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ABSTRACT

An Information Retrieval (IR) system for 5312 social science generalizations and a social simulation game, called "Explanation" are discussed. The game, using specially prepared case studies, is designed to permit players to develop ability in asking questions, generalizing, and stating tentative explanations. The research revealed the development of improved inquiry skills during the learning sessions. As a result of this study, the IR system and the game were then modified and expanded. This report focuses on the first phase of the study in data collection and analysis in an effort to assess the behavior of undergraduate teacher trainees as they experienced both techniques. Results indicate a positive transfer effect between the game and the IR system. A discussion of factors to be considered for future study is presented. Appendices include an explanation of the game and the IR system, and the attitudinal scales. The scales are described further in TM 000 284 and TM 000 285. (Author/AE)

CAI CENTER

TECH MEMO

TWO SIMULATED INQUIRY ENVIRONMENTS: A SOCIAL SIMULATION GAME AND A CAI-BASED INFORMATION RETRIEVAL SYSTEM

Charles H. Adair, Duncan N. Hansen
Gail T. Rayner, & Adesh Agarwal

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13. ABSTRACT

Building upon the earlier collection of 5312 social science generalizations and the development of a taxonomic retrieval system, this study has implemented the Information Retrieval (IR) system within a 1500 CAI system, developed a social simulation game, constructed an attitude scale to appraise three affective factors, within the game and IR learning tasks, and studied teachers' inquiry behavior. An experiment was designed and executed within the game and IR system to further examine the outcomes of the attitude scale and to examine human inquiry behavior more closely.

The results indicated that primarily the IR system experience leads to improved inquiry behaviors. The feasibility and the associated positive reaction of students to both the game and the IR system was established. A discussion of factors to be considered for further study was presented.

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THE PROBLEM

To teach is to pose questions and to offer explanations. To teach superbly is to cause students to pose questions and offer explanations. Teaching itself, regardless of the mode of instruction and given the ultimate purpose of the teacher or the needs of the students, may be reduced analytically to questions and answers. Instruction in reflective thinking and explanation behavior especially demands this ability in the teacher's performance. To assist potential instructors in developing pertinent inquiry skills is the purpose of this research and development effort. A set of learning events to permit a closer examination of the development of inquiry skills has been constructed.

For the purpose of clarity, this study can be viewed in three dimensions:

1. To construct and evaluate an operational CAI-based retrieval system that provides social science generalizations and their sources to the student

Selected from the several social sciences literature, 5312 generalizations were identified by ten doctoral students of Professor Paul Hanna and others at Stanford University (Hanna & Lee, 1962). These generalizations were organized in somewhat similar taxonomy but were not structurally equivalent. Adair and Barbe (1965) developed a taxomonic system which incorporated all ten sets of generalizations. This was employed as the structure of the Computer-Assisted Instruction-based retrieval system. The programming and coding for CAI, a massive task, have been carried on at Florida State University since August, 1968.

The correction of bibliographical errors and procurement of original sources has been more time consuming than anticipated. In the spring of 1969, the CAI generalizations system became operational. While the information retrieval (IR) introduction and question-explanation process following it have undergone revision based on the first study to be reported here, the essential student interaction with the 5312 social science generalizations has remained a stable feature within the IR system.

2. To modify and evaluate a social simulation game which permits players to develop ability in asking abstract questions, generalizing from data in case study form, and stating propositions as tentative, theoretical explanations of puzzling phenomena

The game, EXPLANATION, and decks of case studies have been created and modified to maximize the efficacy of game results (Montgomery, Adair, Williams, & Chadwick, 1968). Now in the fourth modification, the game functions well and is used both in this CAI experiment and the ongoing pre-service teacher education program at FSU (see Appendix A).

3. To experimentally explore the inquiry behavior of social studies teachers in terms of (a) task-no task orientation and (b) simulated experience in the inquiry process as manifested by the structure of the learning events

The experimental effort under study was a simplistic exploration of inquiry skills. The behavioral characteristics of teachers who attempt to satisfy their curiosity via the CAI system were assessed. Experimental groups are those which (a) have not played the game, EXPLANATION, but are stimulated by case studies at the IR terminal, (b) have not played the game and have free inquiry at the IR terminal, (c) have both the Explanation game experience and case study stimulation at the terminal, and (d) have played the game but are not stimulated by case studies.

The purpose of the design is to reveal the development of inquiry skills during two learning sessions that vary the prior knowledge and IR task.

The Need for the Study

While many aspects of classroom behavior have been observed and analyzed in both a logical and psychological framework, the difficulties of defining and observing the functions of inquiry are still present (Smith & Ennis, 1961; Rosenshine, 1968, p. 10). Computer-assisted instruction (CAI) offers a possible means for a closer empirical examination of this behavior. CAI hardware allows for observing and recording an individual's behavior and possesses those indefatigable and veracious qualities so often wished for by theorists desiring a test of their ideas. Heretofore no program of substantive social science materials has existed for CAI application. We have this empirical advantage. Yet others have made conceptual contributions to the theoretical framework of this study.

Observing and Classifying Behavior

At the University of Michigan, Massialas and his colleagues have developed a "Cognitive Category System for Analyzing Classroom Discussion of Social Issues" (Massialas, Freitag, & Sweeney, 1969). Nine intellectual operations have been defined and structured to permit systematic observation of behavior in the classroom. The controls over the observer's behavior, while clear and disciplined in nature, are still related to the rater's perception and judgments.

The work of Massialas, (1969) like that of B. O. Smith, (1961) depends on a conceptualization of teaching as offered by Edward C. Tolman

(1951). To the observer, the behaviors of teachers constitute independent variables while the behaviors of students are dependent variables. In each case, the behaviors are divided into linguistic performance and expressive categories. A need exists to specify, rather than ramify, the nature of these behaviors in each of these dimensions.

To deny that the act of teaching is a social interaction is superflous if the student is aided by a teacher. Coleman (1968) has conceptualized the conditions of a social environment to aid those who would observe specific, functional teaching activities. He applied his concept of social role interactions to the problem of learning simulation, and we have employed this social simulation framework as a guide for this study.

Intellectual Functions in Explanatory Behaviors

As one views the interaction of a teacher with a student in attempting to explain a set of puzzling phenomena, it appears, particularly in the case of social phenomena, that decisions about classes of phenomena and the linking of the classes are occurring. To the degree that the classes can be labeled with familiar concept names, a type of quasi-syllogistic reasoning seems to be occurring. This type of reasoning involves many difficulties identified by examiners (Hunt & Metcalf, 1955).

In a different vein, Bruner and his associates view inquiry and reasoning by stating the question as "what is to be gained by choosing one order (of inquiry steps) as compared to another order of testing instances?" This question leads to opportunities "to obtain information

appropriate to the objectives of one's inquiry" and "to increase or decrease the cognitive strain involved in assimilating information" (Bruner, Goodnow, & Austin, 1967, p. 81). The design of this study offers opportunities for students to work with well-organized and previously structured information as well as opportunities to satisfy self-directed curiosity; hence, both convergent and divergent behaviors are under scrutiny. The techniques of evaluation take into account individual differences in inquiry behavior and emotional strain via CAI flexibility and appropriate self-report instruments.

Evaluating Effectiveness of Explanation as the Product of Inquiry

Within this CAI approach, the event of inquiry is followed by the event of explanation. The behaviors of explanation are complex and especially elusive in the social science area due to the relative weakness of theory. Yet evaluation in social science has been described and categorized (Brown, 1963). Even more important to this study, Meehan (1968) has employed a systems framework within which to evaluate the "appropriateness" and "usefulness" of given explanations. To apply his eight criteria for appraising the effectiveness provides us with an opportunity to test their efficacy. Verification is needed if Meehan's theory is to be credible to teachers.

Equally important to cognitive operations underlying teachers' behavior during inquiry is this disposition towards the effort. The conditions of discovery, boredom, and failure have their effect. A need for an attitude scale that measures interest satisfaction, achievement motivation, cognitive growth, and task coping seemed essential.

The development of these attitude scales has been completed within this study (see Appendices C and D).

Finally, it was apparent to the investigators that a contribution to further research on in-service training could be realized within the context of the two simulations developed in this study. Many institutions like FSU are anxious to provide experience in essential cognitive operations for students somewhat akin to laboratory experience. Teacher educators and educational researchers have needed media which permit more than intellectual skills to be acquired. In the social simulation game of "Explanation" and the CAI based information retrieval program "Retrieve," observers can make discrete observations of continuously adjusted student behaviors that reflect intellectual skills (Bloom, 1965) plus the rated value of the information supplied (see Appendices A and B).

Theoretical Context of the Study

During this decade, the uses of learning games and information retrieval systems for instructional purposes have received extensive exploration. While many possible theoretical interpretations have been provided for these more avant-garde learning activities, the requirement for a theoretical framework which can relate operationally the empirical inquiry behaviors to be reported with the inquiry behaviors of learning games and a computer-based information retrieval system seems apparent to us. Moreover, the most essential feature of such a theoretical framework is a view of the inquiry event as pursued by the student. In its most naive terms, the inquiry event is an intersection of the internal events or mental processes of the student as they interact with the

external events of the game or information retrieval system. The learning event, then, relates information, both internal and external, as it is used to win the game or utilize the IR system. This brief theoretical framework is offered as a consideration of the factors posited as important within inquiry processes (Larrobee, 1964).

