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A CRITICAL ANALYSIS OF INSTRUCTIONAL SIMULATION

DISSERTATION

Presented in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy in the Graduate School of The Ohio State University

By

Robert Fredrick Rubeck, B.A., M.Ed.

The Ohio State University
1973

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"The Curriculum: Make It Relevant! Make It Work!"

FIELDS OF STUDY

Major Field: Educational Communication

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Studies in Communication. Professor Franklin Knower
<table>
<thead>
<tr>
<th>TABLE OF CONTENTS</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACKNOWLEDGMENTS</td>
<td>ii</td>
</tr>
<tr>
<td>VITA</td>
<td>iii</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>vi</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>Rationale</td>
<td></td>
</tr>
<tr>
<td>Statement of the Problem</td>
<td></td>
</tr>
<tr>
<td>Assumptions</td>
<td></td>
</tr>
<tr>
<td>Delimitation</td>
<td></td>
</tr>
<tr>
<td>Method of the Study</td>
<td></td>
</tr>
<tr>
<td>Chapter</td>
<td></td>
</tr>
<tr>
<td>I. FINDINGS OF THE STUDY</td>
<td>12</td>
</tr>
<tr>
<td>The Concept of Simulation</td>
<td></td>
</tr>
<tr>
<td>Examples of Instructional Simulations</td>
<td></td>
</tr>
<tr>
<td>The Research on Instructional Simulation</td>
<td></td>
</tr>
<tr>
<td>II. RESULTS OF THE STUDY</td>
<td>55</td>
</tr>
<tr>
<td>Background</td>
<td></td>
</tr>
<tr>
<td>Stage I of Conceptual Development</td>
<td></td>
</tr>
<tr>
<td>Stage II of Conceptual Development</td>
<td></td>
</tr>
<tr>
<td>Stage III of Conceptual Development</td>
<td></td>
</tr>
<tr>
<td>III. THE GUIDE FOR USING INSTRUCTIONAL SIMULATION</td>
<td>86</td>
</tr>
<tr>
<td>Background</td>
<td></td>
</tr>
<tr>
<td>Method of Review</td>
<td></td>
</tr>
<tr>
<td>Pre-reading and Post-reading Inventory</td>
<td></td>
</tr>
<tr>
<td>Guide Appraisal Form</td>
<td></td>
</tr>
<tr>
<td>Summary of Reactions</td>
<td></td>
</tr>
<tr>
<td>Recommendations for Revision</td>
<td></td>
</tr>
<tr>
<td>Objectives</td>
<td></td>
</tr>
<tr>
<td>The Concept of Instructional Simulation</td>
<td></td>
</tr>
<tr>
<td>Simulation as an Instructional Technique</td>
<td></td>
</tr>
<tr>
<td>The Value of Instructional Simulation</td>
<td></td>
</tr>
<tr>
<td>Post-reading Inventory</td>
<td></td>
</tr>
</tbody>
</table>
IV. CONCLUSIONS OF THE STUDY ........................................... 176

Summary of the Study
Recommendations for Revising the Guide
Implications of the Study

REFERENCES FOR THE STUDY ........................................... 186
# List of Figures

<table>
<thead>
<tr>
<th>Figure</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1</td>
<td>A Preliminary Model Of The Instructional Simulation Development Process</td>
<td>58</td>
</tr>
<tr>
<td>Figure 2</td>
<td>A Revised Model Of The Instructional Simulation Development Process</td>
<td>73</td>
</tr>
<tr>
<td>Figure 3</td>
<td>A Proposed Model Of The Instructional Simulation Development Process</td>
<td>84</td>
</tr>
<tr>
<td>Figure 4</td>
<td>The Relationship of Simulations, Games, and Contests</td>
<td>85</td>
</tr>
<tr>
<td>Figure 5</td>
<td>A Comparison of Four Ways To Learn</td>
<td>104</td>
</tr>
<tr>
<td>Figure 6</td>
<td>The Openness of Certain Instruction</td>
<td>115</td>
</tr>
<tr>
<td>Figure 7</td>
<td>The Variation In Subject Matter Openness</td>
<td>123</td>
</tr>
<tr>
<td>Figure 8</td>
<td>The Amount of Openness Offered By Several Instructional Presentation Methods</td>
<td>125</td>
</tr>
<tr>
<td>Figure 9</td>
<td>The Relationship of Various Degrees of Openness</td>
<td>130</td>
</tr>
<tr>
<td>Figure 10</td>
<td>The Relationship in Degrees of Openness</td>
<td>131</td>
</tr>
<tr>
<td>Figure 11</td>
<td>The Relationship in Degrees of Openness</td>
<td>132</td>
</tr>
<tr>
<td>Figure 12</td>
<td>The Relationship of Three Types of Learning</td>
<td>143</td>
</tr>
<tr>
<td>Figure 13</td>
<td>The Relationship of Learning Outcomes and Openness in Learning</td>
<td>145</td>
</tr>
<tr>
<td>Figure 14</td>
<td>The Relationship Between Outcomes and Level of Learning</td>
<td>146</td>
</tr>
</tbody>
</table>
INTRODUCTION

Introduction: Rationale

Education is on the threshold of a new era mainly because of three current phenomena: the spread of accountability, the rise in learner expectation, and the expansion of instructional technology.

The massive and formerly passive general public is becoming an active, vocal, and inquisitive force in contemporary education. Passage of tax levies is no longer assured. The practice of accountability is beginning to spread. Taxpayers are weighing the educational dollar against the learning it will support. No longer does the routine provision of predictable, predetermined, and limited learning experiences fulfill public expectation.

The standard set of skills and knowledge which was dispensed to the preceding generations does not meet the needs of students who face today's open and dynamic society. Contemporary students wish to inquire openly and to be active participants in instructional planning rather than passive receivers of yesterday's wisdom.

The technology of education is also changing. Growth in the areas of printed and solid state circuitry as well as advances in photography, television, and audio recording have created an "electronic revolution" in the classroom. The introduction of programmed instruction, simulation and gaming, independent study packages, computer-assisted
instruction, and audio-tutorial instruction have brought goals such as individualization and self-paced learning into the realm of possibility.

The spread of accountability, the rise in learner expectation, and the expansion of instructional technology will present a major professional challenge to teachers. Teachers must make more and better decisions in planning for and in using the available techniques and technologies of instruction.

Sound decision-making will require the availability of up-to-date, comprehensive, reliable, and practical information regarding the nature and effects of instructional technology and techniques. Readily accessible and satisfactory sources of current, comprehensive, and reliable information regarding the nature and effects of newer instructional techniques and technologies for teacher use do not yet exist. Though various commissions, state-of-the-art panels, conventions, and symposia have begun the task in any specific area much yet remains to be done.

Efforts, including those of the National Society for the Study of Education, the American Educational Research Association, and the Title III Commission on Instructional Technology, have resulted in broad descriptions of current technology and its applications and its future. Specific information regarding the reasonable learning expectations
for a particular technique or technology and giving practical guidelines for its use has been absent. None of the past efforts have provided enough specific, in-depth, and useful information to be of direct value to the teachers who want to plan and conduct more involving and more worthwhile learning experiences.

**Introduction: Statement of The Problem**

The problem selected for this study is the lack of reliable information about the use of simulation as an instructional methodology. The rise in learner expectation, the advance of instructional technology, and the introduction of accountability in instructional planning must be considered in the analysis of simulation as an instructional methodology. A solution to the problem will be forthcoming when adequate descriptive information has been compiled to facilitate decisions about development and use of instructional simulation in fulfilling current learner expectations.

**Introduction: Assumptions**

The following assumptions have been made in preparing this dissertation:

That instructional simulation is one technique that will fulfill rising student expectations regarding learning.

That critical and descriptive analyses provide useful and usable information for instructional decisions.
That a comprehensive and practical guide for using instructional simulation will facilitate its appropriate use and diffusion.

Introduction: Delimitation

This study is analytical and is meant to provide critical, descriptive information regarding the actual and potential use of and development of instructional simulation. The information provided is intended for those who need to make decisions regarding the appropriateness of simulation as an instructional technique and who need guidance in the development of simulation learning experiences.

Introduction: Method of the Study

The purpose of this study is to develop a comprehensive body of information regarding instructional simulation targeted toward the educational practitioner contemplating the use of this technique. The collection, analysis, and compilation of such information dictates a new type of educational role for the investigator. The role, which could be labeled "educational analyst," involves the investigator in searching for relevant information, analyzing pertinent information, appraising the information needs of the practitioner, and structuring information for particular uses. In that role, this investigator was
involved in three phases of study: the first dealt with the literature, the second involved three field experiences, and the last entailed synthesizing the results.

**Phase I**

Phase I began as a process of literature identification and search. The process was expedited by the availability of the book, *Instructional Simulation Systems: An Annotated Bibliography*, edited by Paul A. Twelker and published in 1969. The Twelker book contained some 1500 annotated references to literature related to the development and use of instructional simulation. Some 400 of the references were screened for possible applicability to the study. Upon closer scrutiny, a few over 200 proved to be of value, and were used. Their contribution is recorded in the "Findings" chapter of this study and their identity is recorded in the "References" list.

Although a review was made of the literature describing a general view of simulation, prime emphasis and in-depth study were directed to the literature which dealt with instructional applications of simulation.

The review of these sources disclosed many fragments of practical information of potential value in the development of instructional simulation experience, together with presentations of existing simulations and their varied applications. In attempting to be systematic
in the synthesis of this information, and at the same
time disclose any deficiencies or contradictions, a
decision was made to model the information in an analogous
manner to existent instructional systems models. The model
was developed to provide conceptual underpinning for the
more practical, "A Guide For Using Instructional Simulation."
Through the modeling process the steps in simulation develop­
ment and application were depicted creating a rough but
reasonable representation of the available information.

Close study of the model and continued reanalysis
of the literature disclosed structural weaknesses and conceptual
flaws. Elements were then created to remedy these deficiencies
and a complete but tentative model was flowcharted (see
Figure 1). So that the model might serve as a stimulus for
field information collection, the flow chart depiction was
translated into a series of statements (see page 63) describ­
ing instructional simulation development procedures. Next
the statements were reworked into uniform statements of cause­
effect relationships called heuristic principles of simulation
design. The heuristic principles and a list of introductory
questions (see Table 1) were the end products of Phase I of
the study and provided the basis for Phase II.

Phase II

Phase II of the study began with the identification
of a group of experts in the field of simulation who, by
reacting to the conceptual model in various stages of its development, provided information about instructional simulation not available in the literature. The experts chosen were Dr. Frederich Goodman, simulation and game developer and researcher, at the University of Michigan; Dr. Frank Broadbent, co-developer of the Teaching Problems Laboratory, at Syracuse University; Dr. Roy L. Bubb, collaborator during development of the Teaching Problems Laboratory, at Brockport State College; Dr. Donald Cruickshank, co-developer of the Teaching Problems Laboratory and developer of the Inner City Simulation, then president of Wheelock College; Dr. Cleo Cherryholmes, developer of the Inter-Nation Simulation, at Michigan State College; Dr. Paul Twelker, writer and researcher in simulation and gaming, now at United States International University; Dr. Dale Garvey, simulation developer and researcher, at Kansas State University; and Dr. Steven Kidder, head of a simulation and gaming research group at Johns Hopkins University.

Of those selected, Drs. Garvey, Bubb, and Kidder were unavailable for one reason or another. Each of the others was visited and interviewed. A group interview with Keith Edwards, Gail Fennessy, Alyce Nafisiger, and Samuel A. Livingston, all gaming researchers at Johns Hopkins University, was substituted for the Kidder interview. The interviews generally lasted one or two hours. Beginning with general
questions and comments about simulation and gaming, the interviews proceeded with reactions to the conceptual model and suggestions for its translation into a practical guide to simulation development.

Drs. Broadbent, Cruickshank, Cherryholmes, and Goodman reacted to the first form of the model, the heuristic principles of simulation development. In reacting to the heuristic principles, each expert was requested to read a series of cards, each presenting one principle of simulation development. The experts were requested to ask questions to clarify the meaning of the principle. Then they were asked to sort the cards into two piles based upon their assessment of the principle's relevancy and irrelevancy to simulation development and use. Following this, the experts were asked to group the cards by whatever criteria they deemed applicable. With grouping complete, the interviewees were asked to sequence the cards in an order most closely reflecting their preference of a simulation development sequence.

Results of the interviews were analyzed to determine their broadest contribution to the development of guidelines for the development and use of instructional simulation. The results are reported in the "Findings" chapter of this study. From the information collected it was determined that the model was inadequate and would have to undergo at least one additional revision and field check.
The prime weakness of the model, as represented by the heuristic principles, was insufficient detail. Not enough attention had been given to the substeps in the development and utilization processes. The principles themselves were misunderstood and criticized for their format. The model was then rethought and reconstructed to reflect the suggestions and criticisms collected in the interviews.

In the revised model, several additional issues were represented, refinements were added, and deletions were made. The revised model was then flowcharted as a test of comprehensiveness. In order that the revised model could be tested, it was translated into a procedural outline. Phrases describing the procedures represented in the model were constructed and arranged under topical headings (see page 74). This step readied the model for another field test.

For this field test another group of experts was selected to be interviewed. Dr. Paul A. Twelker, who has done a vast amount of work in simulation development and research and Dr. Steven Kidder, simulation developer and researcher, were chosen as reactors. Dr. Twelker, now with the United States International University, was visited at his home in Corvallis, Oregon. Dr. Kidder could not meet his appointment and had recommended that four of his staff act in his stead. Therefore, a group interview was held
with Samuel A. Livingston, Keith Edwards, Gail Fennessy, and Alyce Nafziger, game researchers at the Johns Hopkins University.

The second interviews were similar to the others, starting with a few introductory questions and proceeding to the collection of reactions to a set of statements representing a simulation development and utilization model. The information sought in this set of visits was of a more descriptive and less evaluative nature than that of the previous visits. In addition, the interviewees were asked to identify problems, decisions, and issues associated with the procedural statements. Though the information collected was broader and more diffuse than that collected previously, a trend toward acceptance of the revised model was evident. Results of these interviews are reported in the "Findings" chapter.

After the interviews, previously unidentified literature sources offered by the interviewees were consulted. The revised model was then subjected to a reanalysis to determine new or persistent deficiencies and errors. With a few additions, some deletions, and many modifications, another version of the model, entitled "A Proposed Model for Instructional Simulation Development," was prepared. This model (see Figure 3) was envisioned as the final version. For this reason, full explication of the procedures represented
in the model was attempted. That explication of development and utilization procedures was reviewed by Dr. Edgar Dale. His advice and an objective reappraisal of the model's adequacy in meeting the broad needs of an instructional planner clarified the general nature and form necessary for a guide for simulation development.

**Phase III**

Phase III of the study involved the development and testing of a guide for simulation development. The guide provided a presentation of the major issues in simulation development and practical outlines, checklists, question sequences, and procedures to assist the simulation developer in the actual construction of a simulation. After its development, the guide was field-tested by five volunteers from a group of twenty teachers taking an introductory inservice course in simulation and gaming.

The information gained through pilot-testing of the guide was used to construct a set of recommendations for modification and subsequently for revision of the guide. The pilot-testing method, the pilot-test results, recommendations for guide revision, and the revised guide are all included in the chapter entitled "A Guide For Using Instructional Simulation."
FINDINGS OF THE STUDY

Findings: The Concept of Simulation

The problem of evaluating the potential of simulation as an instructional technique begins with first attempts to form a concept of simulation. The broad concept is elusive. Each author seems to have his own impressions and ideas. To the student of simulation, the point at which one notion of simulation becomes clear is also the point at which another notion emerges shedding new light on the concept.

Though the meanings associated with the word simulation vary with its applications, the Latin root similis remains constant. Similis, meaning "like," provides the elemental ingredient of any connotation of simulation. Simulation is related to numerous other words dealing with likenesses such as "similar," "similarity," and "simile." In view of these relationships it is not difficult to understand the lay interpretation of simulation as dealing with imitation or artificiality. Simulated flavors, colors, and textures are common in our world. Any replica or imitation, from artificial lemon flavoring to mock city council, is to a degree a simulation. When we use our imagination to place ourselves within some
scenario, we are simulating another state of affairs. Through simulation, we can obtain the essence of a thing, without its total reality (Thomas and Deemer, 1957).

Simulation is more than a representation or substitution. To the scientist, the term simulation suggests a process by which some variables normally functional in reality can be made to function in other than their real form. By eliminating some of the reality associated with a system of events and actions, the place or time for example, the system can be studied and manipulated to learn more about it or perhaps to reconstruct it. In the distinction between the scientist's connotation of simulation as a process and the lay person's connotation of it as a product can be seen one of the dilemmas blocking full understanding of the concept of simulation.

Even among those in the field, agreement is absent. For instance, Harmon (1961) refers to simulation as the act of representing some aspects of the real world by number or other symbols that can be manipulated easily. Gagné (1965) presents simulation as an entity, an operable model. Cruickshank (1966) thinks of simulation as a technique for the creation of reality models which one manipulates to gain the realistic experiences. Twelker (1962), in attempting clarification of the definition of simulation, suggests the use of the verb "simulate" to mean the act or process and the noun "simulation" as the name of the product or entity.
Breznitz and Lieblich (1972), with irreverence to the existing definition dilemma, offer three things which are central to simulation: that which is being simulated, that which simulates, and the relationship between the two. They offer the word "simulandum" to denote the target of the simulation activity and the word "simulans" to denote that which stimulates the phenomenon of interest. Hereafter, it may be reasonable to see phrases in the literature such as "it is the simulans which simulates the simulandum."

In any case, simulation is a presentation or a method of presenting some likeness of the real world. It can present many or few aspects of reality depending upon its purpose. A simulation is not the real thing, but it is realistic. The process of simulating is not meant to reconstruct reality but to insure realism.

Simulation is used for experimentation, theorization, and instruction where the realism of the real world is desired and where the omission of certain reality is necessary or beneficial. Simulation as an experimental method is used "to affect the analysis of some ongoing situation" (Bushnell, 1966: p. 45).

Simulation effectuates analysis to the extent that it allows control of relevant elements of reality. Gullahorn and Gullahorn (1972) have controlled many reality elements in their simulation of social exchange among
individuals in various social situations. Using the theory of George Homans that humans exchange behavior in an analogous way to their exchange of commodities, the Gullahorns have constructed abstracted "persons" through computer programming.

Their individuals are real to the extent that they have specific identities, abilities, histories, values, needs, and positions in various social groups. The individuals are non-real by virtue of their lack of "flesh and blood." It is the control over reality which allows the Gullahorns to obtain and study the essence of human behavior in various construed social situations without the encumbrance of physical beings. Reduced to an almost absurd dialog between Ted and George, two of the Gullahorns' simulated individuals, the following offers an operable model of human interaction:

"Ted: Asks for help.
George: Gives help.
Ted: Gives social approval.
Ted: Asks for help.
George: Gives help.
Ted: Asks for help.
George: Refers to another worker
Ted: Gives social approval.
George: Gives reassurance, exits."

(Gullahorm and Gullahorn, 1972: p. 194)

Simulation as an experimental method has been used to study phenomena as diverse as interpersonal relations, role playing, international politics, and community organizations. Used as an experimental methodology, simulation allows an experimental problem to be reduced to manipulative abstraction,
offers needed replications, provides analysis of ongoing phenomena without interruption of activity or of rare or dangerous occurrences.

Simulation can also be used "to aid in the development and evaluation of a new design, system, or organization" (Bushnell, 1966; p. 45). These activities are classified within the theory building uses of simulation. As a theory building methodology, simulation has been used to conceptualize the phenomena surrounding the way people dream, the approach of attack aircraft, the operation of bus terminals, the flow of traffic, the motion of an oil derrick, and the dynamics of supersonic flight.

