AN INVESTIGATION INTO THE USE OF A DIDACTIC GAME AS A TEACHING TECHNIQUE

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Abstract

This document and the accompanying didactic game entitled "Point to Point" together constitute a Thesis Equivalent in the Department of Education at Concordia University. This didactic game was designed to teach undergraduate students in education the concept of behavioral objectives.

A pre-test administered to a sample of eighteen undergraduate students registered in the course entitled "Selected Topics in Education. Special Subject: Curriculum Theory," indicated that the sample had an average knowledge of the subject matter, the group mean score being 52.3%.

A post-test, administered immediately after the subjects had played the game, indicated an increase in group mean score to 66.5%. The increment of 14.2% ($p = < .0075$) is statistically significant.

At the same time, eighteen students in the same class completed a programmed text on the same subject matter, after completing the identical pre-test with the group who played the didactic game. The group mean score in the pre-test was 51.6% and the group mean score in the post-test was 67.4%, indicating an increment of 15.8% ($p = < .002$).

It is concluded that this didactic game was an effective and worthwhile technique for teaching the subject matter for which it was designed.

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CHAPTER 1

Educational Games

In the last fifteen years, games have become widely accepted in schools, in business, in management, and in military institutions. These games are seen as "serious" games in the sense that they have a well-thought out purpose and are not primarily played for amusement. An educational game is an activity that takes place in a learning situation and has learning as its prime goal. It is an alternative teaching strategy. The competent teacher will have a variety of methods with which to achieve the intended educational objectives; as well as such traditional techniques as the lecture or discussion group, a didactic game can also be used to teach a concept, or reinforce one that has been previously taught.

Educational games include games and simulations. There have been many attempts to define these terms but for the purpose of this investigation, the following definitions will apply. An educational game is a contest regulated by rules; it features a competitive context for learning concepts and principles and is sometimes referred to as a motivational game. Gaming focuses on the decisions the players make and their outcomes. A simulation, in that it is a carefully controlled yet simplified model of reality, focuses on the character as well as the decisions of the

players. Thus, "Monopoly,"[1] according to this classification, is in the category of a game; though there is some role-playing in that the players buy and sell real-estate, the model on which it is based, the conditions and rules under which it is played bear little resemblance to actual real-estate practices.

Simulations combine the ancient technique of gaming with the relatively recent technique of simulations. A simulation is understood to be a game in which certain social or scientific processes are mirrored in the game's structure and functioning. It is a model or an abstraction of things held to be important in the real life situation. A player is involved in the decision-making process, as he acts out his role within the social environment of a group or organization. Thus, role-playing becomes the keystone in simulations.

Most simulations and games used in social studies instruction are modeled on social reality. The students assume the roles and are required to make intelligent decisions affecting their play of the game as well as the play of others. Thus, in the game "Democracy,"[2] students assume the role of legislators and have to make decisions that reflect the interest of their constituents. In "The Caribou Hunting Games,"[3] students role-play Eskimos, as they plan strategies for hunting caribou.

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[1] "Monopoly" designed by Chas W. Darrow, 1939, Zuckerman and Horn, The Guide to Simulation Games for Education and Training, Information Resources, Inc., Cambridge Mass., 1970, p. 118

[2] "Democracy" designed by James S. Coleman, 1969, Ibid., p. 102.

[3] "The Caribou Hunting Games" originated by Social Studies Curriculum Program, Education Development Center in Cambridge, Mass., Ibid., p. 254.

For "Monopoly" to be classified as a simulation, the players would have to assume the roles of real-estate agents, architects, urban planners, citizens, etc. and act according to these roles, as well as by the control of dice and chance cards. Furthermore, the consequences of their acts and decisions would have a direct effect on their own play and that of the other players.

Educational games and simulations involve skill and chance in varying proportions. Those that emphasize chance have the advantage that the outcome is independent of player capabilities; this kind of game may encourage the underachiever. However, this type of activity can also minimize personal responsibility, as well as skill and effort. Games and simulations of skill, on the other hand, reward achievement and encourage initiative, emphasizing student inequalities. An educational game that involves both chance and skill, might minimize these disadvantages by achieving an acceptable balance between the two.

The variety of games on the market is increasing at geometric rates. In the 1970 edition of the Guide to Simulation Games for Education and Training, Zuckerman and Horn list 385 games, while the 1979 edition includes a list of over 600 games now on the market. Nor has this technical innovation escaped the attention of educators. The March 1971 issue of Social Education containing a special supplement on the "Game Explosion" reported that more articles are being submitted on the topic of educational games than on any other within recent memory. There are short games, designed to be open-ended discovery exercises, or to instruct a concise element in the curriculum. There are year-long games that attempt to immerse the students in participation in every aspect of social

behavior. There are also one-week or two-week games that aim to teach such concepts as election behavior. "Election U. S. A."[4] is one such game; "Top Management Decision Simulation"[5] seeks to teach students the relationship between supply and demand; "Ghetto"[6] presents to the players the problems of ghetto life.

There are some recognized characteristics of educational games. They usually interest and involve the participants. They require action rather than passive observation. They often use techniques of co-operation as well as those of competition. They enable teaching for the long range future to take place by injecting a feeling of realism and relevance. By focusing attention, they can often enable complex problems to be simplified, and therefore be more easily understood. They change the social conditions under which the students learn by being self-teaching and self-evaluating; games allow the teacher to remain in the background while play is in progress, often producing more empathy between the class and its instructor. They also afford students much more freedom of speech and movement than more traditional methods of instruction; this, of course, can become a disadvantage, if not guided.

History and Development of Games

There is nothing new about gaming itself, although the interest in educational games dates back approximately fifteen years. There is

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[4]"Election U.S.A." designed by Civic Educational Aids, Jean Belch, Contemporary Games, Gale Research Co., the Book Tower, Detroit, Michigan, 1973, p. 154.

[5]Zuckerman and Horn, p. 311

[6]Zuckerman and Horn, p. 261

little evidence to substantiate where games originated. War games have been traced back to the game of chess which was probably first played in India. The early Indian chess game involved elephants, horses, chariots, and infantry. As one historian noted, "pieces used in the original Hindu game represented the same four elements of an army and the supporting frame of the chessboard employed today symbolizes the wall of a fortified city."[7] This was a game with very definite rules for the players and the consequences of their actions.

The word 'game' still has the connotation of 'amusement,' 'diversion,' and 'fun' but war games of strategy have long been taken seriously as academic exercises by military experts, who realized their potential in the training of officers.

In 1798, the Prussians developed a complex model of warfare, "Neue Kriegspiel,"[8] the forerunner of modern war games. Military academies throughout the world have used various versions of this model to provide officers with experience in formulating strategy, making decisions under stress, and handling potential crises. With the advent of computers, contemporary war games have become increasingly sophisticated, but the basic idea of replicating reality in the form of simulations has changed little in the last 175 years. "Techniques being used (in instructional gaming and simulation) are as old as civilization itself, but the heuristic means of relating and validating system functioning to precisely defined performance goals is startlingly new,

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[7] Sydney Griffin, The Crisis Game, Doubleday and Co., New York, 1965, p. 9.

[8] Ibid., p. 11.

exciting and most refreshing."[9]

In the United States, the fields of business and management were first to develop the non-military educational simulations. In 1956 the American Management Association produced the first widely used management game, "Top Management Decision Simulation."[10] Players, in teams of five, representing the officers of different firms manufacturing a similar product, were competing on the same market. Decisions regarding such matters as prices, budgets, expenditures for research and development, had to be made. In this way, the players gained experience in carrying out business transactions and in formulating management policies. The bridge between theory and practice had been shortened. This game was enthusiastically received and led to the development of other simulations in the business field, including Esso's "Petroleum Industry Simulation,"[11] and Vance's "Management Decision Simulation."[12]

In 1957, with the advent of the space age, the National Aeronautics and Space Administration in the United States began to use simulations of space flight conditions to train astronauts. Full scale models of space-ships were located at the Manned Spacecraft in Houston, Texas and several other installations. There the astronauts familiarized themselves with space craft layout as well as carrying out simulated docking and lunar landing manoeuvres. They were also placed in simulation emergency

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[9] Russell N. Cassel, "Instructional Gaming and Simulation," Contemporary Education, vol. 45, winter 1974, p. 100.

[10] Paul S. Greenlaw and F. Paul Wyman, "The Teaching Effectiveness of Games in Collegiate Business Courses," Simulation and Games, vol. 4, no. 3, Sept. 1973, p. 259.

[11] Ibid., p. 260.

[12] Ibid., p. 260.

situations to prepare for such occurences in actual flight.[13]

Soon scholars in other areas began to create similar approaches for training and experimentation. Game-simulations were developed in economics, political science, international relations, sociology, and psychology.

In the early 1960's the work and publications of such persons as Clark Abt, James Coleman, and Sarane Boocock were the first to draw attention to this technique as a potentially useful teaching tool for elementary and secondary schools. Soon, there was a game explosion and while there are still some traces of the "fad syndrome"[14] associated with the use of game-simulations, games are here to stay.

Current Research in Educational Games and Simulations

In the past ten years, there have been sufficient data accumulated on games and simulations to indicate that these exercises are potentially useful. Beyond that, the data are inconclusive. Many of the assertions that simulations and games aid in such activities as the socialization process, that they teach structure and content and transferable decision-making skills remain no more than claims or else there is conflicting results from the findings of controlled experiments. Much more research is needed.

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[13] Encyclopedia Americana, Americana Corporation, New York City, p. 563.

[14] William R. Heinzmann, "The Validity of Social Science Simulations: A Review of Research Findings," Education, vol. 94, no. 2, Nov.-Dec. 1973, p. 170.

There is no doubt that this technique is one of the most popular educational innovations in the past several years. The one consistent result of research investigation is that this alternative teaching method is very appealing to the students. Anyone who has taken part in a simulation or a game cannot help but feel the excitement that fills the classroom. This is not a triviality. One of the greatest problems in public school today involves problems of motivation--a general apathy towards learning. If games and simulations can help prevent this malaise, their contribution is an important one to the educational scene.

Educational Games and Problem-Solving Skills

In 1966, Robert Allen et al[15] investigated whether the experience of playing a mathematical type game can provide practice in intricate problem-solving skills and even result in an increase in IQ scores. A group of thirty-five junior high school students played the game "Wff'n Proof" during a summer session, while a control group completed regular class work and took the California Test of Mental Maturity twice at six week intervals. This game "Wff'n Proof" provides practice in abstract thinking and consists of a dice-like set of cubes printed with logical and arithmetical symbols which two, three, four, or five persons roll in a competitive situation to determine who can most astutely construct a logical system, and a proof of a theorem in that system. The overall mean change scores in the junior high school experimental group was found to be an increase of 8.1 points over that achieved by the control group.

[15] Robert W. Allen, Layman E. Allen and James C. Miller, "Programmed Games and the Learning of Problem-Solving Skills: The Wff'n Proof Example," Journal of Educational Research, Sept. 1966, pp. 22-25.

The researchers also reported that the motivational properties were dramatic to watch. The students asked to play the game at recess and while the drop-out rate was 14% in other classes in the summer school, the drop-out rate for the game-players was zero.

Educational Games and Cognitive Learning Outcomes

Myron Chartier,[16] recognizing that involvement and motivation are high in a game-simulation, used the game "Generation Gap" and discussion groups in his investigation to discover any cognitive learning outcomes that might occur. His theoretical hypothesis stated that when simulation games and discussion are combined into a single learning experience, the learning outcomes are greater than simulation without discussion, or discussion without simulation.

The game "Generation Gap" is designed to stimulate interaction between a parent and an adolescent son or daughter with respect to certain issues on which they may have opposing attitudes. Conflict is presented within a context of rules which reflect the attitudes of parents and children. The purpose of this educational game is to generate some understanding of this structure and to shape ways of handling the conflict.

Chartier theorized on the basis of previous research results, that games may be limited in their learning effects and need to be linked to other instructional methodologies. His study compared six selected cognitive learning outcomes--knowledge, comprehension, application,

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[16] Myron Chartier, "Learning Effect. An Instrumental Discussion," Simulation and Games, vol. 3, no. 2, June 1972, pp. 203-218.

analysis, synthesis, and evaluation[17]--and one affective learning outcome--satisfaction,[18] of students experiencing one of four conditions involving various combinations of simulation with discussion--these were simulation combined with discussion, simulation without discussion, discussion without simulation, and individual study involving neither discussion nor simulation. The results did not support the six measures related to the cognitive learning outcomes. These outcomes resulting from the combination of simulation with discussion were not significantly different from those resulting from the simulation itself. However, the measure related to the affective outcome of satisfaction was supported by the research hypothesis.