First, it is important to consider the cybernetic aspects of this framework. By cybernetic, we refer to the essential feedback characteristics of both the external learning context as well as the goal-oriented mental processes to be learned or utilized by the student. The essential feature of the learning process is the development of more sophisticated, adaptive inquiry behaviors on the part of the student. These behaviors generate inquiry events that can be judged as desirable and goal-oriented from a pedagogical point of view. Secondly, the rules and strategies permissible in either the learning game or the IR system provide for a form of adaptive behavior that is consistent with an increasing sophistication in both intellectual skills and search strategies utilized by the students. Lastly, it is important to be aware of the information flow and feedback to the student that provides for a non-threatening but useful match with his current mental strategies. It is this feedback process that allows for improvement in the desired inquiry processes. Thus, it is important to consider that this theoretic framework is process-oriented in that it allows for the posited mental processes within the learning context.

The role of search and abstracting strategies receives considerable emphasis within this framework. On the one hand, there are optimal

strategies specified via the learning game as well as the search structure of the IR system. These are determined by the external criteria or scoring schemes which relate to the pedagogical goals. Perhaps more importantly, we posit that each student utilizes a behavioral search and abstracting strategy which attempts to match the essential features of the optimal game strategy or the operational rules allowed for by the game or IR system. In the game context, the student's strategy is the acceptance of those acts leading to the maximum number of points and the minimum number of potential losses, that is, the minimax solution. For the IR system, the student's strategy is an interplay with the search process that minimizes energy expenditure while allowing for interesting exploration. These student strategies have the essential feature of specifying the sequence of developments within the inquiry event, and are therefore of considerable importance.

As the primary purpose of the game and information retrieval learning task, we consider the development of intellectual skills to be the absolute requisite. These intellectual skills consist of asking insightful and powerful questions which are made up of appropriate sub-skills. Moreover, the recognition of pervasive generalizations and self-generated explanations also is considered a highly sophisticated, complex intellectual skill. It is the point of the game and IR activity to develop these intellectual skills.

Turning to Figure 1, one can see that we consider there are external factors specified by the instructional situation plus internal processes appropriate for consideration within the student. In regard to the

external factors, we gave great consideration to media presentation techniques and their role within the task especially in terms of graphic and verbal presentation. We allowed in all cases for non-destructive and positive feedback of information in order to help the student. We allowed for strategies that related the rules and constraints of the game and IR system that would promote the intellectual skills desired. And lastly, we provided meaningful goals which would promote the adaptive behaviors of the students.

In regard to the capabilities of the learner as these contribute to the inquiry event, prior knowledge as developed by previous educational experiences, be these formal or informal experiences, is obviously an important determiner of the content of the inquiry event. As mentioned

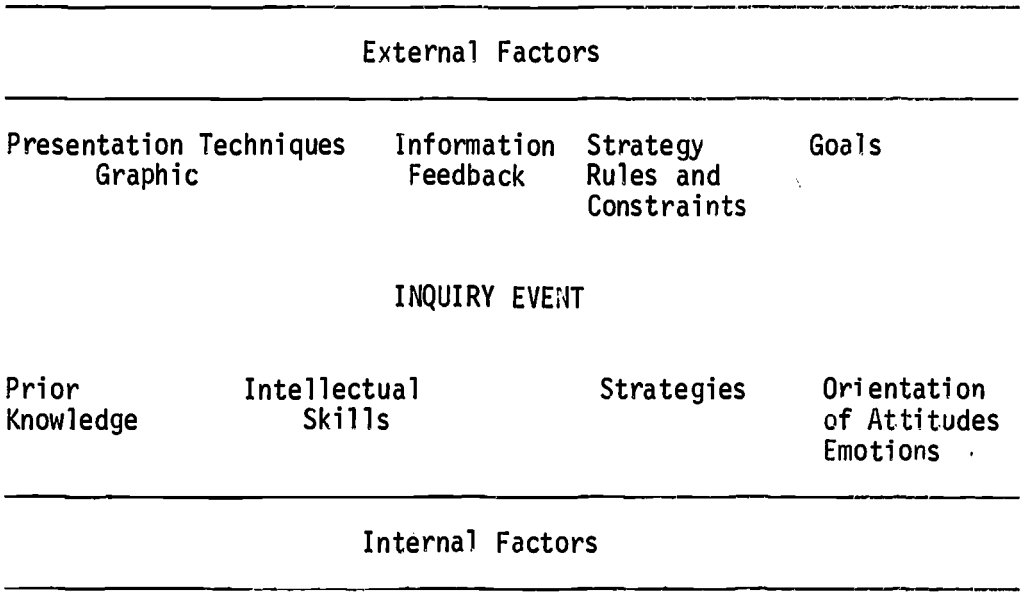

Figure 1--Diagram for Interactive Inquiry

above, the intellectual skills of questioning and explanation are context dependent and highly complex in nature. The student's strategies that relate his intellectual skills and his prior knowledge with the perceived goals of the task situation are also of paramount importance. And lastly, it is important to consider the orientational nature of the attitudes and emotions as they either broaden or constrain the process of the inquiry. While this theoretic framework could be analyzed in greater depth, it does provide us with a terminology for considering the specific rationale and activities for both the learning game as well as the computer-based IR system.

Development of the Computer-Based Systems

The Information Retrieval System

Several extensive efforts were required for the development of the CAI-IR system. First, it was necessary to correct conceptual errors in the taxonomic system reported by Adair and Barbe (1965). A general introduction of 59 frames was written to acquaint the students with the nature and operations of the system (see Appendix B). A total of 6433 information frames were coded using the Coursewriter II Language (see Appendix E). Debugging the computer program required considerable time. Second, the search for original sources and their Xerox reproduction has involved hundreds of man hours over a period of one and one-half years. Third, the results of our first exploratory assessment of the IR system in the spring of 1969 suggested modifications for the learning introduction to the system and the addition of a more extensive

evaluative sequence that amplifies the explanation process. This will be explained in greater depth in the results section.

The Game of Explanation

The principal investigator developed the initial version of the game while participating in a simulation institute conducted by Teaching Research, Oregon State System of Higher Education, in the summer of 1968.* The game was developed as a social simulation from James Coleman's (1968) suggested concepts. It has undergone four modifications due to intensive play and analysis by graduate students, faculty, undergraduate students, in-service teachers and high school students (see Appendix A). Suggestions made by Coleman and Peabody at Johns Hopkins University were quite helpful.

Case Studies

Both the game of Explanation and the IR system require specially prepared case studies as sources of inquiry phenomena (see Appendix F). Approximately 100 case studies, each based on a social science generalization, have been written. Many have been rewritten with improvements derived from evaluation of the game and IR system.

The Attitude Scales

The attitude scales were developed initially by the selection of sets of appropriate quick response items to assess the students' reaction to the cognitive interest and motivational nature of the learning game and the IR system. Two separate forms were developed for the

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*Travel support was furnished by Project THEMIS and the Office of Naval Research.

learning game and IR system respectively. They were employed in pre- and posttesting situations involving 75 undergraduates in the spring of 1969. Results of item analyses and factor analyses served to modify the scales (see Appendices C and D). The statistical analysis is presented in the results section of this report.

In order to develop the attitude scales, a review of the recent literature through May, 1969 revealed no attitude scales specifically for instructional games and information retrieval systems. Consequently a preliminary version was developed for this first study.

The Game Scale. Seventy items were chosen to measure attitudes towards games. Three subscales were included within the items. Items 1 through 29 were identified as Interest Satisfaction, items 30 through 47 as Cognitive Growth and items 48 through 70 as Achievement Motivation. Items were stated both positively and negatively. The nature of these three attitudinal components is as follows:

1. Interest is a process by which a student projects his a priori values for certain activities to select among alternatives. Satisfaction is a process by which the value attached to the participation of certain activities is manipulated. Thus, interests and satisfaction reflect the a priori and a posteriori manipulation of internal values generated by a student to an activity. More specific to games, the interest and satisfaction represent how the internal intuitive pleasure and scope of the learning game manipulates his perceived value of the experience.

2. Cognitive growth is a process by which a student assigns more self-confidence and awareness of greater knowledge and related inter-relationships as he adapts to problematic situations. For learning games, the process of developing an optimal strategy leads to a sense of cognitive growth in that the student realizes that he has developed a complex mental scheme for maximizing his winnings and minimizing his losses.

3. Achievement motivation is a process by which a student both energizes and focuses his behavior in order to pursue goals or related internal states of excellence. In terms of learning games, achievement motivation is the sense of playing with greater concentration and sophistication in order to pursue an optimal strategy.