In seeking to predict voter behavior, the Simulmatics project staff constructed a probabilistic model of voter behavior. Eastern, metropolitan, lower-income, white, Catholic, female Democrats were among their voters, and characterized one of 480 voter types. Each of the voter types in the model is predicted to react in a certain way to each of 52 political issues clusters such as foreign aid or attitudes toward the UN. The probabilistic model took form in a series of mathematical equations which were thereafter programmed into the computer. By using equations which were based on data from the 1960 Kennedy-Nixon Campaign, they could characterize general voting trends probable in other elections. Using equations like \( V_k = P_{56} (1-P_{35}) \), the Simulmatics staff would predict a 1960 Kennedy vote (\( V_k \)) from
Protestant Stevenson vote in 1956 ($P_{56}$) where $(1-P_{35})$ is a factor which corrects for non-voting.

The project, though largely a survey research project, did unite sociological and psychological theories, vast empirical data, and the use of high speed computers to build a probabilistic model of voting behavior which could be used as a predictive tool. That union is characteristic of simulation application as a modeling and theory building methodology (Pool and Abelson, 1962).

Perhaps solely for convenience, a third category of simulation exists, known as instructional simulation. Possibly both experimental and theoretical uses should be termed instructional since the researchers and theoreticians involved must learn from their work. A distinction is possible, though, if one considers the intent of the simulation activity. If a phenomenon is being simulated as a basis for training people it is called an instructional simulation. Instructional simulations have particular learnings as their outcomes.

Sim-I, "the patient" used to train prospective anesthesiologists, possesses the very human attributes of heartbeat, temporal and carotid pulse, mouth movement, and blinking. While appearing life-like, Sim-I is not capable of movement, bleeding, shock, or death and, therefore, makes an appropriate starting point for anesthesiologist training. The purpose in developing Sim-I was to shorten the training
time for anesthesiologists without the sacrifice of high intern performance levels. Sim-I allows practice with four intravenous drug injections and two gas administration techniques. Although Sim-I is not a human patient, he can provide realistic consequences for student ineptness or error. It was hypothesized by the developers of Sim-I, Stephan Abramson, Richard Wolf, and J. S. Denson, that not only would learning time be shortened for training in the same procedures but also the number of operating-room trials by residents would be lowered. Despite the lack of statistical significance for several of the performance measures, the Sim-I experience did tend to shorten the training time and reduce the number of operating-room trials for resident anesthesiologists (Abramson, Wolf, Denson, 1969).

Sim-I gives an excellent example of an instructional use of simulation and is also an example of several dimensions of reality control. Time was controlled in the Sim-I experience, as the dummy is in constant readiness for an "operation." Danger was controlled in that Sim-I is not a human and will not die. Physical reality was controlled in the inclusion of certain characteristics of physiology and the omission of certain others.

As mentioned previously, the distinction between instructional uses of simulation and theory building or experimental uses is a tenuous one at best, since learning
is a result of each. The differences between experimental and theoretical uses are equally vague, due to a tendency on the part of the simulation experimenter to theorize during his research and tendency of the simulation theoretician to experiment with his product. A distinction between the three types of simulation is, however, useful in conceptualizing roles for each and should be made, based on the intention of the simulation more than on the subsequent activities.

For the purpose of this study instructional simulation will be considered as a technique for increasing learner involvement in learning processes through participation in a realistic representation of reality. The reality presented by a simulation is based upon a model which represents, abridges, abstracts, transforms, or translates reality into a more instructionally operational form. By participation through the manipulation of some model of reality, the student can be presented the abstraction of a concrete reality, the concretization of an abstract reality, the intensification of a routine reality, the dilution of an intense reality, the magnified view of some microcosm of reality or the broad view of some gigantic reality.

The learner is thereby directly involved in the real experience of simulation and indirectly involved in the real-life experience. By this involvement, simulation offers the learner an opportunity to experience a manageable and learnable representation of an unmanageable and difficult reality.
Findings: Examples of Instructional Simulations

Instructional simulation is a process by which a learner operates a model of some portion of reality. Historically, war was the part of reality modeled in the first uses of simulation. In the ancient games of Chaturanga in India and Shog in Japan, the players as elements in modeled war situations learned from the consequences of their actions. As play in war games evolved, the players abandoned roles within the model to take up the manipulation of their stylized and abstracted counterparts. This 2000-year-old activity is what we today call chess.

The two types of ancient game simulations, one involving role taking and the other symbol manipulation, persisted. "Neu Kriegspiel," representative of the later type began in 1798 the dated history of simulation. It was part of a proliferation of Prussian war games. Rigid games, using playing pieces, a playing board, and specific rules, and non-rigid games, utilizing human beings in military roles, were both characteristic of Prussian war simulations of the 1800's. This second variety of war games spanned the British, then the American war games beginning about 1880 (Tansey and Unwin, 1969).

American war games spread with practice and perfection through the 19th and 20th centuries, proving helpful during two world wars. (Tansey and Unwin, 1969).
At the time of World War II, the spirit and nature of war simulations took on new form in the flight simulator called the Link Trainer. To this point in history, the human in simulation was not directly involved in the operation of some model of reality. The Link Trainer was a machine which initiated that process. The intervention of machine between man and model soon came to be called man-machine simulation. The machine in this process was dubbed a simulator. The Link Trainer was a physical reproduction of the cockpit of a World War II fighter. With the help of a computer system to effect the realistic reaction of lights and instruments to trainer action, the Link Trainer simulated flight for the training of Air Force pilots. The Link Trainer provided a low-risk environment for the learning and practice of potentially dangerous war-time flying activities. It was safe, yet realistic. Edwin Link's trainer has served as a model for flight simulators for nearly three decades (Tansey and Unwin, 1969).

Today flight simulation has expanded to include the training of navigators, pilots, and even stewardesses in some of our most advanced aircraft. For example, the American Airlines Boeing 747 flight simulator, costing $3 million to build, trains hundreds of persons a year for a variety of airline roles. Though the simulator itself is costly, it frees $50 million worth of real planes for
scheduled service and cuts training time from a forecasted six weeks to only ten days. Because they can reliably reproduce flight characteristics without the investment and risk associated with training by flying, aircraft simulators are a practical instructional device for teaching similar skills to large numbers of people.

Simulation was introduced to the social sciences in 1957 with the creation and use of the American Management Association's Top Management Decision Simulation. The AMA simulation provided business executives with a microcosm of industrial competition. In teams, trainees were placed in the role of company executives for the competing companies. Data from a computer provided teams with a base line of company activities. The teams were then required to make pricing, budgeting, and marketing judgments. Their decisions on these topics were entered in the computer and feedback describing industry-wide and company-specific economic conditions followed. A simulated fiscal year took about four hours and provided the trainees with abundantly realistic and risk-free experience with business decision-making. Executives with only a brief interruption in their business activity could benefit from relevant learning and practice (Tansey and Unwin, 1969).

The success of the AMA simulation can best be measured in its vast impact on the field of simulation. It served as impetus and example for the development of the
Carnegie Tech Management Game, derived from the competition of the detergent industry. Hendrick's game of urban growth and social planning, and a dozen other simulations were produced as a result of the European Research Groups Conference on Management. Business simulations now cover topics such as budgeting, decisions, labor negotiations, organization theory, communication systems, performance evaluation, and patterns of leadership.

Paralleling many of the developments in business and military simulation, the field of education developed simulations of critical educational roles, beginning in 1959 with the Jefferson Township School District Simulation (Tansey and Unwin, 1969). An excellent example of a theoretical simulation put to instructional use is provided by this simulation of the elementary principalship. The materials of instruction were originally developed by John Hemphill, Daniel Griffiths, and Norman Frederickson to simulate the principalship for the purpose of studying its various decision and role dimensions. When the study ended, the materials were disseminated by the University Council for Educational Administration (UCEA). The resulting instructional materials were based upon data collected from an actual school. They included films, slides, tape recordings, and many printed documents describing the simulated school system and many of its significant problems.
These materials were first used in the learning experience to present background information about the school, its sociology, and its history. Learners were then given the role of principal and provided with a myriad of items typically found in a principal's in-basket. The items reflected needs for various kinds of behavior and commanded the involvement of the learner. Each in-basket item required a written response. After responding the "principals" met and discussed their action and offered comparative philosophies. The Jefferson Township School District Simulation offered participants the benefit of realistic fears, doubts, frustrations, and satisfactions without the cost to them or others of real-world failure (Tansey and Unwin, 1969).

Since the Jefferson Township School District Simulation, the UCEA has overseen the development of a score of other simulations. In the 1960's UCEA, a consortium of 65 universities was responsible for the development of simulations of the secondary principalship, the assistant superintendency, the superintendency, and the community college presidency (Cruickshank and Broadbent, 1970). Their simulations are characteristically based upon incidents critical to school operations. A background presentation sets the stage for the overall simulation and the actual role being taught. The "operation" of the school, and more specifically, the role being simulated is then presented by
some audio-visual means. Interruptions in the presentation provide incidents for the role holder's reactions or responses which are then appraised. The participant learns from the action he takes and its appraisal (Blough et al., 1971). This general strategy of background setting, critical incident disclosure, and role playing with appraisal has become a model for most current simulation experiences.

Bert Kersh, working in the area of teacher preparation, used the University Council for Educational Administration's strategy to expose preservice teachers to classroom problems. Then with the Oregon State System of Higher Education, Kersh created the Classroom Simulator to begin the history of simulation in teacher education. Using classroom furniture in front of a large rear projection screen, Kersh familiarized prospective teachers with the incidents characteristic of a classroom. He sensitized them through film accounts of student disruptions, irrelevant student questioning, and verbal student-teacher confrontations on a variety of topics. Though simulation of these critical incidents through role playing proved effective in achieving his learning goals, Kersh later discovered that the paraphernalia associated with creating a realistic classroom were not needed. Small still images for individual study with audio supplement achieved nearly identical results (Kersh, 1965), seemingly pointing up the fact that
realism comes from the model for a simulation not its artifacts.

Kersh's Classroom Simulator was successful in pioneering the use of simulation for teacher education as exemplified by the creation of the Teaching Problems Laboratory and the Inner City Simulation. As a variation on the Hemphill-Griffiths and Kersh methodology, Donald Cruickshank and Frank Broadbent developed the Teaching Problems Laboratory to familiarize and sensitize teacher candidates with the problems of first-year teachers. From an empirical base provided by a survey of teaching problems; Cruickshank and Broadbent identified thirty-one critical problems which were the base for simulated incidents. The incidents presented problems such as handling a constantly disruptive child, dealing with reading problems, helping students who have destructive home situations, and accommodating a distaste for grading papers.

Learning from their involving role as elementary school teachers, students of Teaching Problems Laboratory reported fewer problems in their first year of teaching than did other students not involved in the simulation (Cruickshank and Broadbent, 1969). These results were encouraging enough for Cruickshank to develop a second simulation for teachers. The Inner City Simulation was analogous to the teaching problems laboratory with the exception of its urban school emphasis. Both simulations
were based upon typical problems of the intended audience, and both involved enactment as the method for trainer reaction to the simulated situations.

Other simulations developed in the 1960's employed the critical incident-roleplay approach. Among them were Utsey, Wallen and Beldin's filmed simulated episodes used to instruct teachers in the use of the Informal Reading Inventory, Project Insite's elementary and secondary teacher education skill development materials, Venditti's school system desegregation simulation, and Urback's Science Investigation Simulation (Cruickshank, 1971). Each of these simulations involves the learner in a broader set of behaviors than does the plain in-basket method.

Also developed in the 1960's were literally hundreds of classroom simulations involving the enactment of some portion of a social process or the play of a game based upon a model of reality. An example of the former is the "cardboard store" used in kindergartens. The store, made from "Tide" boxes, displayed make-believe goods sold for button-like tokens. This simulation of grocery store operations was intended to convey some authentic concepts and some social protocol behavior. For some it achieved its purpose and was an exciting and refreshing experience.

The mock city council or mock congress are also examples of non-game simulation used to enact portions of a usually inaccessible social reality. Both generally involve the rearrangement of classroom furniture to make a
of legislators, others of lobbyists, and others executive branch officials. In "bill" passage attempts the students gain knowledge from the concretization of a seemingly abstract legislative process. Such experiences may be remembered for years.

Another example of a non-game simulation is J. A. Drenth's office practice simulation in which students assume any of eight different jobs at one of sixteen work stations to ensure the operation of Simicon Enterprises. In this high school-level simulation, Drenth allows students to experience a realistic role as a receptionist, secretary, clerk, auditor, or manager while developing and practicing the skills needed for such jobs. As a result of his use of simulation, Drenth concludes that "simulation leads to learner stimulation and realism leads to perceived relevance" (Drenth, 1966).

Non-game simulations vary in style and content although most are direct analogs of reality within which students play the roles of real problems to gain a "feel" for the real system. Learner reports of such experiences label them as interesting, exciting, and involving (Cherryholmes, 1966).

Game simulations do not involve role playing as do critical incident or in-basket simulations but rather are a further abstraction of a portion of reality represented as
game pieces, game moves and game rules.

Typical of the game form of simulation are **DEMOCRACY**, **LIFE CAREER**, and the **Inter-Nation Simulation**. **DEMOCRACY**, originated by James S. Coleman at John Hopkins University, simulates various aspects of the American legislative process including log rolling by congressmen. Learners playing legislative roles take actions which result in game consequences analogous to those experienced by the legislator. **LIFE CAREER**, a game developed by Sarane Boocock, then at John Hopkins University, was devised to help young people make vocational choices. Each play of this game portrays various personal and social relationships prevalent in one year of life (Tansey and Unwin, 1969).

The **Inter-Nation Simulation**, developed by Harold Guetzkow and others at Northwestern University, is used by groups of students to learn international political science concepts. It simulates, through student governance of fictitious but realistic nations, the inter-dependency of decision-making on the international level. Players make decisions for their nation and then find out the "international" implications of their action (Cherryholmes, 1965).

During the early 1970's simulation development has become a tool for all teachers rather than the elite few.
As a result of inservice workshops and several new pieces of literature, the classroom teacher is now developing simulation experiences. Another evident trend is the development of game simulations by students. Best exemplified by the work of Fred Goodman at the University of Michigan, the development of game simulations is now a learning activity for game playing students. Characterized by the introduction of a crude game, simulating a few elements of a social situation, the simulation is developed through play and revision cycles. This approach allows the tentative reality models of the game originator and all the players to influence game design. This type of game is never complete or finished; it is always evolving in conformity with the beliefs and needs of the learners who play it. Goodman et al. have shown the "priming game" to be a great asset to instruction. Game playing, as they use it, becomes an involving and exciting activity for those who play and for those who observe. Goodman's approach to gaming strategy involves players in game design, in model manipulation, in social process, and in a learning experience simultaneously.

Over the years simulation has evolved from war games, eventually stylized as the game of chess, to the American military simulation resulting in the development of the Link Trainer and the onset of social science simulation,
and to its introduction into the education field. In
education simulation has been used as an administrative
training technique, a teacher training technique, and a
classroom teaching technique. Through its development,
simulation has always involved role playing in some form,
often involved contests as in chess and "Neu Kriegspeil,"
and often represented rare, risky or other critical
situation. From its history, simulation
appears to be useful in teaming social attitudes and
behaviors associated with various role structures and in
practicing them with an air of realism but with no real
world cost for failure.

Findings: The Research on Instructional Simulation

A prominent issue in the research on instructional
simulation has been validity. Many studies have been
conducted in attempts to measure directly or indirectly the
validity of particular instructional simulations. By compar-
ing student performance or the operational characteristics
of the simulation with some image of the performances
or operations of an actual system, researchers, such as
Cherryholmes, Boocock, Inbar, and Bengtson et.al., have been
able to judge the correspondence between simulated and real.
In instances where a simulation appears to be real or can
be said to offer the learner a feeling of reality the simulation is said to have face validity. Simulations which can be shown to replicate many of the actions or activities of some real system are said to have empirical validity. Simulations in which participants engage in theoretically sound activity are said to have theoretical validity. A particular simulation may have all three types of validity. The issue of validity is an important one in the research on instructional simulation because it does indeed show whether or not a given simulation is accurately simulating something.

The central issue in the research on instructional simulation is, however, effectiveness. This issue of instructional effectiveness has occupied the majority of simulation researchers. Researchers seeking answers to this question have collected testimony and data in attempting to determine the nature and extent of simulation's effect on learning.

Some research has been done to determine the extent to which various components of a simulation affect learning. Notable is the work of Bert Kersh who studied the realism effects of his Classroom Simulator. By varying picture size at various stages of the simulation experience, Kersh was able to show that there is little correlation between the size of a stimulus image and its effect upon a learner.
In 1965 Kersh experimented with learner responses to simulation stimuli to find no significant difference in the learning resulting from verbal versus enacted responses by learners. In a third area of experimentation, Kersh (1965) found that the nature of feedback for learner responses, whether visual or verbal, did not have a marked effect on learning as measured by pre- and post-tests. By studying the results of experiments contrasting still picture stimulus presentations with moving pictures provided by his classroom stimulator, Kersh (1963) concluded that there was no significant difference in learning outcome attributable to the method of presentation. Stahl (1968) in a study of the effect of presentation mode on learning outcome noted increased affective reactions on the part of learners exposed to a video presentation as compared with those exposed to audio or to print. Van Wagener (1963) in his study of simulation techniques and learning effect found the overt response by learners in a simulation to be more beneficial in terms of cognitive outcomes than the covert response.

The greatest amount of simulation research has been done using conventional paper and pencil tests, observational scales, or attitude instruments to measure the learning outcomes of a simulation. By this type of
measure, simulation has often been compared with conventional forms of instruction such as the lecture with recitation, audio tape presentations, performance observations, and case studies.

Much of this work has been done in the area of affective learning. Vlcek (1965), using Kersh's Classroom Simulator, found, as a result of questioning simulation participants and members of a control group, a higher degree of confidence in newly learned skills among the simulation learners. Boocock (1966) in a study of the learning effects of a legislative game and a career game found, through questioning, that the career game created empathy on the part of simulation participants for the roles of employer and job seeker. Bond (1965) using a semantic differential scale to measure attitude found his simulation learners evidencing a positive shift in their attitudes about teaching after their experience with the Classroom Simulator. Data collected by Cruickshank and Broadbent (1968) shows an attitude change toward the positive, as measured by a semantic differential scale regarding the problems of first-year teachers. They also noted an increase in confidence in teaching skill, as measured by a confidence scale that was the result of an experience with the Teaching Problems Laboratory. Cherryholmes (1966), in a much quoted review, reported that students in studies run by Boocock, Garvey and Seiler, and Cherryholmes
acquired realistic political attitudes as well as students who were exposed to conventional instruction.

Also dealing with effect, Cruickshank and Broadbent (1968) reported a high degree of motivation and interest, as measured by informal student comment and by questionnaire, to be characteristic of involvement in the Teaching Problems Laboratory. Cherryholmes (1966), summarizing the work of Robinson, Boocock, Boocock and Coleman, and Cherryholmes, reports that observations and questionnaire responses show students to be more interested in simulation than conventional instruction.

Many researchers, Boocock (1966), Cruickshank (1966), Twelker (1968), McKinney and Dill (1966), and Inbar (1966), have observed a high degree of involvement on the part of simulation learners. The experiences they have observed were stimulating and exciting for the learners involved.

Cognitive learning outcomes have been the substance of most of the simulation research studies to date. Evidence presented by Garvey and Seiler (1966) from pre-test and post-test results shows that students experiencing the Inter-Nation Simulation do learn factual material as a result. Hershey (1961), in comparing test scores for groups learning by classroom observation and by simulation, reports simulation was of benefit in teaching
an understanding of principles of teaching. Boocock (1966) by using paper and pencil tests of factual knowledge showed an impressive increase in knowledge as a result of involvement in a legislative and in a career game used in her experiments. Garvey and Seiler in a study reported by Cherryholmes (1966) tested for retention in simulation learners after three days and after two weeks finding that the retention of political science facts and principles was slightly higher with the simulation method than with conventional methods.

