DOCUMENT RESUME

ED 368 345 IR 016 603

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TITLE Instructional Gaming: Implications for Instructional Technology.
PUB DATE Feb 94
NOTE 21p.; Paper presented at the Annual Meeting of the Association for Educational Communications and Technology (Nashville, TN, February 16-20, 1994).
PUB TYPE Information Analyses (070) -- Reference Materials - Bibliographies (131) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Annotated Bibliographies; Attitude Change; Computer Assisted Instruction; *Computer Games; Computer Simulation; *Educational Games; Educational Technology; Literature Reviews; *Problem Solving; *Recreational Activities; Resource Materials; Self Esteem; *Skill Development; Teaching Methods; Theories

ABSTRACT

Instructional gaming, as distinguished from simulation, is defined as any overt instructional or learning format that involves competition and is rule-guided. The literature review identifies five categories of articles on instructional gaming: (1) research, (2) theory, (3) reviews, (4) discussion, and (5) development. Games have been found to serve many functions, such as tutoring, amusing, helping to explore new skills, promoting self-esteem, practicing skills, or seeking to change attitudes. Some assertions drawn from the literature that might be useful in using or designing a game or in researching its use or design are presented. A chart presents an annotated bibliography of 94 articles related to gaming. (SLD)

INSTRUCTIONAL GAMING: IMPLICATIONS FOR INSTRUCTIONAL TECHNOLOGY

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Instructional Gaming: Implications for Instructional Technology

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Prepared for the 1994 Annual Meeting of the
Association for Educational Communications and Technology
Nashville, TN

Few would argue these days of the potential instructional gaming has for enriching certain educational and training activities. For instance, Faria (1987) has reported that 4,600 of the larger U.S. firms he surveyed by mail or telephone, use business or experiential games in training or development. Those who profess the educational benefits of gaming have been encouraged to some extent by a number of researchers who have found a wide range of benefits which, for example, include improved practical reasoning skills (Wood and Stewart, 1987), higher levels of continuing motivation (Malouf 1988), and reduced training time and instructor load (Allen, Chatelier, Clark, & Sorenson, 1982). Some researchers, however, have questioned certain of these claims due to a lack of sufficient empirical support (e.g., Bredemeier & Greenblat, 1981). Even so, very diverse training applications, such as attention reduction or automaticity training (Jacobs, Dempsey, & Salisbury, 1990) and complex problem solving (Hayes, 1981), are hypothesized to be prime candidates for gaming strategies.

The purpose of this paper is to report on our continuing review of five categories of gaming articles in order to present some implications and, in some cases, guidelines to designers and educators. We see this review as part of the search for the beneficial uses of gaming in the learning processes, particularly as applied to computer-driven media and multimedia.

What is gaming anyway?

Gaming is defined as being separate from simulation and is defined, in a basic sense, as any overt instructional or learning format that involves competition and is rule-guided (Dempsey, Lucassen, Gilley, & Rasmussen, 1993-94). A competitive format, as we see it, does not necessarily require two or more participants. If a simulation, for instance, produces an overall "score," then it is possible for a learner to compete against herself by comparing scores over successive attempts at the simulation. Therefore, this learner may be in a gaming mode. If, however, the focus of the simulation involves the completion of an event only (e.g., navigating a channel in a boat), then according to our definition the simulation would not be considered a game. A game structure may be imposed on the simulation from outside, however. For example, in the boating scenario, learners could compete by seeing how many safe passages they could achieve in a certain amount of time compared with another person or their own prior performance. Gaming elements offer particular characteristics which may be manipulated within the simulation training context, and thus can be treated separately.

Categories of the articles in the Gaming Literature

Our review of the literature to this date consists of 91 sources, most of which are journal articles. We located these using ERIC, PSYCHLIT, MEDLINE, and reference citations from other articles. With few exceptions, we concentrated our review on articles

published in the last 12 years. We oriented (but did not limit) our search to articles concerning instructional games which used some form of technology and were substantive in nature. We felt that our first step in looking at the literature consisted of establishing a typology by which gaming articles could be categorized for study. After some consideration, we defined the following five categories of gaming articles. These definitions were employed in an earlier related article (Dempsey, Lucassen, Gilley, & Rasmussen, 1993-94).

Research:	any systematic approach used in the study of gaming whose goal is to explain, predict or control a particular phenomena or variable. Research studies may be further broken down into their paradigms (e.g., case study, experimental study).
Theory:	articles which offer to explain the basic concept of gaming or aspects of gaming or the outcomes derived.
Reviews:	synthesis of articles concerning gaming in general or a specific aspect of gaming.
Discussion:	articles which state or describe experiences or opinions with no empirical or systematically presented evidence.
Development:	articles which discuss projects involving gaming or the design or development of instructional games.

