

FOCUS ON EXCEPTIONAL CHILDREN

DESIGNING INSTRUCTIONAL GAMES FOR HANDICAPPED LEARNERS

*Sivasailam Thiagarajan*¹

TEACHER-DESIGNED LEARNING GAMES

In recent years, the use of instructional games has increased tremendously at all levels from preschool to postgraduate classrooms. There is a corresponding increase in the use of games with handicapped children. Although a number of excellent instructional games for this type of learner are commercially available, there is still a need for many more. The major emphasis in this article is on how a teacher can design, produce, evaluate, modify, and adapt instructional games for the classroom.

WHAT IS AN INSTRUCTIONAL GAME?

The increasing popularity of instructional games is accompanied by an increasing confusion in the related terminology. The term *game* in this article is used in a technical sense to imply three essential characteristics: conflict, control, and closure. Each of these three is briefly discussed below.

Conflict. A game usually requires the players to compete among themselves to obtain certain limited resources. In chess, for example, there is a conflict to see who can trap the other player's king first; in bridge, each partnership strives to take more tricks than the other.

The element of conflict in games, however, need not always manifest itself as intense competition among players. It may be used to create a high degree of cooperation among members of a team in its competition with other teams. It is also possible to design a "cooperative" game in which all players compete against an external force (such as chance) or criterion (such as a time limit). In a solitaire game, conflict is channeled into the player's attempts to outperform the vagaries of chance or his own previous record.

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Control. All games have a set of rules to control the behavior of players. Thus in chess, the king may move in any direction, but not any number of spaces; in bridge, the lowest trump may take the highest cards of other suits, but a trump may be played only under specific conditions. In addition to these explicit rules, players follow certain implicit rules of fair play. Successful play of any game depends upon the acceptance of these controls by all players. Therefore, even in the most intensively competitive game, there is an element of cooperation in abiding by rules.

Closure. The third critical element of a game is its termination. Open-ended play by children may go on forever, but games come to an end when the king is checkmated in chess or all 13 tricks are taken in bridge. One aspect of this closure is the determination of the winner. Very often, a single player wins and the others lose. However, it is possible to structure a game with multiple criteria for winning so that more than one player wins.

Conflict, control, and closure are the technical characteristics of a game. Each of them presents a number of desirable and undesirable outcomes. In a later section of this paper, we discuss how a game designer can emphasize the former and eliminate the latter type of outcomes. We also

present a list of *desirable* characteristics for games for the handicapped.

While all games help players learn something new, an *instructional* game goes about it with certain deliberation. It is intentionally designed to help a specific group of learners attain a specific set of instructional objectives. In this article, we are primarily interested in instructional games for handicapped learners dealing with cognitive and affective objectives. Although instructional games are effectively used for the teaching of psychomotoric skills, their design requires a slightly different set of competencies. This article does not address itself to these competencies.

Many instructional games are also simulations. The term *simulation* implies that the rules and the materials used in the games represent some real-life objects and processes. In Scrabble where the players use letter tiles to make up high-scoring words, they are not simulating a process—they are doing the real thing. Therefore, Scrabble is not a simulation game. However, in Monopoly, where real estate is bought and rent and taxes are paid, players do simulate an outside reality. Monopoly is a simulation game. Instructional simulation games, especially those which involve roleplaying, are of special use in teaching handicapped children such skills as money management or interviewing for a job.

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RATIONALE

The use of instructional games in special education goes further back in history than their use in regular education. With a few exceptions (e.g., Fink et al., 1971), very little empirical evidence exists on the effectiveness of these games. However, teachers' experiences and logical analysis suggest that instructional games have an important role in the teaching of handicapped children. A few of the salient advantages of using games with handicapped children are presented.

Games and Communication Skills. Many handicapped learners lack verbal fluency and are unnecessarily penalized for poor receptive and expressive communication skills. In games, where both stimuli and responses are very often nonverbal, success is seldom correlated with verbal ability. Many scholars believe that games mobilize intellectual competencies at the iconic rather than the symbolic level. Such games provide the handicapped learner with the ability to grasp a situation intuitively rather than analytically.