Chartier concluded that if student achievement is the only criterion used to evaluate the success of the teaching-learning process, any number of instructional methods may be used in the classroom. However, if the teacher is concerned with student interest and satisfaction, that is, values and objectives of the affective domaine as well as cognitive objectives, the teacher's options are more limited. In his opinion, further research is needed to see what differences there are at the deeper levels of cognitive and affective learning among various methods.

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[17] Benjamin Bloom, Taxonomy of Educational Objectives, The Classification of Educational Goals: Handbook I - Cognitive Domaine, David McKay Co., Inc., New York, 1968, p. 48.

[18] David R. Krathwohl, Benjamin S. Bloom and Bertram B. Masia, Taxonomy of Educational Objectives, The Classification of Educational Goals: Handbook II - Affective Domaine, David McKay Co., Inc., New York, 1964

McKenny and Dill[19] who did an extensive study of influence on learning by the "Business Management Game" at Harvard Graduate School of Business Administration, came to the conclusion that faculty behavior is at least as important as characteristics of the simulation model in stimulating learning. They concluded that what is learned depends almost entirely upon what the faculty emphasizes.

One interesting finding of the McKenny-Dill study is that they found that grouping individuals on the basis of ability affects what they learn from the game. The above-average students were able to learn faster than their classmates and this made them more confident and more satisfied, while the below-average groups seemed to be overwhelmed by the game tasks. Thus, they concluded homogeneous grouping appears to impede the progress of the less able groups.

However, game designer Clark Abt[20] makes a contradictory claim. He reports that students who are the poorest academically, experience a greater improvement in learning facts and principles through use of simulations than do the academically talented. Tansey and Unwin[21] particularly recommend the use of games and simulations for the slow learner. Dale C. Farran[22] reported excellent results when working with

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[19]James L. McKenny and William Dill, "Influence on Learning in Simulation Games," American Behavioral Scientist, 10:2, October 1966, p. 1828.

[20]Clark Abt, Games for Learning, Cambridge, Mass., Education Services Inc., 1966, p. 79.

[21]P. J. Tansey and D. Unwin, Simulation and Gaming in Education, Methune, London, 1968, p. 26.

[22]Dale C. Farran, "Competition and Learning for Underachievers," Simulation Games in Learning, ed. S. S. Boocock and E. O. Schild, Sage Publications, Beverly Hills, California, 1968, pp. 191-203.

underachievers using simulations. An extensive study with a simulation was carried out by Guetzkow[23] at Northwestern University. The study compared "Inter-Nation Simulation," with a case study approach. The purpose of this game is to give students an appreciation of the world a government official experiences. In trying to maintain or achieve a high standard of living for their nations, the players in teams are involved in bargaining, decision-making, strategic-thinking, and coalition-forming. In the study, 134 students attended two one-hour lectures weekly. One half of this number participated in the simulation and the other half in case studies for an additional three-hour session per week. The results showed no significant differences between the groups in terms of content mastery or principle learning. The findings were that simulation studies and case studies scarcely differed in their performance on these two learning outcomes.

There are two reports, however, that claim that the playing of a simulation is a more effective way to communicate facts and to learn principles than the more traditional methods. Sarane S. Boocock[24] reports on an experiment conducted with 1,200 4H Club members, randomly assigned to one of two games, "Life-Career" and "Legislature." The findings of this study were that playing the game produced a consistent though small increase in the amount of information these students possessed.

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[23]Harold Guetzkow, "A Use of Simulation in the Study of Inter-Nation Relations," Simulation in Social Science: Readings, ed. Harold Guetzkow, Englewood Cliffs, N. J., Prentice Hall, 1962, pp. 82-94.

[24]Sarane S. Boocock, "An Experimental Study of the Learning Effects of Two Games with Simulated Environments," Simulation Games in Learning, ed. S. S. Boocock and E. O. Schild, Beverly Hills, California, Sage Publications, 1968, pp. 107-134.

Baker[25] conducted an experiment in which he taught one half of a group of students in a simulation of the American Civil War and the other half in the same subject through the medium of a textbook. He used a self-designed test to measure knowledge of American history prior to and after the experimental treatment. Results showed the two simulation classes were superior in post-test performance to the two control groups. After an analysis of variance, he concluded that simulation techniques are potentially a more efficient means of communicating historical facts, concepts, and attitudes than is the use of a textbook.

However, in the opinion of this author, his study is not sound. His tests were self-devised, he designed the game himself, and conducted the experiment in his own classes, he did not use test validation procedures, or run reliability tests on his measuring instruments.

Another more recent and very extensive study was done by Fenessey et al[26] in 1972 to test the gaming technique as a teaching tool for facts and principles. This has disappointing results for those who are interested in simulations. In forty-seven schools involving eighty-seven teachers and 4,539 students, Fenessey and her associates examined the effectiveness of simulations for facts and principles. The experiment found the control and simulation to be equally effective.

From these research reports, the claim that simulations form a

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[25]Eugene H. Baker, "A Pre-Civil War Simulation for Teaching American History," Simulations and Games in Learning, ed. S. S. Boocock and E. O. Schild, Beverly Hills, California, Sage Publications, 1968, pp. 135-142.

[26]Gail Fenessey, Samuel Livingston, Keith Edwards, Steven Kidder and Alice Nafziger, "Simulation, Gaming and Conventional Instruction. An Experimental Comparison," Center for the Social Organization of Schools Report No. 128, April 1972.

valuable teaching technique to convey facts and principles is largely unsupported by empirical evidence. Such a hypothesis cannot be accepted without more investigations.

Educational Games as a Motivating Activity

The Guetzkow study referred to earlier, found that the case study method succeeded more than did simulation in eliciting student interest. This is one study that refutes the claim that educational games motivate and interest students more than a traditional classroom technique, such as a lecture. However, the study by Boocock[27] reported that students evidence a high degree of interest in educational games.

Cleo Cherryholmes,[28] Roger Kaperson,[29] and Charles and Dorothy Christine[30] are also among those who indicate in their research that students enjoy gaming and were highly motivated by the experience.

Educational Games and Attitude Change

Paul de Kock[31] found attitudes were changed by the playing of the

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[27]Sarane S. Boocock, "An Experimental Study of the Learning Effects of Two Games with Simulated Environments," Simulation Games in Learning, ed. S. S. Boocock and E. O. Schild, Sage Publications, Beverly Hills, California, 1968, p. 120.

[28]Cleo Cherryholmes, "Some Current Research on the Effectiveness of Educational Simulations: Implications for Alternate Strategies," American Behavioral Scientist, 10:2, October 1966, pp. 4-8.

[29]Roger E. Kaperson, "Games as Educational Media," Journal of Geography, October 1966, pp. 71-79.

[30]Charles Christine and Dorothy Christine, "Simulation, a Teaching Tool," The Elementary School Journal, May 1967, pp. 211-217.

[31]Paul de Kock, "Simulations and Change in Racial Attitudes," Social Education, February 1969, pp. 179-184.

simulation "Sunshine," which deals with racial problems. Students felt more positively towards Black America as a result of playing a game in which the players learn the facts and concepts concerning the history of the American Negro.

Samuel Livingston[32] in 1971 found significant changes in attitude towards the poor, following the playing of "Ghetto." That is, the attitudes of the student were more favorable towards the poor. "Ghetto" is a game where each player is a poor person in a poor neighborhood trying to improve his [redacted] situation. The purpose of the game is to illustrate that moving ahead demands a wise and strategic use of time; and also to show that the condition of the neighborhood affects everyone, whether they admit it or not. Finally, the game sets out to demonstrate the economic pressures that cause or influence people to go on welfare or to enter into illegal activities.

Review of Research

From the review of research (see Table 1) several conclusions are evident.

First, that there has not been a great deal of research into the effectiveness of educational games, nor in fact, many recent studies of an empirical nature.

Richard Gross,[33] former president of the National Council of

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[32]Samuel Livingston, "Simulation Games and Attitude Change: Attitudes towards the Poor," John Hopkins University, April 1970, Eric ED 039.151.

[33]Richard E. Gross, "A Decade of Doctoral Research in Social Studies Education," Social Education, May 1972, p. 555.

TABLE I

RESEARCH STUDIES REVIEWED

YEAR	AUTHOR OF INVESTIGATION	SIMULATION	GAME	PURPOSE OF INVESTIGATION	RESULTS: NO DIFFERENCE	RESULTS: POSITIVE
1962	Guetzkow	X		Cognitive outcomes	X	
1966	Allen et al		X	Cognitive outcomes		X
1966	McKenny & Dill	X		Cognitive outcomes	X	
1966	Abt	X		Cognitive outcomes		X
1968	Farran	X		Cognitive outcomes		X
1968	Boocock	X		Cognitive outcomes		X
1968	Baker	X		Cognitive outcomes		X
1972	Penessey et al	X		Cognitive outcomes	X	
1972	Chartier	X		Cognitive outcomes	X	
1962	Guetzkow	X		Interest & involvement		X
1966	Cherryholmes	X		Interest & involvement		X
1966	Kaperson	X		Interest & involvement		X
1967	Christine & Christine	X		Interest & involvement		X
1968	Boocock	X		Interest & involvement		X
1969	de Kock	X		Attitude change		X
1971	Livingston	X		Attitude change		X

Social Studies, remarked in a recent article in Social Education: "Are you interested in simulation? A gaming bandwagon moves across the land, yet on this topic we have found practically nothing to report in the realm of doctoral research."

Paul E. Twelker[34] echoes these sentiments with special reference to games per se as contrasted with simulations. "Non-simulation gaming shares with the simulation area the same paucity of meaningful research pertaining to variations in important dimensions of the game and the claimed learning outcomes."

Yet games and simulations are reported gaining in popularity and use. There are so many games being developed and revised today, that it is difficult to know what is available. This in itself makes research difficult. There is also a lack of standardization of games which makes difficult replications of research. As well, the quality of research and research designs vary in standard. There is also the problem of the "innovation effect" in some studies; Allen admits to this when he reports that the teacher, whose class played the game "Wff'n Proof," knew he was utilizing a new method and in the course of the class, he may have become more committed to the game. The difference between the control and the experimental classes may have been partly the result of the communication to the students of the teacher's special interest, that is, his enthusiasm may have motivated his students to perform better than those in the

[34] Paul E. Twelker, "Basic Reference Shelf on Simulations and Games," The Guide to Simulation Games for Education and Training, Zuckerman and Horn, Information Resources, Inc., Cambridge, Mass., 1970, p. 315.

control group. While realizing the disadvantage of this in his investigation, Allen goes on to ask if these qualities are not just those features the teaching profession wants to build into learning situations.

Second, it is evident from the research, that where interest and involvement and attitude change are concerned, the results have been positive. These claims are important for the field of education and every attempt should be made to capitalize on these positive outcomes of gaming. So, while simulations undoubtedly have their attractions for student motivation, there is disagreement among researchers as to the positive results in the field of cognitive outcomes. Some who have conducted research studies report positive gains (Allen, Abt, Farran, Boocock, and Baker) while others (Guetzkow, McKenny and Dill, Fenessey, and Chartier) report in their findings that simulations provide no more positive outcomes in the cognitive area than do the traditional methods.

Third, with the exception of Allen's investigation into the results of playing the "Wff'n Proof" game, the research had concentrated on simulations rather than on games. Allen and his associates produced some statistically significant results in that his experimental group showed a mean change of an increase of 8.1% in the non-language IQ test over that of the control group. This is a positive result and one that was repeated in further studies by Allen. It is true that there was a difference in student populations; the junior high experimental group average initial IQ score was ten points higher than the average IQ score of the control group. However, these differences were taken into account in presenting the results. Also, the control group contained no high school students; therefore, only the results of the junior high school

sample of the overall group are included in the data presented. These facts emphasize the difficulty in designing and completing a rigorous research project, but with careful evaluation, acceptable data can be obtained. In June 1971, the journal Simulation and Games published the full data and in it, Allen refers to three studies where students exposed to the game increased each time in non-language IQ score, accompanied by a statistically insignificant increase in language IQ scores.

Allen was investigating a complex cognitive outcome--problem-solving skills. In Gagne's[35] hierarchy of learning levels, it is at the apex; he considers it the most complex of all levels. The effectiveness of a non-simulation game to teach cognitive outcomes of a simpler nature has not had a thorough investigation. Games, in the field of science[36] and language teaching[37] have been used to reinforce previously taught material and to give practice in language skills.