The IR Scale. Forty-one items were adapted from the game scale, taking care to select appropriately from each of the subscales. Respondents circled one of five responses for each item ranging from "strongly agree" to "strongly disagree" on a Likert-type scale. Some items from Brown's Scale of Student Attitudes Toward Computer-Assisted Instruction were modified by changing CAI to the IR system. Other items were selected and modified from L. R. Aiken's Revised Mathematics Attitudes Scale and J. Hand's Scale to Study Attitudes Toward College Courses. The rest of the items were written to fit the constructs. The technique for scoring of the scales was as follows:

1. Negative items are reversed and the items summed to obtain the three subscale scores and a grand total attitude score.
2. Internal consistency measures of each scale and subscale were computed (Kuder-Richardson 20) to appraise reliability
3. Validity estimates were based on a comparison of scale scores and performance using the media.

The Kuder-Richardson 20 estimate was R = .95 for both the Game and IR forms. While variability was present among the sessions and the task conditions, all K-R 20 coefficients for the total scale exceeded .91 Thus, the data was pooled to yield the estimated R of .95.

The factor analyses yield varying results depending upon the pooling of data. For the total score for the Game and IR system separately, the three factors were retrieved plus a fourth factor referred to as "coping." This additional factor can be defined as follows:

> While performing in a learning game, the student will have varying degrees of self-assessment as to his performance in comparison to other students. These comparisons will lead to heightened anxiety if rated low or a sense of adequate adjustment if rated high.

Given the high reliability and factorial consistency, the preliminary attitude instrument was judged sufficiently adequate for incorporation within this exploratory study.

The Research Design

The spring, 1969 study involved two primary phases in data collection and analysis. The first was an effort to assess the behavior of undergraduate teacher trainees as they experienced the learning game and IR system. The second phase was an experiment to test hypotheses about the inquiry-explanation behaviors under an improved research design. This report focuses on the first phase.

Phase I. The development of the IR system required initial field testing. In addition, several questions were posed for study during the Phase 1 study. These were as follows:

A. The Retrieval System

1. Are the generalizations meaningful to participants after they have inquired?
2. Are the sources and references helpful to participants who are puzzled about the relevance of the generalizations?
3. Are the reproduction and coding of information in the system sufficiently accurate to permit inquiry and discovery?
4. Do the generalizations possess efficacy in the opinions of the students?
5. Does the taxonomic organization facilitate question formation and generalization retrieval?
6. How important are the primary sources in the inquiry experience?

7. Will the students who are stimulated by a case study be more curious than those who pursue self-exploration?

8. What are the inquiry paths of the students?

9. Are the students who inquire with efficiency the most accurate in their discoveries?

10. Are there conditions surrounding the CRT terminals which affect performance?

11. How long can the students spend at the terminal and maintain interest?

B. The Game of Explanation.

1. Does the game effectively develop skill in asking questions and recognizing generalizations?

2. Does the game aid players in sensing the need for isomorphism between an explanation and the case study?

3. Does the game develop the ability to evaluate generalizations in accordance with the criteria?

4. Does the game motivate and stimulate players during the course of play?

5. Does the game develop competition among players during the course of play?

6. How long can the play continue and maintain player interest?

Design. Fifty-eight FSU students in a junior level course in methods of teaching the social studies were randomly placed in two groups in order to counter-balance order effects. Group A played the learning game for a total period of five hours over a period of two days while group B interacted with the IR system for a possible total of six hours. The experiences were reversed with group B playing the game and group A interacting with the IR system. This was an intense experimental experience during which no other activity in their methods course was conducted. The students

were all taking at least three other teacher education courses during the time of the data collection. No grade or credit incentive was offered for good or bad performance. In group A, only ten of the students performed on the IR system for the full six hours; otherwise, the students participated fully in the experimental sessions.

To permit a comparison of Game-IR performance, the assessment focused on game scores and a criterion measure of question-explanation using Meehan's criteria. The IR score was computed on a five-point scale by establishing the degree of matching between the students' questions and their explanations as agreed on by a majority of five competent judges.

The basic design may be thought of as a crude adaptation of Campbell and Stanley's (1963, p. 46) Design #9, the Equivalent Materials Design

$$M_a X_1 O \qquad M_b X_{10}$$
$$M_b X_2 O \qquad M_a X_{20}$$

Groups A and B indicate the order of learning while the "case" refers to the requirement of having a case study to inquire about within the IR system. Each group had two learning sessions with the Game and the IR system. After each session, the attitude instrument was presented and data collected.

Results

For the purposes of clarity, the results will be presented in three subsections: (1) mean performance of Groups A and B for the Game and the IR system, (2) mean attitude reactions toward the Game and IR system, and

(3) a summary that indicates our tentative findings in regard to the questions posed initially for the study.

In regard to the mean performance within the Learning Game, Table 1 presents the results and statistical assessment. Separate "t-tests" indicated a superiority of Group B on the usefulness and appropriateness of their game explanations. Thus, prior experience with the IR system seems to enhance the explanatory behaviors of the students.

TABLE 1.--Mean Rated Performance on the Learning Game

	USEFULNESS	APPROPRIATENESS	QUESTION	TOTAL
Group A	2.67	2.77	4.27	9.71
Group B	3.10	3.10	4.03	10.23
Statistical value	$t = 4.90$, $p < .05$	$t = 3.05$, $p < .05$	$t = .90$, NS	$t = .95$, NS

In regard to question-explanation performance on the I.R. system, Table 2 presents the results. Analysis of variance yielded no significant results although Group A tends to perform better with case studies. This better performance of Group A in posing questions for case studies is consistent with a positive transfer effect from playing the Game. Perhaps a more in-depth experience with the Game might increase this value to a statistically significant level.

TABLE 2.--Mean Question Performance on the I.R. System

	CASE	NO CASE	TOTAL
Group A	3.20	2.87	3.03
Group B	2.53	3.00	2.77

On the other hand, the lower value on the no-case study condition for Group A in comparison with Group B might indicate a cognitive convergence from playing the Game.

In regard to the appropriateness and efficacy of the question-explanation match while on the I.R. system, Table 3 presents the results. Adjustment had to be made since seven students in Group A did not complete the I.R. treatment (four in the case condition and three in the no-case treatment failed to complete the sessions). Analysis of variance did not yield a statistically significant difference. On the other hand, Group A performance was better in each experimental condition. This provides some indication that the question-explanation process of the learning game transferred positively to the I.R. situation. We interpret this non-significant but consistent result as indicating the need to provide more in-depth experience within both the learning game and I.R. system treatments. Moreover, greater emphasis on the match process of search and explanation might improve the performance.

TABLE 3.--Mean Performance on the Question-Explanation Match on the I.R. System

	CASE	NO CASE	TOTAL
Group A	3.67	3.67	3.67
Group B	2.93	3.00	2.97

As a tentative summary, the results indicate a positive transfer effect between the Game and the I.R. system. While the results are not statistically significant, the positive transfer did heighten the results past the neutral value of 3.00.

Attitude Results. The attitude results were analyzed separately for the three posited factors and for a tri-part split (high, middle, and low) according to the self-ratings of the participating students. The rationale for splitting the students into high positive, middle and low (negative) groups concerned both the assessment for absolute reactions among the students plus the potential relationship between attitudes and performance.

In regard to the attitude results for the Learning Game, Table 4 presents the mean group performance for the attitudes plus their performances within the Game. As indicated, there is a statistical difference between the groups, obviously due to the groupings. More importantly, there is a significant difference in performance on the questioning behaviors generated within the Game. The middle-reacting group appears to perform best on the Game although a "t-test" indicates a significantly lower difference only for the low attitude group. Performance does not appear to be highly related to attitudes although low performance did result in lower attitudes. The middle group had the best performance. These results suggest that higher levels of performance might result in more neutral anxiety related attitudes toward learning games.

TABLE 4.--Mean Attitude Reactions Towards the Game

	ATTITUDE GROUPS			STATISTICAL
	LOW	MIDDLE	HIGH	OUTCOME
Interest Satisfaction	75.96	86.30	106.70	$F = 81.7$ $p < .01$
Cognitive Growth	39.65	49.43	61.83	$F = 90.1$ $p < .01$
Achievement Motivation	52.65	62.48	71.26	$F = 46.5$ $p < .01$
Game Score	9.39	10.39	10.17	N.S
Game Question	3.65	4.57	4.13	$F = 4.69$ $p < .05$
Explanation Usefulness	2.78	2.78	3.04	N.S.
Explanation Appropriateness	2.69	3.04	3.00	N.S.

In regard to the Attitude Reactions towards the I.R. system, the results presented in Table 5 are more consistent with our original expectations. All of the attitude reactions are statistically significant for the low, middle, and high groups and represent a least positive trend for the middle group and a highly positive reaction for the high group. More importantly, the search-explanation performance is significant and ordered monotonically with the attitude reactions. One reason for the more consistent I.R. attitude performance relationships may be the greater degree of student control found in the CAI-I.R. system; that is, the student has complete control over terminating a search or extending the search by investigating the primary printed source materials if desired. In summary, the attitude results indicate a

TABLE 5.--Mean Attitude Reaction Towards the IR System

	ATTITUDE GROUPS			STATISTICAL
	LOW	MIDDLE	HIGH	OUTCOME
Interest Satisfaction	34.09	43.83	55.09	$F = 86.9$ $p < .01$
Cognitive Growth	39.44	50.70	67.96	$F = 91.5$ $p < .01$
Achievement Motivation	17.31	20.52	25.91	$F = 35.7$ $p < .01$
IR Questions	2.87	2.70	3.04	N.S.
IR Questions - Explanations Match	1.91	2.52	3.26	$F = 4.4$ $p < .05$

positive relationship between performance and attitude with the IR system treatment.

