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OPERATIONALIZING A TEST OF A MODEL OF THE USE OF SIMULATION GAMES AND EXPERIENTIAL EXERCISES

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ABSTRACT

The authors propose an addition of two important dependent variables: Student Learning and Student Attitudes, to a previously-reported model of the use of simulation games and experiential exercises. Additionally, a research design proposal is tendered for ABSEL members' inspection and criticisms. The authors specify the anticipated operationalizations of variables, tests for reliability and validity, and the general analysis of the model's postulated relationships. The paper is couched as a necessary step intermediate to theorizing and empirical hypothesis tests.

INTRODUCTION

Burns and Gentry (1977, 1980) have attempted to specify a number of variables assumed critical to the success of simulation games and experiential exercises and place these variables in a causal framework, Their conclusion, arrived at through causal modeling, was that "user Involvement" is the most crucial variable of the twenty-five specified, as it is hypothesized to relate, either directly or indirectly, to all others. However, the model proposed by Burns and Gentry (1980a) considers only independent variables and fails to explicitly relate the independent variables to salient dependent variables: namely, student learning and student attitudes. Recently, Burns and Gentry (1980b) have restructured the hypothesized linkages between the independent variables and postulated impacts on these the dependent variables. Given that the model has been hypothesized, the logical next step is to test the hypothesized relationships empirically.

This paper will focus on a necessary intermediate step between theorizing and hypothesis testing that of developing the research design. Admittedly, it is tempting to go ahead and acquire data from users and participants; however, the intent of this paper is to propose a comprehensive research design that would preclude a "quick and dirty" data collection effort. Given the care taken in the development of this topic thus far, it would be inconsistent to ignore the tenets of proper research. Moreover, an earlier attempt (Gentry, McCain, and Burns, 1979) to operationalize the Bloom taxonomy (Bloom et. al., 1956) showed vividly that the operationalization stage is critical in educational research, for the results indicated a high level of confusion as to the nature of the underlying concepts. Consequently, rather than to rush the data collection process and obtain data of questionable value, our intent is to use this paper to introduce our proposed methodology with the objective of electing constructive feedback from ABSEL members.

DEPENDENT VARIABLES IN TME MODEL

Burns arid Gentry (1977) described the independent variables hypothesized to be related to the effectiveness of simulation games and experiential exercises. These brief descriptions are provided in Figure 1. The two dependent variables, Learning end Attitude, are discussed below.

FIGURE 1

OPERATIONALIZATIONS OF THE VARIABLES

NATURE VARIABLES

Variable	Description
Duration:	How long the exercise lasts: number of decision phases, number of days, or weeks it takes the exercise to run
Decision Variables:	Absolute number of decisions or phases over the Duration
Results Sharing:	Degree to which participants formally share the results of their game or exercise experiences with one another
Participant Grouping:	Number of participants in a group
Course Integration:	Amount of time devoted to the exercise, administration, and teaching related concepts

CONDUCT VARIABLES

Variable	Description
Accountability:	Ability to relate individual results/learning to exercise decisions/performance
Autonomy:	Individual responsibility for performance versus group consensus decisions
Participant Involvement:	Amount of time required (per week or semester) for the average participant
User Involvement:	Amount of time required (per week or semester) in teaching and administering the game and evaluation of participants

CONCEPT VARIABLES

Variable	Description
Complexity:	Simplicity of the concept versus its complexity; the ease with which the concept(s) is understood
Theoretical Nature:	Degree of abstraction in the concept; pragmatic (operational) versus theoretical concepts
Functional/ Environmental Scope:	Number of business functions and outside considerations involved
Precision:	Imprecise (implicit) versus precise (explicit) relationship of concepts to business decisions in the exercise
Stochasticism:	Degree of random variation in the concept(s) versus degree of determination in the concept(s)
Number:	Number of concepts or subconcepts to be taught or used

STUDENT ATTRIBUTES VARIABLES

Variable	Description
Ability to Learn:	Capability of participants to learn due to intellectual level and situational factors
Willingness to Learn:	Attitude toward learning, positive to negative
Ability to Participate:	Amount of outside interests, obligations or other constraints on participants' time
Willingness to Participate:	Attitude toward participating, positive to negative
Number:	Number of students in the class

