informational output of any research study. These major elements are: 1) curriculum, 2) instruction, 3) teacher and 4) learner.*

The curriculum category of the model uniquely includes the resultant plan which has been developed by the process of decision making with respect to the general scope and sequence of the material to be learned. The scope of the curriculum refers to what content, topics and general information is to be included and in what proportions each of these is to be included. The sequence of the curriculum refers to the ordering of the topics, information and content.

---

* The major elements of this research model have been derived from a curriculum systems model of MacDonald, (1966).

The instruction category of the model uniquely includes all different methods or approaches of putting the curriculum plan into action. The discovery method and the expository method are examples of two of the more predominately supported instructional approaches.

The learner category and teacher category uniquely include all possible human characteristics. The learner and teacher categories, then, could include such variables as past experiences, motivation, global intelligence, aptitudes, attitudes and needs.

Included then as input elements of the model are the four major elements and all of the possible combinations of these elements in interaction with one another. A diagram of the model which shows all of the possible overlap areas is shown in Figure 1. There are fifteen areas in all.

The general output element of the model is learning. The general criterion of success of the combinational input variables is always assumed to be learning on the part of the learners or subjects involved in the study. This criterion is to be considered in its broadest sense and thus includes all of the possible levels of cognitive as well as affective and psychomotor domains.

In considering this model for its general use in research, one can then visualize all of the possible input element combinations and the possible combinations of the variables within each input area as well as within the output area of learning. For example, a problem which would be considered as a part of the curriculum-learner area would be concerned with the determination of the best type of curriculum for certain types of learners. The instruction-learner category would include problems of determining the methods or approaches which should be used with which types of learners. The curriculum-instruction category would include the problems of what approaches would result in the greatest amount of learning when used to put into action a certain type of curriculum.