Abramson (1967) in experiments using Sim-I, the patient simulator, found that medical students did learn facts and principles through instructional simulation. In testing college seniors preparing for teaching, Cruickshank (1968) found their knowledge of teaching problems was increased by a simulation experience. Twelker (1968) in a study comparing simulation instruction to classroom observation found that students' course grades and their observed classroom performance were as good as the result of simulation instruction as was the performance of their counterparts who had had actual classroom observation experience. Hershey (1961) using final examination grades, course grades, and the results of the Redwood School Test as indicators has shown that simulation students have slightly higher scores overall than students instructed in a more conventional mode.
An unusual dimension of cognitive outcome has also been noted by several researchers. Twelker (1968) reported from his comparison of interaction analysis and simulation in development of classroom teaching skills that the simulation group needed less instructional time to achieve the same results as the interaction analysis group. Cruickshank (1968) reports that simulation students engaged in teacher preparation activities were ready to assume full teaching responsibility sooner than the students of conventional methods. Abramson (1967) reports, "Despite the lack of statistical significance in several of the analyses, the investigators conclude that there is an advantage in time in the use of this . . . simulation . . . in the training of residents."

In general the research on simulation has been done by comparing simulation to some other instructional method. In the main, few statistically significant differences have been recorded between the two. Such information leads many to conclude that instructional simulation is no worse than many other techniques. The advantage for simulation seems, however, to lie in its ability to create desirable affective learning outcomes in unison with or apart from cognitive learnings.

In summary, a pathway of validation research has characterized the history of instructional simulation.
Researchers of this bent seek to find the degree of convergence between the simulation experience and the actual experience. Another pathway has been taken by those who are seeking to find the instructional effects of simulation. They are currently tending away from comparative effectiveness studies and toward studies of direct effect. Instructional simulations are now being evaluated for their direct effect on learning, whether or not they accomplish what they are supposed to accomplish.

This tendency will have one main effect on the users of instructional simulation. After enough specific research studies have been conducted on enough simulation, the user will have hard data on the effectiveness of specific simulations upon which to base a decision to use a particular simulation.

Findings: Guidance for Simulation Development and Use

The design of an effective instructional simulation is an activity involving considerable effort (sometimes hundreds of man hours) and considerable cost (sometimes thousands or tens of thousands of dollars). "The problem that confronts designers and consumers of simulation alike is that the technique is being exploited faster than the technology can: (1) provide workable guidelines for simulation design, and (2) provide guidelines for simulation
use" (Twelker, 1967: p. 47). Available guidance for both
design and use is scarce, incomplete, and inadequate. Any
help toward minimizing the effort and/or the monetary cost
associated with the design of instructional simulation while
maintaining effectiveness would be a worthwhile contribution
to the art and science of instruction.

This section presents an abstract of the available
guidelines for the design and use of instructional simulation
and reflects the state of the art regarding guidance for
simulation development and use. The guidance available in
the literature is of two general types. The first deals
with conceptual issues surrounding design and use. The
second offers step-by-step procedures for design and employ­
ment. Both the concepts and procedures presented will be
embodied in the final product of this effort.

Cruickshank and Broadbent's work is characteristic
of the concepts and issues type of guidance. Their 1970
publication delineates issues of concern for the developer,
the administrator, the instructor, and the evaluator of an
instructional simulation. Cruickshank and Broadbent point
out that the developer faces six issues:

(1) He must be concerned about the object of
the simulation and define what will be
simulated.

(2) He must define the scope of the simulation--
its treatment of the whole system or a part.
(3) He must decide the issue of using:
a. an open loop simulation in which participants' responses have no effect upon simulated variables, or
b. a closed loop simulation in which participants interact with and manipulate simulation variables.

(4) He must decide the type and target of feedback.

(5) He must decide the degree of realism versus symbolism.

(6) He must determine his process or content mode -- whether the simulation is to teach or to test already learned skills or to practice in developed skills.

Important administrative issues in using simulation are placement in the total program, the spacing of practice, group size, and the length of the simulation experience.

Motivation and the role to be played by the person administering the simulation are concerns of the instructor. The evaluator of an instructional simulation needs to resolve issues concerning the generality of outcomes, the objectivity or subjectivity in the evaluation of participant performance, and the crucial issue of transfer of learning (Cruickshank, 1970).
Dillman also provided guidance oriented toward conceptual issues. In his unpublished dissertation, Dillman synthesized simulation design guidance largely from the business training field. His thorough synthesis shows that instructional purpose, content determination, and length and time of the simulation experience are issues in business simulation. He also presents information about realism, simplicity, information presentation, structure, and interaction in simulation design.

Realism, Dillman points out, has become an issue in simulation design because of the three stances designers have taken concerning the degree of its use. "One position states that the best situation for a simulation exercise is the actual situation which is being modeled. Others contend that verisimilitude, the appearance of reality to the participant, does not necessarily imply realism of the model. A third position suggests that the degree of objective realism need be no greater than that called for by the objectives of the simulation exercise itself" (Dillman, 1969).

A focus of this simulation issue is the warning to preserve simplicity in operation while guaranteeing realism through a certain measure of complexity.

How much information should participants in simulation activities have and how much do they need? How much information scarcity is acceptable? What size
information gap, lag, or overload is needed to insure realism? These questions characterize a concern over information levels in simulation design presented by Dillman (1969: p. 54).

The delicate balance between freedom and structure creates another issue for the instructional designer. The provision of a context for action without inhibiting the action is important (Dillman, 1969: p. 55).

The last issue presented by Dillman deals with the variety of human interaction alternatives characteristic of many simulations. Hierarchial roles for participants, committee management, and heterogeneous teams are all interaction possibilities. Dillman's guidelines present the cognitive interaction type and the objectives of the simulation as paramount.

The preceding guidelines present issues to be resolved during the design process. The following guidelines offer sets of procedures for systematic simulation design.

Virginia Berger, a designer of office simulations for high school, tells her readers of nine steps in the planning of an instructional simulation.

The steps are as follows:

1. Determine objectives
2. Determine what will be simulated
3. Determine guidelines
4. Select student positions (or roles)
5. Prepare forms
6. Prepare transactions
7. Prepare basic script
8. Prepare contingency list (or feedback)
9. Establish grading procedures (Barger, 1970; p. 260)

Although this list of steps involving only the planning of simulation administration, other details were treated by the author. The total cycle appears similar to Hancock's. The Hancock dissertation paradigm uses seven steps to translate a problem into a usable simulation. His steps are as follows:

1. Identify problem areas
2. Establish instructional objectives
3. Stage simulated incidents
4. Develop reading list
5. Try out the simulation
6. Evaluate the simulation
7. Modify the simulation (Hancock, 1970; p. 126)

In his dissertation, Dillman (1969) presents an eleven step flow diagram for simulation exercise development. Taking a progressive specificity tack, Dillman first states
general goals and determines the broad areas of treatment. Conditions affecting simulation design, including interaction and situational aspects, are then specified. Next more specific objectives are stated, followed by the detailing of actual exercises.

After the exercises are prepared, time periods are specified, rules and operation procedures for administration are constructed, forms are developed, and a critique of materials and procedures is made. The exercises are tried and evaluated, and then revised (Dillman, 1969).

In chapter two of a dissemination report for the U. S. Office of Education, Twelker and Crawford summarize the design procedures of the three groups then active in simulation. Twelker summarizes the Johns Hopkins Group design activities in the three following steps:

1. Research into the content
2. Development of a model based on the research

Twelker reports that the Nova group simulation game, developed at Nova High School in Florida, uses outside expertise to determine content, searches for activities to use in the simulation, develops a rough format, tries, and revises the product. Abt Associates in their design employ what they call the "systems approach." They first conduct an analysis and model of some substantive problem, process,
or situation to be taught. Second, they translate the model entity into simulation exercises. Lastly, they try out, refine, and fine tune to insure a quality product (Twelker, 1969: p. 75-77).

After reviewing these three sets of design procedures, Twelker presents the design steps or phases characteristic of his own work. He uses these steps:

1. Define instructional problems
2. Describe the system to be simulated
3. Relate the operation system to the problem
4. Specify objectives in behavioral terms
5. Generate criterion measures
6. Determine appropriateness of simulation
7. Determine type of simulation required
8. Develop specifications for simulation experience
9. Develop simulation system prototype
10. Tryout simulation system prototype
11. Modify simulation system prototype
12. Conduct field trial
13. Make further refinements (Twelker, 1969: p. 79-102). Twelker is by far the most prolific source of simulation design procedures.

Although informative, the literature fails to provide a comprehensive description of available simulation design
techniques and fails to demonstrate adequate sensitivity to the needs of the novice developing the simulation. This inadequacy prompted this investigator to seek more information regarding simulation design. By the method described in the introduction to this study the investigator collected simulation development guidance in interviews with these experts: Goodman, Cherryholmes, Broadbent, Cruickshank, Twelker, Edwards et al., Boocock, and Shirts (1972 interviews). The information will, in a later chapter, be compiled in a usable form.

Goodman's simulation development process was best described by one of his graduate students, Michael Vander Velde. The Vander Velde presentation appears below.

Theory
Begin with a well-defined idea of what is or is not going to be simulated.
Describe basic concepts, variables, relationships, and assumptions.

Scenario
Construct a written model of theory or process being gamed.
Include a profile description of roles involved, the information to be communicated to all participants, identification of game "dummies," player resources, the object of play, and any other pertinent information.

Rules
Define rules for personal, total chance and partial chance moves.
Describe more outcomes, constraints, and resources.

Costs and Consequences
Describe the penalty.
Payoff
Describe the value associated with rule adherence and good play to termination (Vander Velde, 1972: oral communication).

Though similar to general simulation design procedures, the Goodman/Vander Velde process is more characteristic of game simulation development.

Cherryholmes described the simulation development process he has used as follows:

Structure the special (of concern to the learning problem being treated*) body of knowledge under consideration for simulation.

Describe the body as an overlap in a number of related theories (to insure a full perspective on the problem).

Determine what (from the structural knowledge) is to be simulated.

Focus the subject matter by specifying behavioral objectives for the learners.

Arrange a matrix of subject matter statements and behavioral objectives.

Identify the interactions of subject matter and behavioral objectives which are required to produce the desired learning.

For each interaction, then for each group of related interactions, generally describe situations which would promote learning about the subject matter via the described behavior specified.

Add the time dimension by sequencing and spacing the situation so as to form an overlay structure for the simulation.

*Parenthetical phrases added by the investigator to qualify and clarify the direct quote.
Check coverage by identifying areas of overtreatment and areas of undertreatment.

Introduce a format for the learning experience.

Describe the learning setting and the role of needed materials.

Add rules for action and rewards for moves and goal attainment.

Try.

Recycle to improve. (Cherryholmes, 1972; oral communication).

Although the Cherryholmes method, because of its inclusion of a "structured body of knowledge" and "behavioral objectives," appeared consistent with most others, it differed by its use of a subject matter objectives matrix for determining content. Although a clear explanation of the matrix did not come forth, it would appear to depict the intersection of statements like "know about the civil war" and "name three causes." Its utility would then rest upon its ability to help more specific general instructional intentions.

Broadbent described the developmental process which he and Cruickshank used in developing the Teaching Problems Laboratory as follows:

Find empirical base.

Identify an appropriate theory.

Collect data from 'real world'.

Decide on simulation approach or non-simulation approach.

Define what needs to be simulated.
Identify problems (in the object system). 

Form list of problems from many sources.

Narrow problem field to a 100 or so most frequent problems.

Build an instrument to verify proposed target problems.

Verify problems as true problems by questionnaire.

Identify a suitable problem-solving model to use as a pattern for simulation experience.

Construct problem incident scenarios.

Produce instructional materials associated with incidents (Broadbent, 1972; oral communication).

The Broadbent-Cruickshank process differs markedly from the Cherryholmes process in that the former is problem-centered and that latter is subject matter-centered. Cherryholmes' approach reflects concern for theoretical problems of knowledge dissemination and skill development, whereas the Broadbent-Cruickshank team shows concern for the practical nature of remediation and improvement of practice.

Twelker, during an interview, provided the following:

Steps in Designing a Simulation Exercise

The first seven steps are preliminary (and mandatory) to the design of an actual simulation exercise.

* Phrase added by investigator for clarification of the Broadbent concept of "problems"
1. Define instructional problem. Why tamper with the status quo?

2. Describe the operational educational system. In what context do I want to introduce the exercise?

3. Determine and justify tentative, gross characteristics of the instructional simulation system that might be used to solve your instructional problem in its stated context. What might work here? Why is simulation appropriate?

4. Relate the proposed solution to the operational educational system. How is my tentative solution (to my stated problem) going to work in the context I identified?

5. Recycle 1-4 as needed until a clear relationship exists between the instructional problem, the educational context and the proposed solution(s). If more than one solution seems appropriate at this point, don't discard it but keep them all in mind.

6. Specify objectives in behavioral terms. What responses or behaviors do I wish from the learner as a result of participation in the instructional experience?

7. Determine appropriateness of tentative characteristics of the simulation system described in Step 3 by relating them with objectives that have been specified in Step 6. Am I still on the right track? Can the proposed simulation accomplish what is intended for it?

The following steps permit the systematic design of an instructional simulation system
8. Determine the model or look for a prespecified model in the literature. That is, identify the major problem (crisis or conflict) and problem features (location, specific activity, setting, cause, time, etc.). What's the problem? Who? What? When? Where? Why? How?

9. Analyze the model — the structure, the processes involved, and constraints on their behavior. Who are the major decision-makers? What do they do in relation to each other? What is the direction of information flow, type and quantity of information, form of the information, material content, resources of decision-makers, rate of information flow, frequency of information flow, etc.

10. Synthesize the simulation (reconstitute the simulation) after detailing the model. Specify:

   - roles and activities
   - organization of events
   - cycles of activities, etc.

What will my simulation look like? How will I simplify the model so that the exercise is playable and achieves the stated objectives? What can I omit from the model? How can I represent certain essential features of the model?

11. Formulate operating procedures. What starts the exercise? What continues the exercise action? What stops the exercise? The key here is: What individual is doing what action to whom and for what purpose?

12. Determine exercise outcomes. What can happen during the course of the exercise? To whom? Determine appropriateness and desirability of these outcomes. Do I want these outcomes?
13. Integrate all simulation elements with the model. Select one aspect of the simulation as you have designed it, e.g., one information input or same action, and trace it through all intended routes. Determine appropriateness of outcome and loopholes. What will happen if I do this to that element? Does everything hold up, in light of the model?

14. Integrate all simulation elements with the intended objectives. Pay particular attention to learner behaviors. How does this information input or this process or that decision maker relate to this or that objective?

15. Determine specifications for all components of the system (briefing, debriefing, follow-up, etc.) and review in light of objectives. What accompanies the simulation itself?

The next steps allow the designer to develop and evaluate the simulation exercise.

16. Generate criterion measures.

17. Build evaluation instruments.

18. Develop all prototype materials needed for the game, the briefing, the debriefing, etc. Examine all simulation elements for consistency as materials are developed. Be on the lookout for non-essential information, unclear instructions, inconsistent directions, etc.

19. Tryout simulation system prototype, or components.

20. Modify the prototype on basis of tryout.
21. Recycle Steps 18-20 until all "bugs" are determined and eliminated. It is very likely that during the early phases of the tryout-revision process, further design work as specified in Steps 8-15 will occur.

22. Conduct field trial under operational conditions to determine if the simulation system "stands by itself" without designer interaction to "make it work."

23. Revise on the basis of the field trial.

24. Repeat Steps 22-23 until the objectives are fully met as shown by criterion and evaluation instruments.

(Twelker, 1972; Unpublished mimeo)

Though the sequence of development and terminology differ among the processes described, a core of developmental procedures and concerns could be identified which would contribute to the development of a comprehensive body of developmental and utilization guidance. The common procedures of general goal stating, object system identification, theory delineation, instructional problem identification, objectives specification, simulated incident construction, try-out, and validation were constantly evident. Also evident were the issues focusing on the nature and administration of feedback to learners in a simulation experience, the level of realism needed to produce desired effects, the placement of simulation in an instructional program, the spacing of practice, the implementation of evaluation, the complexity of simulation
administration, and the amount of structure in the content of the simulation.

Absent from the literature and the interview information was evidence of a concern and a sensitivity for the needs of the novice designer. Of the guidance available, most provides a record of procedures and issues encountered by other developers and is not specifically in tune with the plight of the novice developer. The developer of a simulation needs more detailed step-by-step guidance focused about his major design problems. He needs recommendations and information not procedural anecdotes.

Also absent from the guidance information collected was a treatment of the cost versus benefit issue so critical to simulation design. The role of modeling in simulation, though presented, was treated only superficially. Also in need of more explanation and interpretation was the type and function of learning stimuli in the simulation experience. Through the addition of more extensive treatment of these topics and an interpretation of topics already described, a comprehensive body of guidance for the development and use of simulation could be produced.
RESULTS OF THE STUDY

Results: Background

Three forces are making it more difficult to make sound selections of suitable instructional techniques. First, a vast and ever increasing array of available instructional technology and techniques presents itself. In any given month a quick perusal of an educational journal will turn up half a dozen new instructional aids or methods, most of which are unaccompanied by empirical data regarding their use or effect.

Second, the spread of accountability is requiring more accurate selections than ever before. Taxpayers and students alike are looking for greater effectiveness with increased efficiency. Third, the students are presenting more frequent and more vocal demands for worthwhile and enjoyable learning experiences.

There is only one rational and positive approach to the selection problem, namely, the collection and critical study of information regarding a proposed or prospective instructional technique or technology. The information studied must not only illuminate the techniques or technology, illustrate its use, and record its potential value, but should also delineate procedures and issues relating to its use.
This study has been an attempt to employ such an approach. Information has been collected and reported in the chapter entitled "Findings of this Study," which describes the broad concept of simulation, defines instructional simulation, provides broad examples of simulations use, offers a record of the potential value of simulation, and delineates some procedures and issues relating to its use. In an earlier chapter, findings from a study of the literature and field visits were also presented. Here the results of attempts to synthesize a body of guidance for the developer and user of instructional simulation are described.

The information in this chapter presents four distinct developmental stages in an attempt to relate, integrate, and expand upon the available guidance regarding simulation development and use. Each stage reported was characterized by the production of tentative guidelines, presented as statements, outlines, or flowgraphs which were evaluated by experts in the field of simulation and revised to reflect their recommendations. The last developmental stage resulted in the production of "A Guide for Using Instructional Simulation" which includes both the contributions from the literature and from the interviews with experts.
Results: Stage I of Conceptual Development

Developing a Preliminary Model

The "preliminary model of the instruction simulation development process" presented as Figure 2 evidences an early study decision to divide the development process into four component parts. The feeling at this stage was that the issues and procedures contained in each the contextual, the developmental, the effectual, and the conceptual components, although inter-related, were distinct from those in any other component.

The contextual component was designed to deal with the general area of instructional problem definition. The developmental component included procedures for instructional resource identification and allocation toward the development of simulated experiences for learners. The conceptual component served the process by providing a model of some real world process from which a simulation could be developed. The effectual component dealt with the evaluation of the development process and the instructional experience resulting from its implementation.
FIGURE 1. A PRELIMINARY MODEL OF THE INSTRUCTIONAL SIMULATION DEVELOPMENT PROCESS.

MODEL I.
In a first attempt at translation of the flow-chart depiction into usable guidelines for simulation development the following procedural outline was developed.

I. **Contextual Component**
   
   A. Identify and delimit the learning needs.
      
      1. Define an area of study.
      2. Set limitations of what will and will not be included in that area.

   B. Specify instruction outcomes.
      
      1. Express general or overall expectations for the learner in the area defined.
      2. Refine expectations to define individual behaviors needed to fulfill the expectations expressed.
      3. List behaviors which the learner will need to learn to accomplish the desired outcomes.

II. **Developmental Component**

   A. Identify relevant alternative strategies.
      
      1. Entertain a broad spectrum of alternative means of instructional presentation.
2. Inventory and catalog the available resources: instructional materials, instructional media, design assistance, production assistance, and utilization assistance.