Games and Instructional Objectives. Games can enhance learning at different levels. The curriculum for the handicapped learner involves a large number of lower-level cognitive objectives such as language patterns and number facts. Though essential, this learning is not exciting. Games can add spice to these dull didactic chores. Handicapped children also need to attain a number of higher-level cognitive objectives, and games are an effective means for achievement in this area. These learners cannot handle abstractions easily; a game could make such abstractions concrete and specific. Finally, games have been proven to be extremely successful in helping learners attain various desirable attitudinal objectives. Play of games is a useful activity for learners to explore the affective domain.

Games and Instructional Feedback. Handicapped children need more frequent and immediate feedback than their normal peers in acquiring new skills and concepts. In a game, such feedback is prompt and real. It is the natural consequence of the player's performance and is related to the ultimate outcome of the game. In this way, the feedback is closer to its real-life counterpart than any other type of classroom feedback.

Games and Socialization. Piaget (1962) and others have pointed out that game experiences are essential for the development of full interpersonal capabilities and capacities of children. Classroom games provide the handicapped learner with a general orientation toward social relations and a realistic perception of life's rules. These games also require cooperation and agreement among the players for their success. Individualized instructional activities in the classroom often isolate the handicapped child. Instructional games compensate for this by encouraging peer learning and cooperation.

Games and Self-Concept. Usually the labeled child has a poor concept of himself and hesitates to participate in the face of repeated failures in the classroom. Games free him to engage competitively in stimulating activities and to develop a healthy attitude toward both success and failure. As he ventures out through instructional games, the learner finds success through a combination of good luck and good judgment. This type of intermittent reinforcement keeps his learning performance at a high level and increases the number of his success experiences. There is room for more success in a game than in a lesson—an ingenious idea which might have passed unnoticed or misunderstood in a classroom discussion may make a dramatic difference in a game. The player feels that power of controlling his environment and enhances his image of self-efficacy.

Games and Motivation. Many problems in teaching

handicapped children are motivational, and instructional games contribute importantly in this area. With a variety of dramatic aspects, these games involve the learner to a degree unequalled by any other instructional activity. Learning from a game is unobtrusive; useful skills are developed at the exact time the learner needs them. Thus games provide a high degree of relevance to what is being learned by the handicapped child.

DANGERS AND DISADVANTAGES

The use of instructional games with the handicapped is not without some disadvantages and limitations. In fact, many of the above advantages can be turned around to reveal a potential danger. In the following brief discussion, we forewarn the designer of some of the more salient limitations of instructional games.

Overstimulation. Instructional games could be so motivating that all other classroom activities are dull in comparison. It is important that instructional activities are sequenced in such a way that the motivating strength of games is used as a positive consequence to encourage other low-probability learning behaviors.

Ethical Considerations. Game designers are becoming increasingly worried about the incidental effects of instructional games, especially those which involve simulation of social processes. All simulations distort reality to some extent; no matter how hard the designer may try, it is impossible to keep his personal biases from coloring players' perceptions. There does not appear to be any simple way out of this dilemma.

Transfer Issues. Simulation games provide a low-risk situation where many real-life skills can be practiced. However, trying to corner the real-estate market on the basis of success in a game of Monopoly is obviously a dangerous exercise. There are many other subtle differences between even the most faithful simulation and reality which could be extremely frustrating.

Peer Pressure. While social interaction during the play of games provides many positive outcomes, it could turn out to be extremely frustrating for a slow child caught in intense competition. Repeated individual failures and blame from other members of the team may do greater damage to the socialization and the self-concept of a child than any of the traditional classroom activities.

DESIRABLE CHARACTERISTICS

At the beginning of the article, we discussed the technical characteristics of an instructional game. We are now ready to discuss the desirable characteristics of an instructional game to be used with handicapped learners. The following list of these characteristics is based upon the experiences of teachers who have successfully designed and used instructional games in their classrooms.