USER ATTRIBUTES VARIABLES

Variable	Description
Motive for Use:	Self-serving versus student-serving motive
Familiarity with Topic:	Number of years user has studied, taught or worked with the topic
Teaching Philosophy:	Amount of effort expected of the student in the course
Choice Set:	Awareness of other exercises which could accomplish the same or similar ends
Resource Base:	Amount of resources available for running the exercise

Learning - One must assume that the educational system exists to develop the student. As such, learning is critical variable of concern when measuring the effectiveness of a particular teaching methodology The operationalization of "learning" poses difficult measurement problems, however, many different measures have been used to represent "learning," including: simulation game or exercise performance, objective test performance, course grade, and self-reports. In fact, the definition and measurement of learning proves to be an elusive goal. Confounding occurs in most instances. For example, simulation or exercise performance measures both knowledge of the concepts and am understanding of the game itself. The use of standardized tests dealing with the general course topic removes this problem, but introduces others. One such problem occurs when the teaching methodology is used with one objective in mind, and the test measures performance not directly related to it.

Bloom et al. (1956) developed a classification system of six different levels of learning. The Bloom hierarchy structures learning in progressive strata: Basic Knowledge, Comprehension, Application, Analysis, Objective Synthesis, and Objective Evaluation. Figure 2 summarizes each level. It is not uncommon to find an objective test emphasizing Basic Knowledge being used to measure learning in a course in which simulation game was employed. As the objective of simulation game would be Application or possibly Analysis, it follows that Basic Knowledge measures are inappropriate.

Figure 2

BLOOM'S TAXONOMY

Learning Objectives	Description of the Learning	Student is Assessed by:
1. Basic Knowledge	Student recalls or recognizes information	Answers to direct questions and multiple choice tests.
2. Comprehension	Student changes information into a different symbolic form	Ability to act upon or process information by restating material in his/her own words.
3. Application	Student discovers relationships, generalizations and skills	Application of knowledge to simulated problems.
4. Analysis	Student solves problems in light of conscious knowledge of the relationship between components and the principle that organizes the system	Identification of critical assumptions, alternatives and constraints in a problem situation.
5. Objective Synthesis	Student goes beyond what is known, providing new insights	Solution of a problem that requires original, creative thinking.
6. Objective Evaluation	Student develops the ability to create standards of judgment, to weigh, and to analyze	Logical consistency and attention to detail.

Clearly, the level of learning sought should be determined very early. If, in fact, the purpose of the course is to provide an awareness of the general topic area, then methodologies aimed at higher levels of learning may be counter-productive. On the other, if the objective is to improve the student's ability to apply the concepts, the use of multiple choice questions from the typical instructor's manual is also inappropriate. Consequently, one must be extremely careful in how he/she defines the dependent variable "learning." in short, the chosen pedagogy must be attuned to learning objectives and results measured by proper tests.

Attitude - "Attitude" refers primarily to the student's affective reaction to the teaching methodology, although the term is often used to encompass the affective reactions to the instructor or to the course. Student attitudes have also received a great deal of attention for several reasons. One reason is that student attitudes are often postulated as an intervening variable between the pedagogy and learning; highly motivated students are likely to learn more. A second reason for the emphasis on attitudes is their use as the measure of teaching ability (in the form of teacher evaluations) in administrative reviews of faculty. Student attitudes, then, represent a tangle of reactions to pedagogy, teacher attributes, and course context. Seemingly inexorable interactions undoubtedly exist.

A relevant consideration is the temporal aspect of the measurement. Most measures are taken either after the termination of a particular exercise or at the termination of the course. Lt has been argued that the proper time to measure the perceived effectiveness of teaching methodology is after the student has been in the business world for a few years. While the authors agree that perceptions are more valid after some period of time has elapsed, we will concentrate on a measure of attitude taken in the short run due to:
(1) the greater feasibility of measurement and (2) the necessity of short-term feedback in most pedagogy decisions.

PROPOSED RESEARCH DESIGN

The study will consist generally of surveying (1) faculty and (2) students, using the questionnaire shown in general for in Appendix A (Faculty version). The questionnaire represents our proposed operationalization of the Several variables under study.