B. Identify relevant alternative instructional strategies.

1. Develop "feasible" strategies (arrangements of "available" resources).
2. Match strategies with desired instructional outcomes.
3. Evaluate coverage (at least one strategy for each outcome).

C. Identify costs.

1. Assemble the cost of time, materials, and media used or consumed.

D. Select strategy.

1. Based upon the expected outcomes and costs for the strategies specified, choose those to be used. (If any of the strategies deal with simulation begin the appropriate modeling
process. For other strategies develop instructional prototype).

E. Produce Instructional Prototype.

1. Identify important situational variables. Specify the various aspects of the learning situation.

2. Produce materials capable of perceptually "placing" the learner in the appropriate situation.

3. Identify the stimuli to which the learner is to react.

4. Specify the desired appropriate learner reactions or responses.

5. Specify the nature of the feedback to be provided for each response.

6. Produce feedback materials.


F. Tryout Prototype

1. Identify test population (size, nature).

2. Administer instruction.

3. Collect evaluation data.

5. Recycle modification.

III. Conceptual Component

Develop model.

1. Select the model determined most consistent with the desired learning outcomes (choose a criterion-determined, norm-determined, or form-determined model).

2. Structure theory to build theoretical construct.

3. Analyze operations and generate operational construct.

4. Collect contextual data and assemble contextual construct.

5. Assemble appropriate constructs into that model.

6. Check validity.

IV. Effectual Component

Design evaluation

1. Develop criterion measures for content evaluation.

2. Develop criterion measures for input evaluation.

3. Develop criterion measures for process evaluation.
Preparing for the Interviews

After an outline of the flowcharted procedures was constructed, the problem of determining how to evaluate the procedures then was confronted. Interviews with experts in the field of simulation were chosen as the evaluation methodology. At this point it was thought that the procedural outline lacked the specificity and vigor needed for evaluating. The investigator then concluded that succinct statements analogous to scientific principles should be constructed. It was hoped that the cause-effect type statements would introduce specific vigor and reduce time needed for full reaction to the model. The following are the statements which the investigator constructed, labeled "heuristic principles of simulation design," recorded on index cards, and then used in field interviews to solicit expert reaction to their form and content. These principles were submitted to Drs. Goodman, Broadbent, Cruickshank and Cherryholmes. Their reactions are given on page 67.

1. That instructional design proceeds from a productive foundation provided by a well specified learning need with apparent boundaries.

* Drs. Frederick Goodman, Frank Broadbent, Cleo Cherryholmes, and Donald Cruickshank served as evaluators.
2. That relevant instruction be insured by a true identification of the limits of instructional treatment with a specified learning need.

3. That the integrity of instructional intent be presented by listing general outcome expectations.

4. That instructional specifications, delivery, and revision be consistent with specific behavioral guidelines.

5. That interim learning needs be recognized and treated as legitimate instructional outcomes.

6. That a broad array of possible instructional strategies be derived from a listing of available instructional resources.

7. That selection of the most satisfactory strategies be made from specifications of a broad array of instructional alternatives.

8. That the identification of untreated outcomes and inappropriate strategies come from a matching of satisfactory possible strategies with desired outcomes.

9. That the selection of lower cost strategies with similar effectiveness can be made from estimated strategy costs.
10. That instructional simulation design be based upon a model situation, operation, or theory.

11. That non-simulation instructional design take form in specifications of its stimuli, its feedback, its situations, and their interactions.

12. That accurate instructional design demands the development of a prototype.

13. That the limits of instructional effect be set through a determination of the nature of the simulation model.

14. That theory-based outcomes be delimited by the building of theoretical constructs.

15. That norm-based outcomes be delimited by the synthesis of operational constructs.

16. That norm-based outcomes be delimited by the generation of contextual constructs.

17. That model efficacy be assured through construct validation.

18. That the control of situational variables demand their identification.

19. That learning be facilitated by the induction of a congruent "perceptual set."
20. That inducement of appropriate "perceptual set" come from the appropriate arrangement of situational variables.

21. That the elicitation of appropriate learner responses follow from the presentation of appropriate stimuli.

22. That the nature of feedback be derived from specifications of anticipated responses.

23. That necessary reconception of learning needs be determined through an evaluation of context.

24. That necessary reconstruction of instruction be determined from an evaluation of product.

25. That the congruency of process and product intentions be measured by process evaluation.

26. That the necessity for prototype revision be determined by the evaluation of product.

27. That product and process adequacy be partially determined through an evaluation of input.

28. That the predictability of instructional effectiveness increase with the accuracy of pilot audience identity.

29. That effective instruction be produced by iterative trial and revision.
The results of interviews with Goodman, Cherryholmes, Broadbent, and Cruickshank showed the decision to translate the procedural model into the list of principles stated above a poor one. Goodman considered the heuristic principles of little value saying that they are inapplicable to the development of the kind of simulation he uses.

Goodman is working primarily in the area of learning games, studying their design and their effect. Although most of his games do not start out to be simulations, many wind up so. The Goodman game development method begins with the building of a simple game with a few moves, some varied roles, and a small variety of artifacts. The game with a crude design and rules is known as a priming game or core game because its function is to ready the players for other activity.

That activity, the most meaningful to Goodman, results in the redesign of the priming game. To achieve redesign, the players first play the priming game long enough for exercise in as many of the play possibilities as can be created and to fully grasp the rules and their basis. In this way he senses the designers implicit model for the game. Each player is then in a position to provide his own recommendations for play, rules, payoffs, and playing pieces. It is those recommendations which Goodman
values highly as game outcomes. He finds players making belief-based commitments in game design that he has seen achieved in no other way.

In recommending ideas for the redesign of the game, the player actually clarifies some of his beliefs and puts them into action. In this way, the Goodman game builds from a simple game based upon an incomplete model into a more complex game with a broad model (Goodman, 1972).

Cherryholmes accepted all but items 2 and 3 of the principles, mentioning that the selection reflected his beliefs about the design process which make 2 and 3 seem unnecessary. He described the principles as partly definitions, partly empirical fact, and partly principles. Through his comments and numerous questions about the principles, Cherryholmes, after sorting the statement cards, grouped them into four classes reflecting his conception of the development process. One class contained items 3, 4, 15, 16, and 17 which he said had to do with "goal setting." Items 6, 7, and 9 Cherryholmes group as dealing with "survey of instructional approaches." Items 11, 12, 13, 18, 19, 20, 21 and 27 he labeled "design items," and 1, 5, 8, 22, 24, 26, and 30 were dubbed evaluation (Cherryholmes, 1972).
Broadbent in his review disagreed with the inclusion of items 2 and 21. The remainder he classified into four categories roughly approximating those developed by Cherryholmes. His "goals" category included items 1, 2, 6, 7, 9, 11, 14, 15, 16, and 17. Items 4, 8, 18, 26, 27, 28 were included in a "control" of the simulation process category. The "developmental" category included items 5, 12, 13, 19, 20, 21, 22. Items 2, 24, 29 and 30 were called "field testing" items. Though the specific items included in the classes developed by Cherryholmes and Broadbent varied, the fact that four classes were needed and that goals, evaluation, development, were to be included remained consistent (Broadbent, 1972).

When Cruickshank reviewed the heuristic principles, he did so reluctantly. He requested many definitions of various terms presented, and identified the statements as partly learning theory, partly philosophy, and partly what he called "system stuff." He did finish sorting the cards and noted that each had some value to the simulation development process, but his feeling about their lack of utility came through.

Turning away from the cards, Cruickshank raised his related reasons. He observed that a behavioral orientation permeated the content of the cards. The orientation, he felt, was of value for some simulations,
but was inhibitory for some. Cruickshank often brought up the topic of instructional outcome, mentioning four kinds of simulation outcomes: (1) outcomes requiring selection from alternative courses of action with related consequences; (2) outcomes more closely associated with beliefs and values; (3) outcomes which force the learner to analyze real world problems; and (4) outcomes which allow the learner to directly apply or practice some training. (Cruickshank, 1972).

Each of the interviews offered different and useful instruction. The Goodman interview introduced the study of the area of learning games, their goals and their methods, and raised first doubt on the adequacy of heuristic principles in describing simulation development. The Cherryholmes interview disclosed a simulation development time technology not available in the literature and verified the thesis leading to the heuristic principles. Broadbent, in the next interview, described the Broadbent-Cruickshank developmental method and cast further doubt on the usefulness of the principles. Cruickshank followed up in the next interview with his own doubt as to the value of the heuristic principles.

In summary, the interviews were fruitful, giving the investigator up-to-date firsthand knowledge of the
people behind well-known simulations and their thoughts about simulation development. These major conclusions resulted from the interviews: (1) That the heuristic principles should be abandoned; (2) That the model was crude and unsophisticated containing no examples and providing inadequate "how-to-do-it" information, and ignoring the issues surrounding the use of simulation; and (3) That revisions and retesting of the model were necessary.

Results: Stage II of Conceptual Development

A major rethinking and redevelopment of the simulation development model initiated Stage II of guidance development. The major impact of the interview information mentioned earlier and a reassessment of the literature offerings resulted in a redefinition of the model. The "revised" model for the instructional simulation development process showed an expansion of the prototype tryout procedures to include the steps of audience identification, administration of instruction, and the implementation of product evaluation.

In addition, the prototype tryout functions were summarized under the "effectual component." Also within the effectual component, points for process evaluation information collection were identified. Context and input evaluations implicit in the developmental sequence were therefore unnecessary in the effectual component and eliminated.
The contextual component was renamed "design component" and the conceptual component renamed "representational component" to better indicate their respective classes of functions. The modeling process had a step added, that of creating scenarios -- written descriptions explicating the model. The choice was made to serve a need for some product to mediate between the model and the actual construction of the instructional prototype.

The remaining changes all occurred in the prototype product activities. The sequence of action was changed to reflect the importance of learning stimuli specifications in determining the nature and form of its function. For a flowchart description of the revised model see Figure 2. After the indicated changes had been made, the flowcharted version of the model was translated into a procedural outline as a test of the relationships depicted and their usefulness in a sequence of development. Explication of outline procedure was not done prior to evaluation. The sequential outline is presented below.

A. **Delimit scope of treatment.**
   1. Select subject matter area.
   2. Define limits of desired competency.

B. **Identify learning needs.**
   1. Delineate "learner-centered" needs.
   2. Delineate "performance-centered" needs.
Components or relationships bearing the superscript "2" have been changed from Model I.
C. **Express general or broad instructional intentions.**

D. **Specify learning objectives.**
   1. Identify desired behavior.
   2. Identify performance level.
   3. Identify performance conditions.

E. **Develop evaluation.**
   1. Specify developmental process measures.
   2. Specify instructional product measures.

F. **Identify instructional resources.**
   1. Inventory available materials.
   2. Inventory available human potential (production and instruction).
   3. Specify budget and time resources.

G. **Develop feasible instructional strategies** (programmed instruction, lecture, independent study, simulation...).

H. **Evaluate strategy and objectives coverage.**

I. **Match strategies with outcomes.**
   1. Specify predicted cost and strategy.
   2. Define role of simulation in total instructional design.

J. **Determine nature of simulation experience outcomes.**
1. Identify outcomes as prescriptive of some theoretical reality, descriptive of some current reality, or circumscriptive about some key element of reality.

K. Develop appropriate model.
1. Build theoretical construct and/or
2. Synthesize operation construct and/or
4. Assemble constructs into scenarios.

L. Check validity.
1. Investigate logical consistency and congruency.
2. Investigate face validity of situations and operations.

M. Identify learning stimuli.
1. Describe desired sensory effect.
2. Utilize behavior specification from objectives.
3. Produce learning stimuli as instructional materials.

N. Identify peripheral stimuli.
1. Specify situational cues other than situational model.
2. Arrange or produce situational prompts or cues.

0. Specify appropriate learner responses.
   1. Develop learner feedback.
   2. Specify the type and nature of response-feedback.
   3. Produce instructional feedback.

P. Assemble simulation prototype.
   1. Sequence and space learning stimuli.
   2. Select a tryout audience.

Q. Try out simulation.
   1. Collect learner performer data.
   2. Report necessary revisions.

With the revised model flowchart and the sequential outline of procedures in hand, two more field visits were made. During these visits the procedures and the flowchart were discussed. The goal of the visits was to collect issues and decisions which related to, but were not presented in the chart or the outline, and to evaluate the content of both. The method for this part of the study is described in the "Introduction."

The first field visit was with Paul A. Twelker, noted simulation developer, at his home. During the visit, the instructional simulation development procedures were explained and the relationships among them described with the aid of the flowchart. Although he made several recommendations,
Twelker accepted the model in general. During a discussion of the design component, he questioned the implication that the three initial design steps — (1) the identification of subject matter, (2) the identification of learning need, and (3) the expression of general retentions — were sequential. After the investigator explained the non-sequential nature of the process he envisioned, it was agreed that the concept was sound but the presentation was in error.

The referential component started a prolonged discussion. Aware of the absence of detailed discussion of modeling in his own writings, Twelker expressed interest in the modeling procedures presented. After an explanation of the role of prescriptive, descriptive, and circumspective outcomes, Twelker expressed agreement with the concept of coordinating learning outcomes with simulation model type. He suggested that an additional figure be presented to enhance depiction of the modeling relationship. He also suggested, in discussing the "assemble model" step, that the analysis and synthesis functions in model development be separated. He recommended that the analytical nature of theory building, operations synthesis, and contextual constructs generation be depicted as such. Synthesis begins at the point of their assembly into the simulation model and should be so identified.
In discussing the later modeling phases, Twelker took issue with the indicated meaning of the word "scenario," used in the last step of the referential component, saying that the meaning was too narrow to represent the concept of that step. The term was later abandoned.

The discussion proceeded to prototype production issues. Agreement was evident regarding the choice of stimulus, response, and context as variables in the instructional process. Twelker suggested that the flowcharting of prototype development be ordered response specification, stimulus specification, and context specification. For example, he mentioned that although the distinction is somewhat arbitrary, his experience has proved continual attention and early treatment of learning responses very productive.

The changes suggested for the effectual component related to the tryout of the prototype functions. Twelker suggested the recognition of different types of prototype tryout. He recalled and described the three types of tryout adopted by the Instructional Development Institutes Program at Syracuse University: (1) Developmental tryout represents a trial of the instruction mechanism and does not involve learners. (2) Validation tryout is a trial of the instruction on a group of learners individually and can supply many observations about the learners interaction with instruction.
(3) Field tryout occurs when the instruction is taken to a representative population of learners and tried full-scale in the absence of the instructional developer.

In summary, Twelker indicated overall agreement with the revised model as presented.

The information collected by the Twelker visit was analyzed before, during, and after the second field visit to determine its relationship to the new information resulting from visit two and, subsequently, its impact upon the "revised model" during the next revision.

The second visit has a disappointing beginning due to the absence of Stephan Kidder. However, a productive group meeting was held with Keith Edwards, Samuel A Livingston, Gail Fennessey, and Alyce Nafzger, games researchers at The Johns Hopkins University. During this meeting Edwards, explaining the group's roles in research and not in simulation development, changed the goal of the meeting. The goal became one of finding out about their concerns and not of evaluating the revised model.

Observations made during their research activities, and expressed by Livingston, suggest that role playing in simulation games can create realistic attitudes and empathy for the roles of others, that the role interacts with the game playing behaviors the role demands, and that the role
interacts with the person's own real-life role and with the role of others in the simulation game.

In current research Livingston has investigated the interactions between role identity and role playing behaviors and has found both to be of effect in altering attitudes. As a result of three types of experiments:

1. One involving role identity without role related actions,
2. One involving role actions without disclosure of role identity, and
3. One involving both role identity and related role action, Livingston concludes that most attitude change in gaming situations occurs when role identity and role behaviors coincide.

In games research at Johns Hopkins, roles are modeled after real-life roles. To designers of such experiences, the games research staff suggests a valid role for each player and careful attention to the direct relevancy and effect of the role played to be sure the role coincides with the learnings desired. A game involving two players and rewarding only one of them by a wholly artificial role contrived by a game designer would be disapproved by these researchers (Edwards, 1972, p. 78).

From the topic of role-playing, the discussion moved to the faults most common to simulation game designs. Listed in order of criticality and frequency by Livingston and Fennessy, the faults are paraphrased as follows:
The failure to specify objectives for the simulation game.

The absence of a model of reality as a basis for the game.

The attempt to include so much subject matter in a simulation game that its specific effects are diluted.

The inclusion of extraneous roles to keep players busy.

The apparent introduction of task irrelevant game components solely to make a learning experience game-like (Edwards, 1972: oral communication).

Two major implications for design were derived from the visit. First, the appropriate use of roles in simulation games is critical to their learning effects, therefore use should be undertaken with forethought and adequate study. Second, although the design of simulation games should be recognized as an activity which does not yet have sufficient empirical basis, that fact should not block progress in game development. However, designers should not be pretentious in predicting learning outcomes for which no research support exists.

In summary these two visits made two distinctly different contributions to the study. The Johns Hopkins
visit provided much information about role playing which was found to be of value during construction of "A Guide for Using Instructional Simulation." Twelker presented a need for in-depth analysis of the revised development model. His comments helped in the construction of a third, improved model.

**Results: Stage III of Conceptual Development**

Stage III in modeling resulted in "A Proposed Model of the Instructional Simulation Development Process." Changes in the model reflected the results of the Twelker visit and the rethinking which continued through both interviews. The introduction into the model of three types of prototype tryout — try-out for operation, tryout for evaluation, and tryout for effectiveness — and the classification of modeling steps as synthesis or analysis activities resulted from Twelker's recommendations. Other minor changes resulted from the continuing reappraisal to which the model was subjected.

As the "Proposed Model of the Instructional Simulation Development Process" (see Figure 3) was being developed it was evident that "loose ends" still existed precluding the full explication and embellishment of the model as a guide for substantial simulation. For example, the
Components or relationships bearing the superscript "3" have been changed from Model II.
cyclical nature of the process for identifying learning outcomes was not depicted, guidance for the administration of simulation instruction was absent, and no "feel" for the needs of the novice developer was implicit in the model. To remedy the situation the investigator decided to participate in the annual workshop on simulation design conducted by the Simile II Project staff of the Western Behavioral Science Institute. Since R. Gary Shirts and Sarane Boocock, simulation experts not previously interviewed, were on the program, it seemed an opportune time to review the "proposed model" and gain a better feel for the needs of the novice instructional simulation user.

The workshop served both as a good review of the issues presented by the literature and past interviews. The issues of validity, realism, transfer, efficiency, and particularly of design were structured as questions about simulation in need of answers. While presenting a paradigm showing the interrelationship of simulation, games, and contests, Shirts stated that the essence of simulation is modeling, the essence of a contest is competition, and the essence of a game is rules or other agreements to abide by a set of conditions. Though many other topics were covered at the workshop, the above were the only notions new to the study. (see Figure 4).
Both Shirts' and Boocock's summary of developmental issues and exemplification of simulation now provided for other insight into the development of a guide for instructional simulation. With their information, with insight gained through three field experiences, and a body of knowledge available in the literature, "A Guide for Using Instructional Simulation" was next developed.
The guide was written to lighten the burden of instructional decision-making for the teacher by providing a useful synthesis of information regarding instructional simulation. Through extensive study of the literature and field visits to experts in the area of simulation, this investigation is able to reduce information that could take the teacher hundreds of hours of study to a practical guide requiring only a few hours of reading. The intention of the guide is to introduce the teacher to the concept of instructional simulation within the broad context of teaching and learning and to the knowledge and skill necessary for developing simulations appropriate to the teacher's explicit intentions.

Philosophically the guide is based upon the belief that a sound instructional decision and subsequent appropriate instructional action are the result of an awareness of one's beliefs about learning, one's intentions for instruction, and one's knowledge of available alternative instructional techniques. Adherence to the guidance provided in these
three areas will make it possible for the reader to make a determination of a role for simulation.

Once such a determination has been made, the reader is in a position to begin to plan for the simulation by developing initial design specifications. Subsequently, the imagination and creativity of the teacher come into play in the actual production of the simulation materials.

