Developments in Business Simulation & Experiential Exercises, Volume 8, 1981

BUSINESS GAME DESIGN: FROM THEORY TO PRACTICE

Jerald R. Smith, University of Louisville

ABSTRACT

This paper discusses the current State of the art of business simulation game design including theory and practice. A new simulation, PERSMAN: A Personnel Management Game, will be introduced and discussed. The player of this simulation will assume the position of a newly appointed personnel director of an organization of approximately 650 employees.

INTRODUCTION

While it might appear that there are scores of business games to meet the needs of teachers in almost any business area, there is always that one professor. like myself, that thinks he/she can design "a better mousetrap." In the case at hand there appeared to be a need for a simulation in the personnel management field. This paper will attempt to describe the thinking and planning that was involved in creating a new simulation, PERSMM; it is hoped this sharing of ideas and theory will aid the next innovator as he/she attempts this Herculean task. The first step in designing a game is to determine what educational objectives are desired.

RESEARCH AND PRACTICE

Bloom (et al) has suggested a classification of educational objectives consisting of three major domains: cognitive, affective, and psychomotor[1]. The first two are of importance in gaming. The cognitive domain includes those objectives that deal with the recall or recognition of learned material and the development of intellectual abilities and skills; the largest proportion of educational objectives fall into the cognitive domain. The affective domain includes objectives that emphasize interests, attitudes, and values. The taxonomy of objectives in the cognitive domain categorizes behavior into six hierarchical categories from simple to complex as illustrated below.

Evaluation
Synthesis
Analysis
Application
Comprehension
Knowledge
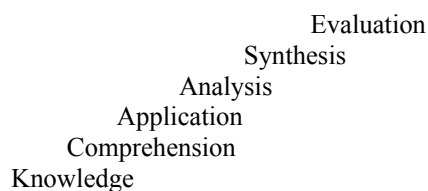
The rationale for the hierarchy is based on the assumption that each level is an extension of all previous levels. (Therefore in order to attain the APPLICATION objective, one must possess the knowledge and comprehension of the subject/topic under consideration.) Knowledge involves the recall of methods and procedures, and/or the pattern, structure, or setting, i.e., "remembering." Comprehension involves the process of translation, interpretation, and extrapolation. Application requires not only comprehension (to know an abstraction well enough to use it correctly when required), but also selection and application of the correct abstraction in a given situation. Analysis is the ability to breakdown the subject into its constituent elements so as to make clear the relation-ships involved. Synthesis occurs when one puts together the

elements and parts of the subject to form a whole that was not clearly there before. Evaluation is the making of judgments about the value of ideas, methods, solutions. etc.

In applying Bloom's taxonomy to the learning involved in gaming. it is probably true that other forms of teaching techniques are better at imparting knowledge to the student while gaming is involved with the higher levels in the taxonomy, e.g., a student would need some knowledge of the personnel management function before playing a personnel game. The real payoff in gaming would seem to come from the application, analysis. synthesis, and evaluation phases of the taxonomy. These objectives are the very raison d'etre for gaming. It would therefore be prudent for the game designer to construct a model that would optimize these objectives.

Other researchers in the gaming field [10, 3] have suggested that Kolb's [8] Experiential Learning Model is useful in game construction and administration. It involves a loop which begins with Concrete experience, advances to observation and reflections, then formation of abstract concepts and generalizations, and ends with testing implications of concepts in new situations. The game designer might also want to consider this model in the construction of a game.

Byrne and Wolfe have summarized some basic assumptions about learning which serve as an excellent guide to game design [4]:

1. Learning is a life-long personal process. Any given course or learning process is but a Concentrated segment in the individual's continuing learning and development process.

2. The underlying purpose of any course or learning process is the development and expansion of the competence (personal and professional) of the total person, and not simply the absorption of specific knowledge, facts and tools.

3. Substantive knowledge, gained by whatever means. is important, but it is incomplete until capabilities for integrating, internalizing, and using the knowledge are achieved.

4. Internal motivation is necessary for optimal learning. The most effective and lasting learning stems from a "need to know."

5. Responsibility for learning lies in the hands of the learner. The learner must own" his learning choices and processes, assuming the initiative, direction and management of them.

6. The primary role of the teacher is to create experiences and conditions for learning and to guide the student through the learning process.

7. Self-assessment and self-evaluation are of primary importance. Feedback and evaluations by others are secondary but important as checks against broader realities.

8. The most important learning is learning how to

learn - through multiple learning methods, but especially how to learn from one's own experience.

The authors have also suggested some assumptions "related to the design for a simulation game.