To date, we have reviewed more discussion articles (n=43) than the nearest category, research (n=33). Although we have only unsystematically sampled a small portion of the literature thus far, we expect the trend in the gaming literature to continue to be dominated by discussion articles. Nine literature review and seven primarily theoretical articles were located. Early on, we were mildly surprised at the low number of development articles (n=4) we have located.

Types of Games

One of our efforts has been to delineate and eventually work toward operational definitions of types of instructional games. In this and our prior review, we separated games into simulations, puzzles, adventures, experimental games, motivational games, modeling, and others (e.g., frame games). To be candid, we are likely to change the types of games delineations we have chosen in future explorations of gaming. At any rate, simulation games accounted for the largest number of articles we encountered in this review (n=42). The "other" category was second (n=20), followed by adventure (n= 10), puzzles (n=4), and experimental and motivation (n=1 each).

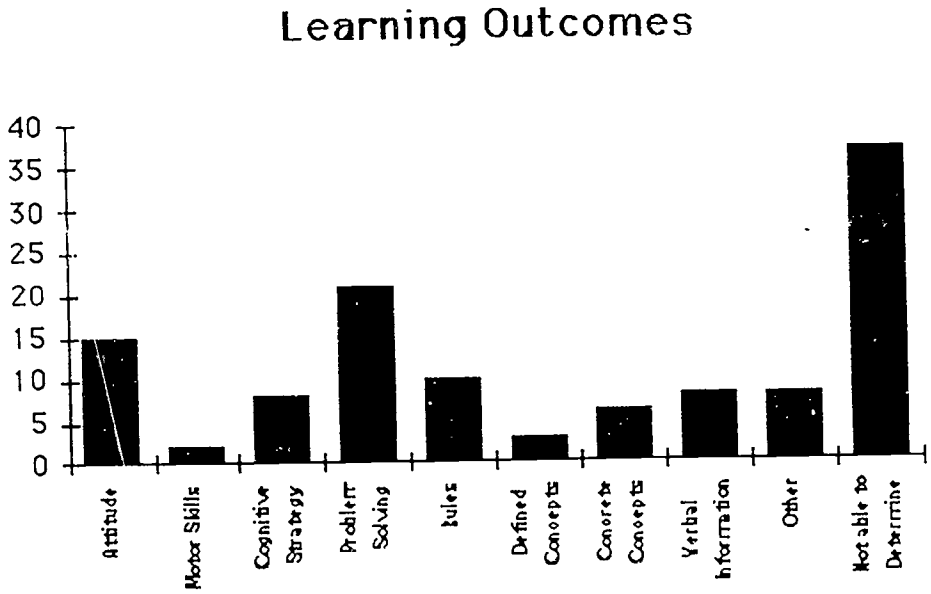
This abundance of articles concerning simulation games may, in part be the result of technological improvements and the long and well-documented history of simulation gaming in education, particularly in the military and in business education. Also, simulation gaming parallels current movements in instructional technology such as situated cognition and anchored instruction which hold that knowledge is inseparable from its context. Theorists in these areas (e.g., Brown, Collins, & Duguid, 1989; Perelman, 1992) support the notion that the human brain is designed to learn through experience and experience has no meaning except in some context. Simulation games can provide that experience in the absence of real life experience. Thus, simulation games are a powerful tool whose use can only be expected to increase.

Learning Outcomes

As our literature review focus on instructional or educational gaming, we were interested in what learning outcomes were discussed. In a large number of articles concerning games or gaming (n=37), specific learning outcomes were ignored or a

discussion of learning outcomes per se was not germane. The largest specific learning outcome discussed in those articles that did so, however, was problem-solving (n=21). As the reader can see in Figure 1, the articles we reviewed covered most of the nine domains and sub-domains of learning in Gagne's taxonomy (Gagne, 1985), suggesting that technology-based instructional gaming has a wide spectrum of utility for learning. We were particularly interested in the preponderance of games intending to promote higher-level intellectual skills and attitude learning as opposed to verbal knowledge outcomes. We see this as a positive testimonial to the gaming mode.