The Guide: Method of Review

A straightforward method of critical review was employed in the evaluation of the guide. Volunteer reviewers were solicited from a teacher inservice training class offered by the Columbus Metropolitan Area Church Board. Six of a class of twenty offered to spend several hours of their own time in reading and reacting to the guide. All were parochial school teachers. The reading was done during the week between the first and second meetings of the class. This time was chosen to increase the probability of receiving responses solely to the guide and not to classroom instruction plus the guide. Reactions to the guide took two forms: marginal comments throughout the pages of the prototype, and answers to questions on a Guide appraisal form. The marginal comments included questions about the guide's content and form, as well as verbal reactions to what was and what was not written in the guide.
By the structure of the prototype guide two other types of evaluative feedback were also gained. One type came through questions demanding responses which were part of the text of the guide. By studying the content and clarity of the reader's responses it was possible to determine just which points needed to be expanded upon, modified, or eliminated entirely. Another type of feedback came from two tests taken by the respondents, one before reading and one after. Each test contained the same items, designed to measure learning toward the objectives of the guide thereby testing the adequacy of the reader's knowledge of the use of simulation. Comparison of the test results disclosed areas where desired levels of knowledge were not evident. This analysis made it possible to rework guide sections which were shown to be ineffective.

All four forms of feedback provided necessary and valuable information for a guide revision. The feedback, when analyzed across reactors, showed that some reactions reflected individual reader preferences and abilities and others reflected guide deficiencies. The information collected was aggregated into a list of criticisms entitled "The Guide: Reactions." The list was then used as a basis for a set of recommendations which became the section entitled "The Guide: Recommendations."
Next the entire guide was rewritten to reflect the reviewers' evaluation and comment. The rewritten guide was included in a chapter entitled "A GUIDE FOR USING INSTRUCTIONAL SIMULATION."

The Guide: Pre-reading and Post-reading Inventory

Define the term instructional simulation. ____________________________

Name four instructional simulations. ____________________________

List five reasonable expectations for the use of instructional simulation. ____________________________

Describe two similarities or two differences between instructional simulation and any three other techniques. ____________________________

Describe the use of one instructional simulation. ______

Name four of the major components or elements of a simulation. ____________________________

Describe the kind of learning outcomes you would judge as suited to the simulation method. ____________________________

List three of your beliefs about teaching and learning which you think to be consonant with the use of simulation. ______
Name three types of learning objectives.

Name the two major dimensions of instructional activity.

Describe the topic of simulation you have planned.

Write something of the rules for a simulation you have planned.

Write something about the roles included in a simulation you have planned.

Write something about the resources available in a simulation you have planned.

Write something about the results expected within the simulation you have planned.

Describe the conditions under which you think it wise to use instructional simulation.

Do you wish to learn about simulation to be conversant on the subject, to be able to use available simulations, or to be able to design your own simulation experience?
Are you now confident enough to talk before a group regarding simulations use in the classroom, to assist another in using an existing simulation, to design a simulation that will work, or to do none of the above? ____________________________________________________________

If you have other comments... _____________________________________________


The Guide: Appraisal Form

What do you think of the guide? ____________________________________________

What would you say about its value? ________________________________________

What did the guide do for your interest in instructional simulation? __________

What did the guide do for your confidence in using instructional simulation? __________

What did the guide do for your confidence in developing a simulation of your own? __________

What did you like best about the guide? ________________________________

What did you like least about the guide? ________________________________
What changes would you have made in the guide?

What did the guide do for your ability to use simulation in the classroom?

What did the guide do for your ability to develop a simulation of your own?

Have you begun the development of a simulation of your own?

What needs do you have regarding instructional simulation?

What experiences do you feel you want in order to meet these needs?

In general, reactions to the guide were favorable. Of the six teachers given guides, five read and returned them. The sixth person did not read her guide. She returned it and resigned from the course, saying that the whole topic was "over my head intellectually." Her guide showed no evidence of any attempt to respond to the material presented. It is difficult to determine whether she made her decision not
to complete the guide because of the content or structure of the guide, because of the nature of the course's introduction session, or for some other reason. The others who did read and react to the guides commented in writing: "Good stuff. Helpful." "Interesting but difficult." "Very thorough." and "Informational, enabled personal insights."

The reaction comments regarding the value of the guide varied from "It could be used very nicely for an introduction to simulation-gaming," to "It was too much to start a person out with."

Different aspects of the guide were the main likes and dislikes of different reactors. One person liked best the pre- and post-test exercises, and disliked the length. A second respondent liked the "This I Believe About Education" section, and disliked the process/content structure figures. A third person liked the thoroughness, and disliked the faulty sentence structure he found. Another liked the depth of background he assumed had contributed to the guide. The last respondent liked the questions presented and she commented, "I couldn't read them quickly because I had to reflect. She disliked the early introduction of what she called "theory."

When questioned about what the guide had done for their ability to use simulation in the classroom, the respondents commented: It gave me some guidelines
to follow." "If I kept this guide as reference, it could be very helpful in planning and criticizing simulations." "Produced interest." "Provided a structure to create simulation games upon and direct existing games." "I feel now I could understand a simulation being done, but I am not ready to do it myself."

A review of all the criticisms collected follows. Each criticism was made by only one person unless otherwise noted.

**Criticisms of the Guide**

1. Some vague charts and graphs.
2. Too much material in one document.
3. Needs better headings and divisions.
4. Shouldn't be stapled along top edge.
5. Had misspelling and faulty sentence structure.
6. Needs some pictures to break up text.
7. Poor descriptions in figures.
8. Needs more emphasis on definitions of terms.
9. Doesn't talk about learner age as design variable.
10. Seemed laborious to read.
13. Some exercise directions unclear.
14. Exercise answers should be on an answer sheet.

15. Needs a few more case studies.

A page by page review of the respondents' guides showed some additional weaknesses. A single respondent did not respond to the exercises on pages 19, 20, 22, 25, 41, 46 and 59. Three respondents did not respond to the exercises on page 25. These observations seem to support criticism Number 13.

In an isolated instance, one reader substituted the term experimental for experiential in a response. A possible conclusion here is that a better definition of experiential is needed.

Comparison of pre-test and post-test results showed specific learning attributable to the guide. Though some of the results varied only qualitatively and were judged subjectively, the overall impression is that the guide achieved most of its objectives.

The following table presents test questions and a judgment as to the adequacy of pre-test and post-test responses by each participant.
The readers evidenced their learning of the similarity between simulation and other instructional techniques. They also showed their understanding of the differences between simulation and similar techniques. Also shown was the learning of reasonable expectations for simulation. In other cases, achievement was noted. For five of the eleven objectives, three of the four respondents
evidenced increases in ability. On three of the eleven items, one-half of the respondents showed an increase. One instance of one person learning a response to one item was evident.

In the main these results would seem to indicate that the guide is, for the most part, quite effective but does have weaknesses in some cases.

Testing, appraisal for reactions, and marginal comments in the guide collectively have provided valuable criticisms. The investigator's reaction to those criticisms has been included in the section of the report entitled "The Guide: Recommendations for Revision."

The Guide: Recommendations for Revision

Based upon study of the test results, marginal comments, and appraisal form responses, several recommendations for improvement of the guide are possible. Some of the recommendations deal with format and some with content.

It was apparent that fewer responses were made to exercises demanding a response on a chart than to those demanding only a fill-in blank response.

It is recommended that the chart responses be converted to matching responses where a blank on the chart is matched with a term to label it.

The guide, as a whole, appeared to be too long and had too much text. It is recommended that the guide be
divided into major sections, each with a pre-test and post-test, and that headings, subheadings, and blank spaces be used liberally to break up the text.

Some responses were omitted by participants. It is recommended that a symbol such as an asterisk accompany a blank requiring a learner response.

It is recommended that the directions for responding be paragraphed and underlined.

Poor test performance suggests inadequacies in the expectation section of content. It is recommended that the expectations section be expanded.

Definition of terms was identified as a problem. It is recommended that important definitions be repeated throughout the text with underlining of the first presentation.

Free-hand charts are not adequate. It is recommended that the charts be redrawn by an expert.

Ready access to particular sections of the guide is difficult. It is recommended that a table of contents be added.

The answers to exercises are not obvious when included in the text. It is recommended that the answers to exercises be placed in the margins of the guide.

The test items are not fully descriptive of the desired learnings. It is recommended that the test items
be rewritten to provide more objective data about learner performance.

By making the changes recommended by the preceding statement, it is predicted that a more effective guide could be produced.

The Guide: Objectives

Upon completion of the guide, the learner will be able to:

Define the term "instructional simulation."
Name four instructional simulations.
List five reasonable expectations for instructional simulation.
Describe the use of instructional simulation.
Name the four major elements of a simulation.
Describe two similarities and two differences between instructional simulation and three other instructional techniques.
Describe one kind of learning outcome suited to simulation instruction.
List three beliefs about teaching and learning which are consonant with the use of simulation.
Name the three major types of learning objectives.
Formulate an initial crude plan for an original simulation.
The recommendations made in a preceding section were followed and a revised guide was the result. The text of that guide appears in the following section pp. 100-176.

**THE GUIDE: MAIN TEXT**

**The Guide: The Concept of Instructional Simulation**

**Simulation Defined**

_Simulac_, a Latin word meaning "like," is the root of the term simulation. Through its Latin ancestry simulation is related to "similar," "similarity," "simile," and several other words dealing with likeness. In view of this fact the normal interpretation of simulation as dealing with imitation or artificicality is understandable. Simulated colors, flavors, and textures are common in our world. Any replica or imitation, whether a fishing lure or a mock city council meeting, is to some degree a simulation. By using simulation it is possible to attain the essence of something without its reality.

In this guide, simulation is defined as a representation of something real, or a method of presenting a likeness of something from the real world. In substituting for reality, simulation can present many or few qualities of the real thing depending upon the application. A simulation is not the real thing but it is realistic. The process of simulating is meant not to reconstruct reality, but to insure realism.
Simulation has both scientific and educational usefulness. In science it is used to generate knowledge, in education to promote learning. Scientific applications of simulation include both experimentation and theory building. As an experimental method, simulation allows the investigator to study a phenomenon similar to the real phenomenon without affecting the real one. Experimental uses of simulation include the study of phenomenon as diverse as interpersonal relations, role playing, international politics, and community organization. Used as an experimental method, simulation allows the scientist to select, control, and study only those elements of reality pertinent to his investigation.

Simulation is also used as a theory building method to aid in the design, development, and evaluation of new structures, systems or organizations. Simulations have helped to conceptualize the phenomena surrounding the way people dream, the approach of attack aircraft, the operation of bus terminals, the flow of traffic, the motion of oil derricks, and the dynamics of supersonic flight. By simulating selected elements of phenomena of interest, scientists are able to collect the information necessary to build theories.

Educationally simulation is used in the fields of military training, business training, educator training,
and classroom instruction. Simulation has been applied to the teaching of leadership skills, management decision-making, educational administration, teaching methods, and academic subject matter. In its educational applications, simulation is employed to provide its participants with a realistic experience in lieu of a real experience. In this capacity it is not a generator of knowledge, it is a dispenser, diffuser, or disseminator of knowledge. When simulation is used for educational purposes it is termed instructional simulation. This guide is about instructional simulation.

**Important Dimensions in Learning**

Instructional simulation is a method for teaching. It is a means by which desired learning outcomes can be realized. It is a way to instruct as are the lecture, programmed instruction, independent study, apprenticeship, and field trips. As an instructional method, simulation is in some ways similar to and, in some ways, different from other methods. Learning in simulation experiences is accomplished through active participation as is the case in learning directly from real-life experiences and through apprenticeship. One difference in these methods is that apprenticeship and real-life experiences deal directly with reality. Instructional simulation experiences do not deal directly with reality through some representation of reality.
Such an indirect experience with reality is also characteristic of learning from case studies and audio-visual presentation. Simulation offers learning through active participation with a representation of reality. In this method of learning it is possible to have realism without reality and involvement without direct experience.

Before a learning activity can qualify as a simulation, it must be both realistic and involving. The degree of realism necessary in order for a learning activity to be termed a simulation can be achieved only if the activity has been modeled after some aspect of reality. The degree of involvement necessary to have a simulation comes when an activity allows the learner an opportunity to have an affect upon the reality representation used. These two qualities are not isolated and distinct. They are interrelated. In a simulation experience the learner learns from the operation of some representation of reality. Put in other terms, simulation learning occurs as a result of the learner's "manipulation" of a model of reality. In contrast, learning that results solely from the observation of some representation of reality, though it may be effective, is not a simulation. Also, if learning occurs as the result of the "operations" directly with reality, the learning experience is not a simulation.
Translation of these distinctions between simulation and non-simulation methods of instruction into graphical terms has been done in Figure 5. In this figure it can be seen that apprenticeship and simulation both offer

![Diagram]

**Figure 5**

A Comparison of Four Ways To Learn

learning through active participation. Apprenticeship offers direct participation with reality, whereas simulation offers participation with a representation of reality. The field trip presents reality to the learner for his observation. The case study presents a representation of reality to the learner for his observation. By depicting these similarities and differences, Figure 5 shows simulation as an instructional method offering an experience where the learner participates through a representation of reality.
Participation and observation are not distinct ways to experience reality or its representation. They are endpoints on a continuum of ways to experience. Beginning with observation, some common methods of experiencing are reading, listening and viewing. In each of these only one sense is involved. As more of the senses are involved through, for example, an audio-visual experience, a dramatization, or a demonstration, the learner's experience changes from merely an observation to an imagined or vicarious participation. When the senses are fully involved and the learner is actually taking part in the reality or its representation, the learner is then participating.

Realism is a perceptual commodity which varies from learner to learner and situation to situation. What appears realistic to one learner in one setting may not appear real to another or in a different setting or at a different time. The learner's perception of realism is a combination of what is presented to him during the learning experience and what he brings with him to the experience. What is presented to the learner can be as close to reality as a full dramatic production or as remote as a written description of an aspect of reality. What the learner brings to the learning experience is an aggregation of memories, particularly those of related phenomena, and creative imagination which allows for the extension and expansion of the learning presentation.
A continuum of reality representation which extends from reality itself to its most remote representation also exists. Representations of reality are possible which are very much like reality and others which bear only slight similarity to reality. In some instruction, realism is achieved by presenting to the learner certain significant elements of the real situation. Reality is, in a manner of speaking, represented or presented again in a slightly different and abridged form. Often representatives of the actual entity or situation are created as substitutes for reality or even elements of reality. Pictures, replicas, graphics, and verbal descriptions are all used to describe or represent the original. Each is a translation, a transformation or an abstraction of reality.

In one learning experience the presentation of a life size 16mm motion picture image with sound may produce the desired level of realism. In another experience written role descriptions presented to several highly imaginative learners might produce the desired realism level. In other instances a demonstration followed by learner re-enactment may be needed.

With a given group of learners it can generally be assumed that the degree of realism corresponds with the amount of abstraction from the real situation. For example, it can normally be expected that a sound and motion picture
representation of a particular aspect of reality will appear more realistic than a set of photographs with captions depicting the same aspect. In other words, a lower level of sensory involvement occurs in solely reading about a phenomenon than in the experience of hearing and seeing a representation of the phenomenon. Therefore, it can generally be assumed that the greater the level of sensory involvement the higher the level of realism of the learning experience.

Realism and participation are both important qualities of instructional experience. In combination they can offer the learner a relevant and stimulating learning experience. By involving the learner in the "manipulation" of a representation of reality, simulation offers both realism and participation.

Examples of Simulation

Simulations vary in their approach to realism and participation. For example, NASA planning exercises, the Ghetto game, the "Classroom Simulators" each have different dimensions of realism and participation. In the NASA exercise learners are presented a description of a realistic but hypothetical situation. Their space craft is said to have crash landed 200 miles from its intended rendezvous point. Because of the crash all but 15 items aboard the craft were damaged or destroyed. The task for the learners
parallels the task of the NASA planners in preparing for exploration contingencies. The 15 items cannot all be taken the 200-mile distance so priorities must be established. Each learner, as his counterpart in NASA has done, rank orders the 15 items from most important to least important. The ranked lists are then used as a basis for the learner's contribution to a group of learners assembled to decide upon an "ultimate" ranking. A comparison of the group's list with a NASA prepared list is then made with the help of the group leader. Discrepancies between the lists as well as the dynamics of group decision making are the topics of subsequent discussion.

In this exercise learners participate in a group decision-making process which simulates the actual process used by NASA personnel in their planning. The instructions, the task, and the group activity are all realistic. The moon crash situation is hypothetical. No attempt has been made by the developers of the exercise to introduce a simulated environment or in-depth role descriptions to increase realism. The instructions, the task, and the group activity provide the desired level of realism and participation.

Realism and participation are dealt with differently in Ghetto, a game simulating many of the social and economic aspects of inner-city life. Each Ghetto player is presented with a detailed description of the characteristics and
conditions of a one ghetto dweller's life. These role
descriptions are based upon case studies of actual ghetto
residents. Play involves the making of lifelike choices
among employment, educational, and personal alternatives,
each of which is influenced by chance and the moves of other
Ghetto players. Through play simulation, changes in marital
status, family size, wealth, educational level, and vocation
are possible. The goal of each player is to improve the
life condition of the ghetto resident he is enacting. The
game is competitive. A winner is determined by comparing
the improvements in life condition each player has made.

Ghetto offers realism through reality-based
roles which are taken by game players. The role descriptions
provide realistic background and plays of the game provide
realistic situations. The players participate by making
choices at realistic decision points in the game. They are
then presented with the lifelike consequences of their action.

The realism of a secondary school classroom and
participation as a teacher solving classroom problems are
characteristic of the "Classroom Simulator" developed by
Bert Kersh. Physically the "Classroom Simulator" is a set
of films of students enacting typical classroom behaviors,
a large rear projection upon which life-sized images of
student actors can be projected, a teacher's desk and assorted
materials, and a monitor's console used for switching films
and operating the electronic equipment. The simulator presents to the teacher-in-training simulated discipline problems typical of an average classroom. Participants in the simulation take the role of teacher for the class represented on the movie screen. Their activity offers them experience in diagnosing and deciding upon action to deal with problems typical of actual classrooms. The participant first views a short film sequence showing a classroom behavioral problem. A set of descriptions of alternative teacher actions is presented next. The "teacher selects the action thought to be most appropriate and then views film of the probable consequences of such an action.

The classroom problems, teacher action alternatives, and consequences are based upon actual classroom activity and offer a realistic situation to the learner. The decision which must be made and the teacher's role as decision maker are also realistic. They offer the simulation participant an opportunity to diagnose situations, prescribe teacher action, and observe the probable consequences of that action without risking possible real world costs of a poor decision to the student, the teacher, and the school.

In each of the examples presented, realism and participation were dealt with differently. The NASA exercise offered a realistic planning task and participation in group decision-making. Ghetto offered realism role descriptions
based upon the lives of actual ghetto dwellers, and participation by determining the course of one "ghetto resident" life. An audio-visual presentation offered participants in the "Classroom Simulator" the realism of typical classroom problems, and participation as a teacher in deciding how to deal with them. Though these examples are by no means inclusive of all the ways realism and participation are handled in simulation experiences, they are certainly representative of some typical treatments of these two important dimensions of simulation.

Simulation As An Instructional Technique

Successful instruction is an intricate weave of subject matter and instructional method. It is a blend of the content of instruction and the process of instruction. It requires the intertwining of experience and knowledge. The tightness of the weave determines the character of the learning experience. Often the weave is tight, making the experience rigid and closed. Other times the weave is loose, making the experience free and open.

The artful blend and appropriate weave results in a learning experience which is enjoyable and worthwhile for the learner and rewarding and fulfilling for the teacher.

An Important Dimension of Instruction

This tightness or looseness which is woven into instruction is a dimension which can be called openness.
Openness is the dimension of instruction which gives it its formality or informality, its predictability and unpredictability, and more. We often speak of people as being open or not open. An open person is generally considered to be frank, candid, and often spontaneous. "Open" instruction has similar qualities. A dictionary definition of the word open would include such meanings as "not closed," "not covered," "not clogged," "not shut," "not enclosed," and "spread out," "unfolded, having gaps or holes," "free to be entered," and "not closed to new ideas." In turn "open" instruction uncovers new knowledge, allows for a free flow of experience and encourages new ideas.