1. The more closely the learning process and environment parallel (simulate) actual practice, the more motivated the students will be and the more rich the learning potential.

2. The more the student embraces the experience as a simulation and not as a game, the more his learning will be enhanced.

3. The more complex, multi-faceted, flexible and interactive the game and learning environment, the more likely the student will perceive it as a simulation.

4. Flexibility and adaptability of the structure and mechanics of the simulation are crucial in order to provide both for close parallels with actual practice and for responsiveness to student initiatives and experimentations.

5. The purpose of the simulation game is learning and not winning. Winning in this context can most appropriately be defined in terms of the individual's learning needs and achievements.

Schreier [9] has pointed out the importance of the administrator to the success of a game. He has identified eight possible roles of an administrator: Administrator, Consultant, Evaluator, Participant, Facilitator, President, Observer, and Presence. In order to help insure the success of a particular game. it would be wise for the game designer to c consider what roles would be crucial to the particular game and attempt to build these roles into the game design and instructor's manual.

Burns and Gentry [2] have contributed greatly to the would-be game designer with their work in building a theory for the use of simulations. Their basic postulated model:

GAME USED (NATURE. CONDUCT) = f(CONCEPTS TAUGHT)
modified by
(STUDENT ATTRIBUTES, INSTRUCTOR CONSIDERATIONS)

This model could be converted to aid the game designer thusly:

GAME DESIGN (NATURE, CONDUCT) =
f(CONCEPTS DESIRED TO BE TAUGHT)
modified by
(STUDENT ATTRIBUTES, INSTRUCTOR CONSIDERATIONS)

Their definitions of the variables provides a valuable starting point in conceptualizing a new game; an adaptation of their variables to game design are as follows:

NATURE VARIABLES

Duration:	Number of decisions and total length of time required 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 with one another
Participant Grouping:	Amount of time devoted to exercise

CONDUCT VARIABLES

Accounta-bility:	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

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
Stochaticism:	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

Ability to Learn:	Capability of participants to learn due to intellectual level and situational factors
Number:	Number of students in the class

USER ATTRIBUTES VARIABLES

Familiarity with Computerized Games:	Relative experience potential user has with computerized games
Computer Support:	Computer support needed/expected from user's computer center
Resources Needed:	Time on the part of the administrator, computer programming and running time, peripheral materials required
Teaching Philosophy:	Amount of time and effort expected of the student for each decision.

A final thought from Burns and Gentry is appropriate for the topic at hand:

"Clearly, the most critical factor in the use of games and experientials is the degree of user involvement necessitated by or permitted by internal and situational factors. The success of the use of games and experientials seems highly dependent on the degree of user involvement with the exercise. '[21

It seems evident that the game designer must consider carefully how a potential user (teacher) might relate to the game and to the participants. The question to be answered is, "How do you make the game interesting and burden-free to the prospective administrator?"

The use of additional supporting modules has been suggested by various writers. Sugges [12] recommends

"…game builders and users (should) collaborate in developing ancillary software to provide staff assistance that a manager would ordinarily have in a real company. The staff assistance would consist of a package of programs which would provide the kinds of reports and decision making information that are required if the game players and the administrator are to function more rationally. Basically I see the need for two kinds of modules. One would be available to the students and the other would be available to the administrator. .

Ron Frazer has made some suggestions in a paper appropriately titled "Some Issues in Game Design." [6] His ideas:

1. Don't worry too much about "realism". . . take a realistic Situation and simplify it greatly to make the situation amenable to meaningful analysis by whatever level of student the game is designed for.

2. Design an on-line game so students can have immediate feedback and reinforcement,

3. Play more than one game in a class during the semester; this would call for the design of several different games or modules.

4. Since there are dominant variables in most real life situations, games should also have dominant variables.

5. There should be one simple, clear-cut goal, such as maximizing profits, in deciding the order of finish.

6. While a certain amount of debriefing is necessary, don't overdo it.

While some (all?) of the statements above are not without controversy, there appears to he sound reasoning to at least consider the arguments Frazer is making.

A concept to enrich the game experience has been proposed by Crino [5] and has been used by the writer in a game previously developed [11]. The idea is to merge the simulation and experiential learning exercise, thereby capitalizing on the strengths of both. Crino believes the behavioral aspects of management can be demonstrated through the use of experiential material. The combining of the two methodologies is certainly worthy of consideration by the game designer.

A final question in game design concerns how decisions (input) and results (output) are handled, computer- wise. In the majority of games students complete some type of decision input form or actually prepare IBM cards. Output is printed out at some central location and administrators are responsible for picking up, sorting, and delivering it. Fritzsche [7] suggests that teams enter their decisions directly onto disc via a computer terminal. Output could be handled by student request at any printing terminal also.