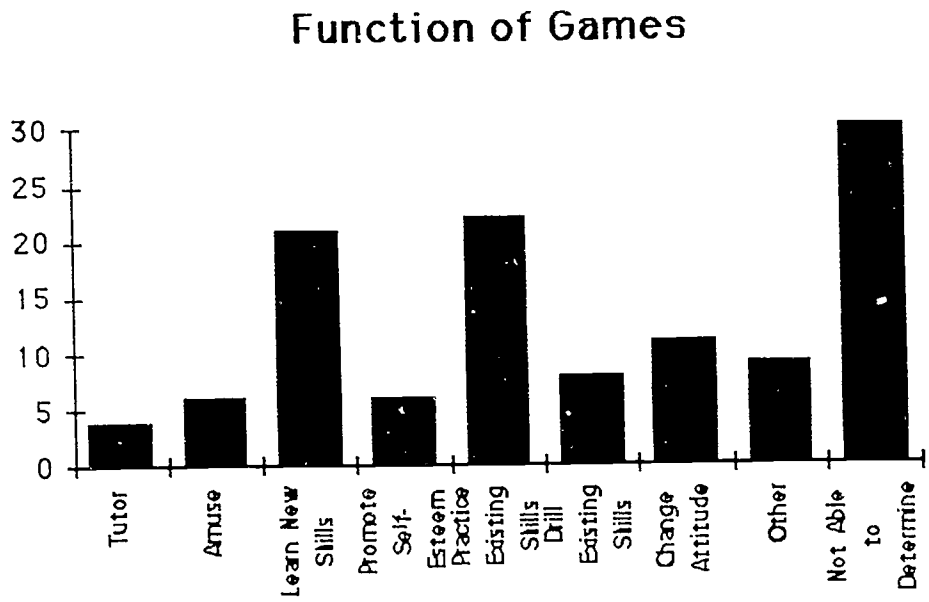
Fig. 1. Learning Outcomes



Function of Games

Games serve many functions such as tutoring, amusing, helping to explore new skills, promoting self-esteem, practicing existing skills, drilling existing skills, automatizing, or seeking to change an attitude. In the articles we reviewed, the functions of the instructional games were moderately well-distributed, but suggested that games were not frequently employed to serve as a tutor. As Figure 2 illustrates practicing existing skills (n=22) was the highest frequency and learning new skills (n=21) was a close second. Many of the articles stated that games were used to learn new skills after some introductory instructional events had prepared the learner for the competitive instructional interaction. The variety of functions discussed in the gaming literature we reviewed is seen as a positive indicator paralleling the agreeable diversity of learning outcomes with which gaming may be used.

Fig. 2. Functions of Games



Gaming environment

There are great environmental differences assumed by the designers of instructional games. We reviewed articles from the following environments: elementary education, secondary education, adult education, business, management, military, health care. The largest number of journal articles considered gaming in the context of adult education (n=25). We came upon no claims in our reading that instructional gaming was more effective in one environment compared to any other.

Media

Clearly, there are more media options available today than there were a decade ago. How has this affected gaming? Many of the articles we reviewed that used technology employed the computer only (n=32). A reasonable number of articles employed a combination of media (e.g., the computer and interaction with a live instructor). Other media employed were video-related media (i.e., video tape and optical videodisc). Role-playing was common regardless of the media.

Measurement

Key issues in gaming research are the appropriateness, validity, and reliability of the measured outcomes. Several authors (e.g., Reiser & Gerlach, 1977; Reuben & Lederman, 1982) have chided the lack of appropriate dependent variables and the lack of clarity of their terminology. Expanding slightly on the work of Bredemeier & Greenblat, 1981, dependent variables of integrity in this literature include creativity, problem-solving ability, achievement, retention, attitude, self-image, self-efficacy, and continued motivation.

The variable mentioned most often in our review of the literature was achievement (n=33). This was mentioned almost twice as much as the next most frequent, problem-solving (n=13). Other measurement variables included attitude and continued motivation (n=10 each), and retention (n=7), .

Learner Characteristics

The various characteristics of the learners participating in gaming experiences were of increasing interest to authors in the gaming literature during the dozen years. Our review searched for personality variables, cognitive style variables, gaming and academic ability, and demographics (sex, race, and age). We found that authors we reviewed were, for the most part, very unclear in reporting these characteristics. Of the articles we reviewed, sex was the most frequently reported (n=11), age was second (9), academic ability and race were reported even less (n=5 and n=3 respectively). Characteristics we expected to be reported such as personality traits or cognitive styles were reported only twice. Although much attention was given in the articles we reviewed to discussion of "the learner", few articles considered variables related to learner characteristics.

Implications

Below are stated some assertions that grew out of the articles that we reviewed that might be of use to designers and educational researchers. After each assertion, at least one article is cited which made, or in our opinion supports in some way, the listed assertion. Nevertheless, as presented below, the assertions are very open to deliberation. Although there is some crossover statements (e.g., regarding sex differences), an attempt has been made to separate assertions which may be practicable in using or designing a game for instructional purposes and a separate section for conducting research related to gaming as a learning activity.

Using or Designing the Game

It is preferable in many cases, although usually more difficult, to use a gaming vehicle which is intrinsically motivating as opposed to an extrinsically motivating game. In an intrinsically motivating gaming activity, the game structure itself helps to teach the instructional content. In an extrinsically motivating game, external rewards (real or imaginary) of some sort are usually given. (Deci, 1972; ; Malone, 1981).