Faculty Population. Many of the independent variables arid, in fact, the 1980 version of the model (Burns and Gentry, 1980) have an instructor-orientation; that is, the effectiveness of the particular teaching methodology is evaluated by the instructor. Consequently, a survey of faculty using simulation games and experiential exercises will be made. While the model of the use of the methodologies is proposed as a general one, we hypothesize that the strength of the relationships will vary according to the following variables:

Methodology Used: Simulation Games vs. Experiential Exercise
Duration of the Exercise: Short vs. Long Scope of the Exercise: Operational vs. Strategic Nature of the Exercise: Stochastic vs. Deterministic

Student Population: While faculty have their own perceptions of the effectiveness of their teaching approaches, students must be studied inasmuch as the dependent variables consider their learning and their attitudes. Moreover, it is highly likely that there will be discrepancies between faculty and student perceptions of the various variables (even the ones that can be measured objectively, such as the number of decision variables, the duration, the number of students, the resource base, etc.) due to the different frames of reference.

Also, nature of the relationships found among the variables are hypothesized to vary with the following student-related factors (as well as those specified for the faculty population):

Background: Business vs. Non-Business Major
Level: Freshman-Sophomore vs. Junior vs. Senior vs. Graduate Student
Sex: Male vs. Female

Time Status: Part-time vs. Full-time

Sample Design. We propose to use the ABSEL membership as a first source of faculty responses (and student responses, as we will ask certain ABSEL members to survey their students). Unless sufficient responses are obtained for all of the various cells, we will sample using adoption lists for simulation games and experiential exercises from cells needing more response.

Proposed Analysis. Proper instrument development procedures dictate that the measuring device be assessed for reliability and validity. A customary approach to these concerns is the multitrait-multimethod matrix method advocated by Campbell and Fiske (1959) . Essentially. this approach requires that reliability be ascertained through test-retest procedures. Validity is apparent when high, positive correlations are deter- mined for the same variable as measured by maximally different methods. The issue at hand, then, becomes the determination of methods which are sufficiently dissimilar yet comparable.

Were it not for the previously stated belief in the differences in the perceptions of faculty users and students, it would have been acceptable to consider the two populations as dissimilar methods. However, the contention requires that reliability and validity be determined within populations. We propose to draw subsamples in addition to the primary sample from each population and to administer instruments with different wording and different response scales. Thus, convergent validity will be assessed with test-retest measures.

Upon satisfactory results from the reliability and validity measurement phase (We realize that this phase may require a number of iterations.), attention will turn to tests of the various postulates and hypotheses within the general model. The model, one will recall, is a set of expected causal interactions among the several variables. Unfortunately, the huge aggregation of variables and relationships renders experimentation impractical; consequently, it is necessary to look to some other device for aid. It would seem that the most likely candidate in this regard is path analysis, which has been used unsuccessfully to isolate causal relationships in associative data.

CONCLUDING COMMENTS

The reader may experience frustration with our description of the proposed analysis; however, it is the intent of this paper to focus attention on the operationalizations of variables proposed research design. In this interest, we earnestly solicit the aid of ABSEL members and interested others in the critical evaluation of our instrument and basic procedure. It is our firm intention to incorporate constructive criticisms and useful suggestions in questionnaire revision before field tests commence. At the same time. any observations or shared experiences by ASSEL members with regard to the expected differences in perceptions within and between the two populations under study will be appreciated. We anticipate a comprehensive progress report for ABSEL next year as the next step in our long- term, programmatic effort to isolate the salient variables and relationships in the successful use of simulation games and experiential exercises.

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APPENDIX
QUESTIONNAIRE DRAFT

SIMULATION/EXPERIENTIAL EXERCISE SURVEY

Introduction

This questionnaire is part of a study on the use of simulation games and experiential exercises by College of Business faculty members. You may be a user of one or both of these types of learning facilitators. The purpose of the study will be best served if you will please select the one simulation game or experiential learning exercise with which you are most familiar. Ideally, we would hope that you would select the one simulation game or experiential learning exercise which you have used most often in your teaching of undergraduate business courses. As you answer all of the questions on this questionnaire please think only of that particular game or exercise.

Questions

1. Please check whether or not the learning facilitator you are thinking of as you answer the questions in this questionnaire is:

_____ Computer simulation,

_____ Experiential exercise, or

_____ Other (Specify; _____)

2. Please jot down a brief description of the game or exercise you have in mind.

3a. Check the functional area for which this game or exercise is primarily used.