In some cases instruction seems to be inflexible, narrow, circumscribed, predictable, and tedious. When instruction has these qualities it is in a sense "closed." It limits alternative pathways to learning and offers a highly structured learning experience. Such instruction is generally regimented and repetitive. "Closed" learning experiences are prescribed by the teacher and deal with subject matter deemed essential. The learning presentation in closed learning is logical and orderly. The role of the learner is to be a passive receiver of information. The teacher's role is transmitter of information. Learning outcomes from closed learning experiences are discrete, narrow in scope, precise, and explicit. They generally deal with individual learner behaviors and are generally directly
measurable. Closed learning experiences are necessary and often desirable. Their value is efficiency and their purpose is the development of specific knowledge or behavioral skills.

In the extreme, instruction like programmed instruction with subject matter such as descriptive statistics intended to develop some fundamental statistical skill would exemplify a closed learning experience. The content of this instruction is highly structured and its concepts are discrete and quite predictable here. There are right answers and known facts. Learning activity in this experience is regimented and rigid. The learner's role is the passive absorption of fact after fact. Such an experience is not only desirable but may be essential to learn the basics of statistical manipulations in order to learn the discipline of statistics.

There are other subjects, conditions and intentions which demand an open type of learning experience. This open type of learning experience involves the learner in more experimentation, more discovery. Its outcomes are not predictable, and often not definable. These experiences involve the learners actively promoting dialog between teacher and student. Investigation, probing, and the trial of alternatives are encouraged. Learning intentions are often implicit not explicit, and generally broad and vague. The subject matter for open learning experiences is broadly
inclusive. It frequently lacks structure and contains gaps in knowledge. Instructional method, subject matter, and learner and teacher activity are many times difficult to separate. The effects of open learning experience tend to be amorphous, diffuse and evocative.

At the extreme in open learning would be found the human relations sensitivity training group. In the "T" group the subject matter is defined by the learners. The instructional method is conversation and questioning. Purposes for the instruction activity are always in question. Exact outcomes from the experience are not easily defined. Increases in specific knowledge or skill are few. Mood or attitude changes are frequent in "T" groups. No book or step by step sequence guides learning. The boundaries for learner activity are broad though depth of learning suffers. In short the experiences is frank, candid, free, personal, and "open."

Open learning experiences also have their place and their value. They are essential to many social and personal learnings. They are important for creating involvement and experimentation.

The distinction created here between open and closed learning experience is conceptual and for convenience in showing the relationship between simulation and other instructional techniques. Purely open or purely closed
learning experiences do not exist. All learning experiences are a blend of openness and closedness. The amount of openness or closedness is the issue here.

The distinction between open and closed learning experiences is useful in describing two recent trends in instruction and the place of simulation in one of them. As is shown in Figure 6 most conventional or traditional classroom learning experience was relatively highly structured.

![Figure 6](image)

Figure 6 The "Openness" of Certain Instruction

In the 1960's programmed instruction became widely used as an instructional technique. Its strength was to provide more effective learning experiences through the application of principles of behavioral psychology. To do this, programmed instruction, needed to be more highly structured than the conventional classroom experience. That movement from conventional methods toward more structured methods was a trend for a time in the 1960's. It was beneficial to the teacher and learner in many respects. Although the use of programmed instruction is still widespread the movement toward more structure in learning seems to have
stopped. An opposite movement seems to be characterizing the 1970's. A trend toward more open forms of learning is evidenced by the spread of Montessori's teachings, the diffusion of the "open classroom" concept, increases in the use of group process learning techniques, and the growth of simulation and gaming as forms of instruction. Many educators now believe that open learning experiences are a necessary addition to the stable of instructional techniques.

Beliefs About Instruction

Beliefs about instruction are of central importance in determining the outcome of any instructional experience. The beliefs held by a teacher and learner(s) about instruction are influential regardless of the method of instruction. These beliefs shape the learning experience by influencing both the teacher's and the learner's behavior. They are influential during the determination of the subject matter to be taught and the selection of an instructional technique. And they influence the students perception during the learning experience. Our increased awareness of the teacher's beliefs about instruction is useful in instructional planning. An awareness of learner beliefs is also helpful but may be more difficult to acquire.

The following is a list of beliefs one might have about instruction. The list has been compiled to present a broad array of divergent beliefs to the reader. They are
based upon the writings of Carl Rogers, William Hitt, Michael Inbar, Frederick Goodman and Diane Manning. It may be used as directed to assist the reader in becoming more aware of his beliefs about instruction.

**My Beliefs About Instruction**

Mark an "X" in the circle accompanying each statement to register your agreement or disagreement with the statement.

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1. Teachers should be the fountainhead of knowledge.
2. Subject matter should be general, aimed to long term.
3. Students should not be trusted to pursue their learning independently.
4. For most subject matter taught in schools today the facts are known.
5. Step-by-step, brick-upon-brick is the way to build a foundation of knowledge.
6. When something has been presented or "covered," it can be assumed that it has been learned.
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7. The learning discipline of passive absorption develops constructive and creative citizens.

8. The extrinsic goal of receiving a good evaluation or grade is necessary for student motivation.

9. The teacher should be the judge of student performance.

10. Students are able to learn little of substance from one another.

11. Relevancy is a learner responsibility to be carried when a real world application of learning shows itself.

12. Inquiry and experimentation are necessary for learning.

13. Individual competition insures positive traits in students.


15. The teacher should control classroom action and have the most to say.
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<td>16.</td>
<td>The disclosure of an inter-dependence is a primary instructional goal.</td>
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<td>17.</td>
<td>The classification and grouping of children help to facilitate learning.</td>
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<td>18.</td>
<td>Experimentation, play, and invention must characterize the learning experience.</td>
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<td>19.</td>
<td>Punishment for deviation is a needed ingredient in the teacher-student relationship.</td>
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<td>20.</td>
<td>Spontaneity and candor are necessary ingredients in the teacher-learner relationship.</td>
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<td>21.</td>
<td>Giving advice is part of the teacher's job.</td>
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<td>22.</td>
<td>The teacher should play with the learner.</td>
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<td>23.</td>
<td>Instruction plans to maneuver the learners into helpful situations are necessary.</td>
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<td>24.</td>
<td>The provision of descriptive feedback is necessary for student development.</td>
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25. The teacher is responsible for molding or steering the student.


27. The teacher must be a model of those things the learners are to become.

28. Self-criticism and self-evaluation are primary to learners.

29. The most socially useful learning that can occur is learning of the process of learning.

30. Doing is an integral part of learning.

31. Self-initiated learning is the most pervasive and lasting.

32. Significant learning occurs when subject matter relevance is perceived by the student.

33. Rigidity of teacher and student roles interferes with learning.

34. Students do better when their teacher knows and recognizes them as individuals.
The conventional student role is incongruent with many other social roles during the school years.

Emotional learning deserves a significant proportion of educational attention.

Interpret your results by totaling your responses as indicated.

Total your "agree" responses for the items numbered 1-10, 12, 14, 16, 18, 20, 22, 24, and 26 here - [ ]

Total your "agree" responses for the items numbered 11, 13, 15, 17, 19, 21, 23, 25, 27-36 here - [ ]

The items listed were constructed and sequenced to make items in the first set (1-10, 12, 14, 16, 18, 20, 22, 24, and 26) representative of the traditional beliefs which surround much current educational practice. The items of the second set (11, 13, 15, 17, 19, 21, 23, 25, 27-36) were selected to represent a growing reform theme in education.

Put another way, agreement responses to the first set of items are evidence of a value for closed learning experiences. "Agreement" responses to items in the second set are characteristic of a value for open learning experiences.
This distinction between sets of items is not meant to draw any sharp boundaries in belief but rather to show trends or tendencies in believing. The person who shows agreement to more items in the first set than in the second tends to value closed over open learning experiences. Conversely the person showing more agreement with the second set of items tends to value open learning experiences over closed ones.

Simulation is an instructional method which has risen in popularity recently. Its rise in popularity is in part due to a trend allowing for more open kinds of learning experiences. The growth and development of group learning methods including the "T" group or encounter group and role playing exercises are indicators of the trend.

**Instructional Influence**

The dimension of openness ranging from closed learning experiences to open learning experiences is influenced by many variables. Among the influential variables are the amount of openness intrinsic to the subject matter, the amount of openness offered by the instructional method, and the tolerance for openness of the teacher and the learner.

The amount of openness intrinsic in the subject matter being taught has direct effect upon the openness of the learning experience. The greater the amount of openness
in the subject matter the more it can allow for exploration and investigation. Subjects with less openness on the other hand often restrict and narrow the learning experience. Subject matter dealing with Euclidean geometry is tightly structured and extremely closed. It is a mature subject with an abundance of rules for its use, all restricting openness. Its theorems, postulates, and proofs are also evidence of its rigorous formality. The subject of interpersonal behavior, on the other hand, lacks definite structure. It is more open. It is open in part because it deals with the constant variability of human behavior and in part because its scientific study is comparatively new. In this area there are gaps in the body of knowledge and all the facts are not known. There is room for exploration, tentativeness and exploration.

Figure 7 The Variation In Subject Matter Openness
If a line were drawn which represented the amount of openness intrinsic in some particular subject matter the line would look like the one in Figure 7. Points along the line have been plotted to represent the relative amount of openness of various subject matter. Euclidean geometry (as shown) thereby assumes a low position on the line. The study of interpersonal behavior would correspondingly assume a higher point on the line. Chemistry as represented has an amount structure closer to geometry than to the study of interpersonal behavior. American History is shown as having less structure than chemistry but more than the study of interpersonal behavior.

Each subject varies in the amount of "openness" it brings to the learning experience. The amount of openness it presents is also affected by the instructional method used to present it. It is the combination of subject matter and instruction method which produces successful instruction.

The amount of openness offered by the instructional method is also a determiner of the openness of a learning experience. Different instructional methods tend to offer openness in differing amounts. Those using conversation as their primary vehicle are generally very flexible, active, and candid experiences. Audio-visual presentations and
lectures offer more structure and less openness in the provision of pictorial and audio representations which have been organized, sequenced, and programmed. The fidelity of media, in a manner of speaking, tends to set boundaries on the experience. More structure, less openness, and greater predictability of outcomes is characteristic of methods like programmed instruction. Its sequencing is generally invaluable. It is characteristically unresponsive to learner and instructor demands. In short, it frequently presents a rigid and formal experience.

![Diagram showing the amount of openness offered by several instructional presentation methods.](image)

**Figure 8** The Amount of Openness Offered by Several Instructional Presentation Methods

Note in Figure 8, which is based upon Edgar Dale's "cone of experience" (Dale, 1969: p. 107), that the various classes of instructional presentation methods each
have a characteristic amount of openness. No quantitative measure of that openness is possible or necessary. However, relationship among techniques is an important instructional variable. The relationship should be considered in selecting a specific instructional technique to perform toward particular outcomes. The relationships shown are meant to demonstrate the general case. In specific uses of any method it might offer considerably more or considerably less openness than its position in Figure 8 indicates.

In general, instructional methods which involve more than one of the learner's senses offer more openness than techniques involving only one sense. Multisensory methods which involve the learner in doing rather than just observing are the most open.

The degree of openness in a learning experience is also influenced by the nature of the teacher and learners in that experience. Some teachers and learners can be comfortable in very open unpredictable, informal, amorphous or abstract experiences. Others cannot. Some teachers and learners are most comfortable with very closed, predictable, formal, rigid, or concrete experiences. The reason for these differences lies in the teacher or learner's ability to structure the learning experience for himself. Each teacher and learner tends to structure the learning experience in a unique way. Both teacher and learner have different tolerances for openness and different needs for openness.
Those whose thinking mode could be characterized as abstract can be comfortable with a greater amount of abstraction or openness in a learning experience. In turn their tolerance for largely closed or concrete experiences is lower. Such persons seem to need a degree of openness in some of their learning experiences. Other individuals whose mode of thinking is mainly concrete are not comfortable with largely open learning experiences. They are not as adept at structuring such experiences and are comfortable working at a more concrete level.

To summarize, the open learning experience seems to be best suited to the abstract thinker. These persons can provide structure for the experience themselves and are most comfortable when learning has a degree of openness. The more concrete thinkers, by this reasoning, would tend toward the closed experience for comfort. These persons would be less comfortable in very open experiences.

Though this discussion of experience, comfort and need has drawn a dichotomy between closed and open experience it should be noted that all experiences or sets of experiences are at times open and at times closed. Therefore the relative amount openness matched to the tendency of the teacher or learner toward abstractness or concreteness is the main issue.
O. J. Harvey, who studies individuals' tendencies toward abstraction or concreteness, has developed a number of characteristics of each type of person. Some of the characteristics he has identified were used as the basis for the list of traits below. The list contains qualities typical of the more abstract thinker and qualities of the more concrete thinker. In order to make better use of the information previously discussed, the reader should identify his tendency toward either abstract or concrete thinking.

To do that read each of the items listed and circle all those which are descriptive of your mode of thinking.

The Way I Think

1. I am able to withstand great amounts of uncertainty.
2. I tend to be judgmental.
3. I am flexible.
4. I rely upon status and power in judging things.
5. I acquire my beliefs through insight and inductive thinking.
6. I tend to over-generalize my information.
7. I am able to play the role of another or "fill the other's boots."
8. I am not very tolerant of ambiguity.
9. I base my decisions upon facts.
10. I concentrate on the details of a task given me.
11. I can withstand much stress.
12. I acquire my beliefs through practical experiences.
13. I can be committed to things but still open.
14. I prefer the tried and true approach to things.

Next record your results.
Record the total number of even numbered responses here. [ ]
Record the total number of odd numbered responses here. [ ]

Now interpret your results - the even numbered items are mainly characteristic of persons with relatively concrete modes of thinking. The odd numbered items are mainly characteristic of persons with relatively abstract modes of thinking. The higher the odd total the greater the indicated tendency toward concreteness.

Next select those traits which are relative to your learner or learners.

Analyze results in the same way.

A familiarization with the tendencies toward concreteness or abstractness of a teacher and his learners is an important ingredient in good instructional planning. Tendencies in thinking toward abstraction or concreteness
influence both the way the teacher feels and performs in the instructional situation and the way the learner feels and performs. When an instructional experience is quite open it will most probably be comfortable for teachers and learners who tend toward the abstract. An experience which is quite closed would better suit the more concrete teacher or learner. With knowledge of teacher and learner tendencies, it is possible to predict their respective comfort in particular instructional experiences.

The distinction between teachers' and learners' tendencies toward abstraction or concreteness is useful in predicting the effectiveness of a particular instructional method involving a particular teacher and learner. Figure 9 shows a continuum from very open to very closed experiences. Arrows have been placed on that continuum to show the hypothetical positions of the learner, the teacher, and the instructional method with regard to openness. The arrows are grouped quite closely to show an ideal case. In the

![Figure 9 The Relationships of Various Degrees of "Openness"](image)

Figure 9 The Relationships of Various Degrees of "Openness"
experience depicted, the degree of openness offered by the instructional method and the degree comfortable for the teacher and learner are similar. In this case the teacher is comfortable with relatively closed instructional experiences, the learner is also comfortable at that approximate level, and the technique offers a relatively closed experience. The teacher and student here are probably fairly concrete types. The instructional method is probably a conventional discussion or lecture recitation method offering a moderately high amount of structure. A prediction of high learning effectiveness can be made here.

Figure 10 shows a case which is quite different from the previous one. A comparatively low level of effectiveness would be expected in the situation shown here. The reason, the teachers lack of comfort with open experiences. The teacher put into such a situation would be ineffective as a
facilitator of learning and would probably manifest his
discomfort in many visible forms. The learner comfortable
with even greater degrees of openness than the instructional
method offers would be quite comfortable here. However,
learning would probably suffer due to a lack of teacher
guidance in this very open experience.

A situation like this might occur when learners
are rapping about some particular subject matter in a
loosely structured group. For a while the experience seems
exciting and productive. Soon the learners probable lack of
subject matter depth and the absence of direction to the
conversation would dissipate enthusiasm and introduce ineffectiveness.

Simulation generally offers a fairly open
experience to learners. As is shown in Figure 11, it is
best suited to teachers and learners who are comfortable with

\[
\begin{array}{c}
\text{Amount of Openness} \\
\text{Offered by} \\
\text{Instructional Simulation}
\end{array}
\]

\[
\begin{array}{c}
\text{Very} \\
\text{Closed} \\
\text{Experience}
\end{array} \quad \begin{array}{c}
\text{Amount of Openness} \\
\text{Very} \\
\text{Open} \\
\text{Experience}
\end{array}
\]

Figure 11 The Relationship in Degree of Openness
open learning experiences. Those teachers and learners who do not tend to be concrete in their thinking will be most comfortable involved in a simulation experience.

The central point to this discussion is that effective instruction comes from the close matching of instructional method with learner and teacher modes of thinking. For high effectiveness instructional methods offering much openness should be employed with teachers and learners who are comfortable with very open experiences. Instructional methods offering very closed experiences should be used with teachers and learners who are most comfortable with little openness.

The Guide: The Value Of Instructional Simulation

Reasonable Expectations for Using Simulation

The first question to be asked in determining the potential value of simulation is, "What can simulation do?" Answers to this question are found in the reported results of experimental uses of simulation and in the testimony of instructional users of simulation. An understanding of what simulation has done for others is helpful in judging its potential.

Simulation has been used to increase the relevance of instruction, to permit the student to learn without the
rigidity of the traditional student-teacher relationship, to increase the learner's involvement in learning, to permit control of certain aspects of activity during the learning experience, to wed classroom theory and real world practice, and to provide economics over the time, energy, and money required for direct experience.

Claims have been made that simulation is an exciting, interesting, stimulating, and involving experience offering the student an experimental environment for exploring his beliefs and for having simplified encounters with real-world issues. The claims for simulation have reached far beyond their support and the use of simulation has greatly overshadowed research into the effectiveness. Yet, in the face of this, the development of simulation mushrooms. Simulation users appear to be blending a large measure of enthusiasm and a small measure of research evidence to build a foundation for their simulation design and development efforts.

One means of promoting the effective use of simulation is to develop simulations for which success can be reasonably expected. By defining the limit of research expectations for simulation, the user can restrict it to appropriate applications. In attempting to set such limits the following discussion will first present to the reader an opportunity to state expectations for simulation. Next a listing of the research results and testimony offered by
many simulation users will be presented. The list should then be compared to the readers' set of expectations. This comparison will show which of the readers' expectations are, in fact, supported by research or user testimony.

(1) **List in the space provided several of your expectations for instructional simulation.**

I. I expect simulation to

II. I expect simulation to

III. I expect simulation to

IV. I expect simulation to

V. I expect simulation to

(2) **Read the following instruction about the effect and effectiveness of instructional simulation.**

Research into the use of simulation has dealt with a variety of simulation topics, learner types, and instructional levels and purposes. In most cases simulation has been compared with conventional instruction or some research control experience minimizing the effect of subject matter or learner character. Thereby information about the effect of simulation as a method of instruction could be collected.
The following are such effects:

Students who underwent simulation training were ready to assume their full performance responsibilities weeks earlier than those not having such training (Kersh, 1965).

Simulation created learner confidence in his abilities to deal with subject matter (Ulcek, 1965).

Simulated problem situations were reported to have increased the problem-solving skills of some students (Ryan, 1968).

Simulation can be successfully used to increase student interest in the subject matter area being taught (Cruickshank, 1968).

In general, simulation orients learners to new content (Cruickshank, 1968).

Simulation experiences are reported to be involving for learners (Broadbent and Cruickshank, 1968).

Simulation has been found to create high involvement and motivation (Weinberger, 1965).

Simulation addicts are escapees from reality (Kersh, 1967).

Simulation oversimplifies and presents false ideas (Kersh, 1967).

