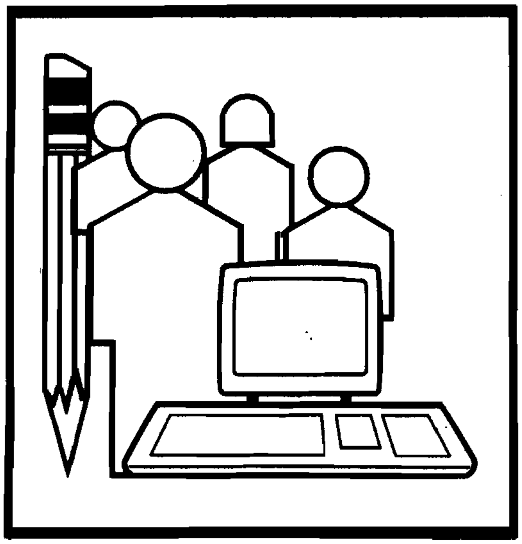

TECHNICAL REPORT

# TAPPING THE APPEAL OF GAMES IN INSTRUCTION

Technical Report No. 6

January 1980


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# TAPPING THE APPEAL OF GAMES IN INSTRUCTION

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## ABSTRACT

The appeal of games to all levels of computer users is well known. This paper analyzes some of the reasons for this appeal, and applies them to more traditional forms of computer-assisted instruction. Games are popular because they are highly motivating, simple, creative, interactive, and have clear and consistent goals. The conscious application of these principles to computer-based instruction should enhance the effectiveness of computer-assisted learning.

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This paper was presented at the National Educational Computing Conference in Norfolk, Virginia, in June, 1980.

Around the time when computers began appearing in classrooms and ceased being a complete novelty, the theory began that the ideal way of teaching with a computer was to put instruction in the form of a game. Actually, this teaching method has been around for years; pioneers in the Dewey teaching method used many games in their curriculum, and a number of Montessori techniques also involve games.

Probably one reason the game idea so caught and held the attention of educators with computers was the mania for computer games in general. The observation was made that the really brilliant students (and instructors) spent an inordinate amount of time designing and programming new games. Other instructors and students spent a huge amount of time playing these games. Why fight it? Design instruction to take advantage of the built-in motivation; there is a pool of course developers anxious to develop instruction (i.e., games) and a large audience of enthusiastic students (players).

With a few exceptions, the results were notably disappointing. Problems arose on two fronts when games were made an integral part of computer-assisted instruction:

- The game quickly took over the instruction, and frequently became more important than the content of the lesson.

- Language-oriented subject matter required a huge amount of programming effort to bend to an effective computer game. Human languages and thought processes simply are not <u>easily</u> transferred to a computer, except on the simplest level. (Note the word "easily" -- there are brilliant exceptions to the above statement.)

The pendulum recently has appeared to swing in the opposite direction: games are now anathemas and are viewed as frivolous pastimes at best. But this approach ignores the fact that games are immensely popular, and have a tremendous attraction for game players and designers both. This paper proposes to extract some of the good points about games, and then apply them to "real" computer-assisted instruction.

What points are worth saving? What can games do that other methods of instruction do not do as well? The observable characteristics of computer games (and computer game players) are:

- <u>A high level of motivation</u>. Game players and designers spend hours working at the terminal.

- <u>Clear and consistent goals</u>. All true games have a clear ending in mind. How much instruction becomes bogged down because of muddy goals and objectives?

- A high amount of player interaction. Game players are doing something: they are manipulating the terminal, the computer, and the game structure itself.

- Maximum choices for the player. Studies of children's toys have shown that the flashiest toy is not the one that is played with most often. The toy that gets the most attention is the simplest one that allows the child to use imagination. The most popular games (on or off the computer) are those with the simplest constructs and widest range of choices.

- Simplicity. How much instruction fails because the starting sequence for the student is too complex? Complexity in itself is not the horror -- the problem is that no one bothers to explain all the details to the user. Most good games come with very detailed instructions. (How come the programmer that balks at providing documentation churns out reams of instructions for the game he just designed?)

- Creativity. Many of the aspects of computer games -- whether they are traditional or invented by the user -- have highly creative parts. An axiom among game designers that is frequently used to justify their interest in games is that some of the most highly creative ideas and programs are first developed in a game.