_____ Accounting

_____ Business Policy

_____ Economics

_____ Management

_____ Marketing

_____ Quantitative Analysis

_____ Other (Specify; _____)

3b. Check the level(s) of the course in which this game or exercise is typically used.

(Check One)	(Check One)	(Check One)
_____ Undergraduate	_____ Introductory	_____ Required
_____ Graduate	_____ Advanced	_____ Elective
_____ Both		

4. Please indicate the approximate number of class days the exercise or game normally covers.

_____ class days

5. Or the average, how many decision variables do players decide per period.

_____ decision variables

6. Approximately how many students are placed on a team participating in the game or exercise? (If none, indicate "1" for one student per team)

_____

7. During normal conduct of the exercise or game, approximately how much do competing participants _share results_ from their individual experiences? (Check one)

_____ None whatsoever
_____ A limited amount
_____ A fair amount
_____ Almost everything
_____ Everything

8. Please indicate the approximate number of hours that you devote to each of the following tasks in the typical use of the game or exercise.

    a. Approximate hours for orientation: _____ hours
    b. Approximate hours for game administration: _____ hours
    c. Approximate hours for decision making: _____ hours
    d. Approximate hours for teaching related concepts: _____ hours
    e. Approximate for "other": _____ hours

9. On the average, in the conduct of this game or exercise, which of the following items indicates the amount of individual accountability for the typical student participant? (Check one)

_____ No accountability whatsoever
_____ Limited accountability
_____ Fair amount of accountability
_____ A considerable amount of accountability
_____ Complete accountability

10. For each individual student participant, approximately how much individual responsibility is there for the performance of the "team"? (Check one)

_____ No responsibility whatsoever
_____ Limited responsibility
_____ Fair amount of responsibility
_____ A considerable amount of responsibility
_____ Complete responsibility

11. Approximately how much amount of time per semester (or, per quarter, if it applies) does the average student spend, both in class and out of class, being involved with the game or exercise? _____ total hours.

12. Approximately how much amount of time per semester (or, per quarter, if it applies) do you personally devote to the teaching and administering of the game and evaluation of participants? _____ total hours.

13. Approximately how many _business concepts_ (e.g., span of control, economic order size, forecasting) are demonstrated, applied, or taught by this game or exercise? _____ business concepts.

14. On the average, how complex are these business concepts involved in the game or exercise? (Check one)

_____ Very simple concepts
_____ Simple concepts
_____ Somewhat complicated concepts
_____ Complex concepts
_____ Very complex concepts

15. Approximately how many separate business functional areas (e.e., accounting and finance would be two functional areas) are involved in this game or exercise? _____ total business function areas.

16. Approximately how many subfunctional areas are involved in this game or exercise (i.e., personnel and organizational development would be two subjunctional areas) _____

17. Approximately how many environmental factors (e.g., government regulation, consumer environmental factors. _____

18. On the average, how _theoretical_ are the business concepts involved in this game or exercise? (Check one)

_____ No theory whatsoever
_____ A limited amount of theory
_____ Some theory
_____ Considerable theory
_____ Completely theoretical

19. How closely related are the concepts in the game or exercise related to real-world business decisions? (Check one of the following)

_____ Almost no close relationship
_____ Very little close relationship
_____ Somewhat closely related
_____ Moderately related
_____ Very closely related

20. Please use the following scale to indicate the amount of random variation involved in the game or exercise. It has. . .

_____ Almost no random variation (i.e., deterministic)
_____ A limited amount of random variation
_____ Some random variation
_____ A great deal at random variation
_____ A very great deal of random variation (i.e., stockastic)

21. On a scale of 1 to 10, where 1 equals very little ability to learn and 10 equals a very great ability to learn, please indicate the capability of your average student participant to learn. (Please write in a number from 1 to 10 in the space below..

_____

22. On a scale of 1 to 10, where 1 equals very little willingness to learn and 10 equals a very great willingness to learn, please indicate the willingness of your average student participant to learn. (Please write in a number from 1 to 10 in the space below.)

_____

23. Sometimes students have difficulty participating in games or exercises due to extracurriculum activities, work, commuting, etc. On a scale of 1 to 10, where 1 equals very little ability to participate and 10 equals a very great ability to participate, please indicate the capability of your average student participant to participate in the game or exercise. (Please write in a number from 1 to 10 in the space below.)