Preliminary Results to Problem Questions

As indicated earlier in this report, a set of investigatory questions was posed for the initial study in the spring of 1969. Many questions are still unanswered due to either marginal statistical outcomes or the need for more sophisticated forms of assessment. Turning now to a summary review of the questions:

The IR System

1. Are the generalizations meaningful to participants after they have inquired by questions? In all protocols, the student searched out one or more generalizations for study. The better their question-explanation performance, the better their attitude. The comments made by students tended to be positive. Thus, we tentatively conclude that the IR generalizations presented by the CAI system are interpreted as meaningful by the students.

2. Are the sources and references helpful to participants who are puzzled about the relevance of the generalizations? First, approximately 17 percent of the time was spent in reading original sources. Moreover, there was a tendency (non-significant) for this time to increase from session one to session two. It would appear that the students do find the references relevant for their inquiries. We plan to increase the time for this type of study plus their self-assessment of each source at the explanation point in the IR program.

3. Are the reproduction and coding of information in the IR system sufficiently accurate to permit inquiry and discovery? While some errors were found and some machine problems encountered, the CAI interaction was smooth and stimulating. The main criticism concerned the introductory directions which have been revised. In the main, the accuracy was sufficient as indicated by the attitude ratings.

4. Do the generalizations possess efficacy in the opinions of the students? There is limited evidence as to this question. While there was an increase in search time among the generalizations during sessions, the increase was not significant.

5. Does the taxonomic organization facilitate question formation and generalization retrieval? In comparison with the student ratings of lecture-discussion teaching and the learning game, the IR taxonomy did appear to be superior in the question-explanation processes.

6. How important are the primary sources in the inquiry experience? While we have no direct evidence, the amount of time spent reading the sources indirectly indicates some importance. This question remains to be answered more completely.

7. Will the students who are stimulated by a case study be more curious than those who pursue self-explanation? No significant differences were found although there was a tendency for case study students to search longer, read more primary sources, and have better question-explanation performances.

8. What are the inquiry paths of the students? Considerable idiosyncratic pathway structures were recorded. We are still working on techniques to relate pathway structures with the quality and nature of the question-explanation inquiry process.

9. Are the students who inquire with efficiency the most accurate in their discoveries? Given that the first study was still evolving measures of efficiency and accuracy within the performance domain, no attempt was made to answer this question.

10. Are there conditions surrounding the CRT terminal which affect performance? No identifiable conditions arose concerning the equipment. We did identify the need for skillful monitoring during the initial session so that inquiry might proceed without ambiguity.

11. How long can the students spend at the CRT and maintain interest? Given the dropout rate at the end of the study, students' criticism of the three hour session, and the dropping performance in the last twenty minutes of each session, we now recommend more frequent one-hour sessions.

The Game of Explanation

1. Does the game effectively develop skills in asking questions and recognizing generalizations? Analysis of the game scores indicates that a strong judgemental bias developed among the students. This tendency to score questions and explanations at an unduly high level attenuated the mean score results; consequently, only the rated questions within the game proved to be significant in the analysis. For future work, we plan to bring in independent raters to increase the reliability, and, consequently, the validity of the assessment of developing inquiry skills.

2. Does the game aid players in sensing the need for isomorphism between an explanation and the case study? Preliminary assessment would indicate that the game did aid players in relating the case study to the inquiry process in that the group that learned the game first performed better in this condition on the IR system. This suggests to us that the students were developing an understanding of the relationship of generalizations and case studies.

3. Does the game develop the ability to evaluate generalizations in accordance with the criteria? The evidence in this area is non-conclusive. We are attempting to clarify the criteria, believing that this plus using external raters will lead to improved criteria for the inquiry process.

4. Does the game motivate and stimulate players during the course development? The interpretation of the attitude data indicates that students are motivated and stimulated while playing the game.

5. Does the game develop competition among players during the course of play? No evidence was collected in regard to this question at this time.

6. How long can the play continue and maintain player interest? Our best estimate is that the players can continue to play, given good case studies, for longer durations than found in this first study. This is based on student reactions, plus their rating of the game situation.

SUMMARY

In order to assist potential instructors in developing pertinent inquiry skills, this study has produced the massively complex computer-based retrieval system for 5312 social science generalizations. An initial test group has interacted with the IR system and with the social simulation game designed to permit players to develop ability in asking questions, generalizing, and stating tentative explanations. The research design revealed the development of inquiry skills in learning sessions that varied the prior knowledge and IR task. As a result of the study conducted thus far, the IR system and the game have been modified and expanded, and an attitude scale has been developed to measure interest, cognitive growth, and achievement motivation for both the game and the IR system. This report focuses on the first phase of the study in data collection and anaysis, namely, an effort to assess the behavior of undergraduate teacher trainees as they experienced the learning game and IR system. Tentatively, results indicate a positive transfer effect between the game and the IR system. Marginal statistical outcomes leave many of the original questions unanswered; more sophisticated forms of assessment and evaluation are presented.