How can the principles from games be applied to instruction? It turns out that the items that make games so appealing are intertwined, and by incorporating several facets of games into genuine instruction, several objectives can be achieved at once (high motivation, strong interest, etc.).

The remainder of this paper is a checklist of items to look for in any computer-assisted instruction. These are items which have been found to most reliably increase the quality of computer instruction, and hopefully the skills of students taking the course. An important point about this list is that it is not meant to be exhaustive -- it is a start. Persons wanting to use the questions as a checklist may also have their own principles and procedures to add to the list.

## IS THE METHOD OF PRESENTATION CONSISTENT WITH THE MATERIAL?

The best computer games require player actions that fit the total concept of the game. Players move tokens by giving directions to the computer, in a manner similar to picking up the piece by hand (for board games). If the game is a "thought"-type game, the player makes decisions that are consistent with real-world decision methods. The computer in both instances is a referee, informing the player of the consequences of their actions.

Poorly designed instructional "games" or simulations use methods of advancing players (students) that are not related to real actions. In a number of computer board games, students race cars, horses, or other items around a track. But instructional racing games make the pieces move around the track by answering questions. These games are not notably successful, because the action is slower and races are not normally run by answering questions. This design error occurs because the developer has inferred that actions that game players enjoy in one setting must be good in all settings. This mistake results in a product that is neither good instruction nor a good game.

Lesson developers can avoid this trap by choosing a presentation method without regard to the observed popular appeal of a method in a different setting. A "natural", or consistent, method of presentation enhances the appeal of a lesson considerably. If the subject is math, the game should use mathematics naturally, not as a means of moving a token. The Minnesota Educational Computer Consortium has developed economic models that allow children to run simulated businesses (lemonade stands, bicycle factories, etc.). Both mathematics and economic fundamentals are taught through these games. English teachers can use word processors available on most computers in their classes. Students take naturally to word processors -- they enjoy seeing their work turned out in a "professional" format. There are many other examples -- the key is to ensure that the presentation matches the material.

## IS THERE A LARGE AMOUNT OF PLAYER INTERACTION?

The charge raised against television can also frequently be raised against education: the student sits and absorbs the material passively. The lecture format certainly has its place, and brilliant and stimulating lecturers are rare individuals that should be sought after. But computer-assisted education as a lecture or electronic page-turning format usually does not rise to these heights -- and is also a bad use of the medium.

An examination of the most popular games shows a high amount of player interaction. This interaction is not simply key-pushing: some of the popular games are also limited to single-key responses after lengthy actions by the computer (football, adventure, road race, etc.). But the player is constantly thinking -- decisions must be made, paths chosen, strategies worked out.

Again, an objection will be raised that the material in education cannot be adapted to such a lengthy decision-making format. But an examination of the actions that students take when studying shows several possibilities for increasing the student's participation:

(1) Path choice. When a student is studying away from the classroom, he at least has the option of choosing which page or chapter to start on. Why not include this choice in the computer session?

(2) Notes. It is relatively simple to provide an "electronic scratch pad" -- each student can be provided with a comment or note option during the lesson. At the end of the lesson, the student can either store the notes, or (if disk space is limited) take a printout of the notes away.

(3) More inquiry. This does not mean "more questions". Inquiry can be a form of path-taking, or an invitation to speculation. The student chooses which subject to take first. Incidently, this also answers the frequent question of the correct order to study subtopics. The student can choose the topic, and also skip from topic to topic if necessary. The same material is eventually covered, but along paths that the student has chosen.

## IS THE MATERIAL CREATIVE?

One puzzling problem that appears in computer-assisted instruction environments is that the same individuals that produce ho-hum instruction also are turning out brilliantly designed games. Obviously the same effort is not going into both projects. This problem is a management, not a computer, problem. There can be several reasons for this dichotomy when it appears:

(1) Freedom to experiment and make errors. If you insist on error-free and perfect instruction from your developers, that is exactly what you'll get -- with all the creativity and originality of the Saturday morning cartoon shows. A perfect lesson is not necessarily a good lesson. In fact, lessons that have incomplete sections may even be more useful, since the student must fill in the missing portions.