1. Materials and equipment for the game should be assembled into a self-contained kit, so that the children are not required to improvise anything. Materials used in the game should permit self-checking of the correctness of the responses required of the players. This eliminates the need for constant supervision by the teacher.
2. Game materials should be attractive and colorful. Whenever appropriate, they should make maximum use of nonverbal cues such as color coding. The use of three-dimensional objects for kinesthetic stimuli and physical manipulation is highly recommended. Audiotape cassettes provide interesting variation to stimulus materials used in a game. The combined use of such diverse materials permits a multisensory approach.
3. Materials used in the game should be of high personal and local relevance. The board for a map-reading game, for example, may show the layout of the classrooms in the school. Polaroid pictures of children can be used as integral material for a number of games.
4. Game materials should be appropriate for use by children at a given age level. The usual dice have to be enlarged to large wooden cubes, and cards should be the size of postcards rather than the usual playing cards.
5. Each game should be of fairly brief duration and should permit repeated replaying. In this way, the games accommodate fairly short attention spans, and the handicapped children receive the necessary redundancy.
6. Games for use with handicapped children should permit equal competition among learners at different levels. This could be accomplished by prescribing different roles and objectives or by providing different amounts of resources for children at different levels. Also, elements of skill and chance may be combined in such a way that the below-average student wins from time to time.
7. Rules of the game should be simple and unembellished. They should be stated in children's own language. This will permit other teachers and parents to read them directly to the children and get them into the game with minimum delay.
8. A series of short games is preferable to a single complex game. These games may use the same materials and the same basic set of rules, but require increasingly complex skills from the players. This permits gradual shaping of the learner's behavior toward the terminal performance.

ADAPTING INSTRUCTIONAL GAMES

Although an increasing number of instructional games are becoming available for use with handicapped children, there is still a large gap to be filled through local production. The remaining portion of this article discusses various strategies for use by the special educator in designing instructional games. In addition to increasing the number of available games, this activity results in several positive outcomes.

1. Teachers of the handicapped understand the needs of their learners better than commercial game manufacturers. As a result, the games teachers design are likely to be more appropriate for use with exceptional children.
2. Teacher-designed games have more local relevance and are more smoothly integrated into the curriculum.
3. The process of translating an abstract lesson into concrete game activities provides the teacher with insights about the structure of the curriculum.

The best way to learn game-design strategies is through adapting *frame games*. A frame game is a basic game format which can be easily modified to teach new content and skills. Obviously, this is not an innovative idea—many classroom teachers frequently use such traditional frame games as Bingo to teach different skills to their children. These frame games make it easy for the teacher to plug new instructional content into existing game formats. They are also useful from the learner's point of view because the mastery of one game permits him to play a large number of variations. Thus, children spend more time learning from the game than learning the game.

Where does one get the basic frame-game formats which are adaptable to teach different instructional con-

tent to handicapped children? The best sources are traditional children's games such as Old Maid and Dominoes. There are also some newer commercial games which can be analyzed to provide instructional adaptations. Descriptions of suitable games may be found in such game magazines as *Simulation/Gaming/News*, in teachers' magazines such as *Instructor* and *Teaching Exceptional Children*, and in specialized magazines such as *Arithmetic Teacher* and *Science Teacher*. There are also a number of books on old and new games (Bigson, 1971; Golick, 1973) which describe many useful frame-game formats.

EXAMPLES OF ADAPTING A FRAME GAME

Earlier, we mentioned the fact that many teachers use adaptations of frame games such as Bingo to help their learners attain different instructional objectives. Actual examples of these adaptations are presented below to demonstrate the process of converting a frame game into different instructional variants. For those readers who are unfamiliar with Bingo, here is a brief description of the original game.

BINGO

Equipment and materials:

1. A number of Bingo cards. These contain 5 x 5 grids with 25 random numbers from 1 to 75 arranged in a random pattern. The arrangement of numbers in each card is different from the arrangement in every other. The middle box of the grid is a "free" one; it does not contain a number.
2. A set of counters for each player.
3. A set of 75 counters for the game leader, each with an individual number from 1 to 75.

Number of players: Any number can play.

Approximate time requirement: Depending upon the draw of the counters, anywhere from 3 to 10 minutes.