In considering which game to employ in a learning activity, pay special attention to gender preferences. There appears to be some disparity in the types of games and the types of gaming activities preferred by males and females (Braun, Goupil, & Giroux 1986; Malone, 1981).

When possible, employ debriefing as an a part of or in addition to gaming activities. (Carrol, 1986).

Change the methods of scoring in a game to channel attention and vary the level of challenge (Allen, Jackson, Ross, & White, 1978).

Gaming used for instructional purposes should not be overly complex. Complex rules and scoring require the learner to use up limited learning time in order to understand the game (Jacobs, & Dempsey, 1993).

Change the levels of complexity or difficulty based on the learner's experience with the gaming structure. This will help promote interest in instructional materials as the learner's gaming abilities increase (Jacobs, & Dempsey, 1993).

When developing or adapting games for instructional purposes, look for existing gaming strategies which can be used for your particular purposes (Driskell & Dwyer, 1984).

If the learning activity is construed to be less than exciting to the learning population, consider using adventure games or other games which have a strong challenge component and add an uncertain outcome to the fantasy of the game (Grabe & Dosmann, 1988).

For issues of conflict or control, use or adapt games which employ both role-playing and fantasy. The role playing requires the student to play an active part. The fantasy allows the student to make serious errors with minimum detriment (Kowitz & Smith, 1989).

Intrinsically motivating strategies for use in an educational gaming environment may be discovered by interviewing or observing very effective learners in a particular content area (Logan, Olson, & Lindsey, 1989, Oxford & Crookall, 1988).

If your goal is to change the learner's attitude, simulation gaming, if designed with a theory base in mind, has been shown to be an effective vehicle (Renaud & Stolovitch, 1988; Williams, 1980).

Use a highly visual simulation game which includes all participants to help understand, address, and resolve group decision-making (Hasell, 1987).

Make sure your game has a way of ending so the satisfaction of the learner may be maximized (Reuben & Lederman, 1982).

Researching the Game

Identify the direct and indirect aims of the game (Barnett, 1984).

Avoid the apples and oranges comparison studies between games and traditional teaching techniques. (Barnett, 1984; Fraas, 1982; Megarry, 1977).

Much of the research involving gaming should involve variables relating to motivation (Malone, 1981). The use of motivational scales such as Keller's Instructional Materials Scale should be adopted, adapted, and validated. (Klein & Frietag, 1991).

Consider the effect of being on a losing team or in losing roles? For example, how are self-esteem and attitudes toward the winners affected (Greenblat, 1980)? In addition, how do these change when one of the teams or players is a computer?

Allowing learners to "wager" tokens or imagined currency in an instructional gaming environment holds some promise for representing some aspects of learner certitude and therefore internal processes of expectancy. There is some a possibility of unwanted intervening variables, particularly those related to gambling (Griffiths, 1990; 1992).

As gaming becomes a more important area for exploration, there will be an increasing need to develop worthwhile measures of strategy (Laughery, 1984).

Regardless of the findings of some researchers that arcade-style gaming is a social and not an achievement oriented activity (McClure & Mears, 1986), this activity is increasing greatly as a result of more sophisticated and lower priced hardware and software in personal computers. Educational researchers will be more frequently asked how this type of gaming activity can be incorporated into learning environments.

Much of what takes place on a gaming environment may not be easily measurable or, at least easily reduced to a few variables. Therefore, although experimental studies have an

important place in the instructional gaming literature, it is critical that researchers honestly recognize the limitations of objective-oriented research for assessment and also look at the effects of incidental learning. (Barnett, 1984; Remus, 1981).

The validity of the assessment of an instructional game is somewhat different than with other learning environments and, according to Reuben & Lederman (1982) is dependent on rules, interactions, roles, goals, & criteria.

Girls are often thought to be not as competitive as boys in a gaming environment. To some extent that is situational or a result of a less socially reinforcing scenario (Hughes, 1988).

Increased involvement (being in control of the program) has been found to increase learning with a simulation game (Wishart, 1990).

Four clusters of factors which influence the effects of a simulation game include administrative variables (characteristics of "who runs the game"), learner variables (e.g., ethnicity or learning style), procedural variables (such as postgame discussion), and game variables (e.g., depicting reality). (Williams, 1980).

Bibliography

Something we thought might be useful to designers and researchers interested in educational gaming was a fairly recent reference list with the category of article, the statistical analysis used for those articles involving quantitative research, the environment for which the instructional gaming is intended, and an additional comment describing the article or its purposes. A table with this information follows.