The Problem

Can a non-simulation game effectively present new facts and concepts for comprehension and application? Can a game combining skill and chance, competition and co-operation, succeed in doing this as well or perhaps better than other methods? Can a simple board game adapted from the children's games such as "Parchesi" and "Snakes and Ladders" be used as a format on which to build an educational game that will cover

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[35] Robert M. Gagne, The Conditions of Learning, New York, Holt Rhinehart and Winston, 1968, p. 59.

[36] Allan Jack Levine, "A Study of Cognitive and Affective Outcomes of a Chemistry Learning Game," Sir George Williams University, Montreal, 1974.

[37] "Language Lotto" designed by Lassar G. Gotkin, New York University, Zuckerman and Horn, p. 205.

material in approximately the same time, that is; one and a half hours, as a lecture or a chapter in a text? If a game can be shown to do this, it is conceivable that other subject matters can be so transposed, the didactic game becoming an effective alternative teaching method.

CHAPTER II

Game Design

As there are many types of games on the market, there are also many ways to design them. Process models and flow charts can be used; the principles of game theory can be envoked. A game can also be constructed without using any particular theoretical model. This diversity of design has promoted the conclusion that, as yet, no single type of game design is best suited to promote student learning.

A flow chart (see Figure 1), similar to the one illustrated by Jim McCormick[38] in his article "Simulation and Gaming as a Teaching Method" in the journal Programmed Learning and Educational Technology, was used for the design and implementation of this game.

I. The Idea

In this case, the idea was to design a game to evaluate the effectiveness of game playing to produce positive cognitive outcomes. The Subjects were to be a class of students in a Department of Education. The secondary purpose of the game was to illustrate to the group of education students that a non-simulation type of game was a useful technique in the classroom, thus encouraging them to employ this alternative technique in the future.

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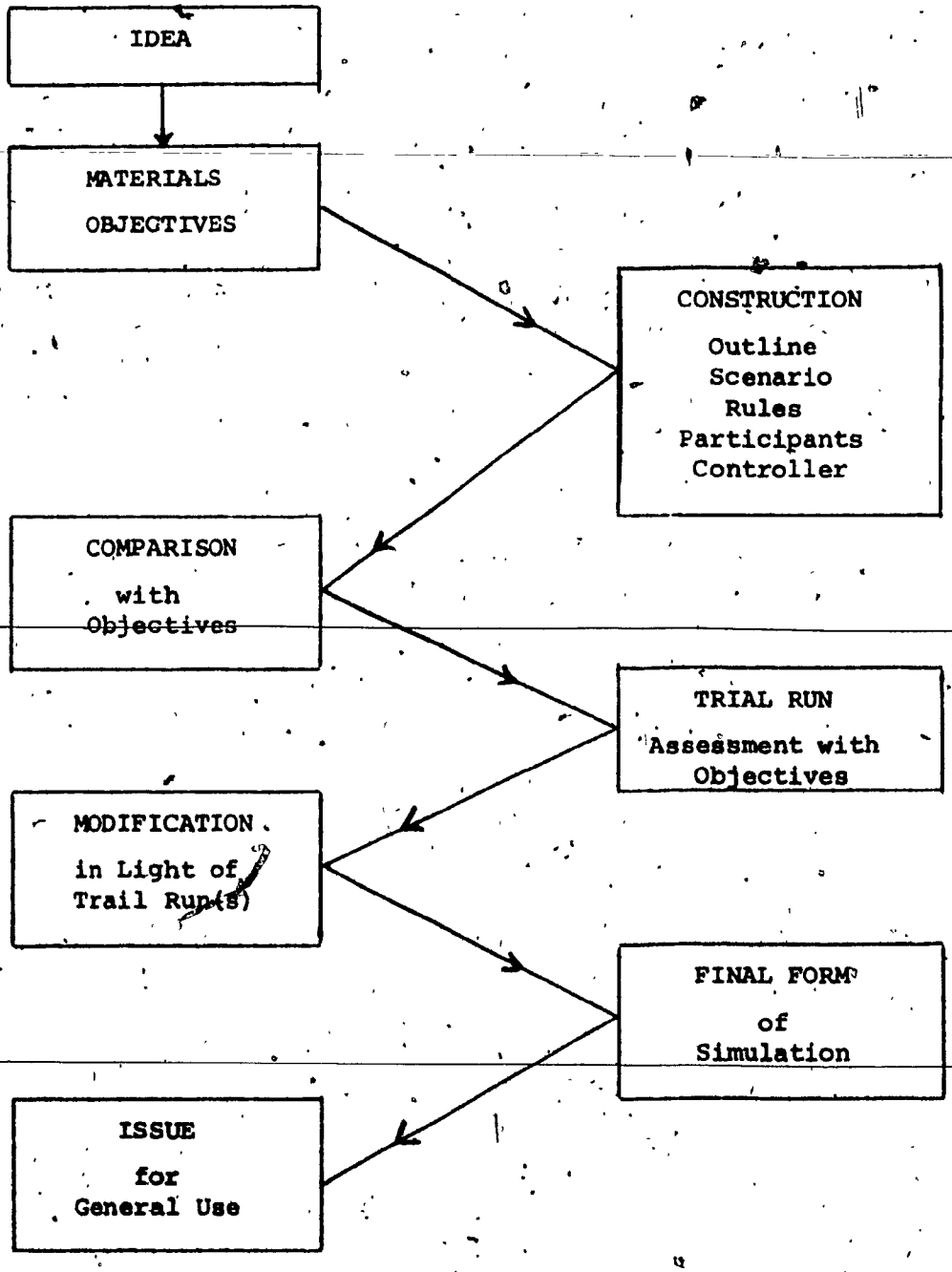
[38] Jim McCormick, "Simulation and Gaming as a Teaching Method," Programmed Learning and Educational Technology, July 1972, p. 200.

Figure 1. Stages on Construction of a Simulation



SOURCE: Jim McCormick, "Simulation and Gaming as a Teaching Method," Programmed Learning and Educational Technology, July 1972, p. 200.

As this investigation was limited to a one-class session of a course in a Department of Education, this game must be relatively quick to play--a maximum of two hours; it must have simple rules which are easy to follow so that it can be completed in the allotted time. Because the author wished to emphasize that even the familiar board games can be adapted to teach new subject matter, a board game was adapted to cover the subject matter selected. These then, were the guidelines with which the author proceeded.

II. Objectives and Materials

Because the subject matter selected for this game is Behavioral Objectives (see Chapter III), the objectives of the games are as follows. At the termination of the game, the player will be able to:

A. Identify the action or terminal verb in a behavioral objective.

B. Identify the conditions under which a lesson or program is to be completed by the student

C. Identify the standards or criteria of performance required by the student

D. State what is meant by the action or terminal verb, the conditions and the criteria in behavibral objectives

E. Demonstrate his recognition that a behavioral objective is stated in terms of student activity

F. Demonstrate his recognition of the difference between a general instructional objective and a behavioral objective

G. Demonstrate his recognition of a completely stated behavioral objective

H. Complete an incompletely stated behavioral objective

The materials selected were a game board, two dice, five counters, five packs of index cards, one time card, as well as the answer card.

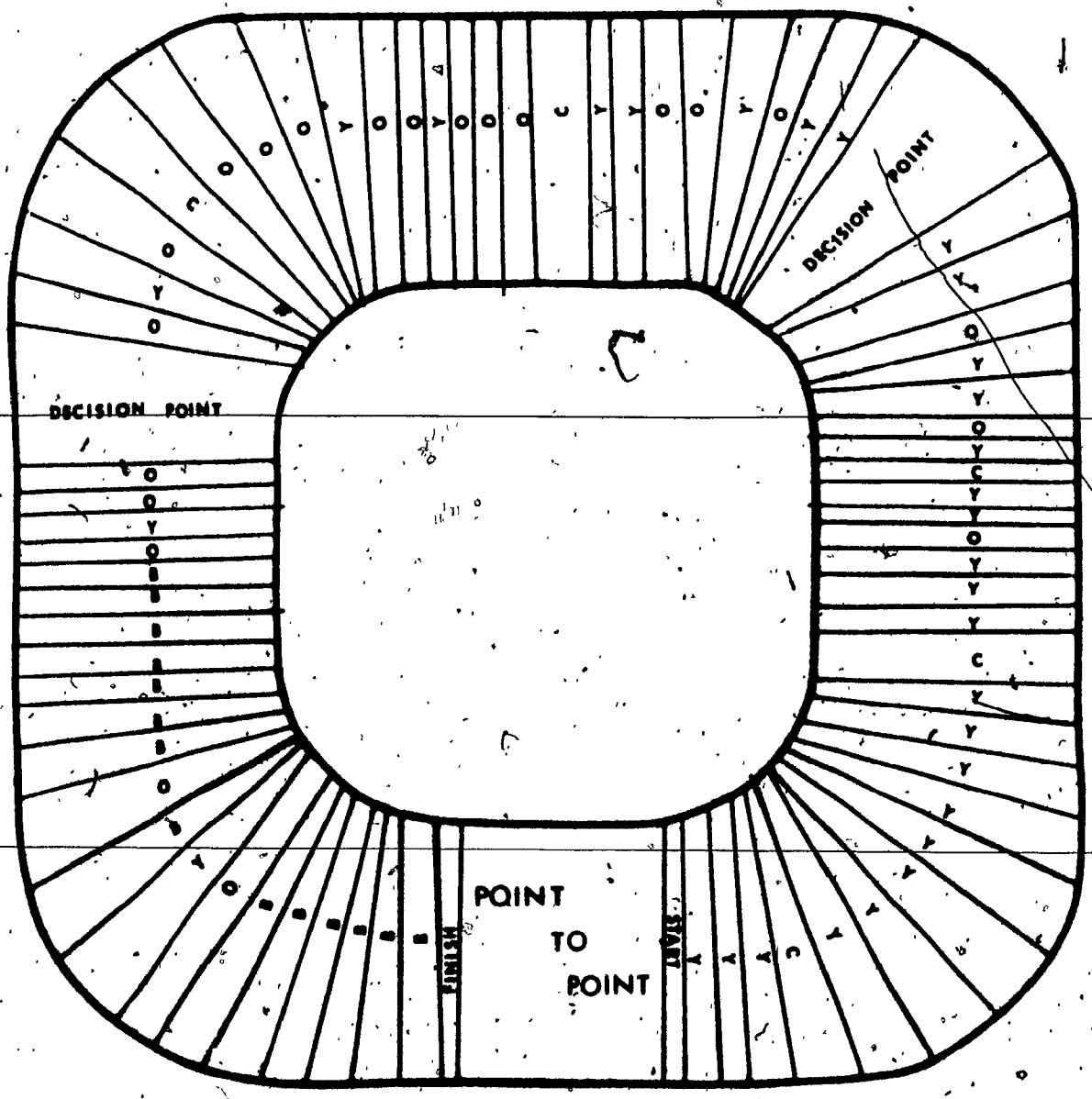
III. Construction

The third step involves the construction of the game, the design of which is based on pedagogical reasoning so as to accomplish the desired educational objectives.

1. Outline of the game. A board (see Figure 2) with 100 steps from starting point to finish line was selected on a trial basis. From experience in playing board games, 100 steps was considered the number that would allow for the approximate necessary number of turns in the allotted time. It was not felt that the actual number of steps on the board was as important as the number of turns that would be provided for the players. The number of turns is of course, also dependent on the throw of the dice and the skill of the players.

Since the subject matter of the game (see Chapter III) divides itself naturally into three sections, it was decided to divide the steps of the board into three different colours--yellow, orange and blue, each colour denoting a different concept of the subject. There is some overlapping of the different coloured steps; that is, towards the end of the yellow section, there are a few orange steps; similarly towards the end of the orange section, there are a few blue steps. This was done so that the next topic of subject matter could be gradually introduced, providing a continuity and a gradual sequencing.

Figure 2. Game board



Y = YELLOW STEP

O = ORANGE STEP

B = BLUE STEP

C = CHANCE STEP

Chance steps are placed on the board at various intervals, these steps indicate to the player such instructions as "Take another turn" or "Move ahead two steps." They are included for the sake of variety and also form another chance feature in the game.

Before a player can leave one section, he comes to a decision point which necessitates a correct answer before he can progress any further. In other words, he must give a right answer to a problem before leaving that particular part of the subject matter. This is the remedial feature built into the game and an important one.