Play of the game:

1. Each player receives a Bingo card and a set of counters. The player places a counter on the free box.

2. The game leader throws the number counters into a bag, mixes them thoroughly, and draws them out one at a time. He announces the number on each counter and places it on a master sheet for verification at the end of the game.
3. Whenever a new number is called out, each player checks his grid to see if it appears in any one of the boxes. If so, he places a counter on that box. During a round, more than one player may find the number in his grid; some may not find it at all.
4. Whenever a player has 5 boxes in a straight line covered by his counters, he shouts, "Bingo." These 5 boxes may be horizontal, vertical, or diagonal and may or may not include the free box.
5. The game leader verifies the placement of the counters and, if correct, declares the player to be the winner.

The purpose of the traditional Bingo game is to provide an entertaining way to persuade players to contribute to a charitable cause. Although this is hardly an instructional objective, the game can obviously be used to help children attain the skills of identifying numerals, matching oral numbers with printed numerals, scanning a field to detect the presence of a numeral, and recognizing the placement of five items in a vertical, horizontal, or diagonal straight line. More useful instruction can be achieved through an analysis of the Bingo game and adaptation to teach specific skills. Any game may be analyzed in terms of what is given to the learner and what is expected from him in terms of specific behaviors. In Bingo, the player is given an auditory stimulus (a number) and he is required to make a multiple-choice response by placing his counter on a printed version of the same number.

The first set of adaptations which follows involves giving a visual stimulus to the player and requiring him to give a visual matching response. For example, in a game for beginning readers, the teacher holds up cards with different letters. The player searches his grid for the same letter and places a counter on the box which contains that letter. The play of the game is exactly the same as in the traditional Bingo. The procedure of having the teacher (or one of the players) hold up a series of cards is also used in the adapted games listed in Figure 1.

The number of variations of this theme is obviously unlimited. In the next series of adaptations, both the stimulus

given to the player and the response required of him are again visual. However, the player has to process the information given to him before he identifies the appropriate box. For example, in an arithmetic game, the teacher holds up cards with simple addition problems. The player has to add the numbers together and identify the sum in his Bingo grid. More adapted games along the same theme are listed in Figure 2.

In the final set of adaptations, we return to the original arrangement of the game—the stimulus is auditory, and the

player responds by identifying a suitable visual. For example, in a history game, the teacher names different presidents of the United States. The players identify the picture of that president in their Bingo grid and place a counter on that box. The adaptations in Figure 3 use the same type of auditory stimuli and visual matching responses.

As you may have noticed, we have come back to the original Bingo game in our last example. This demonstration of adapted games illustrates the tremendous flexibility afforded by the frame-game approach.

Figure 1

INSTRUCTIONAL TOPIC	WHAT THE TEACHER HOLDS UP	WHAT THE PLAYERS DO
Color recognition	Different colored cards	Identify the same colored box in their grids
Picture matching	Cards with pictures of different animals	Identify a box in their grids with the same shape
Shape recognition	Cards cut into different shapes (e.g., circle)	Identify a box in their grids with the same shape

Figure 2

INSTRUCTIONAL TOPIC	WHAT THE TEACHER HOLDS UP	WHAT THE PLAYERS DO
Sight reading	Pictures of various objects	Identify in their grids the word which stands for the object
Traffic rules	Pictures of different road signs	Identify in their grids a short sentence about what this sign stands for
Phonics	A short printed word (e.g., <i>hot</i>)	Identify in their grids another printed word containing the same vowel sound (e.g., <i>mom</i>)
Initial consonants	Pictures of various objects	Identify in their grids the initial letter of the name of the object
Map reading	Pictures of mountains, lakes, railroad lines, etc.	Identify the appropriate map symbol in a teacher drawn map divided into a BINGO grid

Figure 3

INSTRUCTIONAL TOPIC	WHAT THE TEACHER HOLDS UP	WHAT THE PLAYERS DO
Initial consonants	Different words	Identify in their grids the initial letter of the word
Listening comprehension	Names of different animals	Identify in their grids a picture of the animals
Vocabulary	Different words	Identify in their grids the opposite word (antonyms)
Auditory discrimination	Different words	Identify in their grids the vowel sound in the words
Numerals	Different numbers	Identify in their grids the appropriate numeral

MORE EXAMPLES

In this section, we present another set of sample adaptations of an instructional frame game. The original game is a teacher-developed one called Shapes.