Gaming Articles Page 1; February 11, 1994	Statistical Analysis	Category	Environment	Comments/Purpose
Affisco, J.F. and Chanin, M.N. (1990). An empirical investigation of integrated multicriteria group decision models in a simulation gaming context. *Simulation and Gaming*, 21(1), 27-47.	correlation, t-test	research	management, higher education	proposes and compares 2 models of group decision making in a simulation gaming context
Allen, L.E., Jackson, G., Ross, J., White, S. (1978). What counts is how the game is scored: One way to increase achievement in learning mathematics. *Simulation and Games*, 9(4), 371-389.	descriptives, student t	research	elementary education	explore the effect of channeling attention by changing the method of scoring
Atkinson, F.D. (1977, Feb). Designing Simulation/Gaming activities: A systematic approach. *Educational Technology*, 38-43.		discussion	not able to determine	explains systems approach to design of games
Baltra, A. (1990). Language learning through computer adventure games. *Simulation and Games*, 21(4), 445-451.		discussion	adult education	adventure games for language learning and motivating students
Barak, A., et. al. (1987). Increasing the level of empathic understanding by means of a game. *Simulation and Games*, 18(4), 458-470.	ANOVA	research	adult education	assesses the effectiveness of a simulating game in increasing empathic understanding
Barker, J.A. (1982). Simulation and gaming, without computers, for school biology courses. *Journal of Biological Education*, 16(3), 187-196.		discussion	secondary education	describes differences between and uses of games, simulations, and case studies; gives examples of use in biological context; appendix gives list of commercial games and articles on biological games.
Barnett, T. (1984) Evaluations of simulations and games: A clarification. *Simulation/Games for Learning*, 14(4), 64-75.		theory, discussion	not able to determine	discusses evaluation issues including identification of direct and indirect aims; limitations of objective-oriented research for assessment; criticizes comparative evaluations of simulation and games with traditional teaching techniques
Brand, C F. (1980). Learning from simulation games: Effects of sociometric grouping. *Simulation and Games*, 11(2), 163-176.	ANOVA	research	elementary education	looked at sociometric grouping of students in two games; concluded that this type of learning was not influenced by peer acceptance or membership in work groups with varied degrees of cohesiveness
Branwyn, G. (1986). Gaming: Simulating future realities. *Futurist*, 20(1),29-35.		discussion	not able to determine	examines future gaming realities
Braun, C.M., Goupil, G., and Giroux, J. (1986). Adolescents and microcomputers: Sex differences, proxemics, task and stimulus variables. *Journal of Psychology*, 120(6), 529-542.	correlation, chi-square	research	secondary education	questionnaire re: attitudes using microcomputing and arcade games and analyze type of games and behavior of clients in video arcades
Bredemeier, M.E. and Greenblat, C.E.(1981). The educational effectiveness of games: A synthesis of findings. *Simulation and Games*, 12(3) 307-332.		literature review	secondary education, business, other	review of gaming constructs; concluded that there is not yet a theoretical-based taxonomy that has clear theories
Bredemeier, M.E. and others. (1982). Ba Fa Ba Fa and Dogmatism/Ethnocentrism: A study of attitude change through simulation-gaming. *Simulation and Games*, 13(4), 413-436.	factor analysis, anova, t-test/eta, mean scores, mean differences, correlation	research	adult education	assesses game effects on student attitudes; summarizes research evidence and reports methodological problems
Brenenstuhl, C., & Catalanello, F. (1976). An analysis of the impact upon the learning effectiveness of traditional instruction, simulation gaming, and experiential learning teaching methodologies: An experimental design. Proceedings, Association for Business Simulation and Experiential Learning (ABSEL), 463-473.		discussion	adult education, business, higher education	overview of proposed research project involving college student; discusses research design
Brownfield, S. and Vik, G. (1983, December). Teaching basic skills with computer games. *Training and Development Journal*, 53-56.		development	adult education, military	describes development of military instructional system that includes gaming elements for literacy development
Butler, R.J., Markulis, P.M., and Strang, D.R. (1988). Where are we? An analysis of the methods and focus of the research on simulation gaming. *Simulation and Games*, 19(1), 3-26.		literature review	not able to determine	evaluates current (1988) status of research on simulation/gaming
Carlson, J G. and Hill, K D. (1982). The effect of gaming on attendance and attitude. *Personnel Psychology*, 35(1), 63-73.	one-tailed t test	research	other	gaming as a vehicle to improve attendance and attitude in the work place - operant conditioning
Carroll, C E (1986) Computer Simulations. *Social Studies Review*, 25(3), 57-59.		discussion	elementary education	discusses 4 commercial programs; emphasizes debriefing; simulations not intended to standalone; emphasizes development of thinking and problem solving and not merely mastery of content