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APPENDIX A

EXPLANATION

A Social Simulation Game of Didactic Teaching

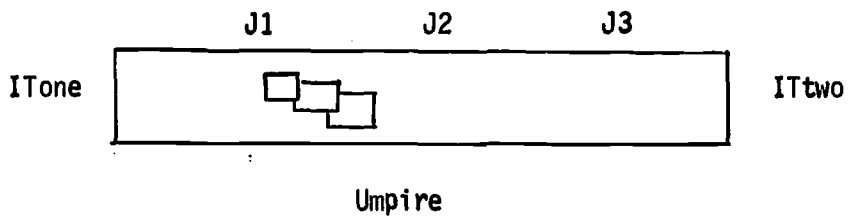
Charles H. Adair and Rodney F. Allen

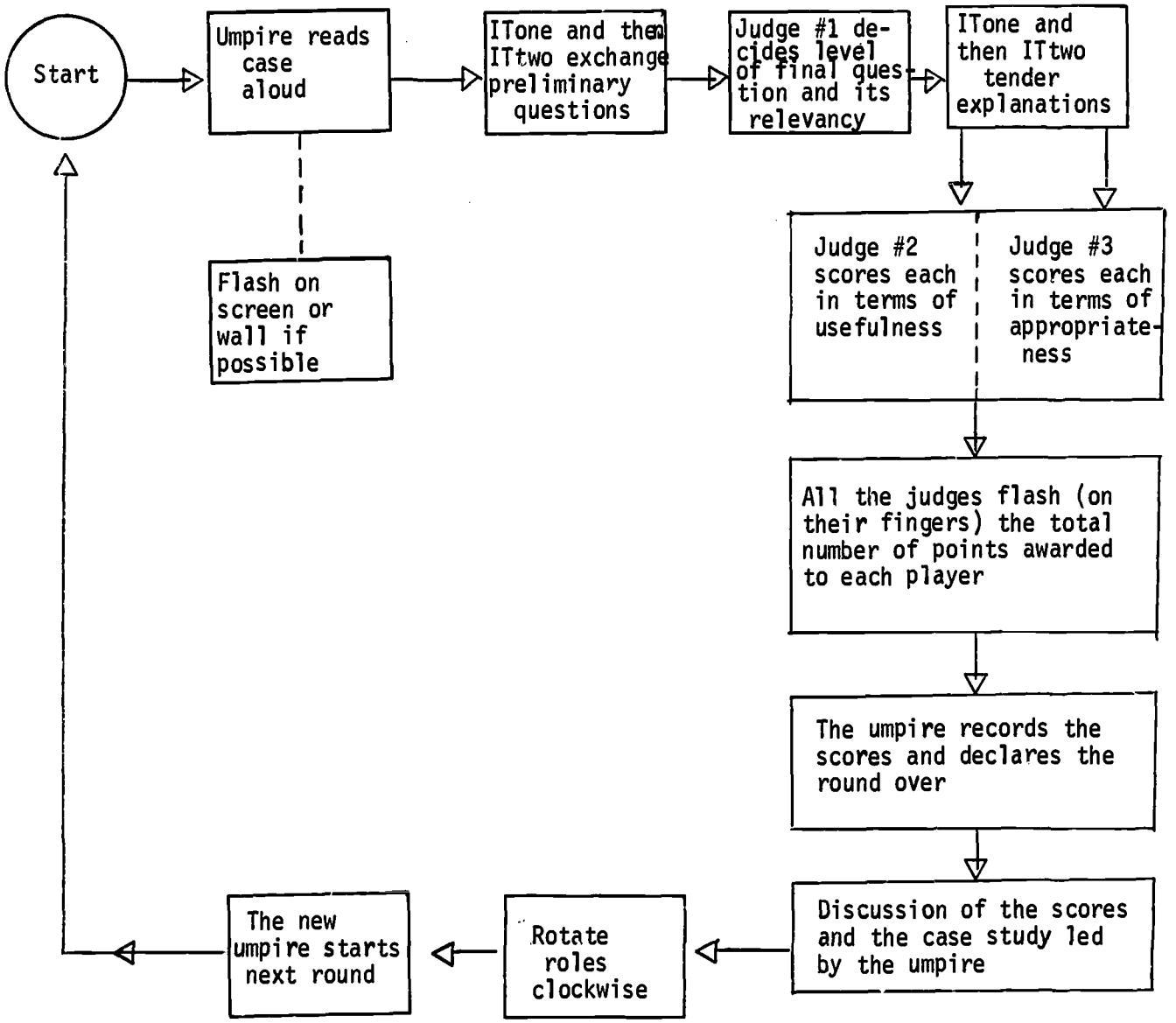
Purpose of the Game

The general objective in playing this game is to learn a variety of powerful, widely applicable theories to explain an important social problem. Two other objectives are important; to learn to form questions and to evaluate explanations. To play, one must do what Socrates did: ask clever questions and tease out explanations of puzzling information. In each case the theoretical explanation must follow the questions based on data, i.e. form follows function in the game.

Procedures

The players sit down around the table which has the case study deck in the middle. The ump faces the judges and ITone faces ITtwo.




Start
Umpire reads case aloud
Flash on screen or wall if possible
ITone and then ITtwo exchange preliminary questions
Judge #1 decides level of final question and its relevancy
ITone and then ITtwo tender explanations
Judge #2 scores each in terms of usefulness
Judge #3 scores each in terms of appropriateness
All the judges flash (on their fingers) the total number of points awarded to each player
The umpire records the scores and declares the round over
Discussion of the scores and the case study led by the umpire
Rotate roles clockwise
The new umpire starts next round

THE MATERIALS

NOTE: Before playing the game for the first time, players should identify the function of various materials.

Deck of Case Study Cards:	A series of case studies based on some theme. Each case may be explained with one or more abstract theories.
Booklet of Case Studies Keyed to Theories and Sources:	A series of case studies with one or more explanatory theories and original sources to provide the umpire with a means for helping (cueing) players and leading discussion after each round.
Evaluation Sheet #1: (Criterion-Question)	A six-level set of criteria based on cognitive processes (Bloom) which provides a standard for Judge #1 (J1) as he awards points to the best questioner. All players have a copy.
Evaluation Sheet #2: (Criterion-Usefulness of explanation)	A four-category set of criteria based on dimensions of usefulness (Meehan) which provides a standard for Judge #2 (J2) as he awards points to the best explainer. All players have a copy.

Materials - continued

Evaluation Sheet #3: (Criterion-Appropriateness of explanation)	A four-category set of criteria based on dimensions of appropriateness (Meehan) which provide a standard for Judge #3 (J3) as he awards points to the best explainer. All players have a copy.
Umpire's Record: Sheet	An expendable form to aid in keeping and tabulating the score of players as they progress.

UMPIRE: He reads the case study aloud and flashes it on a screen behind him (if possible) to aid everyone in understanding the facts of the case study. He may ask questions or make suggestions to players only to keep the pace of the game going. As the only one who possesses a copy of both case studies and explanations, he must be judicious in giving out clues. At the end of each round he leads discussions of the case study after recording the points awarded by the judges. To begin discussion he may read the "theory" aloud and check the issue of relevancy with J. He is also a time keeper and records penalties for delay of game.

ITone: and ITtwo The two players who are "IT" must ask one another three questions about the case study. Since judge #1 must decide on the best of the last questions tendered by ITone and ITtwo, it is to each's advantage to ask his final question on as high a cognitive level as possible. When each has tendered his final explanation he should make it as "useful" and "appropriate" as possible, even if the questions did not help.

Judge #1: He must listen to the case study and the final questions tendered by ITone and ITtwo. He judges relevancy and awards 2 points plus the "level" in terms of the criteria (Bloom). He makes the award and tells the umpire his choice by flashing the number of points (1-8) with his fingers.

Judge #2: He must listen to the case study and the final explanations tendered by ITone and ITtwo, then judge the explanation in terms

of the criteria (Meehan) for usefulness by telling the umpire the number of points (1-4) at the end of the round.

Judge #3: He must listen to the case study and the final explanations tendered by ITone and ITtwo, then judge the explanation in terms of the criteria (Meehan) for appropriateness by telling the umpire the number of points (1-4) at the end of the round.

NOTE: All three judges may interact with the umpire if they have difficulties in their tasks, but the judgments must be their's alone.

JUSTIFICATION

Theories can be very useful in the conduct of inquiry. They help to explain. Theories which have been developed in the various academic and scientific disciplines establish structures which aid us to attend to those facts which are likely to have a high degree of relevance in the prediction and control of social phenomena. In addition, theories provide our most powerful explanations for the concurrence of phenomena. Given a set of facts surrounding an event--a case study, if you will--a knowledgeable person can relate those facts to a theory which would account for the event. Once we have an adequate explanation for an event we have taken a big step toward predicting and controlling similar events. And so it goes in the process of inquiry.

The criteria for judging questions is based on Benjamin Bloom's Taxonomy of Educational Objectives: Cognitive Domain and the criteria for judging explanations is based on Eugene J. Meehan's Explanation in Social Science For those interested in Types or Categories of explanations aside from the game, Robert Brown's classification is reproduced on the other side of this sheet.

One of the most difficult steps learning to play the game EXPLANATION is to become generally familiar with the categories of questions and the categories of explanation. One must have these categories in mind; and, of course, in the beginning of the game there is a constant reference to them. This tends to slow down the game and perhaps takes some of the crispness out of it. An analogy might be that one has to chase the ball a good deal as he is learning to play tennis. As we "chase the balls" of EXPLANATION, what we might remember is that as we gain sophistication and skill in using the two hierarchies--that of explanation and that of questioning--we can attend, more provacatively and interestingly, to the subject matter under analysis. So let's get started and enjoy ourselves.

ROBERT BROWN'S TYPES OF EXPLANATIONS-SIMPLIFIED

Explanation: To explain why something happened, limited by the relevant information, the cause and effect relationships between factors is made understandable to the auditor.

Empirical Generalization

When a law or highly verified principle is employed to explain a factual situation in a logical manner, this type of explanation is taking place For example, the relationship of science and technology is a puzzling matter for one who asks which came first in the case of the invention of the wheel and why. An anthropological principle is that technology is a function of science in an advanced culture, and the reverse is characteristic of a primitive culture. Therefore, an explanation at this level would start with the classification of the culture as advanced or primitive at the time the event occurred. Then, applying the anthropological principle, one would deduce that in this case, the invention of the wheel led to the advancement of the science of physics, rather than the science of physics leading to the invention of the wheel. In summary, one states the rule of which the event under consideration is an instance

Functions

This type of explanation takes one of two forms. For the first form, it is only necessary to state an end to which some means is directed; no agent is necessary. An example is in the explanation of the function of a second arm in a record player. It holds a brush for removing dust and static from the record.

In the second form, it is necessary to specify how a particular function of a system is related to the whole system. An example is provided in why people throw rice on a just-married couple. It is part of the traditional symbolism of the marriage ceremony and expresses the hope for a bountiful relationship.

Dispositions

When an explanation of an event refers to implicit general tendencies and to related situational variables, this type of explanation exists. An example is apparent in explaining why the landlord insisted in going out in the rain to collect the rent. "Because, being avaricious, he can't wait to collect what is due him," explains a behavior in terms of a human tendency.

Intentions

When a statement of intentions of an agent's actions and a suggestion about his purpose or goal are made, this type of explanation exists. For example, the following explains the behavior of a hunter: "He remained still because he did not want to frighten the curious animal."

Reasons

A stated condition is given as the expressed or observed cause for a related action. An example would be that a man refused to speak to his wife during a holiday because she invited her mother to join them.

Genetic

When an origin, an origin and development or just a development is specified to explain a sequence of events leading to the present event, this type of explanation is employed. To explain why the industrial revolution occurred, one would cite the invention of the steam engine, which resulted in the development of cheap power, which led in turn to the industrial revolution.

For a thorough presentation of the categories above, see Robert Brown, EXPLANATION IN SOCIAL SCIENCE, Aldine Publishing Co., Chicago, 1963

CRITERIA FOR JUDGING QUESTIONS — Total 6 points

Questioning: Generally, to question is to inquire with the purpose of gaining information relevant to some puzzling matter. Herein, the powers to discriminate and to compose are valuable to the questioner if he wishes to aid his respondent. The purpose of questioning in the game is to aid "IT" in the discovery of his own explanation. The questioner receives higher points for questions on the upper levels of Bloom's Cognitive Taxonomy.