Problems are stated on cards of different colours that are placed face down on the board in stacks at the beginning of the game. The subject matter on the card is controlled by its colour; and the colour of the card that a player picks up is controlled by the throw of the dice. The player picks up the appropriate card and reads aloud the question. A correct answer allows him to advance further on the board (five steps), while an incorrect answer forces him back (two steps). This decision to reward a correct answer with an advance of five steps was arrived at in order to allow the player giving a correct answer to move ahead more quickly; similarly the rule which makes the player with the incorrect answer move back two steps was incorporated so that this player would move at a slower pace than his fellow players, but not too slowly to discourage him. Both these decisions were arrived at after trying the game out several times.

The purpose of play is to arrive at the last step as quickly as possible. The feedback on all answers is immediate, as there is a Monitor, who does not join in the play, but supervises the game and

verifies the answers on the answer sheet. He also keeps the time card where a record of the game time from start to finish for each player is jotted down.

The questions on the cards are phrased in various ways to provide as many synonyms and antonyms as possible applying to the subject matter.

2. Participants. The minimum number of players in this game is three, because it is a competitive game which involves at least two players who compete against each other, as well as a Monitor who supervises the play. The maximum number of players recommended is five; although more can play, it slows down the game.

While the quantative outcome was to finish first, the qualitative outcome is to learn the educational objectives while participating effectively in the social interaction among the players. The play involves rapid thinking by individual players as there are no teams involved. Rules of play are drawn up which will reinforce learning by rewarding the correct answer and providing a slower pace for an incorrect answer. The Scenario selected for this game is that of a steeple-chase. The name "Point to Point" is chosen as appropriate for a game whose dynamic activity parallels a steeple-chase and one that is attempting to teach behavioral objectives by proceeding from point to point.

IV. Comparison with Objectives

Upon review, it was felt that this game was ready and might accomplish the educational objectives and instructional purposes for which it was designed. Therefore, the author proceeded to Phase V.

V. Trial Run

After a trial run, when only one die was used, it was decided that the game should progress faster; one way to do this would be to use two dice. In this way, the players who answered correctly could advance even faster. This would cut down on the number of turns the players had to answer questions. Whether this would impede learning would have to be ascertained in the next game-play.

The number of steps (five) for a player giving a correct answer was finalized, as well as the number of steps (two) to penalize the player with the incorrect answer.

"Point to Point" was played with friends, teachers and members of the family, all in all over ten times. Even those players who were completely uninformed about behavioral objectives before playing seemed to have a grasp of the subject after playing "Point to Point."

VI. Modifications

Two dice were used on the second trial run and it was concluded that although the players answered fewer questions, they did not appear to be hindered from content learning. The pace of the game with two dice increased and became more enjoyable. The number of steps to advance or go back was finalized.

VII. The Final Form

Thus, the final form was achieved and the game "Point to Point" is complete.

Description of Cards (see Appendix for game rules)

This game board has one hundred steps for each player to complete. The first steps are coded yellow which signifies that the player landing on these steps should pick up a yellow card. The yellow cards ask questions about the terminal verb or action verb in a well-stated behavioral objective. There are forty-one yellow steps which is more than in the two other sections; this is because this concept of the terminal or action verb is one that is the most basic to the whole subject, and often the most difficult to understand and apply. Towards the end of the yellow section orange steps are randomly inserted. These orange steps refer the player to a pile of orange cards, which pose problems on the criteria expected of a student in a behavioral objective, and the conditions under which the assignment or instructional program should be carried out. The orange steps eventually lead into the blue section; again there is an overlapping, this time between the orange steps and the blue. The blue cards are concerned with the recognition of a complete behavioral objective and its three component parts. The players are asked to name the different component parts or identify the missing part.

At the end of the yellow section, there is a decision point, green in colour, which refers the player to a pack of green cards and beyond which a player cannot go unless he gives a correct answer. There is another test point at the end of the orange section. This one is pink and leads to a pack of pink cards. Thus, by the time a player reaches the blue section, he should be well prepared to answer questions on completely stated behavioral objectives.

In summary then, the subject on the cards is as follows:

1. Yellow cards; terminal verbs (Figure 3)
2. Green cards; remedial questions on terminal verbs (figure 4)
3. Orange cards; conditions and criteria (figure 5)
4. Pink cards; remedial questions on conditions and criteria--(figure 6)
5. Blue cards; completely stated behavioral objectives (figure 7)

Play Procedure

Figure 8 illustrates the play procedure of the game "Point to Point."

Figure 3. Yellow cards

a) "The pupil will demonstrate a general understanding of Newton's Law."

Does this statement say precisely what the pupil will be able to do at the end of the program?

b) i. "The student will know the paintings of Manet."

ii. "The student will be able to identify the paintings of Manet."

Which statement says what the student will be able to do at the end of the program?

c) "To acquire a taste for literature ..."

Does this objective imply:

i. a general objective

ii. a behavioral objective

Figure 3 - Continued

d) Which of these says what a person can DO?

i. know the phrases

ii. recite the phrases

Figure 4. Green cards

a) A terminal verb in a behavioral objective describes the pupil's

i. knowledge

ii. behavior

b) i. "To understand fully ..."

ii. "To list correctly ..."

Which says what a person can do?

Figure 5. Orange cards

a) "On the basis of his readings, the student will be able to discuss the problems of urbanization."

Are

i. conditions

ii. criteria

indicated?

b) "Given a list of possible solutions, the public must select the correct one."

Name the conditions under which the subject is expected to complete the assignment.

c) Does the following indicate criteria of performance?

"Given no reference material, the pupil will answer correctly the following question."

Figure 6. Pink cards

a) "... at least 12 out of 20."

Does this imply:

i. criteria

ii. conditions

iii. neither

iv. both

b) Add conditions to the following assignment:

"... the pupil will circle the correct answers."

Figure 7. Blue cards

a) Are the three components of a well-stated behavioral objective present in the next statement?

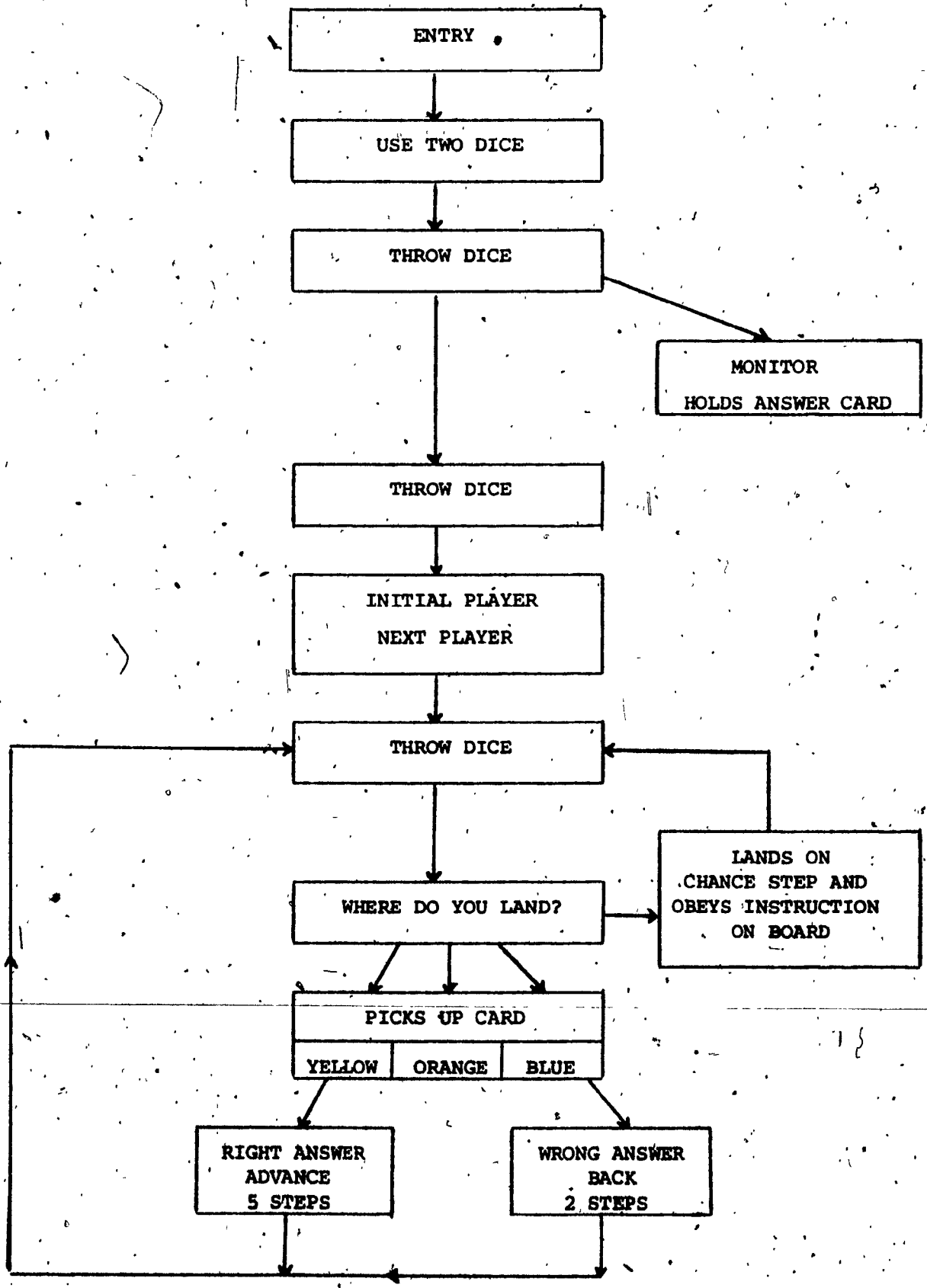
"The student will be able to recognize major, minor, and diminished and augumented triads at least 80% of the time. Comment."

b) What does the criteria of an objective imply?

c) "The student will be shown how to play 'C' on the flute."

Could this behavioral objective be improved?

Figure 8. Play procedure for game "Point to Point"



A Didactic Game and a Programmed Text

As the game evolved, it became obvious to the author that there are many similarities between an educational game and a programmed text. A programmed text is a simple way of presenting teaching machine type material sequences without the hardware.

At the outset, the programmer, like the game designer, identifies the objectives of the program; he specifies the terminal behavior desired; he describes the intended outcomes, indicates the conditions under which learning will take place and specifies the standards or the criteria expected. He then proceeds to design an instructional procedure to accomplish these goals.

The statements and problems are listed on a page in the programmed text, in much the same way as the frames of programmed instruction. The material is presented in small, graded steps and the answer to each question is verified before the student progresses any further. The small steps reduce errors and in this way, the correct information is reinforced immediately. If every learner follows the identical sequence, the program is a linear one. While the game players follow the same procedure, the information on the cards they pick up at each turn is controlled by chance. In both techniques, the amount of work is low per reinforcement. Both call for overt responding; in the game, it is answering the question orally and in the programmed text, with a pen or pencil.

There are two main differences between the two methods of instruction; one is that the programmed text is completed by an individual;

there is no social interaction, not even as much as between student and computer! The game, however, provides for interaction of a social nature; co-operation and competition are the result. In addition, the game does not allow for self-pacing, which is an important advantage of the programmed text; a student can progress at his own pace.

Because of these many similarities and two definite differences, it was thought by the author to be of interest to test the effectiveness of the two different teaching techniques in this investigation. Would the students learn more, as evidenced by a post-test result, by using the didactic game or the programmed text? Would they prefer one method to the other? Would they consider either method as a worthwhile technique?

The programmed text (see Appendix) selected for use in this investigation is called Defining Objectives, A Teaching Programme[39] by Martyn Roebuck and Derick Unwin (1965, 1966). It is a text that presents material on behavioral objectives in forty frames. It has been used several times at Concordia University by Professor D. Unwin in his course "Educational Simulation and Gaming." This text presents definitions, in various ways, of the component parts of a behavioral objective--that is, the terminal or action verb, the criteria of success, and the conditions under which the assignment is to be carried out. The student is asked to identify missing parts and supply them. The phraseology is varied and the questions on the frames are multiple choice or require a yes or no answer. One question asks the student to make up a complete objective with the three component parts. The text is accompanied by an answer sheet in scrambled

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[39] Martyn Roebuck and Derick Unwin, Defining Objectives, A Teaching Programme, 1965,1966.

form at the back and the students are instructed to confirm their answers before proceeding.

In order to confine the study to the limitation of time (two hours) only thirty-four of the forty frames were used in this investigation. The six frames omitted required the student "to write an objective about the addition of numbers up to ten." The wording of this problem is vague and confusing. As well, it was felt to be superfluous, as another section of the programmed text required the student to write an objective (Frame #31). For these reasons, the six frames that pertain to that particular assignment were left out, without in this author's opinion, any detriment to the whole programmed text.