Gaming Articles Page 5; February 11, 1994	Statistical Analysis	Category	Environment	Comments/Purpose
Pierfy, D.A. (1977). Comparative simulation game research: Stumbling blocks and steppingstones. *Simulation and Games*, 8(2), 255-268.		literature review	elementary education, secondary education	review of studies and focuses on the question of whether games teach particular things better than alternative methods
Randel, J.M., Morris, B.A., Wetzel, C.D., Whitehill, B.V. (1992). The effectiveness of games for educational purposes: a review of relevant research. *Simulation & gaming*, 23(3), 261-276.		literature review	elementary education, secondary education, military	compares instructional effectiveness of games to conventional classroom instruction
Reigelth, C.M. and Schwartz, E. (1989). An instructional theory for the design of computer-based simulations. *Journal of Computer-Based Instruction*, 16(1), 1-10.		discussion	not able to determine	focuses on instructional overlay as a simulation -- optimize learning and motivation.
Reiser, R.A. & Gerlach, V.S. (1977). Research on simulation games in education: A critical analysis. *Educational Technology*, 17, 13-18.		literature review, discussion	not able to determine	review of articles involving simulation games and their effects in areas of interest, attitude, efficacy, knowledge, intellectual skills; looks at weaknesses in research methods and notes on how to overcome this problem
Remus, W.E. (1981, June). Experimental designs for analyzing data on games: On even the best statistical methods do not replace good experimental control. *Simulation and Games*, 12.		discussion	not able to determine	discusses research designs and shows that they need good experimental control and most sophisticated statistical methods can't remove the effects of a lack of experimental control
Renaud, L. and Stolovitch, H. (1988). Simulation gaming: An effective strategy for creating appropriate traffic safety behaviors in five-year-old children. *Simulation and Games*, 19(3), 328-345.	MANOVA, ANOVA	research	elementary education	discusses gaming as an effective strategy for behavior creation in 5-year olds
Reynolds, A and Martin, J.V. (1988, January). Designing an educational computer game: Guidelines that work. *Educational Technology*, 45-47.		discussion	not able to determine	gives guidelines for designing educational computer games
Ruben, B.D. and Lederman, L.C. (1982). Instructional simulation gaming: Validity, reliability, and utility. *Simulation and Games*, 13(2), 233-244.		theory	not able to determine	provides a framework for analysis of games by assessing validity, reliability, and the utility of the activity
Rutherford, M (1976) The use of computer games in education: A critique. *Economics*, 12, 31-36.		discussion	not able to determine	locates assumptions that underlie views of the potential of computer games and examines them
Saegesser, F. (1981). Simulation-gaming in the classroom: Some obstacles and advantages. *Simulation and Games*, 12(3), 281- 294.		discussion	secondary education	discusses general difficulties encountered while introducing simulation/games into the school system
Saunders, D. and Crookall, D. (1985). Playing with a second language. *Simulation/Games for Learning*, 15(4), 166-172.		discussion	not able to determine	simulation gaming application to learning foreign languages
Saunders, D. and Gunn, R. (1990). The assessment and evaluation of communication skills associated with simulation/gaming. *Simulation/Games for Learning*, 20(2), 215-234.		theory	not able to determine	discussed assessment of communication skills related to gaming
Shubik, M. (1989). Gaming: Theory and practice, past and future. *Simulation and Games*, 20(2), 184-189.		discussion	business, military, other	history and potential of gaming
Smith, P. (1986). Low-cost simulations: The impossible dream revisited. *Educational Technology*, 26, 35-38.		discussion	adult education	
Sorenson, D.S. (1981). "Nuclear deterrence" as an adaptive game frame for crisis decision-making. *Journal of Experiential Learning and Simulation*, 3(2), 103-109.	mean, frequencies	research	adult education	discusses game "nuclear deterrence," links to other crisis behavior theory and case study
Szafran, R.F. and Mondolini, A.F. (1980). Test performance and concept recognition. The effect of a simulation game on two types of cognitive knowledge. *Simulation and Games*, 11(3), 326-335.	regression	research	adult education, higher education	studies test performance and concept recognition; concludes that there is no evident that simulation games substantially increase cognitive knowledge
Taylor, M (1990) Simulations and adventure games in CALL. *Simulation and Gaming*, 21(4), 461-466.		discussion	not able to determine	discusses use of communication language teaching approach using CALL