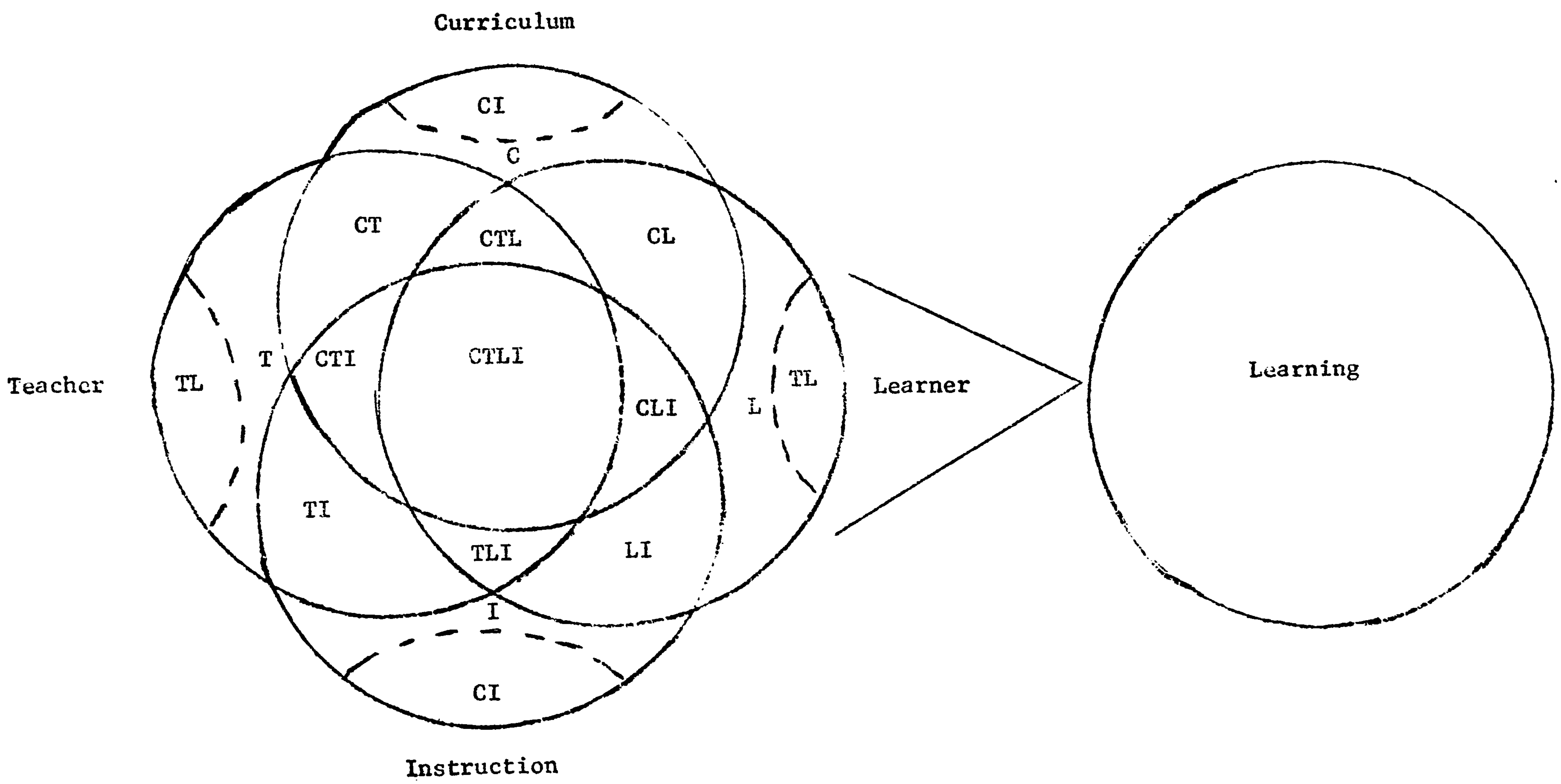

Figure 1. A general research model: input and output elements of the educational process.

Research of different types and in different subject matter areas could be done using this general model (see Figure 2). After the research was completed there would hopefully be information and knowledge gained which could be used to improve the general knowledge of the types of variables which are within each one of the areas. A research study in Education which maximizes its potential informational output must be concerned with all of these major dimensions.

If a "CI" input area and a cognitive domain output study is to be done, the teacher and learner dimensions must also be considered. Since the teacher and learner elements are not to be studied directly, they must be either experimentally or statistically controlled. The learner element is usually controlled by requirement when any of the usual modes of analysis such as analysis of variance and analysis of covariance are used. In these instances subjects (learners) are randomly selected for participation in the experiment and then randomly assigned to the treatment conditions.

The teacher element can either be controlled by random assignment of teachers to treatment condition if the numbers are large or random rotation of teachers to the various treatment conditions if the numbers are small.

Another consideration is the separate and unique condition of each of the major elements. If the definitions discussed previously are accepted, this is possible. Similarly it must be feasible to interact the levels of each of the element variables to be studied. If, for example, the curriculum variable to be considered is sequence and the instruction variable is the deductive versus the inductive approach, interaction treatment conditions are possible. The major elements are still seperable by statistical analysis of covariance or variance.

The informational output of this type of study is maximized because now there is comparative information about six experimental conditions rather than one or possibly none when only one curriculum variable or instruction variable is compared to an unknown control variable.