SHAPES

Equipment and materials: A deck of fifty 3 x 5 cards, with one side blank and different shapes drawn on the other. These shapes contain examples of squares, rectangles, and triangles with variations in their size, color, and orientation. In addition, nonexample shapes which do not belong to any of these categories (e.g., pentagons, parallelograms) are also included. A bag of marbles is used to simplify score keeping.

Number of players: Two to eight. Best game is for four to six.

Appropriate time requirement: Depending upon the number of players and their skill, a game may last anywhere from 5 to 15 minutes.

Play of the game:

1. Each player is given 5 marbles. The rest of the marbles are set aside in a paper cup.
2. The teacher specifies a particular shape for the game.
3. Cards are dealt out, one by one, as far as they will go. It does not matter if some players receive one more card than the others.
4. Each player gathers up his cards and without looking at them arranges them in a neat pile with the shape sides facing down.
5. Beginning with the first player, players take turns flipping up the top card of their pile and placing it face up in the middle of the play area.
6. If the turned-up card contains the shape specified for the game, players may slap it. The first player to slap the card gets a marble from the paper cup.
7. If a player mistakenly slaps a card with a shape other than the one specified for the game, he loses a marble. He has to return one of his marbles to the paper cup.
8. The game ends when all cards have been turned up. The player with the most marbles is the winner.
9. The game is replayed with a different shape specified.

The shrewd reader may have recognized the children's card game of Slapjack as the original frame for this game. However, let us concentrate on the Shapes version as a frame game and demonstrate various ways of adapting it. As before, the first step in this process is to analyze the game in terms of what stimulus is given to the player and what response is expected from him.

What is given to the player? A card from a deck with different examples of a few closely related concepts and "nonexamples" which belong to none of these concept categories.

What is expected from the player? (1) Generalization: Slap all examples of a particular concept. (2) Discrimination: Do not slap nonexamples of that concept (i.e., examples of other concepts).

With this basic analysis, let us see how the game may be adapted to teach different instructional skills. At the first level of adaptation, the rules and the structure of the original game are retained intact; the content of the cards is changed.

Adaptation 1: PEOPLE

This game is designed to help players recognize key people in the school. Although this is not a formal part of the curriculum, the teacher thought it important for the children to know the librarian, custodian, principal, school nurse, and the bus driver. With a Polaroid camera, she took pictures of these different people in different locations and wearing different clothing. There is a total of 40 cards in the deck; at the beginning of each game, the teacher specifies a particular person (e.g., the school nurse). The play of the game is exactly the same as in Shapes.

Adaptation 2: COLORS

This is an extremely direct adaptation of the Shapes game. A piece of different colored paper is pasted on one side of a card. Six different colors are used, each on ten cards. At the beginning of the game, the players are told to look for a particular color.

Adaptation 3: LETTERS

This game is used to provide drill practice for children in recognizing letters. A deck of 50 flash cards is used in the game, each with one of the 10 different

hard-to-discriminate letters. Each letter appears in slightly different styles of printing. Each card contains the picture of a small smiling face on the top right corner to prevent confusion of a letter like "p" as "q," or "d" as "b." At the beginning of each round of the game, the children are told to slap a particular letter.

Adaptation 4: PARTS OF THE BODY

The deck for this game contains 10 pictures of each of the following parts of the body: face, arms, legs, chest, and back. Children are required to slap the cards with a specific body part. The pictures show a variety of child and adult, male and female bodies.

Adaptation 5: MAKING CHANGE

The cards used in this game contain pictures of different coins in various combinations. At the beginning of the game, players are asked to slap a specific total (e.g., 27¢). They can slap any combination (e.g., 2 dimes, a nickel and 2 pennies; a quarter and 2 pennies; 4 nickels and 7 pennies) as long as the coins add up to the required total.

The next two adaptations go beyond the mere substitution of the content of the cards. The players' responses are the same, but there are some ingenious modifications in the rules which result in more exciting play and more complex skills.