Advantages of such a system include the following:
1. The work of the administrator is substantially reduced.
2. Fewer errors are made by student teams (due to a unique value "checker" program).
3. Students become more familiar with computer terminals and tend to view the terminal as simply another communication device instead of something awesome.
4. The entry and pickup of decisions should be more convenient for students and much less trouble for the administrator.

The writer has employed student input at terminals for two years with much success. This question of input/output mode, as well as techniques of making a game easier to administer, is certainly an important element of game design. It could make the difference between wide-spread and little use of a new simulation. Of course mobility of the program between different computers is also a constraint as to the method of input! Output.

To summarize, the game designer needs to consider many variables in order to create a game that produces a meaningful learning experience with ease of administration. Paramount among the factors to consider is the learning objectives of the game and how these will be achieved.

PERSMAN: A NEW PERSONNEL SIMULATION GAME

Employing some of the theory and practice suggested above, the writer has started to design a personnel management (computerized) simulation. The program is written in Fortran IV and is currently running on a Dec-10 computer. Design and program changes are still occurring as this paper goes to press. Highlights of the game are explained below.

The Scenario

The player assumes the position of a newly appointed personnel director of an organization of approximately 650 employees. The organization has grown rapidly, and the personnel department (and functions) have not kept pace with this growth.

Currently there is no union involved, but the industry is slowly becoming unionized. At the lower levels there are both semi-skilled and skilled workers (about 500). The firm has had no policy on promotions and has hired into the upper levels of management from the outside as well as promoted from within. Responsibility for training now resides primarily with department heads and is strictly on-the-job type training. Wage rates for the organization are somewhat below the average for the industry.

One of the problems facing the personnel director is the lack of females and minorities at all job levels. Due to the rapid growth of the organization, little effort was made to have a representative work force. Although there is no litigation concerning this unbalanced work force at this time, the new personnel director has been directed by the Chief Executive to begin integrating the work force. There are no physical factors involved that would prohibit a female from doing most jobs in the organization. Currently females represent 12% of the workforce and minorities 8%. Minorities represent about 25% of the total population in the local community.

There are two methods of replacing employees. The first is to hire qualified people on the open market.

The second method is to promote from within. Although this has been a primary method of filling management positions in the past, the lack of formal training has resulted in less-than-desired performance by people promoted in this manner. The Chief Executive has therefore suggested the organization conduct its own training. Although training program costs and open market hiring costs are relatively equal, it is felt that supervisors and managers will be somewhat better prepared by the training program to assume managerial positions in the organization.

Decisions concerning the level of wages and benefits are not traditionally the sole responsibility of a personnel director. However, the Chief Executive Officer has given the personnel director the responsibility for making these decisions within certain budgetary constraints (discussed below).

One of the problems facing the Personnel Director is an accident rate which is higher than the industry average. It is felt the causes of this are a higher than average turnover rate (i.e., there are always new employees coming into the organization), less than satisfactory morale level, and a lack of any type of accident prevention or safety program. The accident rate for the organization (as measured by man-days lost per 1 million man-hours) is 500; the industry average accident rate is 310. It is estimated the Cost for a safety program could range from $1,000 to $5,000 per quarter. The Personnel Director has the option of implementing a program and can decide the level of budget for such a program.

Currently, the organization does riot have an orientation program for new employees. This fact could also possibly contribute to the higher than average accident rate. The cost of an orientation program would by $1,000 per quarter.

The organization does not have a formal grievance procedure. Grievances are currently handled informally by deportment heads. The department heads estimate there were 25 grievances last quarter. It is felt there are probably many more than this number, but employees either quit or Continue working with lower morale instead of pursuing a grievance. The high turnover rate and very average morale index would certainly add credence to this theory. The cost of establishing a formal grievance procedure is $5,000 in the initial quarter and $2,000 each quarter thereafter to maintain the program.

Productivity in the last quarter was 2.000 units per employee. Although industry wide figures are not available, it is felt that improvements could be made in productivity. An estimate has been made as to the level of quality of production. An index has been established which has a range of from 100 (highest quality) down to 0 (extremely low quality). Currently the organization has a quality index of 50. This represents "average" quality. A formal quality control program could be established with a budget of $0--15,000. ,000.

The current turnover rate of this organization of 10.45% is higher than the industry average of 9%. Overall morale of this work force could be a contributing factor. It has been estimated by department heads that morale is currently 50 on a scale of 0 to 100. An employee attitude survey night provide some information concerning the morale problem. The cost of such a survey could by $3,000. The lack of a formal performance appraisal program has been mentioned by some managers as a contributing factor of low morale. The cost of establishing and maintaining a performance appraisal program would be $2,000 per qtr.