_____

24. On a scale of 1 to 10, where 1 equals very little willingness to participate and 10 equals a very great willingness to participate please indicate the willingness of your average student participant to participate in the game or exercise. (Please write in a number from 1 to 10 in the space below.)

_____

25. Please indicate the approximate number of students in an average class section in which you use this particular game or exercise. _____ students per class section

26. Please indicate on a scale of 1 to 10, where 1 equals very little familiarity and 10 equals total familiarity, your familiarity with the business concepts involved with this particular game or exercise. (Please write in a number from 1 to 10 in the space below.)

_____

27. Approximately how many hours of time do you expect the average student in the particular course in which you are using this game or exercise to spend on the _entire course_ per week. "Total time" includes time preparing for classes, time in classes, and time devoted to the learning of course material. _____ total hours per week

28. Please indicate the number of other exercises or games of which you are aware which could have accomplish the same or very similar ends as those accomplished by the game or exercise you are using now. _____ other exercises or games

29. Approximately how many of your Graduate Assistant's hours are spent on this game or exercise in a typical week? (If you do not have a Graduate Assistant, indicate 0) _____ total hours per week.

30. Approximately how many of your Undergraduate Assistant's hours are spent on this game or exercise in a typical week? (If you do not an Undergraduate Assistant, indicate 0) _____ total hours per week.

31. Approximately how many of your departmental secretary's hours are spent on this game or exercise in a typical week? _____ total hours per week.

32. Approximately how many hours of any other invulaed individuals are spent on this game or exercise in a typical week? _____ total hours per week.

33. To what extent is your use of this game or exercise is a facilitator of student learning in your course? (Check one of the following)

_____ Almost no extent whatsoever
_____ To a little extent
_____ To some extent
_____ To a considerable extent
_____ To a very great extent

34. To what extent is your use of this game or exercise is a facilitator of your own personal career goals? (Check one of the following)

_____ Almost no extent whatsoever
_____ To a little extent
_____ To some extent
_____ To a considerable extent
_____ To a very great extent

Classification Information

1. With regard to this game or exercise did you: (Check one)

_____ design it   _____ adopt it   _____ modify it

2. For approximately how many total semesters or quarters have you used this particular game or exercise? _____ semester or quarters

3. Your highest degree held? (Check one)

_____ Masters
_____ Doctorate
_____ Post Doctorate
_____ Other (Specify: _____)

4. What is your normal course and section load?

_____ courses   _____ total sections   per (check one) ___ semester
                                                        ___ quarter

5. Is the course in which you primarily use the game or exercise? (Check one)

_____ required of all business majors
_____ required of all majors in a particular business function
_____ an elective course

6. Please indicate the year of your most recent degree. _____

7. Please indicate the approximate total number of papers or articles you
   have given or have had accepted in each of the following:

   a. Referred journals   _____
   b. National proceedings   _____
   c. Regional proceedings   _____
   d. Unrefereed journals   _____

8. Please indicate the approximate emphasis on each of the following
   types of learning effected through this game or exercise.

Learning Objectives	Description of the learning	Amount of emphasis (Circle one) Very little / Some / Moderate / Considerable / Great
a. Basic Knowledge	Student recalls or recognizes information	1 2 3 4 5
b. Comprehension	Student changes information into a his/her own frame of reference	1 2 3 4 5
c. Application	Student discovers relationships generalizations and skills	1 2 3 4 5
d. Analysis	Student solves problems in light of conscious knowledge of the relationship between components and principles organizing the system.	1 2 3 4 5
e. Objective Synthesis	Student goes beyond what is known, providing new insights	1 2 3 4 5
f. Objective Evaluation	Student develops the ability to create standards of judgement, to weigh and to analyze	1 2 3 4 5

9. Please indicate your frank opinion of the average student's
   reaction to the game or exercise and the teaching methodology
   you employ in the use of this game or exercise (Check one of
   the following)

_____ Enjoys it almost not at all
_____ Enjoys it very little
_____ Enjoys it somewhat
_____ Enjoys it considerably
_____ Enjoys it immensely

Thank you very much for helping in this survey. Please place the
completed questionnaire in the attached self-addressed, postage
paid envelope and drop it in the mail.