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6 Evaluation

When judgments depend on internal or external criteria, the test applied is one of consistency. An example: If in a historical document, a letter purported to have been written by Lincoln, mention is made of the Spanish-American War, an external error is revealed. An internal error would be reference to Teddy Roosevelt's bravery in the Philippines.

5 Synthesis

This category of question calls for creativity and imagination in the production of a unique communication, plan, set of operations, or set of abstract relations. Synthesis requires the bringing of things together to make a whole. An example might be a question which calls for relating two phenomena, "Would you explain why the decisions of Robert E. Lee to commit treason and David Farragut to remain loyal are both admired by Americans today?" Another example: Reflecting on the varying political needs of the House of Representatives Appropriations Committee members, explain their allegiance in terms of a commonly valued objective. A still different example would be, "Why did Frederick Jackson Turner's Frontier Hypothesis upset historians advocating the old germ theory of American social development?"

4 Analysis

To analyze is to break down into parts. When relevant information data is separated into constituent elements such that a hierarchy, or the relations between the parts, is made explicit, analysis has taken place. An example: "Why did economic production in the United States in 1850 tend to be quite different in the South and North?" Another question: "Why do automobile manufacturers produce only three body sizes for the many models produced each year?"

3 Application

Questions which cause the respondent to apply abstractions to explain concrete situations are in this category. The abstractions may be in the form of principles, models, or propositions. An example: "Why do children perceive, according to Gestalt theory in psychology, a fifty-cent piece as being larger than a circular piece of paper equal in size?" Another example: "Why did the social scientist preface his statement by saying 'All other things being equal?'" A final example: "Would you explain in terms of the balance-of-power theory the behavior of France in regard to testing atomic weapons?"

2 Comprehension

Questions demanding comprehension are those involving translation, interpolation, and extrapolation. Some examples of the first could be, "Can you give me an analogy in the history of civilization to the metamorphosis of a human life?" and "In explaining the functions of a federal system of government, why is the term 'federal government' misleading?" Examples of interpolation: "Considering your general knowledge of the birth rate data between 1900 and 1935 and your certain knowledge of the birth rates in 1915 and 1925, what was the birth rate in 1920?" and "What is the equation of a circle?" Extrapolation calls for questions like, "What was the birth rate in 1940?" and "As the ship has been increasing the distance traveled ten miles each day and we traveled 400 miles yesterday, how far will we go tomorrow?"

1 Knowledge (Recall)

Questions which fall in this category ask for "the remembering, either by recognition or recall, of ideas, material, or phenomena." In general, the recall of anything, concrete or abstract, belongs in this category. "What was an important historical event in 1776?" is an example. Another is, "What are the six levels of cognition in Bloom's Taxonomy?" A final example: "What was the term, still in use, created by Adam Smith to explain the coordination of a market economy?"

CRITERIA FOR JUDGING USEFULNESS — Total 4 points

Is the Explanation USEFUL in terms of: (Yes or No)

Scope? - _____

Is the range of events that it can explain as wide as possible within the limits of the concepts in the case study?

Precision? - _____

Is it as exact as possible with the concepts used in the case study? Are both the key factors and their interrelationships considered specifically?

Power? - _____

Is it powerful in the amount of control over the case study situation? Control is a function of the validity of its elements, the identification of relationships and the completeness of the two.

Reliability? - _____

Does it provide specifications for control in this case without changing the case study information?

Total _____

CRITERIA FOR JUDGING APPROPRIATENESS — Total 4 points

Is the Explanation APPROPRIATE in terms of: (Yes or No)

Isomorphism? - - - - - - - - - - - - - - - - - - _____

Is it applicable to the framework of content in the case study?

Compatibility? - - - - - - - - - - - - - - - - - _____

Is it compatible with other reasonable explanations in this case?

Predictive? - - - - - - - - - - - - - - - - - - - _____

Is it dependable as a suggestion for the conditions of the future in this case?

Purposeful? - - - - - - - - - - - - - - - - - - - _____

Does the means of intervention or plausible action implied, enable the user to achieve some specific objective?

Total _____

SCORING THE GAME FOR SIX ROUNDS

Monitor _____ Date _____ Case Studies Deck_____

1. Only the judges award points for questions and explanations.
2. Only the umpire records points. He circles the highest score.
3. Only the umpire awards penalty (deducts 3 points) for delay of game.
4. After six rounds the "last umpire" totals the scores to see who wins.

Player's Name							Com-ments

Note: Please fill in the "Student Attitude Toward Instructional Games" form after each of the game sessions.

APPENDIX B

Social Science Generalization Retrieval System:

INSTRUCTIONS

Charles H. Adair and Rodney F. Allen

Social Science Generalization Retrieval System: INSTRUCTIONS

Your are going to work with our CAI System to find generalizations that are explanations of case studies. It is necessary for you to interact with "Retrieve" for awhile before a feeling of awkwardness disappears. You will find that "Retrieve" is an able servant, not perfect, but quite willing to reveal the generalizations in any category requested. There are more than 5,300 generalizations so you must inquire by using the ten (10) categories which follow. They are in the system too but it might be helpful to have these by your side.

Whenever you find a generalization that you want to read about in its original source, note the reference number. If it has a "C" in it you will find it in a book on the shelf near you. (Example C10-32). Just choose the book and turn to page ten. If it does not have a "C" you will find the relevant pages from the original source in Xerox reproduction in the black loose leaf folders. Please do not remove from the folders. Please note the legal size paper attached. Tear it off and please make any notes on it that are of use to you. For example, when it comes time to ask a question of "Retrieve" write it down first. Then you can refer to it at will.

Ask questions of either of the two CAI Monitors by raising your hand. They will assist in any way requested.

Topic 1

1. Producing, Exchanging, Distributing, and Consuming Food, Clothing, Shelter, and Other Consumer Goods and Services.

A. Producing

1. What is produced?
2. Controlling Elements
   a. general
   b. increases
   c decreases
   d. specialization
   e factors of production
3. Agricultural production
4. Extractive production
5. Manufacturing
6. Relationship with non-economic factors

B. Exchanging

1. Extent of Trade
   a. controlling factors
   b. limiting factors
   c. stimulating factors
2. Manner of Exchange
   a. general
   b. barter
   c. medium of exchange
3. Price
4. Geographic relationships
5. International trade
6. The market

C. Distributing

1. General
2. Wages
3. Rent
4. Interest
5. Profits
6. Equality -- Inequality
7. Redistribution

D. Consuming

1. Demand
2. Income
3. Investments
4. Expenditures

TOPIC I (continued)

E. General

1. Relationship with basic human abilities
2. Interrelationships among Producing, Exchanging, Distributing and Consuming
   a general
   b. producing and consuming
   c. producing and exchanging
   d. producing and distributing
   e. consuming and exchanging
3. Institutional factors
   a social
   b. political
   c. family
4. Technology

Topic 2

2. Creating Tools, Techniques, and Social Arrangements

A. Creating
   1. General
   2. Man
   3. Need
   4 Opportunity
   5. Cultural base

B. Tools
   1. General
   2. Economic
   3. Social
      a. general
      b. symbols
      c knowledge
      d. myth
   4. Esthetic

C. Techniques
   1. General
   2 Economic
   3 Social
      a. general
      b communicating
      c. controls
      d. religions
   4. Esthetics

D. Social Arrangements
   1. General
   2. Groupings
   3. Institutions
      a. general
      b. economic
      c education
      d. government
      e. religion
      f. social controls
   4. Social change

Topic 3

3. Transporting People and Goods

A. Transportation in General
B. Historical development
C. Economic aspects of Transportation
   1. Transportation routes
      a. general
      b. roads and highways
      c water routes
   2. Transportation costs
   3 Availability of resources
   4. Specialization of production
   5. Transportation and industry
   6 Transportation demand
   7 Transportation and trade
   8 Human transportation
   9. Animal transportation
   10. Water transportation
      a general
      b ocean transportation
      c inland water transportation
   11. Air transportation
      a general
      b advantages
      c airports and airways
      d safety
   12. Highway transportation
      a. general
      b. advantages
      c. terminals
   13. Railroad transportation
      a general
      b. passenger service
D. Socio-cultural Aspects of Transportation
   1 Urban development
   2. Cultural diffusion
   3. Distribution of population
E. Political Aspects of Transportation
   1 National defense
   2 Political units
F. Geographic aspects of Transportation
   1. Climate
   2 Surface topography
   3 Location of settlements

Topic 4

4. Communicating Facts, Ideas, and Feelings

A. Purpose of Communication
   1. Effect of purpose on communication
   2. Development and preservation of a culture
   3. Sharing and acquiring meanings
   4. Achieving unity in sub-groups
   5. Acquiring and using power
   6. Emotional expression
   7. Transmitting values

B. Structure in communication media
   1. Modern mass communication
   2. Written languages
   3. Print
   4. Spoken language
   5. Linguistic structure
   6. Humor
   7. Rumor
   8. Propaganda