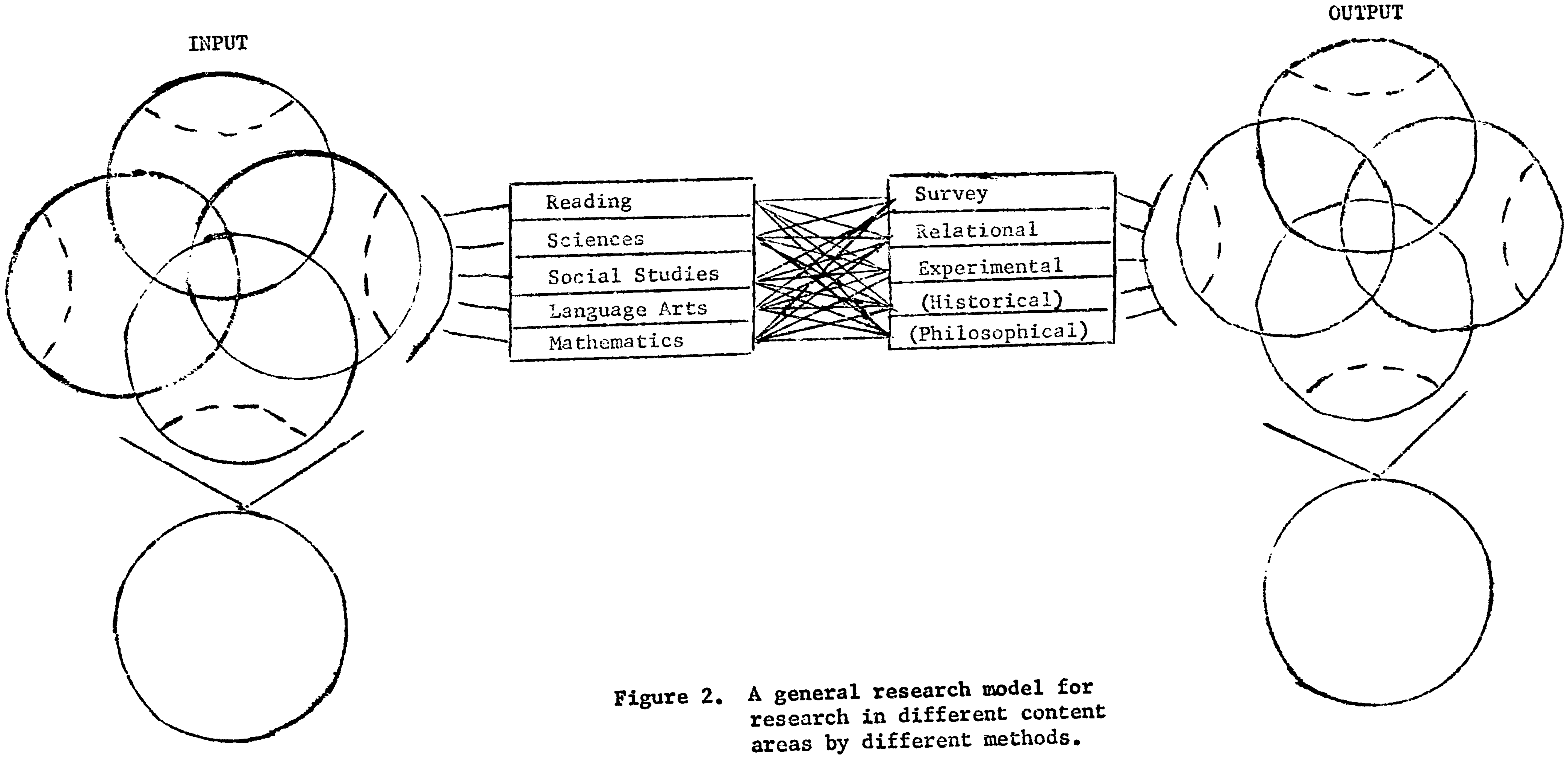

Figure 2. A general research model for research in different content areas by different methods.

Failure to Make Meaningful Comparisons. A second factor which is directly related to the minimum of informational output of educational research is the failure of researchers to make meaningful comparisons. Too often the variables of the major input elements which are studied are not logically comparable. Many of the studies done using the pre- post test, treatment-control group design are of this type. Too often the control group is not a "control."

Consider for a moment a study which proposes to investigate the relationship of an instruction input to a certain learning output. Suppose that the "pre-test, post-test, treatment control group design is used with random assignment of subjects to treatment and control groups. Whether or not this experiment results in the maximum amount of informational output is dependent upon the way in which the two groups are defined. There are many possiblities.

Assume that the instruction variable is the deductive approach to instruction. The only logically meaningful control for this instructional variable is its logical counterpart or instruction by the inductive approach. A comparison between the deductive approach and "whatever has been done before" is meaningless and provides no new educational information. Therefore, the situation which maximizes the educational informational output is the situation wherein the "control" group becomes a treatment condition.

Failure to Make Non-Confounded Comparisons. Another factor which has contributed to the minimum amount of educational information has been the confounding of the major elements as well as the confounding of the variables within the elements. The typical research study in Education is "method A compared to method B."