Gaming Articles Page 6; February 11, 1994	Statistical Analysis	Category	Environment	Comments/Purpose
Towne, D.M. and Munro, A. (1991). Simulation-based instruction of technical skills. *Human Factor*, 33(3), 325-341.		discussion	not able to determine	discusses an authoring language called RAPIDS used primarily for instruction of technical device-oriented topics; no reference to gaming
Tyson, G.A. and others (1988). Games playing strategy as an indicator of racial prejudice among South African students. *Journal of Social Psychology*, 128(4), 473-385.	descriptives	research	higher education	examined cooperation attitudes of black and white South African students
Van Sickle, R.L.(1986). A quantitative review of research on instructional simulation gaming: A twenty-year perspective. *Theory and Research in Social Education*, 14(3), 245-264.	mini-analysis	research	not able to determine	quantitative review (mini-analysis) of simulation/gaming; indicates small position effects for affective variables and retention; appendix shows coding sheets for study
Van Ments, M. Simulations, games, and role-play. *Techniques of Teaching and Assessment*.		discussion	not able to determine	defines simulations, games, role play, examples, advantages, disadvantages
Watkins, M.W. (1986). Microcomputer-based math instruction with first grade students. *Computers in Human Behavior*, 2, 71-75.	ANCOVA	research	elementary education	study assessed posttest math scores; concluded that results were consistent with existing literature, but much remains to be explored in educational applications
Westrom, M. and Shaban, A. (1992). Intrinsic motivation in microcomputer games. *Journal of Research on Computing in Education*. 24(4), 433-445.		research	secondary education	discusses intrinsic motivation in two games (instructional and noninstructional)
Whiteley, T.R. and Faria, A.J. (1989). A study of the relationship between student final exam performance and simulation game participation. *Simulation and Games*, 20(1) 44-64.	ANOVA	research	business	studies whether participation in a game is related to final grade
Williams, R.H. (1980). Attitude change and simulation games: The ability of a simulation game to change attitudes when structured in accordance with either the cognitive dissonance or incentive models of attitude change. *Simulation and Games*, 11(2), 177-196.	ANOVA	research	adult education	describes factors that influence effects of simulation/gaming; discusses identification and playability
Wishart, J (1990). Cognitive factors related to user involvement with computers and their effects upon learning from an educational computer game. *Computers and Education*, 15(3), 145-150.	chi-square	research	elementary education	builds on Malone's theory, adds control to complexity and challenge
Wood, L.E. and Stewart, R.W. (1987). Improvement of practical reasoning skills with computer skills. *Journal of Computer-Based Instruction*, 14(2), 49-53.	3-way ANOVA	research	adult education	study of student reasoning ability increases scores on critical thinking appraisal
Yeo, G.K. (1991). A framework for developing simulation game systems. *Simulation and Gaming*, 22(3), 308-327.		development	adult education, business, managment, higher education	discusses integrated networked to coordinate activities surrounding a simulation game to have game administration and decision support system more easily be built and maintained

Gaming Articles Page 2; February 11, 1994	Statistical Analysis	Category	Environment	Comments/Purpose
Chaffin, J.D., Maxwell, B., & Thompson, B. (1982). ARC-ED curriculum: The application of video game formats to educational software. *Exceptional Children*, 49(2), 173-178.		discussion	other	motivational features of video arcade games: feedback, high response rates, improvement, unlimited ceilings on performance; references to Malone, motivation and mastery
Chambers, B. and Abrami, P.C. (1991). The relationship between student team learning outcomes and achievement, causal attributes, and affect. *Journal of Educational Psychology*, 83(1), 140-146.	descriptives, ANOVA	research	elementary education	examination of relationship between prior achievement, individual outcome, team outcome, student achievement, and academic perceptions
Cruichshank, D.R. (1988). The uses of simulations in teacher preparation. *Simulation and Games*, 19(2), 133-156.		discussion	adult education	review of simulations for teacher education; one game
Cryer, P. (1988). Making decisions about an educational game, simulation or workshop: A 'games theory' Perspective. *Simulation/Games for Learning*, 18(4), 245-255.		theory	adult education	explores theories of games in education settings
Deci, E.L. (1972). Intrinsic motivation, extrinsic reinforcement, & inequity. *Journal of Personality and Social Psychology*, 22, 113-120.	ANOVA	research, theory	adult education	will there be changes in a person's intrinsic motivation when external rewards for performing an activity are given
Dempsey, J.V., Lucassen, B., Gilley, W. & Rasmussen, K. (1993-94). Since Malone's theory of intrinsically motivating instruction: What's the score in the gaming literature. *Journal of Educational Technology Systems*, 22 (2), 173-183.		literature review, discussion	other	discusses interpretations of current gaming literature
Driskell, J.E. and Dwyer, D.J.(1984). Microcomputer videogame based training. *Educational Technology*, 24, 11-17.		discussion	military	defines video games and their benefits and characteristics, lists instructional properties, gives gaming strategies; example of game included
Duchastel, P.(1991). Instructional strategies for simulation-based learning. *Journal of Educational Technology Systems*, 19(3), 265-276.		discussion	not able to determine	discusses instructional strategies for simulation features: fidelity, interactivity, artificiality; global strategies: simplification, support; specific strategies: demonstrating, tasking, explaining
Duke, R. D and Kemeny, N.K. (1989). Keeping score one score later: Two decades of the Simulation and Games Journal. *Simulation and Games*, 20(2), 165-183.		literature review	not able to determine	discusses state of simulation/gaming from historical perspective of articles in simulation and games journal
Dunne, J J. (1984). Gaming approaches in educational software: An analysis of their use and effectiveness. 13 p. Evaluations conducted by Educational Products Information Exchange Institute.		discussion	secondary education	investigate use and effectiveness of gaming techniques in educational software; the extent s/w uses gaming; ways it is being used; overall effectiveness
Ellington, H , et. al. (1982). Games and simulations teach social relevance of science. *Impact of Science on Society*, 32(4), 481-491.		discussion	secondary education	broad introduction to simulation and gaming to show how such techniques can be used to demonstrate social relevance of science
Fisher, J.E. (1976). Competition and gaming: An experimental study. *Simulation and Games*, 7(3), 321-328.		research	adult education	to investigate the effects of variations in competitive form on the cognitive learning outcome of an educational game
Fraas, J W. (1982) The influence of student characteristics on the effectiveness of simulations in the principles course. *Journal of Economic Education*, 13(1), 56-61.	t-test	research	adult education	investigate effectiveness of simulation-gaming to teach college introductory course, especially in are of student characteristics; findings: neither simulation game nor lecture discussion could be considered exclusively superior, depends on student characteristics
Goodman, F.L. (1990). Graphix. *Simulation and Gaming*, 21(4), 467-472.		discussion	not able to determine	describes gaming procedure and design of graphix
Grabe, M. and Dosmann, M. (1988). Application report: the potential of adventure games for the development of reading and study skills. *Journal of Computer-Based Instruction*, 15(2), 72-77.	descriptives	research, discussion	elementary education	use of adventure games as an academic activity to develop text processing skill