Adaptation 6: BUILD A WORD

Flash cards with various letters are used in this game. A spelling word (e.g., apple) is specified at the beginning of each game. The players are required to slap the correct letters, one at a time, in the correct order. They first look out for the letter "a," then the "p," then the second "p," and so on. Thus, the game helps children learn how to spell different words.

Adaptation 7: COMMUNITY HELPERS

The deck used in this game consists of a number of pictures of such community helpers as the policeman, mailman, fireman, and milkman. The cards show these

people at various appropriate tasks. There are also some cards showing the same people doing incongruous things, such as the policeman delivering milk. The children are required to spot and slap those cards which show a particular community helper (e.g., policeman) doing an unusual thing. The game is very popular with children who enjoy the comical combinations in the pictures.

In the next three adaptations, the original frame game is changed more radically. The basic operations of generalization and discrimination are still expected from the players, but the examples and nonexamples are no longer cards and the response is not limited to slapping.

Adaptation 8: DANGER

This game is designed to teach various safety rules to handicapped children. The game uses a number of color slides which are projected on a screen one at a time. Players sit in small groups of four or five and watch the screen. A wooden block painted red is placed in the middle of each play group. Children are required to pick up this block whenever they see something dangerous shown on the screen (e.g., a child walking across the street when the light is red). The first player in each group to pick up the block scores a point. After verification, this player is given a marble, and the block is replaced in the middle for the next round.

Adaptation 9: SOUND OF VOWELS

Each child has a small tile with the symbol for a short vowel on one side (e.g., o) and a long one on the other (e.g., o). A cassette tape recorder is placed in the middle of the play area. The tape presents different short words with ample pauses in between. As soon as each word is heard, *each* child places the tile with the appropriate sound symbol facing up in front of him and hides it with his hand. If the vowel sound in the word is neither of the two sounds represented on the tile, the child merely places his hand in front of him. After each player has his hand in front of him, all players raise their hands to reveal the face of their tile (or the absence of the tile). Those players who have classified the sound correctly receive a marble; those who made a mistake return a marble. The game continues until all the words recorded on the tape are played out.

Adaptation 10: MAP READING

A large map hangs on the classroom wall, and players are free to move around it. Each player has a "compass" card with the names of the four directions marked on it and a movable pointer. The teacher names two locations on the map. The players locate them and determine the direction of the second relation to the first. Each player secretly sets up the pointer in his compass card to indicate the appropriate direction. When all players are ready, they reveal their response. The scoring method for the game is the same as in Sound of Vowels just described.

DESIGNING INSTRUCTIONAL GAMES FOR THE HANDICAPPED

The two sets of examples presented above strongly suggest that with a little imagination a teacher can adapt a frame game to teach new content. While a single frame game may lend itself to a number of content and structural variations, it will still involve the same basic type of learning. Thus, in order to provide for the wide variety of learning in the curriculum, the teacher-designer should have a wide base of flexible frame games.

In these adaptations, we begin with a suitable frame game and seek out those instructional topics which are amenable to it. Although very efficient, this approach lets the form determine the function. A more desirable alternative approach is to begin with an instructional objective and then design a suitable game to help handicapped learners attain this objective. Designing a game from "scratch" is more complicated than adapting a frame game. However, there is considerable overlap between these two activities; adapting frame games provides an excellent introduction to the strategies of more elaborate design.

A systematic procedure for designing an instructional game for handicapped children is outlined in the flowchart (see Figure 4). Each of the steps in the flowchart is described below.

Task Analysis. In this step, the game designer specifies the behavioral objective for his game. This main objective is analyzed into various subobjectives. The major type of learning implied by these objectives is also identified. All of these pieces of information help in the selection of a suitable frame in a later step.

Learner Analysis. An analysis of the relevant characteristics of the learner for whom the game is being

designed is undertaken parallel to the task analysis. Learner analysis involves identifying relevant skills and knowledge which the player already possesses. It also identifies preferences for different types of games. Finally, various handicapped conditions of the learner (e.g., hearing impairment) and the level of his language are also determined.

Selecting a Frame. A suitable frame for the game is now selected on the basis of the earlier analyses. The structure of this frame parallels to a large extent the structure of the instructional task. The learner's entry level determines whether the game is to be used for initial learning or for providing practice. The players' game preferences for the type of game plays an important role in the final phases of this step.