Too often, however, researchers fail to make a distinction between curriculum and instruction and even teacher and learner elements. The better designed studies due to the randomization requirement typically block out the learner effect. Similarly the teacher element is blocked out by one of the previously mentioned methods. The most frequent confounding, therefore, is found between the curriculum and instruction elements.

Typically method A is curriculum "1"; mode of instruction "2"; while method B is curriculum "3"; mode of instruction "4". The results of such an experiment are uninterpretable. If method A results in a higher level of cognitive learning than method B, one doesn't know to what variable to attribute the difference.

Confounding of the variables within the major elements is just as prevelant. Consider the study within the instruction input area where method A is deductive approach with concrete materials and method B is inductive approach without concrete materials. Again, interpretation of the results of the experiment are confounded and thus the informational output of the experiment is minimized.

Failure to Research the Higher Order Overlap Areas. A fourth major factor which has contributed to the minimizing of educational information output from research has been the failure of researchers to do studies within the higher order overlap areas of the model. The maximum informational output of any research study in Education could be gained by researching the "C-L-T-I" overlap area with output concern for many different types and levels of learning. A study in the "C-L-T-I" overlap area could if properly designed and analyzed, yield valuable information not only about variables within each of the major areas but also within all of the combinational areas of overlap.

A general pattern for the lay-out and design of the "C-L-T-I" type of classroom research study has not been adequately explored. Although the large mathematics projects such as the Madison Project, the School Mathematics Study Group Project, the Illinois Project and other individual projects reported and sponsored through the U.S. Office of Education, as well as, several of the large Research and Development Centers are now focusing their attention on classroom research of the educational processes, little progress has been made in the development of general designs or lay-outs which can be used in order to maximize the informational output of such studies. Therefore, a general layout and design useful for the "C-L-T-I" type of classroom study will be briefly outlined.

A Suggested Lay-out and Design of "C-L-T-I" Classroom Research Studies in Education. Let us consider that the learner variable to be studied is intelligence stratified into high, middle, and low strata; the teacher variable to be studied is also the intelligence dimension again stratified into high, middle and low strata; the curriculum variable to be studied is sequence - a block sequence versus a spiral sequence; and the instructional variable to be studied is approach- a deductive approach to instruction versus an inductive approach to instruction. The four dimensions, then, of the design would be 3X3X2X2. The general experimental lay-out would involve a stratified random sampling of both a pupil and teacher population which had thoroughly been defined in terms of such factors as geographic location, general census data, etc. Pupils and teachers would then have to be randomly assigned by stratum to the four treatment conditions. The dependent variable would realistically be considered to be some phase of learning. If measurement instruments would permit, assessment of learning at the different cognitive levels would seem to be desirable and give more information about the resultant effects of the independent variables.

This experimental design and general lay-out maximizes the informational output which could be obtained from this type of research study. If one refers back to Figure 1, one can easily see that all of the possible areas of overlap would be covered and information provided about each of these areas.

In summary, the classroom research which has been done primarily in the mathematics education area, but in other areas as well, has failed to: 1) consider all of the major input elements of the educational process, 2) make meaningful comparisons, 3) make comparisons which are not confounded and 4) to research the higher order input and output areas. A hypothetical model which suggests what the major input and output elements of the educational process are is proposed, and a general design and lay-out for classroom research which would maximize the informational output of future classroom research studies in Education has been briefly outlined.

LITERATURE CITED

Campbell, Donald T. and Stanley, Julian C., Experimental and Quasi-Experimental Designs for Research on Teaching. Chapter V. In the *Handbook of Research on Teaching*, 1963, 171-246.

MacDonald, James B. Some Contributions of a General Behavior Theory for Curriculum. *Ph.D. Dissertation.* Madison: University of Wisconsin, 1956.

MacDonald, James B. Structures in Curriculum. (A speech delivered at the University of Wisconsin-Milwaukee), May 23, 1966.

Rice, Joseph M. The Futility of the Spelling Grind, I and II. *Forum*, 1897, 23: 163-172; 409-419.