A validation for this prog[redacted] text was requested by this author from Mr. Derick Unwin but u[redacted]nately none was available. However, from personal experience, t[redacted]ext was considered to be an effective one, and one worth using in this piece of research.

CHAPTER III

Subject Matter of the Game

A well-designed game has a precise educational goal; there is a clear relationship between the structure and the objectives of the game. Very often this is not the case; it is anything but clear just what the game designer expects the students to learn as a result of the experience. However, when the objectives have been clearly outlined and then implemented into the game, the well-designed educational game, such as "Wff'n Proof"[40] and "Democracy,"[41] becomes a potentially powerful instructional vehicle. It can also be more easily integrated into the curriculum and for a game to be effective, it must be an integral part of the curriculum.

As this investigation was to be carried out in the Department of Education at Concordia University, it was necessary to find a subject area that was part of the curriculum of one of the courses offered and to transpose it to a game format. The subject chosen--behavioral objectives--is one that students in Education study in the course, "Selected Topics in Education: Special Subject Curriculum Theory." When presented with this material, some students have difficulty in grasping the meaning of the content and applying it. This was

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[40] Zuckerman and Horn, p. 102.

[41] Allen, Allen and Miller, pp. 22-25.

experienced by the author. Because of this difficulty, it seemed a reasonable area in which, for purposes of this investigation, to try another teaching method, other than the textbook, lecture or discussion.

While there are many persons who oppose their use, it is unlikely that anyone in the educational field can avoid taking a position in respect to behavioral or measurable objectives. Their main purpose is to provide clarity of intent and the measurement of outcomes in a learning situation.

Although the phrase "behavioral objectives" had not been widely used until lately, every program of training does in fact have behavioral objectives, whether they are stated explicitly or not. The purpose of training for a specific task is to develop the capability for the behavior required by the task.

With the advent of teaching machines and programmed instruction, the usefulness of behavioral objectives became more apparent. In the case of programmed instruction and the more complex learning systems, the need for specific detailed instructional objectives is obvious. Their use for teachers in lesson or curriculum planning may be less obvious. But educational planners including teachers and curriculum planners, have always been deeply involved in the identification and clarification of their goals. Objectives of many kinds emerge from such planning operations. They can be stated from a number of points of view: for example, an educational system, a particular school, or very specific objectives at the lesson level.

The idea of behavioral objectives emerges from the behavioristic and connectionist learning theories. Within these concepts, learning is inferred from a change in behavior. That is, "people do not learn in a general sense but always in the sense of a change in behavior that can be described in terms of an observable type of human performance."[42] The teacher is the one who expedites this learning or change in behavior. Therefore, to do this most effectively, the teacher must outline objectives of the program in behavioral terms. This procedure helps the teacher to select appropriate learning experiences and teaching strategies, as well as set the proper learning environment. If pupils are aware of objectives, it also communicates to the pupil what is expected of him. Thus, evaluating progress is simplified.

Do behavioral objectives have clearer, more definite meaning than non-behavioral objectives in conventional classroom instruction? In one sense they do, because behavior is overt and observable, whereas the long term goals of knowledge, understanding, ability, etc. are hidden inside the students. These internal qualities can only be assessed by eliciting behavior that is dependent on them. However, it is important to remember that the overt behavior is not the real objective but only an indicator of whether the objective has been accomplished. Behavioral objectives then, are the immediate objectives of a learning program. Defining them or stating them may assist the teacher at the functional and day-to-day practical level to complete the long range instructional goals of the learning program. Behavioral objectives, if considered as a means to the end of increasing precision in teaching, can be very helpful.

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[42] Robert M. Gagné, The Conditions of Learning, Holt Rhinehart and Winston, Inc., 1965, p. 172.

Mager's formula for preparing behavioral objectives is perhaps the most well known and is included here for examination.

> First, identify the terminal behavior by name; we can specify the kind of behavior which will be accepted as evidence that the learner has achieved the objective. [eg. The student will be able to solve quadratic equations.]
>
> Second, try to further define the desired behavior by describing the important conditions under which the behavior will be expected to occur. [eg. Using his text, the student will be able to solve quadratic equations.]
>
> Third, specify the criteria of acceptable performance by describing how well the learner must perform to be considered acceptable. [eg. Using his text, the student will be able to solve quadratic equations, getting eight out of ten correct.][43]

To review then; in assuming that objectives form a significant function in the curriculum and that there is a useful place for objectives in the design of instruction, then the clear and unambiguous statement of objectives can icnrease their benefit. One way to do this, is to state them in behavioral terms.

Mention must be made of the different kinds of behavioral objectives; there are large and small objectives--long term and immediate; terminal objectives would state mastery behavior or whole steps while statements referring to subordinate skills and knowledge to be acquired along the way would be called interim objectives. However, when looking at objectives in a contingency relationship like this, it is important to remember that what is considered terminal behavior in one construction may be interpreted as an interim or enroute objective in another.

Bloom's Taxonomy in the cognitive structure has proven to be of special value in the evaluation process of behavioral objectives. It has

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[43] Robert E. Mager, Preparing Instructional Objectives, Fearson Publishers, Palo Alto, California, 1962, p. 12.

a remarkably direct application for the curriculum maker, or teacher attempting to design behavioral systems in learning programs. Its conceptualizations of behavior, especially in the first three levels, that is, knowledge, comprehension and application, are reflected in their own language in the classroom. If one keeps in mind that it is an attempt to simplify a very complex subject and that there are no clear outlines where one cognitive activity stops and the other starts, it can be a very helpful taxonomy for the educational system designer.

A major objection to the idea of behavioral objectives is a reaction to a too dogmatic insistence on the observable and measurable aspects which can result in their being meaningless. Critics like Atkin[44] declare that the assumption that measurable goals are most worthwhile is untenable. Rather, the evaluation of an objective comes first, not the methods for assessing progress. Goals, says Atkin, need to be determined in terms of their significance, not their measurability.

However, Wight[45] states that one remedy for this disadvantage is to keep the aspects of the goal and the measurement completely separate. The two aspects are present in behavioral objectives and that too often the goal aspect is de-emphasized to the point that it is virtually non-existent. Most so-called behavioral objectives are not really objectives but indicators (samples of behavior or tests) that serve as evidence that the true objectives have been achieved. He claims that many of the

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[44] J. Myron Atkin, "Behavioral Objectives in Curriculum Design: A Cautionary Note," The Science Teacher, May 1969, p. 171.

[45] Albert Wight, "Beyond Behavioral Objectives," Educational Technology, July 1972, pp. 176-178.

disadvantages of behavioral objectives, such as placing a restriction on the teaching strategies, emphasizing trivia, and the negative psychological aspect of stating every objective in terms of a task or test, will be overcome if two things are kept in mind; one, that the objectives be meaningful to the learner in terms of his interests, aims, ambitions, and perceived needs; two, that flexibility be an important and continuing aspect of the learning program.

Elliot W. Eisner[46] makes the interesting difference between instructional objectives and expressive objectives. The former specify the particular behavior (skill, item of knowledge) the student is to acquire after completing a learning activity. They are used in a predictive model of curriculum development. If unsuccessful, this model can be changed. Expressive objectives on the other had, describe an educational encounter; they provide the student with a situation in which to work, a task or a problem but it does not specify exactly what is to be learned. Eisner consideres the expressive objective to be evocative rather than prescriptive. It serves as a theme which skills and understandings learned earlier can help develop. An example would be "to interpret the meaning of Paradise Lost" or "to visit a zoo and discuss what was of interest there." These objectives stress the individual responses and learning of the students and help to remedy the problem of too much specificity. While the instructional objectives emphasize the acquisition of the known, expressive objectives emphasize the elaboration and modification of the known and even the production of the new. This

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46 Elliot W. Eisner, "Instructional and Expressive Educational Objectives; Their Formulation and Use in Curriculum," An Educational Research Association Monograph, Series on Curriculum Evaluation, no. 3, 1969.

concept of behavioral objectives helps to keep a better perspective on the entire subject; however, both kinds of objectives are important.

The whole issue of behavioral objectives is not so much whether the teacher should or should not use them but rather whether the teacher should ask himself what goals the employment of behavioral objectives will enable him to achieve and to what extent he wishes to commit his teaching to these goals.

Thus, this subject of behavioral objectives which often forms part of the curriculum in teacher education, gives the prospective teacher an approach to lesson planning that he would not otherwise have. Whether teachers actually do use them, and if so, what percentage consider them useful, is another question.

CHAPTER IV

Evaluation Design

Subjects

Thirty-six undergraduate students in the Department of Education at Concordia University participated as subjects in this research. These students were registered in a course on "Selected Topics in Education; Special Subject: Curriculum Theory." Included in the curriculum of the course was the subject of behavioral objectives. This subject matter had not yet been presented to the class, though some subjects had already read Preparing Instructional Objectives by Robert Mager (Fearson Publishers, Belmont, California, 1962) which deals with this topic and which was on the reading list of the course.

Theoretical Hypothesis

TH_1 If students of education who have not been taught the concept of behavioral objectives in class, play a didactic game designed to teach this subject matter, they will exhibit an increase in knowledge and comprehension of this subject matter.

TH_2 If students play the didactic game designed to teach behavioral objectives, they will exhibit a greater increase in knowledge and comprehension of the subject matter than a group of students in the

class who complete a programmed text intended to teach the same subject and who do not play the game.

Operational Hypothesis

OH_1 If students in a course entitled "Selected Topics in Education; Special Subject: Curriculum Theory" in the Department of Education at Concordia University, who have not been taught the subject of behavioral objectives in class, play the didactic game "Point to Point" designed to teach this subject matter, they will exhibit an increase in knowledge and comprehension of this subject matter, as measured by a pre- and post-achievement test designed for this investigation.

OH_2 If students in the above course who have not been taught the concept of behavioral objectives in class, play the didactic game "Point to Point" designed to teach this subject matter, they will exhibit a greater increase in knowledge and comprehension of this subject matter than a group of students in the same class who complete the programmed text Defining Objectives, A Teaching Programme[47] (modified version).

Statistical Test

A t-test[48] for correlated samples was conducted using Concordia University Computer Center's Program as well as a two way analysis of variance. The alpha cut-off was set at .05.

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[47] Martyn Roebuck and Derick Unwin, Defining Objectives, A Teaching Programme, 1965-1966.

[48] Bruce Tuckman, Conducting Educational Research, Harcourt, Brace and Jovanovich, New York, 1972.

Procedure

The procedure for this research attempted to be consistent with the usual classroom practice; that is, it was a regular classroom session. All students would participate in two teaching techniques, either the game or the programmed text.

After the students had taken their seats, the class was divided into two groups on the basis of left and right of center rather than front to back in order to control for the possibility that seat selection might correlate with test performance. Those to the left of center were Group I, those to the right of center were Group II. There were eighteen subjects in each group.

1. Pre-test. All subjects (thirty-six) were given a pre-test on the subject matter of behavioral objectives. This pre-test was presented on one of two forms, Form A and Form B (see Appendix) to all participants. Half of each group (nine) completed Form A and half completed Form B.

2. Teaching Technique. The subjects then experienced one of two teaching techniques; that is, Group I left the room and played "Point to Point" in another classroom. Group II completed the programmed text, Defining Objectives, A Teaching Programme, in the same classroom.

3. Post-test. For the post-test, the subjects who played the game (Group I) returned and completed the post-test with Group II. As the two tests, Form A and Form B were parallel and interchangeable, those who had completed Form A in the pre-test were now given Form B to complete; those who had been given Form B in the pre-test were given Form A. In

this way, the pre-test and post-test were compared and controlled for test difficulty (see Table 2).

TABLE 2

RESEARCH DESIGN TO CONTROL FOR TEST DIFFICULTY IN THE PRE-TESTS AND POST-TESTS

	Group I		Group II	
Pre-test	Form A	Form B	Form A	Form B
	Didactic Game		Programmed Text	
Post-test	Form B	Form A	Form B	Form A

4. Description of tests. Form A and Form B each consist of nineteen multiple choice questions; twelve questions concern the terminal verb or action verb of a behavioral objective, three deal with the conditions under which the students would be expected to perform the assignment outlined in the behavioral objective, and three questions are on the standard or criteria of performance required by the teacher, and which is always a part of a well-stated behavioral objective. The last question in each test Form A and Form B requires the participant to write a complete behavioral objective.

The questions were weighted and scored out of one-hundred points.