Simulation has been found to provide the student with a feeling of efficiency (Coleman, 1967).

Learners are taught the consequences of their actions through simulation (Coleman, 1967).
Simulations have the ability to create an awareness of the variety of courses of action available in particular situations (Wynn, 1964).

Simulation helps the learner see the big picture, the broad context (Wynn, 1964).

Student interest is high during simulation learning experiences (Cherryholmes, 1965).

Students can gain insight into complex decision-making processes through simulation (Cherryholmes, 1965).

The taking of simulated roles can facilitate attitude alteration and attitude shifts (Cherryholmes, 1965).

Simulation environments have been found to be simulating to students (Drenth, 1966).

Simulation can teach the understanding of principles and relationships in addition to factual knowledge (Parker and Downes, 1961).

Simulation is effective for the teaching of procedures and behavioral sequences (Parker and Downes, 1961).

Simulation can teach the identification of important aspects of a problem situation (Parker and Downes, 1961).

Complex decision making can be taught through simulation (Demare, 1961).

Students can learn complex perceptual and motor skills through simulation (Flexman, Townsend, and Ornstein, 1967).

(3) Compare your expectations with the research and testimony reported.
(4) Find evidence to support your expectations.
(5) Rate each of your expectations in the spaces provided below.

Was there....

<table>
<thead>
<tr>
<th>Turn to your</th>
<th>little support</th>
<th>moderate support</th>
<th>much support</th>
</tr>
</thead>
<tbody>
<tr>
<td>- expectation I</td>
<td>//</td>
<td>//</td>
<td>//</td>
</tr>
<tr>
<td>- expectation II</td>
<td>//</td>
<td>//</td>
<td>//</td>
</tr>
<tr>
<td>- expectation III</td>
<td>//</td>
<td>//</td>
<td>//</td>
</tr>
<tr>
<td>- expectation IV</td>
<td>//</td>
<td>//</td>
<td>//</td>
</tr>
<tr>
<td>- expectation V</td>
<td>//</td>
<td>//</td>
<td>//</td>
</tr>
</tbody>
</table>

In using simulation one should be wary of expectations for which little research or testimonial support exists.

In summary, the question "What can simulation do?" is a difficult one. Attempts to answer it have been made by many. The essence of their work can be presented in a listing of reasonable expectations for instructional simulation. Such a list appears below.

Based upon available research and testimony, it is reasonable to expect a simulation--

-- to provide some of the motivation necessary for learning.

-- to lead students into sophisticated inquiry and problem-solving experiences.

-- to provide the student with an integrated, holistic view of subject matter.
-- to generate more student interest than conventional techniques.

-- to create an empathy for the roles used in the simulation.

-- to provide learners with experience to use as referents for later learning.

-- to encourage learner experimentation and exploration.

-- to teach the causal relationships between simulated actions and consequences.

-- to elicit a high level of involvement on the part of students.

-- to be perceived as more relevant to the real world than conventional instruction.

-- to encourage self-awareness and self-assessment.

It should be noted that the last, truest and best test of simulation capability and one's expectations for its use comes in trying a particular simulation with appropriate learners.

Clarifying Instructional Intentions

The second question to be asked by a prospective user in determining the potential value of simulation is, "What do I want simulation to do?" The answer to this question comes only through the clarification of one's intentions in using simulation. A user of simulation, or any other instructional technique, must state in one form or another the purpose for which the technique is being used.
The purpose should be stated in terms of the outcomes intended from the instruction being developed.

Instructional intentions are the single most significant ingredient in effective instruction. Clear intentions are necessary for the effective use of simulation or another technique because:

- They provide a focus for the learning experience.
- They guide the instructional planning and development process.
- They link the instructor's beliefs about instruction with the actual experience of instructing.
- They facilitate evaluation of instruction and appraisal of learning.

Instructional intentions are made clear in a number of forms. They may take form as prosaic statements of mission or ultimate purpose, as broad goals, or as precise learning objectives. In any form they serve to communicate the nature and scope of outcome expected from a particular instructional experience.

Instructional intentions which are characteristically broad and general are often known as goals, missions, or broad purposes. Such statements define either the adumbration of intent for a whole area of instruction or the depth of intent for some particular learning experience. These
statements with their broad scope and low specificity would not serve as guides for development and use of very closed learning experiences. They do not provide direction for a specific pathway to learning or precisely define a particular learning outcome. These broad and general intentions do, however, set boundaries or limits within which unstated but specific learning outcomes are possible. Therefore, they are best suited to the more open forms of instruction.

An example of one of these broad and general intentions is, "for the student to develop a sense of the here and now elements of life." The development of a "sense" of something is certainly broadly inclusive and could mean: a view of, a physical feeling for, a familiarity with the sound of, or something else. The "here and now" emphasis does set some limits or boundaries on the instruction intended to achieve this purpose. An intention like the one stated would guide a human relations instructor through the selection and provision of a very open experience with the potential of developing "a sense of the here and now."

Instructional intentions which are very precise and specific in their form and narrow in their scope are often termed performance objectives, learning objectives, instructional objectives, or behavioral outcome statements.
They specify a narrow slice of learner behavior which is intended as the outcome of instruction. These intentions are written, using highly specific and formal terms to explicate learning outcomes dealing with relatively isolated behaviors which are components of larger behavioral sequences.

Statements like "the student will name three of the main component parts of a jet aircraft tail section" or "the student will be able to classify five common North American animals as either mammal or non-mammal" are examples of the narrow, precise, and specific form of instructional intention. Such statements are more appropriately used to make explicit intentions for a closed learning experience than for an open one.

Instructional intentions whether broad or narrow, whether general or specific deal with either the intellectual, emotional, or physical outcomes of learning. Intellectual intentions are those dealing with thought, reason, memory, or other mental processes. Intellectual outcomes are described by statements of cognitive intention. Emotional intentions deal with attitudes, values, and feelings. They are described by statements of affective intention. Physical intentions deal with perceptual and body processes and are described by statements of psychomotor intent.

Cognitive, affective, and psychomotor are the three types of learning. They are seldom distinct in their
effect and are generally interrelated in their action.

![Diagram showing the relationship of three types of learning: Affective, Cognitive, and Psychomotor Learning.]

**Figure 12** The Relationship of Three Types of Learning

The Venn diagram in Figure 12 shows the interrelatedness of these three types of learning. Most learning is a blend of all three domains with an emphasis on one. The distinction among the domains is qualitative rather than quantitative.

The following are examples of objectives, with emphasis in each of the three domains.

**Cognitive Emphasis**

The learner will create written symbols which designate the numbers of a numbering system.

After listening to taped editorials, the learner will identify the three main ideas and six supporting details presented.

**Affective Emphasis**

The learner will indicate that he found the scheduled musical activity enjoyable and
challenging by making affirmative responses on a questionnaire.

**Psychomotor Emphasis**

The learner will correctly thread a film into a 16mm motion picture projector.

While measuring with a micrometer, the learner will achieve the proper "feel of tightness" as he turns the knob.

Instructional intentions (broad goals or specific objectives) have a great deal of influence in the learning experience. Their effect is felt in several ways. One way is in the direct relationship between the emphasis of the intentions and the openness of the learning experience. A blend or mix or intertwining of affective, cognitive, and psychomotor intentions usually accompanies an open learning experience. Relatively, discrete emphasis whether cognitive or affective or psychomotor is characteristic of closed learning experiences. Closed learning experiences are also characterized by a predominance of cognitive or psychomotor emphasis. The more open learning experience is often characterized by greater affective emphasis.

Graphically the relationship between openness and emphasis could be depicted as three converging lines which are distinct and separate at their origin in very closed types of learning experiences and terminate in the blend or mix characteristic of very open learning experiences.
Figure 13 The Relationship of Learning Outcomes and Openness in Learning Experience

A second relationship exists between the character of instructional intentions and the amount of openness in the learning experience. In this relationship it is the level of the intention which affects and is affected by the openness of the learning experience. Level is the dimension of instructional intention which accounts for the depth or extent of learning. The learning of difficult, sophisticated, or advanced material could be termed high-level learning. Less difficult learning requiring and demanding less advancement, ability, or experience could be termed low-level learning. As a concept, learning level is equally applicable for cognitive, affective, and psychomotor instructional intentions.

For example, intellectual outcomes (cognitive intentions) requiring only the memorization of a fact or principle would be considered low-level learning whereas
the evaluation of facts or their application to a particular situation would be considered high-level learning. In the affective area, low-level learnings deal with awareness as of feeling, interest, attitude, or value. Higher level affective learnings deal with the relating of awareness or with their evaluation. For psychomotor intentions the learning of simple behaviors such as hammering a nail are low in level and the learning of complex behavioral chains or sequences of procedures such as the execution of a pole vault are of a high level.

The level of learning outcome has an effect upon the emphasis of the learning. Very low level learnings may be and often are discrete. As the level of learning increases, however, the emphasis meld. In other words relatively pure intellectual, physical or emotional learning is possible at low levels. For high level learning there needs to be a blending of thought, feeling, and action.

![Diagram showing Increasing Levels of Learning](image)

**Figure 14** The Relationship Between Outcomes and Level of Learning
Figure 14 shows this relationship graphically. On the left of the figure are separate bands representing cognitive, affective, and psychomotor instructional intentions. As they progress toward the right, they merge until they are fully interrelated in an area representing high level learning.

In the preceding discussion it has been shown that as either the level of learning or the amount of openness increases in a learning experience a blending of outcomes occurs. Cognitive, affective, and psychomotor outcomes can be and normally are fairly discrete for low levels of learning or in very closed learning experiences. However, for higher levels of learning and in open learning experiences they blend fully.

To exemplify this point the training of a pole vaulter will be discussed. As with much other instruction to produce high quality outcomes, intellectual, emotional, and psychomotor learnings are all demanded. The memorization of rules and regulations and an understanding of the fundamentals of pole vaulting are low-level intellectual (cognitive learnings). They can occur in situations without any attitude change or any actual pole vaulting. Low-level emotional learnings such as the development of interest in
watching or reading about pole vaulting can occur in relative isolation as can the development of basic physical skills such as running down the approach, and holding a vaulting pole correctly. These learnings can be accomplished expeditiously as the result of a closed learning experience such as the reading of a rule book or the study of photographs showing correct pole holding postures.

High-level learning cannot be accomplished through closed experiences nor can it be accomplished in discrete physical, emotional, and intellectual learning experiences. To fully perfect the complex chain of physical maneuvers necessary to execute a vault, a measure of courage and tenacity must be added to a thorough intellectual evaluation of the situation, including the effect of the running surface, the type of pole, the wind, and the accomplishment desired. To provide a learning with this blend at this high level an open learning experience is essential.

In any learning the full blend of cognitive, affective, and psychomotor ability is necessary to perform with excellence, and is achievable only through open learning.

Simulation is a method of instruction which offers a relatively open learning experience. It is therefore well suited for instruction where a fairly full blend of
affective, cognitive, and psychomotor intentions are present. It is also suited to less open applications where an interrelating of intellectual, emotional, and physical learning is desired.

This discussion of instructional intentions began with the presentation to the reader of the question, "What do I want simulation to do?" The subsequent discussion was intended to provide background enough to make the reader comfortable in stating some of his intentions for the use of simulating. From this point forward a procedure for stating intentions will be presented. The reader is requested to follow the procedure step-by-step through its completion.

1. Write at least five statements which are descriptive of outcomes desired from a simulation which you might use.

Write statements which are parallel in form to these examples. "Upon successfully completing this instruction the learner will have increased his appreciation for modern art." "Upon successfully completing this instruction the learner will be able to write the Roman numerals corresponding to the Arabic numerals 1-10." Consult Table A for an assortment of verbs of potential use in constructing your statements.

Upon successfully completing the instruction the learner will -

A. ___________________________
2. Obtain a critique of your statements of intention from another teacher - use the questions in Table B as a guide.

Guide Questions for Critiquing Statements of Instructional Intent

Is the intention mainly -

* affective — dealing with emotions, interests, values, attitudes, or feelings.*

* cognitive — dealing with thoughts, intellectual outcomes.*

* psychomotor — dealing with actions, movements, or coordination.*

Is the intention clearly stated?

Yes   No

Does the intention deal with meaningful learning?

Yes   No
Is the intention

Narrow
Specific
Testable

Broad
General
Non-testable

Do you think the intention is attainable?

Yes
No

What other reactions or comments do you have?

_________________________________________________________________

_________________________________________________________________

_________________________________________________________________

How would you state the same intended outcomes?

_________________________________________________________________

_________________________________________________________________

_________________________________________________________________

3. **Rewrite each statement of intent making improvements based upon the reviewer's critique.**

4. **Classify each statement of intent by marking an "X" in the most appropriate box in figure below.**
Cognitive Affective Psychomotor

Statement 1
Statement 2
Statement 3
Statement 4
Statement 5

5. Mark with an "#" the statements which are:
   ○ intermediate or high level cognitive
   ○ intermediate or high level affective
   ○ intermediate or high level psychomotor

The statement of clear instructional intentions provides the user of the simulation method with an answer to the question, "What do I want simulation to do?"

Previously, answers were attempted for the question, "What can simulation do?" With answers provided for these two questions it is possible to answer the question "Will simulation do what I want done?" To answer this question a comparison of the users' expectations for simulation and the users' instructional intentions must be made. For intentions which are consistent with reasonable expectations for simulation, probable success can be predicted. A good match between what simulation can do and what the user wants done is necessary for instructional success. Such a match is not, however, sufficient to ensure instructional success.
Sound instructional design and mindful administration of instruction are essential.

The Guide: Simulation Design

Basic Issues

To simulate means to "operate like." Simulation is the realistic operation of something which is not the real thing. A simulation is a representation of reality which operates like a particular real world phenomenon or systems. Simulation becomes instructional when it offers a learner involvement as an active element of a reality representation which operates as if real. Learning occurs readily for the student engaged in the operation of a likeness of reality. Therefore, it is important in constructing a simulation that it be created as a likeness of reality and that provision be made for its operation.

A likeness is the same as a model. It is something which is created to represent reality. A model is used to show important elements of a real-world phenomenon or entity. As a substitute for reality it can be used independently. The elements of reality it portrays are no longer linked to their real world setting. The model generally represents reality by presenting abstract counterparts for selected elements of reality. It may represent reality by presenting directly certain elements from the real
situation. A good model presents key elements of reality. The selection of reality elements which have significance in the model and to those who will use it is of paramount importance to the model's realism.

Most models are static representations or depictions of reality. They remain the same with the passing of time. The plastic heart, for example, which is used in science education has the same shape, size, and color as its real-world counterpart. It is a model of a real heart. It presents size, the elements of color, and form as significant aspects of the reality of an actual heart. The plastic heart model presents an accurate representation of many elements of reality. Through visual and tactile observation of this reality representation and through inquiry, the learner forms related concepts and learns specific facts about real hearts.

Some models operate or change over time. These models, if their operation over time corresponds to the operations of some real world systems phenomenon, are simulations. A simulation is any operating model of reality. Consider again the plastic heart model. If hoses, fluid, valves, and some pumping force were added to the plastic heart, the simulation of blood flow would be possible. "Bloodflow" would become part of the model and thereby a significant aspect of understanding the real world heart.
The pumping force used to move the fluid ("blood") through the tubes, valves, and plastic heart could come from the learner's hands. The learner would then be involved in the simulation of blood flow and heart function. In this case the learner was involved or engaged in the simulation taking place. It could be said that he participated in the simulation. If a pump was used to course the "blood" through the tubes and heart, the learner would not be so involved and would learn through observation of the simulated blood flow.

Let us not forget in this discussion that a great portion of learning occurs through experience directly with real phenomena. Significant understanding could develop, for example, from the observation of an actual functioning heart, as might be the case during an operation or dissection. The possibility of learning the massage of a real heart causing blood flow also exists.

The type and extent of learner involvement is a critical issue in all instruction. In the preceding discussion the following four types of involvement were discussed: (1) Learner involvement through tactile or visual observation of a static model (the plastic heart model). (2) A higher level of involvement through the operation of a model (simulated blood flow using plastic
heart and tubes). (3) Observation of a real phenomenon (viewing of actual heart function). (4) Participation in a real phenomenon (open heart massage).

These four types of involvement are characteristic of many forms of instruction. Observation of the real world is often used for learning. Study trips are examples. Observation of something representing the real world as is done by viewing of films, slides, or dynamic models is even more prevalent. Participation directly with reality exemplifies apprenticeship and other forms of on-the-job training. Participation with a representative of reality characterizes simulation. The decision to use one or another of these types of instruction is linked to the teacher's beliefs about the role of the teacher, about the role of the student, and about instruction, and to the purpose or intentions of the instruction being developed.

In the final analysis instruction is an artful blending of participation and observation, and of reality and its representations. The exact nature of that blend is up to the instructional designer.

Simulation offers a unique blend of realism and participation. Instructional simulation is used to provide realistic experience in lieu of real experience. Realistic
elements are built into simulations in sufficient quantity to make the experience realistic. Through careful study of some real phenomenon, the simulation designer can identify the component parts and characteristics of the real situation. The designer must then select the elements that he will use to restructure the original phenomenon. Artistry is involved in the mindful selection of elements of reality capable of creating realism without the encumberance of total reality.

Simulation by its realism without reality finds its place among instructional techniques which offer various degrees of relevance and involvement to learners. Simulation is perhaps most closely aligned with apprenticeship. Both are realistic and both are distinct from direct experience because there is instructional control outside the learner. Apprenticeship provides learners an interesting and highly relevant experience through controlled participation in real situations. Simulation also offers a high level of involvement and relevance through controlled situations based upon reality rather than real situations.

Several other instructional techniques can be related to apprenticeship and simulation. The case study, for example, is a method which also bases instructional activity upon real situations. It does not, however, offer
learning through participation. Learners using case study method merely observe through reading, viewing, or listening to a representation of reality. Physical models such as mock-ups and replicas are also representations of reality suited to learning through observation. The study trip or field trip is slightly different. It is suited to learning through observation although the observation is of a real situation or phenomenon rather than a reality representative.

Learning by observing a real phenomenon or a representation of reality, as though the study trip and case study respectively, requires the learner to involve himself usually by using his imagination to contrive an application or exercise helpful in learning. Learning by participating directly with reality, as in apprenticeship, requires the imposition of controls to help sort the routine from the atypical and the important from the insignificant. Learning by participation in a representation of reality, as in simulation, requires some imagination to perceive the realism and offers great control over reality elements.

In a total learning experience using several instructional techniques, the placement of each is important. Simulation is a technique with maximum flexibility. It can be appropriately placed before, during, or after other
instructional experiences. For example simulation can be used to provide a safe practice environment preceding apprenticeship or another real-world application of learning. Simulation can also be used to provide concrete practical experience amidst an abstract instructional presentation. In addition simulation is equally as well suited to the provision of practice after a case study, film, or some other observational experience.

In planning for simulation the following questions need be asked:

Does simulation provide all of the experience a student will have regarding a particular subject?

Is simulation to be used in combination with other techniques?

If so, what are the respective roles or functions of each of the techniques being employed?

Simulation should precede other learning experiences if its outcomes are prerequisite to other work or if it is used in a diagnostic way to gauge past experiences or potential for future experiences. A position amidst other instructional experiences is appropriate if the simulation experience allows for the application of facts or principles
preceding its use and if practice is essential to subsequent learning. Simulation would assume a position after some other instructional experience if its function was to provide a practice prior to actual performance.

Describing Something to be Simulated

Deciding what to simulate is a problem basic to simulation design. The simulation of virtually any system is possible although some offer greater difficulty than others. Social, political, economic, and business processes dominate the recent history of simulation, including the simulation of legislative procedures, international relationships, interpersonal interactions, government policy formulation, land utilization, aeronautical navigation, teaching situations, and others.