C. The Process of Communications
   1. The changing process
      a. general
      b. linguistic change
      c. semantic change
   2. Barriers in the process of communication
      a. general
      b. associational
      c. psychological
      d. semantic and linguistic
      e. noise in transmission
   3. Facilitation in the process of communication
   4. Coding and decoding in the process
   5. The use of signs in communication
   6. The use of words in communication
   7. Using signals in communication
   8. Using symbols in communication
   9. Levels of abstraction in communication
   10. Using a frame of reference in communication
   11. Redundancy in communication
   12. Using inferences
   13. Using controls

D. The Communicator
   1. Characteristics
   2. Acquiring a language

Topic 5

5. Protecting and Conserving Human and Natural Resources

A. Physical Elements
   1. Atmosphere, Climate and Geographic Position
   2. Oceans and Tidelands
   3. Water
   4. Water Pollution
   5. Floods and Erosion
   6. Land and Space
   7. Soil
   8. Minerals
   9. Fuels
   10. Fire

B. Biotic Elements (excluding man)
   1. Crops
   2. Grasslands and range
   3. Forests and forest products
   4. Wild flowers
   5. Fish and sea life
   6. Wildlife

C. Material Culture and Its Sanctions
   1. Agriculture
   2. Production
   3. Economics
   4. Power and energy
   5. Property
   6. Taxes
   7. Laws and regulations
   8. Research
   9. Technology
   10. Change

D. Social Institutions and Processes
   1. Family
   2. Groups
   3. Culture
   4. Institutions and formal organizations
   5. Nation
   6. Government
   7. Education
   8. International
   9. Crime
   10. War and crisis

E. Man
   1. Human beings
   2. Population
   3. Health
   4. Manpower
   5. Morality
   5. Religious and spiritual
   7. Recreation and esthetics

Topic 6

6. Organizing and Governing

A. Organization
   1. Social Organization
      a. function and purpose
      b. determinants
      c. product
      d. control
   2. Social Institution
      a. function and purpose
      b. determinants
      c. product
   3. Social Association
      a. function and purpose
      b. determinants
      c. product
   4. Group Association
      a. primary
      b. family
      c. secondary
   5. Quality of Relationship
      a. competition
      b. cooperation
      c. cooperation, competition and conflict
      d. conflict

B. Governing
   1. Purpose and function
   2. Determinants
   3. Product
   4. Control
   5. Ideology
   6. Reorganization

Topic 7

7. Providing Education

   A. Attitudes and values
   B. Curriculum
   C. Educational systems
   D. Group influences
      1. Family
      2. Other groups
   E. Interaction
   F. Purposes and goals
   G. Socio-Cultural influences
   H. Symbolization-Communications
   I. Teaching-Learning process
   J. Transfer

Topic 8

8. Providing Recreation

A. Characteristics of recreation
   1. General characteristics
   2. Importance
B. Historical aspects of recreation
C. Social aspects of recreation
   1. Influence of the culture on recreation
   2. Community type of recreation
   3. Social change and leisure
   4. Socialization through recreation
   5. Interpersonal association and groups
   6. The church and recreation
   7. The family and recreation
   8 Industrial-occupation provision of recreation
   9. Organized community recreation
   10. Commercial recreation
   11. Recreation in primitive societies
D. Politico-economic aspects of recreation
E. Bio-Psychological aspects of recreation
   1. Biological aspects
   2. Psychological aspects
F. Geographic influences on recreation
G. Specific recreational forms

Topic 9

9. Expressing Religious Impulses

A. Intellectual religious expression
   1. General
   2. Myth and doctrine
   3. Belief and tradition
   4 Symbolism
   5 Salvation
B. Cultic religious expression
   1. General
   2. Cultic integration
   3. Cultic change
   4. Group worship
   5. Prayer
   6. Objects of worship
      a general
      b nature
      c supernatural
      d God(s) and/or absolute reality
      e other objects of worship
   7 Sacredness
C. Organizational religious expression
   1. General
   2. Identical socio-religious groups
      a general
      b family and kinship groups
      c. parochial groups
      d ecumenical groups
   3. Specifically religious groups
      a general
      b the mystery society
      c the higher religion
      d the church
      e the sect
   4. Religious leadership
      a general
      b. the priesthood
      c the founder
      d prophets, reformers, and saints
D. Dimensions of religious expression
   1. The Spacial Dimension
   2. The Temporal Dimension
   3. The Valuational Dimension
E. Institutional Interrelationships
   1. The arts and religion
   2. Culture and religion
   3 Economics and religion
   4. Politics and religion

Topic 10

10. Expressing and Satisfying Esthetic Needs and Impulses

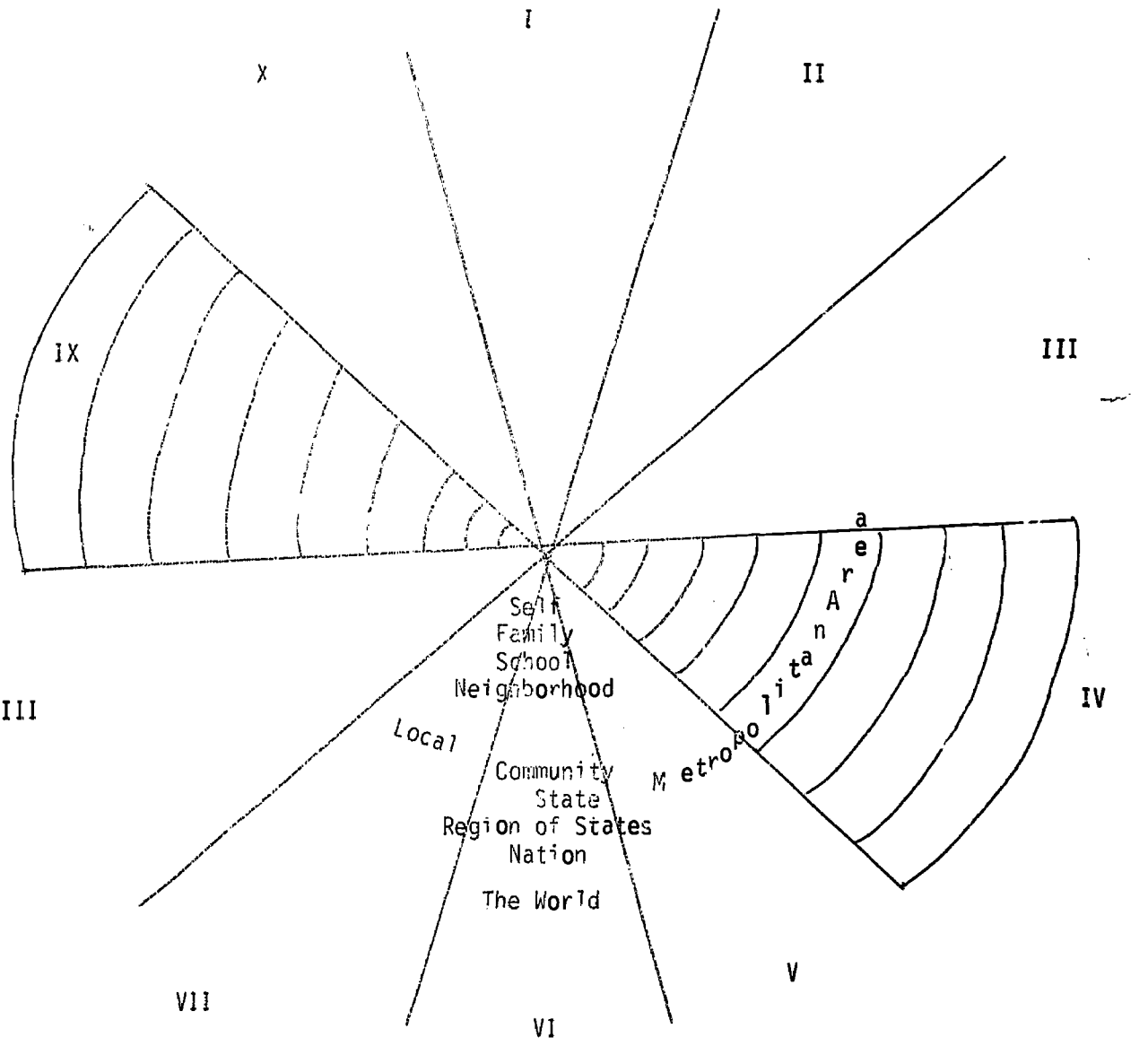
A. General
   1. Universality
   2. Need for esthetic expression
   3. Art as a part of life
   4. The esthetic experience
   5. Esthetic appreciation
   6. Beauty: basis for esthetic values
   7. Valuation
   8. Changes in the arts
   9. Separation between fine and applied
   10. Imagery
   11. Creativity

B. Art and Social Institutions
   1. Art and economics
   2. Religion
   3. Social control
   4. Control of art

C. Art and Society
   1. Art and culture
   2. Art and the home
   3. Art and the community
   4. Social status
   5. Artists as a group
   6. Communications
   7. Expression
   8. Emotion
   9. Symbols

D. Elements of Esthetics
   1. General
   2. Medium (art media)
   3. Style (individual expression)
   4. Design (esthetic factors of plan)
   5. Form and function
   6. Unity and variety
   7. Balance (harmony between parts)
   8. Spacial organization
   9. Rhythm
   10. Ornament

E. Art Forms
   1. Literature
   2. Music
   3. Dance
   4. Drama
   5. Handcraft
   6. Architecture
   7. Industrial arts and design
   8. Commercial art
   9. Sculpture
   10. Painting



Ten Basic Human Activities

I. Producing, Exchanging, Distributing and Consuming Food, Clothing, Shelter and Other Consumer Goods and Services.
II. Creating Tools, Techniques and Social Arrangements
III. Transporting People and Goods
IV. Communicating Facts, Ideas and Feelings.
V. Protecting and Conserving Human and Natural Resources.
VI. Organizing and Governing
VII. Providing Education
VIII. Providing Recreation
IX. Expressing Religious Impulses
X. Expressing and Satisfying Esthetic Needs and Impulses

APPENDIX C

STUDENT ATTITUDE TOWARD INSTRUCTIONAL GAMES

Charles H. Adair and Rodney F. Allen

STUDENT ATTITUDE TOWARD INSTRUCTIONAL GAMES

This is not a test of information; therefore, there is no one "right" answer to a question. We are interested in your opinion on each of the statements below. Your opinions will be strictly confidential. Do not hesitate to put down exactly how you feel about each item. We are seeking information, not compliments; please be frank.