5. Information supplement. (see Appendix) An additional questionnaire was stapled to the post-test, which asked the students to complete five questions. The first question asked how worthwhile the technique in which the subject had participated was considered to be. The next three questions asked how frequently the subjects would recommend its use in primary school, secondary school and university respectively, while the last question asked if its frequent classroom use would be recommended to the principal.

6. Assumptions concerning data. In order to test the above hypothesis, several assumptions were made:

a) Since the subjects must be divided into the experimental group playing the didactic game and the control group completing the programmed text, and since the treatments for each group were chosen in a random block selection, as explained above, it will be assumed that the groups are matched.

b) Errors in measurement will be assumed to be randomly distributed around the mean scores of each tested group and therefore it is possible to consider the increase in the mean from pre- to post-test as a gain for each group.

CHAPTER V

Results and Discussion

Summary

The basic variables in each analysis were the teaching technique (didactic game and programmed text) and the test sequence--Form A and Form B, or Form B and Form A. According to the results of a t-test done on correlated samples, there was a significant trial effect, indicating that the post-test scores in both groups, that is, didactic game and programmed text, were higher than the pre-test scores. The p value was $<.003$. This shows that there was an increase in the understanding of content across both groups. The results of the two way analysis of variance are illustrated in Table 5. No significant group interaction was found.

Test Validity

The Kuder-Richardson formula was applied to both Test A and Test B. For Test A, the result was .700 and for Test B, the result was .841. If .50 is accepted as the lower limit on acceptable values, then both these results are satisfactory. Test A and Test B can be assumed to have validity.

Didactic Game

The mean score for those who played the game was 52.3% in the pre-test. In the post-test, the level had been raised to 66.5%, an increase of 14.2 points ($p < .0075$).

The monitors. There were four monitors in the group of game players; they did not join in the game but supervised the game and verified the answers. The average mean score in the pre-test for these monitors was 53.4% and in the post-test a score of 65.3%. Both these scores are very similar to those of the rest of the group of didactic game players, suggesting that the amount of learning by the four monitors and the players was similar.

Programmed Text

The mean score on the pre-test of the subjects who completed the programmed text, Defining Objectives, A Teaching Programme, was 51.6% and the score on the post-test was 67.4%, indicating an increase of 15.8 points with a $p < .005$. It can be concluded that both teaching techniques, this didactic game "Point to Point" and this programmed text, Defining Objectives, A Teaching Programme, as applied to content learning, were of the same effectiveness in this investigation.

Table 3 and Table 4 represent the pre-post score frequency distribution in the didactic game and programmed text, while Figure 9 is a bar chart illustrating the frequency distribution of the subjects who played the didactic game and Figure 10 illustrates the frequency scores of those who completed the programmed text.

The first theoretical hypothesis, that students of education who had not been taught the concept of behavioral objectives in class and who play a didactic game designed to teach this subject matter will exhibit a statistically significant increase in knowledge and comprehension of this subject matter was confirmed by this investigation.

The second theoretical hypothesis, that those who play the didactic game will exhibit a greater increase in knowledge and comprehension of the subject matter than a group of students who completed a programmed text on the same subject matter was not demonstrated.

Figure 9. Bar chart of frequency distribution of the subjects who played the didactic game.

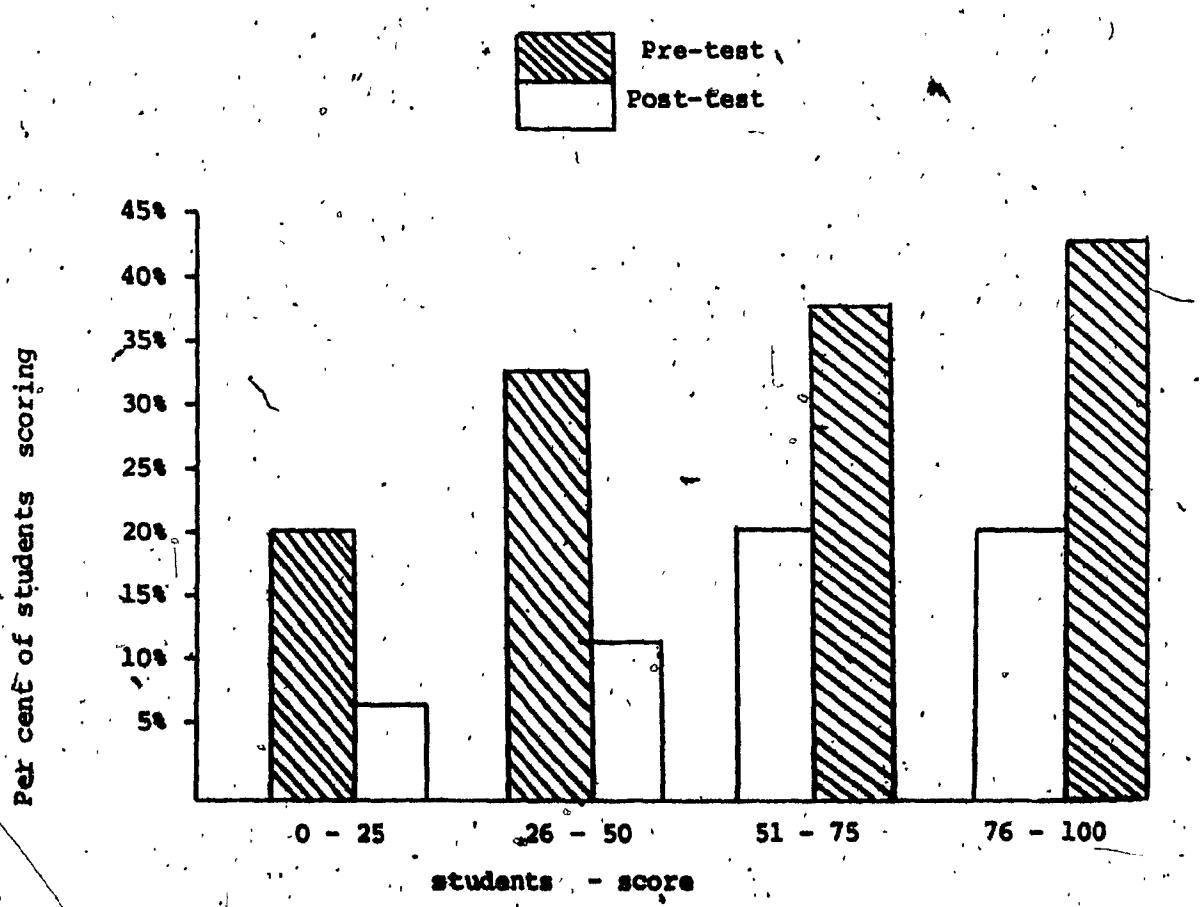

TABLE 3

SCORE FREQUENCY DISTRIBUTIONS
DIDACTIC GAME

Score	0 - 25	26 - 50	51 - 75	76 - 100
No. of subjects Pre-test	4 (22%)	6 (34%)	4 (22%)	4 (22%)
No. of subjects Post-test	1 (6%)	2 (11%)	7 (39%)	8 (44%)

n = 18 $p < .0075$

Figure 10. Bar chart of frequency distribution of the subjects who completed the programmed text.

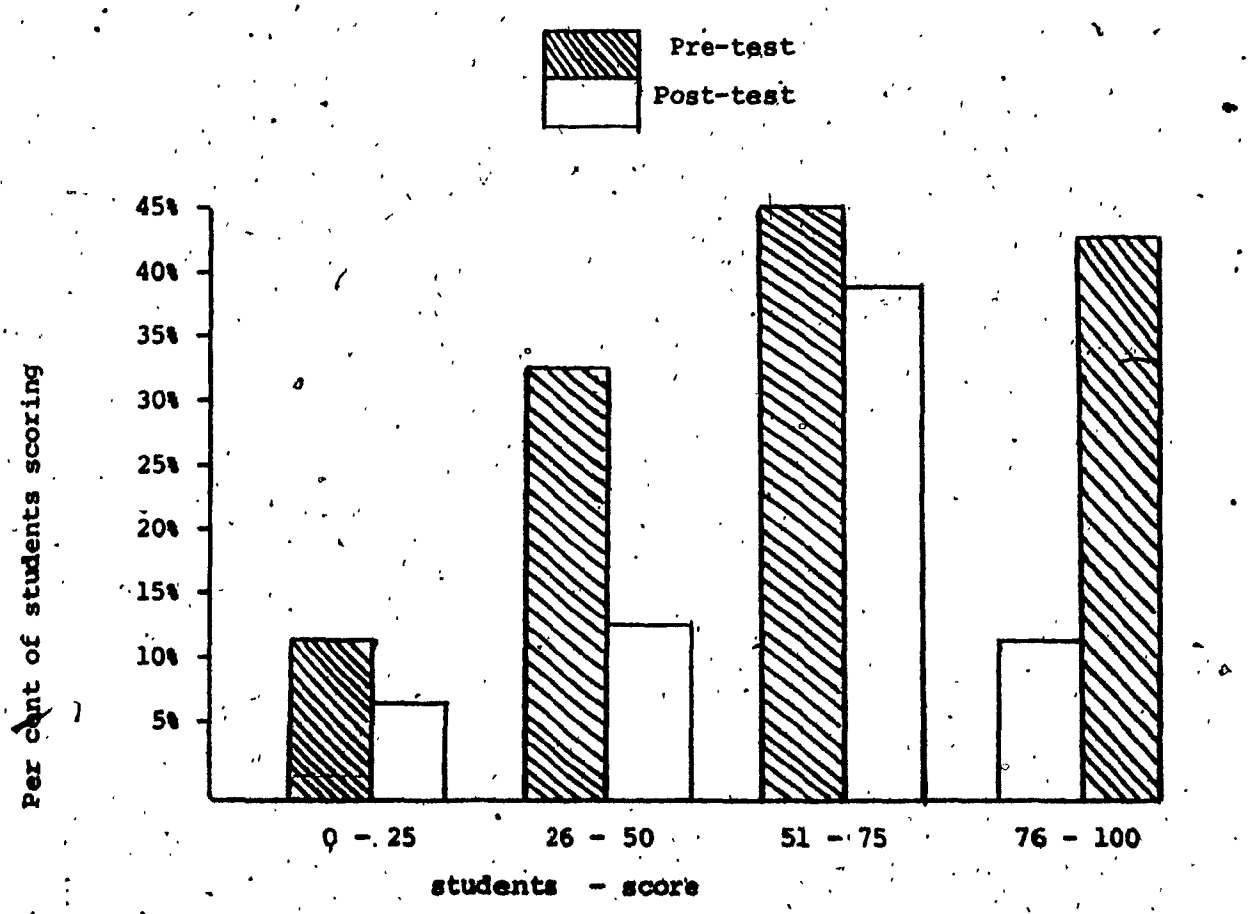

TABLE 4

SCORE FREQUENCY DISTRIBUTIONS
PROGRAMMED TEXT

Score	0 - 25	26 - 50	51 - 75	76 - 100
No. of subjects Pre-test	2 (11%)	6 (33%)	8 (45%)	2 (11%)
No. of subjects Post-test	1 (5%)	2 (12%)	7 (39%)	8 (44%)

$n = 18$ $p < .005$

TABLE 5

ANALYSIS OF VARIANCE

Analysis of Variance 1

Dependent Variable 1

Source	Sum of square	Degrees of freedom	Mean squares	F-ratio	Probability
Total	36592.486	71.	514.120	—	—
Between	24954.986	35.	713.000	—	—
A	.222	1.	.222	.0003	.9836
Error	24954.764	34.	733.964	—	—
Within	11547.500	36.	320.764	—	—
T	4020.056	1.	4020.056	18.1860	.0003*
TA	11.681	1.	11.681	.0528	.8143
Error	7515.764	34.	221.052	—	—

(*) This confirms that in the combined score of both groups there was an increase from pre-test to post-test.

Information Supplement

The information was qualified in the following way:

The four inch line between "not worthwhile" and "very worthwhile" was divided into four sections. One point was allotted for a mark placed on the first inch, two points for a mark placed on the second inch, three points for a mark placed on the third inch, four points for a mark placed on the fourth inch; while those who circled "very worthwhile" on the first question or "frequently" on the other questions were given five points.

Fifteen of the eighteen game players filled in the supplement while seventeen students out of eighteen who completed the programmed text gave their responses to the questionnaire.

Table 6 gives the results of question 1: "How worthwhile is this method of learning, in your opinion?"

TABLE 6

RESPONSES TO QUESTION 1 IN INFORMATION SUPPLEMENT

Score on question 1	n	1	2	3	4	5
Responses of those playing didactic game	15	0	3	4	2	6
Responses of those completing programmed text	17	0	1	5	7	4

Table 7 gives the results of question 2: "If you were teaching primary school, how frequently would you use this method?"