Instructional simulation offers the teacher an opportunity to create involving and relevant learning experiences without inviting the inconvenience, impracticality, or ineffectiveness which may be associated with direct or vicarious experiences. Simulation offers a degree of economy, accessibility and control of learning unparalleled in other methods. Simulation allows participation in an experience representing reality. The role of the representation of reality is to offer realism without unwanted or unneeded elements of reality.
Modeling is the first step in translating a real phenomenon into a simulation. Modeling transforms information about some aspect of reality into a representation of reality. The model can replicate, abridge or abstract reality. In selecting something to simulate, the ease with which it can be represented for the simulation is important. The instructional simulation model is in a sense a caricature. It accentuates certain aspects of reality and ignores others. For this reason phenomena or systems with obvious characteristics are best suited to modeling for simulation. For example, an analysis of archeology might identify digging to disclose relics, study and identification of relics, and cultural description as its obvious characteristics. These elements of reality are unique and would provide an excellent basis for a simulation.

A model of the phenomenon or entity to be simulated can usually be presented in written form. Five aspects of the reality to be modeled which are important to the model are as follows:

1. The major "actors" in the phenomenon under study must be determined. Who or what is centrally active? Whether they be machines or men, the "actors" in the phenomenon under study must be identified and described. In the archeological example, the major
"actors" might include archeologists, laborers, research associates, and governmental representatives.

(2) The model should include a description of the kind of activity taking place. In the archeological model, digging, dusting, reference reading, conferring, and reporting would be major activities.

(3) The model should also include a description of the event which initiated or precipitated the major activity being modeled. For example, a letter from a former student identifying a potential site for archeological discovery might have precipitated an archeological expedition.

(4) The environment of the action must be described in the simulation model. Where did the activity take place? What was the time? What of the mood prevailing during the activity under study?

(5) The information, knowledge, skill, or tools necessary for the "actors" to conduct the major activity must be described in the model. Any books, hand tools, procedural knowledge,
or special information characteristic of the real situation and thought to be necessary for the simulated situation must be described.

(6) The terminal or culminating event of the phenomenon or activity under study must be noted in the model. How did the particular activity end? What caused termination? How might it have otherwise ended?

An accurate description of the initiation of a real-world activity, of its actors, the major action, the environment for action, prerequisites for action, and the culmination of action will produce a solid foundation for an instructional simulation.

Selecting the type of simulation to be used

The selection of a type of simulation to be employed is dependent upon the intent of the instructional experience. An instruction to develop empathy for the plight of the laborers in archeological work demands a simulation-type different from one aimed at identification of three causes of the Great Depression. A review of instructional intentions should precede the selection of a simulation type.
Many classifications of simulations have been made and still others are possible. The one used here is believed to be of practical value in the simulation design process. For this purpose four classes of simulation, labeled "context," "procedural," "situational," and "Gestalt," have been created. Each class or type of simulation has particular properties.

**Context** simulations are those based upon the environmental aspects or background of a real situation. The context simulation offers learners only the shell of a real experience. The experience is analogous to stage acting where no script, or actor roles have been provided, merely a set.

**Procedural** simulations offer a thread of functional continuity. They are built about a functional model of some phenomenon or system. For this reason they are greatly reliant upon the modeled descriptions of action and activity. In a comparison of simulation and dramatics, this form of simulation would parallel a dramatic reading using only scripts, no set or role descriptions.

The **situational** type of simulation more closely parallels dramatic activity in which roles are played without the benefit of scripts or sets. This form of simulation puts its participants in the realistic roles of a modeled
situation stimulating their imaginations and interaction.

A Gestalt simulation would best compare to a stage production where set, script, and acting roles are complete. Gestalt simulations have two distinct applications which make them different from the other types. This form of simulation can offer each participant an experience where perception of the total model of reality is possible. A full measure of role playing with a realistic system of consequences and related events is possible within a Gestalt simulation experience. A Gestalt simulation can offer benefits to persons other than its principal actors. A person outside the simulation in a sense can manipulate some simulation variables such as which roles are used, who plays them, what role descriptions are available, what the set looks like, and what artifacts are used to represent reality. Such action and the observation of its consequences within the simulation can create significant insight into the real phenomenon after which the simulation was developed.

Some Gestalt simulations, including roles, action, and results similar to real ones, are created in game form. In these instances the actors, actions, and consequences of action in the real system are represented by physical artifacts. The artifacts and their use accompanies the human interaction modeled into the simulation game.
Each of these types of simulation has the potential of fulfilling certain instructional intentions. The context simulation is of particular value where intentions are to specify divergent learner behavior and where imagination is a necessary and useful ingredient in the experience. Such a simulation could result in a highly interactive and creative experience for learners.

The procedural form has the potential for the development of a complex set of behaviors or a behavioral sequence.

The situational simulation may result in the invention of realistic dialog and human encounters.

Gestalt simulations tend to impart a general understanding of a total phenomenon or a broad view of a particular aspect of reality. The selection of a type of simulation to use is up to the intentions of the designer, his target audience, and his design resources.

The ingredients of a simulation

Certain essential ingredients are necessary for all simulations regardless of type. They are: the roles played by the participants of the simulation, the rules under which the simulation is carried out, the resources available to participants to assist in the fulfillment of their roles, and the results expected from the simulated activity.
Roles - Each role to be used in a simulation must be mindfully developed. A name for the role should be included with a clear description of the role for all participants to see. Role names should be informative and descriptions brief, clear, and concise. The following list of questions about roles in the simulation under development have been prepared to guide role creation. The answers to these questions should provide all of the information necessary to describe a particular role to a prospective simulation participant.

(a) How many persons will take part in the simulation?
(b) How many different roles will be involved?
(c) What label would you give each?
(d) Will more than one person have the same role?
(e) Do role holders act as individuals or on behalf of others involved in the simulation?
(f) Which roles are intended to interact with which others?
(g) What is the nature of the anticipated interaction?

(h) Is a particular attitude necessary for an accurate role play?

(i) Are roles switched from one person to another at any time during the simulation?

(j) Who determines the roles? The players? The simulation designer?

(k) How will role information be communicated to simulation participants?

Rules - Each rule of operation for a simulation should serve an expressed purpose in the learning experience. Superfluous rules should be eliminated. As few rules as possible should be used. For each rule the penalty for rule breakage should be spelled out. Answers to the following questions should assist the simulation developer in rule construction.

(a) What would you describe as normal activity for the simulation under development?

(b) What activity can you imagine which might occur under a typical circumstances in the simulation?
(c) Which typical activities will be allowed under the rules?
(d) What penalty will accompany each rule?
(e) How will the rules be communicated to simulation participants?
(f) Who can change the rules?

Resources - A major ingredient in any simulation is the resources available within the simulation. Money, time, and information are typical resources. Resources can be distributed or centralized in a simulation. They can be possessed or exchanged during simulation activity. Unique individually owned or similar group-owned resources are possible. The following questions about resources will be of help in design of a simulation.

(a) Are material resources used in the simulation?
(b) Are resources equally distributed across participants?
(c) Are all resources identical?
(d) Is time used as a resource as with timed games or simulation in which participants have turns?
(e) Is there a mechanism for the exchange of resources from participant to participant within the simulation?

(f) Is information a resource in the simulation?

(g) What information does each participant have?

(h) What information does each lack or need?

(i) How are resources distributed at the initiation of the simulation?

(j) Can resources be accumulated during the simulation?

Results - Any simulation which is effective offers its participants a sense of direction. It provides them a goal, an end point, a target, a terminal condition, or something else to strive for. That which we are terming results should provide these functions. Simulation participants need to know what is expected of them, what they are expected to accomplish or reach. Information about the results expected of a simulation can be developed using the following list of questions as a guide.

(a) Is it the intent of the simulation that the participants maintain the status quo in some realistic situation?
(b) Are the participants expected to solve a realistic problem in the simulation?

(c) Is the simulation intended to engage participants in the accomplishment of a certain task?

(d) What is the task?

(e) What are the standards for accomplishment?

(f) Are the simulation participants to be involved in alleviating some predicament?

(g) How will the participants know when they have achieved the desired result of the simulation?

(h) How will information about the adequacy of results be communicated to participants?

(i) Will this knowledge of results come during the simulation or after it?

By using your answers to the questions about roles, rules, resources, and results you should be able to develop necessary role descriptions, a list of rules, appropriate resource information about any needed material resources, and a statement about simulation results.

The information developed in these categories may take written, pictorial, physical (as in the design of a game playing piece) or audio form depending upon its use in the simulation and in fact depending upon the nature of the simulation itself.
Use a measure of "imaginativeness!"

Add to the materials you produce a statement of purpose which will inform the learners of the intent of the simulation experience. Also include a brief orientation presentation to familiarize participants with the general nature of simulation experiences. Mention simulation ability to create realism without total reality. Give an indication of what you expect the experience to be like for the learner. Finally add to your information a list of questions to be used by the person administering the simulation during post-simulation discussion to extend the simulation experience.

At this juncture the designer needs a preliminary appraisal of his materials. The designer should find another teacher who is familiar with the content of the simulation and simulation method and solicit that person's candid reactions. A list of recommended improvements should be cooperatively developed after this first appraisal. Next, improvements should be made.

The simulation is ready for tryout.

**Trying Your Simulation**

By trying your simulation on learners similar to the target learners you will gain valuable information about its adequacies and inadequacies. The tryout is the only reliable way to find out if your simulation learning
experience has hit its mark, accomplished the learnings it was intended to accomplish. In a simulation tryout as many conditions as possible should be controlled which relate to the anticipated actual conditions for the simulations use. Learners should be selected who have subject matter knowledge and aptitude similar to that the intended users of the simulation are expected to have.

In preparing for the simulation experience it is essential that you ready yourself for your role. How much a part of the simulation are you, the teacher, to be? How remote? Will you have to assume much of the responsibility for instructing the learners or does the content of the simulation take care of that.

The simulation tryout should begin with a statement of the stated instructional purposes of the simulation. Subsequently, the role and nature of simulation which is used for learning should be discussed. Finally the introduction should communicate rules, roles, resources and results information. Although the introduction of a simulation is important, it need not be long. Remember the learners will be anxious to get directly into the experience.

During the simulation experience one of your important responsibilities is the maintenance of continuity in the simulation. By reducing any unnecessary ambiguity in the materials or activities and watching for "hang-ups" you will perform these functions adequately.
A crucial stage in simulation learning comes after the simulation experience itself. It is called debriefing and seems to account for much of the meaning students derive from the simulation experience. Providing a time for any one to speak after the simulation may stimulate student expression of initial reactions. If that technique is not productive, a few questions may be needed, such as -

Did the experience seem real?
What did you get out of it?
How could the simulation be improved?
How did the people you were with appear?
How did they act? Realistically? Convincingly?
What questions do you still have about the simulation?

Evaluating the simulation

The tryout aims to discover whether the simulation does what it is supposed to do. Appraising student learning is, therefore, central. By developing a test derived from your learning intentions, goals or purposes, and administering it prior to and directly after the experience, can measure much of the learning which has occurred. The test may be written, oral, individual, group or be an observation of peak learner performance early in the experience. For instructional intentions not amenable to testing you should construct a list of positive indicators of progress toward your intention. Indications of a positive attitude,
a value, or an interest will help you appraise the less salient effects of the simulation. Indicators such as the volitional choice of another simulation exercise or another experience with a particular subject matter, a response on an interest survey, or casual oral comments made after the experience all provide evidence of attainment of general, broad, or mainly affective intentions.

Your assessment of the instructional process is also important to your evaluation of the tryout. How did it go? Were there any "catches?" Where were the highspots? Where were the low? How did the experience match with your hope for it? Was what happened something consistent with your beliefs about what should happen?

The last step in the tryout process is the recommendation step. In all the information you have collected there should be an adequate basis for your recommending revisions and modifications in the simulation to improve it. You should also be able to recommend the substitution of another instructional technique if needed. Or you may just resolve to be better next time.

**Concluding Statement**

The simulation design process is a complex and important one. It is essential that simulation be used appropriately and efficiently. The design of good simulation may take many hours and many iterations but the job and enthusiasm of the learners using it will offer more than adequate compensation.
CONCLUSIONS OF THE STUDY

Conclusions: Summary of the Study

This study was proposed as an analysis of instructional simulation. The study was founded upon the assumption that more and better information regarding this instructional technique would help teachers select instructional techniques which meet learner expectations. In fulfilling this challenge, the investigator assumed an analytical role in which he identified, collected, studied, evaluated, interpreted, structured, and presented information regarding the use and development of instructional simulation.

The method chosen for the study consisted of three phases: The first, dealing with the literature, included the review of research reports and books on general simulation applications and instructional simulation development, evaluation and use. The second, involving field collection of information, resulted in six interviews to collect expert opinion about instructional simulation. The last involved the synthesis of information regarding the use of instructional simulation into "A Guide for Using Instructional Simulation" and pilot testing that guide.
The literature concerning simulation yielded a broad concept of simulation as a technique for experimentation, theorization, or instruction. It described simulation as a representation, the essence of reality without the totality. An example of simulation in each of the three modes was available. A study definition of instructional simulation could thereby be constructed. Instructional simulation was defined as a technique whereby a learner manipulates an operable model of reality to learn from it. The technique involves the learner as a participant in a situation representative of a real situation.

The history of simulation as presented in the literature added perspective to the definition. Knowledge of 2000-year-old war game simulations like modern chess and the military simulations of the 1800's showed the origin of simulation. Description of the Link Trainer (simulator) and of the American Management Association decision simulations, disclosed the evaluation of simulation methods. The recent history of simulation, including educational administrator and teacher training applications, lent a broad context for current simulation consideration.

The use of simulation for teacher preparation and in-service training was discussed. Notably The Classroom Simulator, offering audio-visual stimuli for student reaction,
the Teacher Problems Laboratory, dealing with critical problems of beginning teachers, and the Inner City Simulation, providing teachers sensitization to urban problems, were described. Classroom applications of simulation, DEMOCRACY, LIFE CAREER, and Inter-Nation Simulation games were presented.

In light of past applications of simulation in education and future educational uses, a summary of its assets and liabilities was compiled. The summary showed that stimulation provided by the dynamic and realistic nature of simulation experiences creates learner involvement. A second attribute presented was relevance. The learner perceives relevance in simulation because it has a basis in reality and because it allows for active learning.

Among the liabilities presented was the inconvenience in using simulation experiences and the paucity of research results. Simulations do not fit neatly into existing instructional programs. No strong foundation can, as yet, be laid for the use of simulation as an instructional technique. Therefore, the attributes of simulation were presented in light of both the meager research findings and the abundant testimony available concerning desirable simulation effects.

The next findings related to the development and use of instructional simulation. These findings were the
result of literature reviews, synthesis, and field testing. Guidelines provided in the literature and by visitation were compiled and studied for their usefulness in constructing a guide for instructional simulation. The body of guidance was then modeled into a flow chart and a procedural outline which were evaluated by experts in the field of instructional simulation. Three versions were constructed, tested, and revised through field and literature study before the final "A Guide for Using Instructional Simulation" was produced.

"A Guide for Using Instructional Simulation" presents major considerations surrounding the development and use of instructional simulation: (1) simulation as an instructional technique, (2) prospective roles for instructional simulation, (3) defining an instructional problem, (4) selecting a system to simulate, (5) modeling for simulation, and (6) using instructional simulation.

The first consideration was explained by comparing instructional simulation with other instructional techniques. Three elements - (1) control of reality, (2) accessibility to real situations, and (3) economy of time and money - were mentioned as they relate to instructional simulation. The possibility of using simulation to provide practice, introduction, or subject matter for the learner was then presented. Next the analysis of an instructional
problem through investigation of learning needs, formulation of objectives, and the selection of an instructional strategy was discussed.

To provide guidance in the event that simulation was the strategy chosen, the next section laid out criteria for the selection of a system to simulate. Systems with clear human role and function definitions, which were relatively easy to model, were described as good candidates for instructional simulation.

Techniques for creating models of theoretical or actual systems to be used as bases for simulation experiences were next presented. The construction of appropriate types of models for appropriate learning outcomes was described, and examples were presented.

The translation of the model into an actual learning experience was the topic of the next portion of the guide, where means of structuring learning situations, planning for roles, preparing materials, and collecting tryout feedback were delineated.

The construction of "A Guide for Using Instructional Simulation" represented the final phase in demonstrating the analyst's role through application to the instructional uses of simulation. The guide embodied information collected from each stage of the study and by literature review, interview, analysis synthesis, and testing.
Conclusions: Implications of the Study

In the course of a study many bits of philosophy, prognostication, and prescription come to mind. Those bits of information are presented in this section. In retrospect it appears that the study has really two "products": the first "A Guide for Using Instructional Simulation" and the second a methodology for analyzing educational innovation.

Investigation toward the former product uncovered the current state of instructional simulation and the paucity of research and sound research results regarding the effects of instructional simulation.

Although some research studies have been done, their results are meager and call for a greater effort at simulation research. Researchers must determine the ability of simulation to change attitude, the source of simulation's appeal for learners, the nature of the concretizing function of simulation, and the dependency of simulation on role playing. Research results in these areas will allow for needed fine tuning of instructional planning and decision-making.

Also uncovered during the study was the emergence of a new psychological foundation for instruction. Instructional simulation is one technique that is so broad in its instructional use and effect as to elude direct
linkage with behavioral psychologies. Instructional simulation and its parent, social psychology, appears to be filling a theoretical gap between the social realities of the real world and the behavioral realities of the learning process. In this view, simulation offers a social context or milieu for learning events and provides an integrating force for learning experiences. More broadly, the principles of social psychology applied through other techniques can offer the social learnings needed to complement the behavioral learnings already possible. By these observations, it appears that simulation in its diffusion will offer entry for social psychology into instructional planning and development.

The second "product" of the study appears to gravitate around the creation of a role which we earlier called "educational analyst." The role of analyst is a stimulating and important one. The analyst operates best when not constrained by normal temporal and geographic barriers to the information he seeks. He must be able to travel to the site of relevant information he seeks and collect the facts firsthand. The analyst should continually seek out new sources of information and new tests for available information. Some of the best sources of information are unavailable to the library researcher and available only
in the minds of specialists in the field. He must also be knowledgeable in the general field of instruction before encountering the experts of any particular technique or technology.

The role has many benefits to the role performer, by allowing for concentrated study of one major problem at a time, collecting expert opinion at any stage in the analytical process, disclosing the personalities and work situations behind the words in literature, and allowing the cumulative effect of information collected and transmitted from expert to expert. The role also bridges the time lag (often two or three years) existing between the conduct of key simulations and the evidence in the literature.

In addition, author reaction to literature presentations can be accumulated as well as instruction not yet in print. From this role individuals influential in the field who will not have or have not published can be identified. The major effect of the analyst's role comes from the constant rethinking and reappraisal of the subject being studied. Not only is information supplied by the literature and field visits but it is intellectually processed by reading and conversing.

This particular experience in the analyst role was found to be developing and stimulating. Not only did the subject matter develop and evolve but so did the technique
and ability of the investigator. On one side of the coin, the most exciting development of the study was the discussion of the nature and role of game simulations, with specialists in the field, and I especially cite Fred Goodman and his staff at the University of Michigan. On the other side of the coin was the realization that simulation is not an instructional panacea. In a curious way this investigator's feeling about instruction simulation seemed to evolve in the same way as did the history of simulation. The study seemed to begin with over optimism regarding simulation as an instructional technique, then it progressed to pessimism due to the absence of a research basis for conclusion, and finally to a realistic, cautious optimism regarding the capabilities of simulations.

Though this investigator's experience in the role of educational analyst was stimulating and rewarding enough to be of potential benefit and interest to other individuals, the individual occupancy of such a role will not adequately meet educational needs parallel to those addressed by this study. Systematic, massive, organized, and prolonged effort at information collection, analysis, evaluation, and compilation is necessary to prevent a fruitless collision of the forces of accountability, learner expectations and instructional technology.
Perhaps the educational analyst's role should become a part of our regional educational centers, perhaps the role should be taken by major publishers of educational journals as part of their research and editorial activity, or still better, the role should be shared by national and regional centers and major educational periodical publishers. Clearly, the analyst's role is needed, is productive, is possible and must become permanent.
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