(2) Appropriate comments at appropriate times. Kibitzers seem to abound in educational development areas. The discussion of approaches and critical analysis of lessons under development is an impor tant part of the creative process. There are many cases where a

promising bit of instruction has been discarded because constructive criticism was heaped upon the material -- before it was developed and before advice was requested. While a developer is writing a game, no one is leaning over his/her shoulder and commenting. Leave the developers alone until there is something to criticize other than a first draft.

(3) Responsibility. One shortcoming of management is lack of confidence in the persons working under them. This is often manifested in very detailed instructions to the developers, to avoid errors. If a developer is presented with a cut-and-dried package, there is obviously little room for a new and creative approach. For someone to become truly involved with a project, they must feel that the project is at least partly theirs, and must have some involvement with planning. And responsibility extends down to some very low levels. In a Language Arts project in Norfolk, Virginia, the computer operators were employed to enter some of the questions students would be given. They were asked to use their imaginations when entering the "praise" response students would receive on correct answers. The results were a series of questions with highly original responses, that the students could relate to. The operators also took a personal interest in the development of the course, and frequently monitored student progress and asked to change lessons that were not popular.

## IS EVERYONE USING THE MATERIAL ENTHUSIASTIC?

Here is another factor that is a function of the people involved and not the computer. "You will be enthusiastic!" is obviously an unworkable approach (but one which is sometimes tried!). But check: if everyone involved with the development of a particular piece of instruction finds it tedious and difficult to work with, then perhaps the entire instruction set should be looked at. If persons who are working in their subject area find the topic boring, then what about the students? What is needed is either a fresh and creative approach (see above) or a different topic. If a subject is completely boring, then its value is open to question. Tepid topics usually result if the individuals can see no value in them whatsoever.

Enthusiasm, once engendered, tends to be catching. Enthusiasm most frequently stems from freedom and responsibility -- two subjects discussed under creativity and maximum choices above. Freedom and responsibility extend to all levels: supervisors, developers, teachers, and students. Teachers and administrators tend to be wary of allowing students to take part in the teaching process, and for good reason: it is difficult to manage and control. It is also a novel idea for most students; they have been passive consumers of instruction for so long that they may not be able to handle such a responsibility without careful pre-training. But the results can be spectacular.

Here are some areas in the instructional process where personnel at all levels can directly participate:

(1) Level of instruction. Too hard? Too easy? Should it be presented to a different grade level or in a different subject area?

(2) Method of presentation. Is the format (question-and-answer, screen display, essay and choice, etc.) appropriate for the subject?

(3) Effectiveness. Does the content of the lesson stay with the student?

(4) Correctness. Is the content free of grammar, syntax, spelling, and content errors? (Here is an area where younger students delight in showing off. If you choose to release them on this one, prepare for an avalanche.)

(5) Additional lessons. What other material should be added or changed?

(6) Design of instruction itself. Developers can work with older students, or students who have just completed the course, to redesign and evaluate the instruction.

## IS THE COURSE SIMPLE AND DIRECT?

One fault of some of the innovative courses is that they tend to be immensely complex. While at some time in the future humans may learn to think recursively and in complex algorithmic patterns analogous to the machines they use, at the present time people still think in the same old way. Presenting highly complex study structures, maps, objective fields, and learning paths can set up a forest that quickly discourages even the most determined students.

If the structure is too complex, there are three solutions:

(1) Check the presentation. In complex structures, a simple, direct path can frequently be found in the material.

(2) <u>Turn routing over to the student</u>. If given a list of topics or objectives, the students can make their own choices of what to study first, and when.

(3) <u>Hide some of the complexity</u>. Some of the structure may be due to the enthusiasm of the developers for marvelous structure. A lot of the design elements can be safely hidden by having the computer do the routing work.

Great advances have been made in the use of computers in classrooms in the past few years, and the pace of development and discovery increases with each new application. The procedures discussed in this paper are a starting point for developing better computer-assisted instruction. The key to successful computer-assisted instruction, as in any other form of instruction, is the people involved in the project. There is no substitute for a creative, dynamic, and highly qualified individual in the right position at the right time. Fortunately, these persons appear to be available, because computer-assisted instruction has made great gains in recent years. The continuing analysis of what constitutes "good technique" in use of computers will continue this trend.