NAME:_____DATE_____

NAME OF COURSE_____

CIRCLE THE RESPONSE THAT MOST NEARLY REPRESENTS YOUR REACTION TO EACH OF THE STATEMENTS BELOW:

1. As a change of pace from usual classroom learning the game was welcome.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

2. All of the students enjoyed this game.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

3. I would rather learn the material some other way than games.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

4. I would choose to play the game rather than participate in a group discussion on the topic.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

5. The time spent playing this game was completely wasted.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

6. There is a definite need for instructional games.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

7 The value of games is overestimated by some people.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

8. I would prefer playing this game to playing a non-instructional game that I personally enjoy such as bridge, chess or poker.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

9. In preference to lectures on the same subject, I would like to try more learning games.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

10. The game was stimulating.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

11. Only a few of the students enjoy this game.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

12. Universities should use class time for games.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

13. The game I just played was interesting

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

14. Instructional games should be considered a valuable part of this course.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

15. I was inspired by this game to make full use of my capabilities.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

16. The experience was not particularly beneficial.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

17. In view of the amount of time involved, I feel too little was accomplished.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

18. This game increased my knowledge in this subject area.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

19. I found it difficult to concentrate on learning anything.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

20. I would have learned more from a lecture.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

21. I learn more from games than from individual study.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

22. I learn more from games than from group discussion.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

23. The students don't remember anything they learned in the game.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

24. While playing the game I had moments of great insights.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

25. Playing games such as this one is the most effective way to learn new concepts.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

26. Games do not provide the necessary motivation to learn the subject.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

27. This game is not worth the time and effort to play it.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

28. I was not conscious of time passing.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

29. I was aware of game and implications but did not enjoy time spent.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

30. Games are fun to me

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

31. Games make me feel uncomfortable and irritable.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

32. My liking for games outweighs my disliking.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

33. When I hear the word "game", I have a feeling of dislike.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

34. I approach games with a feeling of hesitation, resulting from fear of doing poorly.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

35. The feeling I have toward games is a good feeling.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

36. I feel a definite positive reaction to games.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

37. Games make me feel lost.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

38. Games are something I've never enjoyed.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

39. I don't like to play games.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

40. I like games that are challenging.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

41. The material covered by this game was uninteresting.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

42. I'll remember what I learned in the game.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

43. After graduation, the information obtained from this game will be valuable.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

44. I don't know any more than when I started.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

45. I learned while playing but it was hard work.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

46. This game has no influence upon the students.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

47. I played because I had to.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

48. I felt like getting involved in game playing.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

49. I didn't apply myself.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

50. I'd cut class if I thought we were going to play again.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

51. I felt like learning the concepts so I could play the game better.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

52. I worked hard playing the game.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

53. This game didn't suit the situation.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

54. When the game got difficult, I gave up.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

55. I wasn't bothered about learning anything while I was playing the game.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

56. It is important to play well.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

57. I found myself just trying to get through the game rather than trying to learn.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

58. It was difficult to become motivated within the game context.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

59. I felt insecure playing the game.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

60. I felt at ease playing the game.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

61. I was under a strain while playing the game.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

62. As I got into the game, I learned painlessly.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

63. My mind went blank and I was unable to think when playing the game.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

64. I felt the role I played was very unnatural.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

65. This was a confusing game.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

66. I wasn't satisfied with how I played the game.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

67. I didn't know what I was doing during the game.

:	:	:	:	:
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

APPENDIX D

STUDENT ATTITUDE TOWARD INFORMATION RETRIEVAL

Charles H. Adair and Rodney F. Allen

STUDENT ATTITUDE TOWARD INFORMATION RETRIEVAL

(Information Retrieval will be referred to as IR)

This is not a test of information; therefore, there is no one "right" answer to a question We are interested in your opinion on each of the statements below Your opinions will be strictly confidential. Do not hesitate to put down exactly how you feel about each item. We are seeking information, not compliments; please be frank.

NAME:_____DATE_____

NAME OF COURSE_____

CIRCLE THE RESPONSE THAT MOST NEARLY REPRESENTS YOUR REACTION TO EACH OF THE STATEMENTS BELOW:

1. As a change of pace from usual classroom activities using the IR system was welcome.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

2. I would rather find the material some other way than using IR.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

3. I would choose to use IR systems rather than participate in a group discussion on the topic.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

4. The time spent learning to use the IR system was completely wasted.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

5. There is a definite need for IR system.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

6. The value of IR is overestimated by some people.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

7. The material covered by IR was uninteresting.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

8. In preference to lectures on the same subject, I would like to try using more IR.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

9. Using the IR system was stimulating.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

10. Universities should teach IR.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

11. The IR system I just learned about was interesting.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

12. I don't like IR systems.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

13. Learning to use IR systems should be considered a valuable part of this course

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

14. The experience was not particularly beneficial.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

15. Using the IR system increased my knowledge in this subject area.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

16. I found it difficult to concentrate on learning anything.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

17. I would have learned more from a lecture.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

18. After graduation, the information obtained from using the IR system will be valuable.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

19. I don't know any more than when I started.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

20. I learn more from using the IR system than from individual study.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

21. I learned while using the IR system but it was hard work.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

22. I learn more from using the IR system than from group discussion.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

23. Using IR systems is the most effective way to find references.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

24. Using IR does not provide the necessary motivation to learn the subject.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

25. I felt like learning the concepts so I could use the IR system.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

26. I felt unsure using the IR system.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

27. I approach learning new techniques such as IR with a feeling of hesitation, resulting from fear of doing poorly.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

28. I was under a strain while learning to use the IR system.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

29. The IR system was confusing.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

30. My mind went blank and I was unable to think when using the IR system.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

31. I worked hard learning the IR system.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

32. I was not conscious of time passing.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

33. I didn't apply myself.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

34. I was inspired by using the IR system to make full use of my capabilities.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

35. I'll remember what I learned from using the IR system.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

36. In view of the amount of time involved, I feel too little was accomplished.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

37. The students don't remember anything they learned using the IR system.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

38. While using the IR system I had moments of great insights.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

39. I studied because I had to.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

APPENDIX E

A Sample of Generalizations in IR System

Charles H. Adair and Rodney F. Allen

A Sample of Generalizations in IR System

01-05031-496A Some normative definition and regulation of economic
01-05031-496B activity is present in every society, social controversy
01-05031-496C arises over the amount and kind of regulation - It is not
01-05031-496D a simple matter of regimentation versus freedom. c/12-501.

02-03040-182A Art arises out of man's need to create for himself
02-03040-182B ---a meaningful and valuable world. 2/41-104 2/45-16
2/41-438

07-08000-180A Speech itself has to develop in the slow, primitive fashion,
07-08000-180B but, once it is acquired, other learning is greatly speeded.
c/5-210

09-02024-180A The emergence of a new faith--and the rejection of the
09-02024-180B traditional cult--affects all fields of expression of
09-02024-180C religious experience, theology, cult and organization
9/44-307

APPENDIX F

CASE STUDY

Charles H. Adair and Rodney F. Allen

Case Study

Having missed the bus, Mr. Downs walked to the middle of the street toward home. He marveled at the beauty of the converging sidewalks and balanced rows of trees. In the quiet of early morning he observed the symmetry of church steeples and roofs, parabolic arcs of wires overhead and matching cannon in front of the courthouse. For the first time he noticed the grace of the old public building with its silent, grey columns and wings, projecting equally from either side of the building. He felt at ease.

Example of question asked by a S in IR system on the basis of above case study, and the generalization Ss chose, as adequate explanation to his question.

Question: What is it about the symmetry and balance in architecture that makes us feel at ease?

Explanation: Balance, probably the major principle in design, plays an important part in our reaction to art. A sense of stability, permanence and equilibrium is sought by everyone.