TABLE 7

RESPONSES TO QUESTION 2 IN INFORMATION SUPPLEMENT

Score on question 2	n	1	2	3	4	5
Responses of those playing didactic game	15	1	3	5	2	4
Responses of those completing programmed text	17	4	2	3	6	2

Table 8 gives the results of question 3: "If you were teaching secondary school, how frequently would you use this method in your classroom?"

TABLE 8

RESPONSES TO QUESTION 3 IN INFORMATION SUPPLEMENT

Score on question 3	n	1	2	3	4	5
Responses of those playing didactic game	15	2	0	4	6	3
Responses of those completing programmed text	17	1	0	4	10	2

Table 9 gives the results of question 4: "If you were teaching university level students, how frequently would you use this method in your class?"

TABLE 9

RESPONSES TO QUESTION 4 IN INFORMATION SUPPLEMENT

Score on question 4	n	1	2	3	4	5
Responses of those playing didactic game	15	3	1	3	5	3
Responses of those completing programmed text	17	1	0	2	9	5

Table 10 gives the results of question 5: "If you were a teacher, would you recommend this method to your principal for classroom use?"

TABLE 10

RESPONSES TO QUESTION 5 IN INFORMATION SUPPLEMENT

Score on question 5	n	1	2	3	4	5
Responses of those playing didactic game	15	3	0	3	0	9
Responses of those completing programmed text	17	1	1	7	1	7

Conclusion

The results of the investigation indicate that the game that was designed for this piece of research is an acceptable teaching technique. The increment of 14.2 points in the mean difference score between the pre-test and post-test indicate that learning did take place.

It is interesting that the four Monitors in the game "Point to Point" who did not take part in the game, icnreased their scores as much

as the players. In other words, they learned vicariously by supervising the play and listening to the other game players.

The subjects were not told that taking part in one of these teaching techniques was, in fact, an investigation into their effectiveness. Thanks to Professor Frances Friedman these two activities were presented to the class as though they were an integral part of the course and merely an attempt to expose teachers to less traditional modes of teaching which formed part of the course in Curriculum Theory. In this way there was an attempt to keep a similar atmosphere in the classroom, in order not to influence the results of the investigation in any way.

However, the hour at which the investigation took part, was not, in the author's opinion, a good one. It was 4:00 P.M., after the subjects had completed a day's teaching in the schools. (Considering this fact, the subjects were most co-operative.) This was the only two-hour class where the subject matter of behavioral objectives was to be taught and two hours was necessary for the completion of the pre-test, the teaching technique and the post-test.

Some of the subjects whose first language was not English were responsible for the low scores and little increment in learning. As there were subjects with this problem in each group, it cannot be assumed to have influenced the results to any significant degree.

While there was a remedial factor built into the game in the form of two decision points beyond which a player could not go without giving a correct answer, there was no branching integrated into the game. This branching technique supplies further problems in a specific area when an

incorrect answer is given. (It is the pedagogical treatment for landing on the "Snake" in the game of "Snakes and Ladders.") This lack of branching is a limitation in the design of the game "Point to Point." However, as the problems were written on cards drawn at random, the only remedial feature possible was to slow down the pace of the player giving an incorrect answer.

One of the guidelines for designing the game was to have it as an alternative teaching technique; that is, the game was designed to present a completely new subject matter. However, as the increment in content learning was not dramatic, it is possible that it would be more effective as a supplementary technique to be used after a subject matter had already been taught by another method--that is, by a lecture or a discussion group.

A certain amount of time is always required merely to set up the game, learn the rules and start the game process before any learning of the subject matter can take place. As two out of four groups did not finish the game, perhaps one and a half hours is not sufficient and a longer time is needed for effective learning to take place.

Again, perhaps the game should be played more than once for those who have not finished by the allotted time.

These are both areas that might be explored in future research projects.

As this is an academic game, the subjects who had difficulty in reading and writing English did not increase their score as much as the others. Therefore, this type of game is not as effective for those students whose facility with the English language is low. A game which

involves pictures or diagrams or oral interaction alone would be more appropriate for such students.

This game was designed for this particular piece of research; it cannot be said to have generalizability.

Comments on the Evaluation Design

It was thought that one attempt to collect data with thirty-six students was limited, not only in number of trials but in the number of subjects as well. So it was decided to use both this game and this programmed text again with another class in the Department of Education. The only other appropriate class in which the subject matter of behavioral objectives was covered was just an hour in length. By asking the students to stay longer, it was hoped to repeat the whole procedure and thus collect more data. However, it was not possible for enough students in each group to remain long enough to complete the post-test and no further data were accumulated.

Although the tests A and B used in this research score well in validity by the Kuder-Richardson formula, only further trials would indicate reliability. A limitation of this research is that these tests were only used once and that therefore reliability cannot be assumed.

There is always the possibility that a pre-test alone sensitizes the subjects; that is, there is an increase in score in the post-tests, not only from experiencing the teaching technique (game or programmed text) but from completing the pre-test as well. Therefore it is recommended that when the game "Point to Point" is used again, the pre-test be completed as well to ensure effective content learning.

As well, when repeating the experiment it might be of value to include a third group of students who would be taught the same subject matter, behavioral objectives, by means of a lecture. This group would serve as a control group to the other two groups. In this way, it could be ascertained which of the three teaching techniques—didactic game, programmed text or lecture—was the most effective.

Lack of Validity of the Programmed Text

It was assumed at the outset of this research that validity for the programmed text Defining Objectives, A Teaching Programme could be procured from the authors. Unfortunately, this was not so. A letter (see Appendix) from author Derick Unwin confirms this. This lack of validity was most disappointing and a definite limitation to the evaluation design.

Results of Information Supplement

From the results of the information supplement, two facts are evident. The responses to each technique are predominantly positive. If the scores of the last two columns are added, in every case but one, it is a positive response by over half the group.

Secondly, these responses are remarkably similar. Neither technique is considered to be significantly more or less worthwhile than the other, nor is it more or less often recommended than the other. Each technique is most highly recommended at the primary school level.

APPENDIX

POINT TO POINT

A GAME FOR FIVE PLAYERS

RULES OF GAME

MATERIALS:
1 Playing Board
2 Dice
4 Counters
1 Pack of Yellow Cards
1 Pack of Blue Cards
1 Pack of Pink Cards (with red dots)
1 Pack of Orange Cards
1 Pack of Green Cards

DIRECTIONS: Open the board and place the green (with green dots) and pink (with red dots) packs face down on the board where indicated. Place yellow, orange, and blue packs face down beside the board. Each player throws the dice, and the player who throws the highest number is Time-keeper and monitors the game. He does not join in the play but takes the Envelope with the time-card and answer sheet. He notes down the time at which play begins. The four remaining players line up at the starting line. The dice are thrown and the player throwing the highest number starts off by throwing the dice once more and moving the indicated number of spaces. If he lands on a space with a yellow dot, he picks up a Yellow Card. (If he lands on a space with an orange dot or a blue dot, he does the same) The player then reads aloud the contents of the card and give his answer, which can be verified by the Monitor on the Answer Sheet. If the player answers correctly he moves ahead five additional spaces. If he answers incorrectly at the start of the game he remains at the starting point. If a player answers incorrectly in future turns during the game, he has to go back two spaces.

The play moves to the left and continues in this way.

Each player must pick up a Green Card (with a green dot) when passing over the second jump, and a Pink Card (with a red dot) when passing over the fourth jump. He must answer the Card correctly before proceeding. If he answers incorrectly he remains in the same position and takes another Green or Pink Card his next turn. And so on until his answer is correct and he can proceed.

A player must also obey the instruction on the board, if he lands on the indicated space.

The first player to cross the finish line is declared the Winner. The Monitor notes down on the Time-card the time at which the players finish.

Play continues until all players have crossed the Finish Line.

D E F I N I N G O B J E C T I V E S

___a teaching programme

(modified version)

c 1965, 1966 - Martyn Roebuck & Derick Unwin

The objective of this programme: At the end of the programme and for a reasonable period of time thereafter you will be able to identify a precisely defined programme objective.

This programme will take you between 30 minutes and 180 minutes to complete.

Write nothing on the programme itself. Please write your answers on the answer page provided. Number the answers appropriately with the frame numbers.

The programme consists of short items called 'frames', with questions to be answered or gaps* to be filled in. Decide on your answers to each frame before you look at the answer supplied.

After each gap or question is a number in brackets e.g. (33)

When you have made your responses check that you have given the correct _____(33) by looking at the number on the answer sheet - the back page of this booklet. Look now and check number 33.

---

* ____stands for one missing word

____ ____ stands for two missing words

*** stands for any number of missing words

Write your NAME, the DATE and the STARTING TIME at the top of your paper.

1. (a) "The nurse will know how to prepare insulin for injection"
   (b) "The nurse will be able to measure correctly a prescribed amount of insulin"
   (b) is a relatively _____ (ambiguous/unambiguous) (31) statement

2. The statement (1(b) above) is a precise description of what the nurse will be able to _____(24). It describes her

   _____ (knowledge/behaviour) (29)

3. The statement does not describe what the nurse will KNOW; it describes what she will be able to DO.

   The statement describes her _____ (40)

4. Which of these two statements describes observable behaviour?

   (a) ...to understand fully...
   (b) ...to list correctly.... (37)

5. Which of these says what a person can DO?

   (a) ...know the phrases...
   (b) ...recite the phrases... (16)

6. Which is open to fewer interpretations?

   (a) ...to grasp the significance of ...
   (b) ...to compare ... (37)

7. Which is open to wider interpretation?

   (a) ...to understand...
   (b) ...to identify... (5)

8. Which has the greater number of possible meanings?

   (a) ...to write...
   (b) ...to know... (16)

9. A person is described as "knowing the paintings of Manet". Which of the following are to be presumed to be within his capabilities?

   (a) ...can identify a painting by Manet...
   (b) ...can state the date and location of any landscape or outdoor scene painted by Manet...
   (c) ...can name the present owner of every Manet painting...
   (d) ...given the title of a Manet painting he can state the current market value... (4)

10. The student "can identify a specimen of the grass Dactylis glomerata, given flowering stalk, leaves and root complete".

    Therefore:

    (a) ...he can identify the grass from a botanical drawing.
    (b) ...he knows the grass Dactylis glomerata.
    (c) ...he can give a botanical description of Dactylis glomerata.
    (d) ...he can identify another complete specimen of Dactylis glomerata.

    (23)

11. "At the end of the programme the pupil will Know Ohm's Law" is open to *** (a single/many) interpretation(s). (15)

12. TERMINAL BEHAVIOUR is what the pupil will be able to do after working through a programme.

    "At the end of the programme the pupil will know Ohm's Law", *** (does not) define the terminal behaviour.

    (3)

13. Which of the following statements are in 'behavioural' terms, in other words, which say what will be DONE?

    (a) "The pupil will know Ohm's Law".
    (b) "The pupil will understand what is meant by Ohm's Law both as an equation and as a verbal definition"
    (c) "The pupil will recite a definition of Ohm's Law".
    (d) "The pupil will write down an equation for Ohm's Law".

    (28)

14. The words 'know' and 'understand' are capable of

    _____(15) shades of meaning whereas 'write' and 'identify'

    are open to _____(21) interpretations.

15. A statement of the terminal behaviour of a programme is a precise description of *** (2) after having worked through the programme.

16. Which two of the following would not be used in a statement of terminal behaviour?

    (a) "...state three reasons..."
    (b) "...recite..."
    (c) "...Really understand the principles..."
    (d) "...be able to use the technique..." (28)

17. A programme is an ordered sequence of material which is revised until it brings about certain behaviour changes. The behaviour changes have to be defined before the programme is written so that they can be measured and the programme effectiveness evaluated.

Many people, even experienced teachers, find it difficult to define clearly their educational intentions. They use generalisations. They do not make up their minds as to what it is they want their pupil to _____(24) at the end of the programme.

18. Both of the following objectives define terminal behaviour.

One adds further precision. Which one?

(a) "The pupil will be able to write down an equation for Ohm's Law"

(b) "Without the use of reference material the pupil will recite a definition of Ohm's Law".

(37)

19. Both objectives said what the pupil would be doing but only (b) stated <u>conditions</u> under which he would work. What were the conditions?

(1)

20. Check these objectives for (A) behavioural terms and (B) conditions

(i) "Given a dictionary the student will be able to write a translation of the passage."

(ii) "Given a dictionary the student will be able to write down correctly the German equivalents of at least 12 of the 20 words."