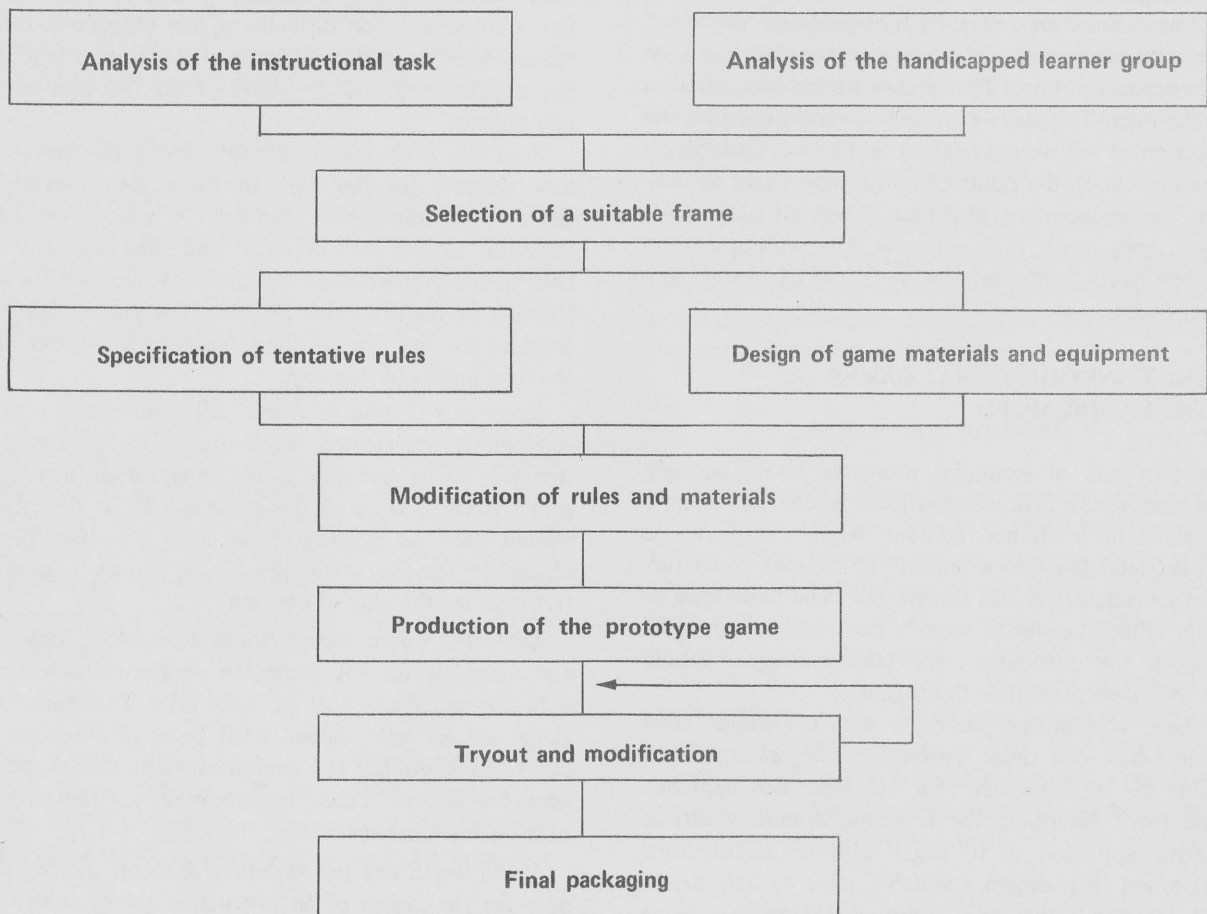
Specifying Tentative Rules. All games need a closure rule which determines the winner. This is usually the first rule to be specified in the design of an instructional game. Ideally, winning the game should be directly correlated with the mastery of the main objective. The subobjectives for the instructional task usually suggest control rules for the play of the game.