Personnel records an& the record keeping system have not kept up with the rapid growth of the organization. There are occasions when some employees receive their weekly check on Monday instead of the usual Friday payday. The Personnel Director has received a bid for $3,000 per quarter to install and maintain personnel records on a computer. The vendor claims the benefits of this system would be improved decision-making in all areas of the personnel function--selection, staffing, training and development, performance appraisal, and job analysis, as well as record keeping.

The quarterly decisions must be made within certain budgetary constraints. Each quarter, the additional funds available for all purposes will be printed on the Status Report. For the first quarter, the new budget is $75,000. This includes all monies available for wage increases, hiring and training costs, and all other activities.

Other decisions and personnel incidents will occur from time to rime, and these will be indicated on the quarterly printout. The simulation player should follow the instructions issued at the time and input the required information along with the standard decisions.

Conclusion

The simulation game is currently under development, and it is difficult to judge its effectiveness at this time, It is expected to require at least another 6 to 12 months to test the game in the classroom and make modifications on it. The writer had forgotten how much distress and tine is involved in the design and programming of a simulation gene; he is painfully aware of that fact now.

REFERENCES

[1] Bloom. B. S., editor, Taxonomy of Educational Objectives: Handbook I, Cognitive Domain (New York: David McKay Company, Inc., , 1956).

[2] Burns, Alvin C. and James W. Gentry, 'Moving Toward a 'Theory' of the Use of Simulation Games and Experiential Exercises." in Daniel C. Brenenstuhl and William D. Biggs (editors) , Experiential Learning Enters the 80's, ABSEL Proceedings, 1980, pp. 17-20.

[3] Burns, Alvin C. and James W. Gentry, "Some Thoughts on a 'Theory' of the Use of Games and Experiential Exercises,' in Carl C. Nielsen (editor) , New Horizons in Simulation Games and Experiential Learning, ABSEL Proceedings, 1977, pp. 187-194.

[4] Byrne, Eugene T. and Douglas E. Wolfe, "The Design, Conduct and Evolution of a Computerized Management Game as a Form of Experiential Learning," in James Kenderine and Bernard Keys (editors), Simulations, Games and Experiential Learning Techniques: On the Road to a New Frontier, ABSEL Proceedings, 1974, pp. 22-3D.

[5] Crino, Michael D., .,"Computerized Business Simulations and Experiential Learning Exercises: An Instructional Interface," in Samuel C. Certo and Daniel C. Brenenstuhl (editors), Insights Into Experiential Pedagogy, ABSEL Proceedings, 1979, pp. 315-317.

[6]   Frazer, J. Ronald, "Some Issues in Game Design," in Daniel C. Brenenstuhl and William D. Biggs (editors), <u>Experiential Learning Enters the 80's</u>. ABSEL Proceedings, 1980, pp. 184-186.

[7]   Fritzsche, David J., "Let's Simplify the Administrative Requirements of Computerized Educational Simulations," in Daniel C. Brenenstuhl and Samuel C. Certo (editors), <u>Exploring Experiential Learning: Simulations and Experiential Exercises</u>, ABSEL Proceedings, 1978. pp. 39-43.

[8]   Kolb, D. A ., "On Management and the Learning Process," in D. A. Kolb, I. M. Rubin, and J. M. McIntyre (editors), <u>Organizational Psychology</u> (Englewood Cliffs: Prentice Hall, Inc.. 1974).

[9]   Schreier, James W ., "Measurement of Administrative Role for Feedback on Structure and Goals," in Daniel C. Brenenstuhl and Samuel C. Certo (editors) , <u>Exploring Experiential Learning: Simulations and Experiential Exercises</u>. ABSEL Proceedings, 1978, pp. 139-145.

[10]   Seeborg, Irmtraud Streker, "Teaching about the Implementation of Job Redesign Using Simulation and Group Discussions," in Carl C. Nielsen (editor) , <u>New Horizons in Simulation Games and Experiential Learning</u>, ABSEL Proceedings, 1977, pp. 23-31.

[11]   Smith, Jerald R .."Gaming and Attitudinal Change,' in Samuel C. Certo and Daniel C. Brenenstuhl (editors), <u>Insights into Experiential Pedagogy</u>. ABSEL Proceedings, 1979. pp. 231-234.

[12]   Suggs, Peter R .."New Technology for Business Games," in Daniel C. Brenenstuhl and William D. Biggs (editors), <u>Experiential Learning Enters the 80's</u> ABSEL Proceedings, 1980. pp. 67-71.