(iii) "The pupil will recite a translation of the given passage making not more than two errors of tense".

(i) (12)
(ii) (13)
(iii) (5)

21. Objectives (ii) and (iii) above differed from objective (i) in that they both gave, further, an indication of the _____(20) the pupil was required to reach.

22. "Given no reference material but supplied with logarithm tables the pupil will be able to write down in five minutes the correct answers to three of the given problems".

This objective contains the <u>terminal behaviour</u>, the <u>conditions</u> applying, and the <u>criteria</u>, (i.e. standard required). Split the objective up into those parts, viz.,

(a) What does the pupil have to do (the behaviour)?

(b) Under what conditions?

(c) To what standard?

(11)

23. A precise objective has the three parts stated in the last frame:
(a) Terminal Behaviour, (b) Conditions, (c) Criteria

Here are parts of the objective (ii) of frame 20.

Label them a, b and c as appropriate.

"...correctly .. at least 12 of the 20 .."
"...will be able to write down the German equivalents of the words
"...Given a dictionary..."

(7)

24. Which of the following are CONDITIONS under which a pupil might demonstrate his attainment of programme objectives?
(a) "...in fifteen minutes..."
(b) "...without reference materials..."
(c) "...Making no more than three errors in grammar..."
(d) "...after three weeks..."

(17)

25. Which of the following are CRITERIA of success?
(a) "...in fifteen minutes..."
(b) "...with no more than six omissions..."
(c) "...by long muliplications..."

(30)

26. Label the following appropriately as either criteria or conditions
(a) "...getting all correct..."
(b) "...from photographs..."
(c) "...with a slide rule..."

(25)

27. A precise programme objective has three characteristics. The objective should:
(1) State the _____ _____
(2) Add the important _____applying.
(3) Add the _____of acceptable performance.

(10)

28. Add <u>criteria</u> to the following:
(a) The pupil must be able to solve the quadratic equations.
(b) The child will be able to complete the jig-saw.
(c) The student will be able to translate a given passage from Gaelic into English.

(27)

29. Add <u>conditions</u> to the following:
(a) The Technician will locate the faulty T.V. component.
(b) The pupil will identify any British farm animal.
(c) He will give two possible explanations of the drop in exports and four reasons for each of his choices.

(27)

30. Which, if any, of these is acceptable as an objective for a programme?
    (a) "He will know about cubism".
    (b) "The student will understand the second law of thermodynamics."
    (c) "The pupil will explain the relationship between the moon and the tides."
    (d) "They will be able to do fractions."
    (e) "He will be able to translate the French sentences."
    (8)

31. Write an improved version of one of the above statements, make it into an acceptable objective. (27)

32. Here are some answers given to Frame 31 in an earlier version of this programme:
    (a) "The student will be able to apply the second law of thermodynamics."
    (b) "The student will be able to state the second law of thermodynamics."
    (c) "The student will fully understand the second law of thermodynamics."

    Which one does not use behavioural terms? (35)

    Which do not give conditions under which the behaviour will be demonstrated? (39)

    Which are not completely satisfactory as instructional objectives? (7)

33. Here are more answers to Frame 31.

    (a) "He will be able to translate the French sentences into English."
    (b) "The student will be able to translate into English the given French sentences. A maximum of one mistake per sentence will be allowed."
    (c) "The student will be able to translate the given French sentences into English to an O-level G.C.E. standard."

    (a) includes neither _____ (6) nor _____ (18)
    (b) and (c) both appear to indicate a standard but only one makes an attempt at precision. Which one? (16)

    Does it matter what sort of mistakes are made in (b)? (38)

34. If you feel you need to alter your objective (Frame 31) after having read frames 31 and 33 then do so. Re-write it so that it can only be interpreted in one way. Make it so that it is obvious when a person is behaving as defined by the objective and when a person's behaviour will not be acceptable. Make sure that both the original version and the revised version are present on your answer sheet.

(27)

THIS IS THE END of the programme.

Note down the time. Please hand in your answer sheet and keep the programme.

Further reading: (a) Specific

MAGER, Robert F. : "Preparing objectives for Programmed Instruction" - Fearon, 1962.

GAGNÉ, Robert M. : "The Analysis of Instructional Objectives" in 'Teaching Machines and Programmed Learning II', R. Glaser. (Ed.) 1965.

(b) General

BLOOM et al : "A Taxonomy of Educational Objectives" Vol. I and II, Longmans, 1965.

ANSWER SHEET FOR PROGRAMME ON OBJECTIVES

1. It referred to reference material
2. what the student will DO
3. does not
4. all of them, the original statement is vague
5. a
6. conditions
7. c, a, b
8. not one of them is precise enough
9. How many correct, in what time?
10. Intended terminal behaviour conditions
11. (a) write down the correct answers
    (b) no reference material except logs
    (c) 3 correct in 5 minutes
12. A, B
13. a, b.
14. several
15. Many
16. b
17. b, d- and sometimes a
18. criteria
19. If it can then it is imprecise; return to frame 9 and work through the program again.
20. standard of criterion
21. fewer
22. does not
23. d only, the other three do not necessarily follow
24. do
25. criterion, conditions conditions
26. Do they get any help?
27. No answer given. Frames 33 to 37 are test frames. Write your answers on a piece of paper and give them to the instructor at the end.
28. c, d
29. behaviour
30. b, c - and a in some cases
31. unambiguous
32. lemon
33. answer + now start the programme
34. Blank
35. c
36. Have you said exactly what they will do
37. b
38. The objective fails to differentiate between errors of grammer, spelling or translation.
39. All 3
40. Behaviour

FORM A

NAME..... DATE.....

PART I

Please read carefully each of the following items and circle the letter corresponding to the answer(s) you think best fits each question.

1. Which of the following is stated in behavioral terms:

   a) To be able to repair a radio
   b) To know how a radio works
   c) Both
   d) Neither

2. Which statement has a greater number of possible meanings:

   a) The pupil will be able to identify poetry by Keats
   b) The pupil will be familiar with the poetry of Keats
   c) Both a) and b) yield a similar number of meanings

3. "A general survey of the organization and administration of elementary shcool libraries....."

   Does the above statement indicate

   a) an objective of a course
   b) a description of a course
   c) both of the above

4. Which of the following objectives is written in performance terms:

   a) "To understand the rules of logic"
   b) "To know the rules of football"
   c) "To have an appreciation of literature"
   d) none of the above
   e) all of the above

5. "The student will comprehend simple French sentences similar to those in Chapters 1 and 2 in 'Everyday French'."

   This statement is

   a) an observable goal
   b) an unobservable goal

6. Behavioral objectives should be stated in terms of:

   a) teacher intent
   b) pupil activity
   c) both of the above
   d) none of the above

7. Which phrase would be used in a precisely stated behavioral objective?

   a) to demonstrate a knowledge of
   b) to divide into ten categories
   c) neither of the above
   d) both of the above

P A R T II

8. Next to each of the following write "N" if the behavior is not observable:

   a) ___ to understand
   b) ___ to define
   c) ___ to grasp the significance of
   d) ___ to realize
   e) ___ to distinguish between

9. "To really understand the law of magnetism"
   Does this objective specify a precise terminal behavior?

   a) Yes
   b) No
   c) I don't know

10. In a properly stated behavioral objective what indicates how well the teacher wants the student to perform?

11. In the following behavioral objective underline the conditions underwhich the student is expected to perform:

    "Using a dictionary the student will write the Spanish equivalent of the first ten lines of the text."

12. What does standard or criterion imply?

P A R T III

13. Restate in behavioral terms the following objective:

"The student will gain an appreciation of the importance of Einstein in the development of modern science."

14. Rewrite the following objective to describe the student activity rather than the teacher activity:

"To assist the pupil to count to ten by ones"

15. Underline the criterion of behavior in the following objective:

"Given a list of thirty-five chemical elements, the learner must be able to recall and write valencies of at least thirty."

16. Add appropriate conditions to the following behavioral objectives (i.e., fill in the blank):

"..... the pupil will list the four basic steps to administering first aid."

17. (i) Is the following objective precise enough:

"The student will demonstrate a general understanding of Newton's law."

a) Yes b) No c) I don't know

(ii) Can you improve it?

.....

.....

18. "To help the student name the insects in five pictures in the 6th Grade reader."

To improve the above behavioral objective you would:

a) Rewrite the above objective to describe pupil activity
b) Specify in the above statement a level or criterion
c) Both a) and b)
d) Neither a) or b)

19. Write a well-stated behavioral objective.

.....

.....

.....

FORM B

NAME..... DATE.....

PART I

Please read carefully each of the following items and circle the letter corresponding to the answer(s) you think best fits each question.

1. Which of the following phrases are open to fewer interpretations:

   a) To compare
   b) To have an appreciation of
   c) Either of the above

2. "The student will know the five rules of oxidation."
   This statement describes an

   a) observable goal
   b) unobservable goal

3. Which of the following demonstrate(s) a precise terminal verb:

   a) To give examples of
   b) To acquire skills
   c) To separate into categories

4. When used in a behavioral objective which of the following refer to the <u>conditions</u> under which the pupil will be expected to work:

   a) After the field trip
   b) In small groups
   c) Referring to the text
   d) Accurately solve

5. Does the following behavioral objective clearly state the acceptable standard of success expected of the pupil:

   "To write an essay comparing the economics of Eastern and Western Canada"

   a) Yes
   b) No
   c) I don't know

6. Terminal behavior at the end of a program of instruction is what the student is expected to:

   a) know
   b) do
   c) accomplish
   d) discover

7. "To take a field trip"
   This statement indicates:

   a) activity
   b) objective
   c) instructional program
   d) a measurable learning experience

P A R T II

8. Next to each of the following write "O" if the behavior is observable:

   a) ___To have learned about science
   b) ___To construct a triange
   c) ___To be knowledgeable about World War II
   d) ___To define a verb
   e) ___To learn about science

9. Underline appropriate action verbs that would be used in a properly stated behavioral objective:

   a) To recite
   b) To achieve mastery
   c) To discover
   d) To compare

10. From the following list, circle the two "Most behavioral" objectives:

   a) To employ sound thinking habits
   b) To locate specific entries in the card catalogue of the school library
   c) To make pupils conscious of the correct form and usuage in speech and writing
   d) To compare in written form the opinions of several journalists on a particular subject

11. "Given no reference material....."
What does the above phrase denote? (Circle a, b, or c)

a) criterion of success
b) conditions under which the behavior is to take place
c) neither

12. Which of the following indicate a standard of performance?
(Circle a, b, c, or d)

a) 5% error or less
b) 50 words a minute
c) using a Bunsen burner
d) list correctly

PART III

13. What are the three component parts of a properly stated behavioral objective?

a)
b)
c)

14. Rewrite the following to describe student activity rather than teacher activity:

"The student will be shown the Red Cross method of artifical respiration."

15. Improve the following objective by restating it in behavioral terms:

"To become familiar with the words of 'O Canada' "

16. In each of the following statements underline the conditions (if any) underwhich the students are expected to perform:

    a) After recess, the pupils will list the names of five trees found in the school playground.
    b) With the help of a dictionary, the pupil will translate the passage.

17. Complete the following objective by adding a criterion of success:

    "The student will label equations as quadratic or not quadratic....

    .....

18. What is terminal behavior?

19. Write a well stated behavioral objective.

INFORMATION SUPPLEMENT

NAME..... DATE.....

You have participated in a particular learning activity dealing with behavioral objectives. Please read the following items carefully and indicate your answer by drawing a vertical line through the horizontal line given at the point representing your answer.

1. How worthwhile is this method of learning, in your opinion?

   NOT WOTHWHILE ——————————————— VERY WORTHWHILE

2. If you were teaching primary school how frequently would you use this method in your classroom?

   FREQUENTLY ——————————————— NEVER

3. If you were teaching secondary school how frequently would you use this method in your classroom?

   FREQUENTLY ——————————————— NEVER

4. If you were teaching university level students how frequently would you use this method in your class?

   FREQUENTLY ——————————————— NEVER

5. If you were a teacher would you recommend this method to your principal for classroom use?

   _____

   _____

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Telegrams 'University Coleraine'

7th February, 1975

Dear Ms. Beardmore,

Thank you for your letter. Unfortunately the date you require is lost in the mists of time, and I am afraid that I can be of no help to you in this matter.

All best wishes.

Yours sincerely,

DERICK UNWIN
Senior Lecturer in Education

Ms. F.S. Beardmore,
1414 McGregor Ave.,
Montreal,
CANADA,
H3G 1B7

DU/he

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