Designing Game Materials and Equipment. Equipment and materials for the game are designed simultaneously with the specification of tentative rules. The frame for the game and its rules suggest what types of materials (e.g., cards and counters) and equipment (e.g., timers and spinners) are needed. These, in turn, make the tentative rules of the game more specific.

Modifying Rules and Materials. A recommended procedure for the design of an instructional game, or any other creative design activity, is to produce a rapid and spontaneous first draft, leave it aside for some time, and critically review and revise it later. The revisions and refinements are based upon the designer's hindsight, aided by notes from task and learner analyses, to ensure that the outline for the game meets the requirements of the task and the needs of the learner. The game may also be evaluated with a suitable checklist; the eight desirable characteristics of an instructional game mentioned earlier form the basis for a useful checklist.

Producing the Prototype. Once the revised outline for the instructional game is prepared at the end of the previous step, the game designer is ready to produce the prototype version. This is a suitable step for collaboration among teaching colleagues and for involving the learners themselves. The following list of practical tips will simplify this production process for the uninitiated.

Figure 4
SYSTEMATIC PROCEDURE FOR DESIGNING A GAME



1. Collect discarded games from parents and local rummage sales. Spare parts from these games make excellent components for your prototype.
2. Suitable game boards may be copied from samples found in game catalogs. Styrofoam insulation and masonite peg boards make unusual but functional game boards.
3. Your beautiful game boards can be protected with clear contact paper. Stains and thumbprints can be wiped off with a damp rag.
4. For consistent and readable lettering, use a primary typewriter. You may also want to try stencils and lettering guides for larger letters. Press-on letters come in different sizes and styles and produce a professional result.
5. Metal washers, golf tees, colorful buttons, and foreign coins make excellent pieces for different games.
6. Index cards come in different sizes and colors: The 5 x 8 card is the most suitable size for children's games.
7. Spirit duplicating masters come in different colors, too. They are handy for reproducing large numbers of cards and play money.
8. Children's coloring books and comic strips provide excellent illustrations for game materials. Larger illustrations for game boards may be obtained from discarded posters.
9. Felt markers are very useful for coloring game boards, cards, and other materials.
10. Large wooden blocks make better dice for children than the standard ones. Spots for different faces of the dice may be cut out of gummed paper.

Tryout and Modification. This is the most important step in the design of an instructional game. The most sophisticated and attractive game is of no instructional value if the children find it unplayable. Here is another set of practical tips for getting the most out of this formative evaluation/modification step:

1. Have a group of your colleagues play the game before introducing it to the children. This will help you identify and eliminate major problems in the game.
2. Use a small group of representative children. Three or four such players make a nice group.
3. Get the players into the game as soon as possible. Don't lecture them about all rules before the game. You can explain some of the rules later when the need arises.
4. Participate in the play of the game, but be sure not to dominate.
5. Help the children only if there is a serious danger of the game breaking down. Very often children come up with their own simple but practical solutions to minor dilemmas.
6. Listen carefully to children's comments and watch their reactions. You will be able to identify those sections of the game which need to be changed.
7. At the end of the game, ask children how they feel and what they learned. This debriefing will give you additional suggestions for improving the instructional and motivational effectiveness of the game.

The modified game must be tested out with a fresh group of players. The game may have to be recycled a few times through this revise-retest loop before satisfactory results are consistently obtained.

Final Packaging. When the designer is satisfied with the effects of the instructional game with handicapped children, he undertakes the final packaging. The designer may seek professional help during this step if needed, but it is perhaps more effective and definitely more rewarding for him to use the skills which he used earlier for the production of a prototype. The outcome of this step will be a self-contained, student-tested game for helping handicapped learners attain specific instructional objectives.

CONCLUSION

Our experiences with successful teacher-game designers suggest that their skills were learned through three dif-

ferent approaches. First, designers learned and applied theoretical principles of game design. Second, they repeatedly modified the content and the structure of frame games. In this article, we have attempted to give explanations and examples for the beginning game designer consistent with these two approaches. However, the most effective way to learn game design is the third approach—to actually design a game and try it out with handicapped learners. These learners are the game designer's best teachers. Through repeated testing and modification, both individual games and the game designer's techniques become refined. We hope that the reader will find opportunities for such "on-the-game" training.

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