Gaming Articles Page 3; February 11, 1994	Statistical Analysis	Category	Environment	Comments/Purpose
Gredler, M.B. (1990). Analysing deep structure in games and simulations. *Simulation/Games for Learning*, 20(3), 329-334		theory	not able to determine	discusses deep structure of games and reinforcement theory in relation to gaming -- as well as related concepts such as negative utility
Greenblat, C.S (1982). Games and simulations. In Mitzel, H.E., *Encyclopedia of Educational Research* (5th ed). The Free Press: New York.		discussion	elementary education, secondary education, adult education, business, military, health care	defines games/simulations
Griffiths, M.D. (1992) Pinball wizard: the case of a pinball machine addict. *Psychological Reports*, 71(1), 160-2.		discussion	other	discusses addiction of person to pinball machine gaming -- gambling
Griffiths, M D (1990) Adolescent gambling-An observational pilot study. *Perceptual and Motor Skills*, 70(3), 1138		discussion	other	observation of gaming machines; 4-hour monitoring session; discussion of results
Griffiths, M.D. (1990). Arcade clientele and gaming preferences: A long-term study. *Perceptual and Motor Skills*, 70(2), 1258		discussion	not able to determine	observation of gaming preferences
Hasell, M J. (1987). Community design and gaming/simulation: comparison of communication techniques in participatory design sessions. *Simulation and Games*, 18(1), 82-115.	small number of cases, used n	research	other	evaluate the use of gaming/simulation as a participatory method for including users in the design of community projects
Hatch, C.W. (1984) Solution of problems which involve a difference between an individual's behavior and expectations. *Education*, 104(3), 329-331.		discussion	business, other	proposes model for solving problems involving differences between behavior and expectations in a gaming environment
Hubbard, P. (1991) Evaluating computer games for language learning. *Simulation and Gaming*, 22(2), 220-223		discussion	other	discusses evaluation criteria for using games in foreign language classes
Hughes, L.A. (1988) "But that's not really mean": Competing in a cooperative mode. *Sexroles*, 19(11-12), 669-687		research	elementary education	girls are often thought to be not as competitive as boys in a gaming environment; to some extent that is situational or a result of a less socially reinforcing scenario
Jacobs, J.W & Dempsey, J V. (1993). Simulation and gaming: Fidelity, feedback, and motivation. In J V. Dempsey & G.C. Sales, *Interactive Instruction and Feedback*. Englewood Cliffs, NJ: Educational Technology Publications		discussion	not able to determine	examines feedback and motivation in simulation and gaming
Jacobs, R L and Baum, M. (1987). Simulation and Games in training and development: Status and concern about their use *Simulation and Games*, 18(3), 385-394.		discussion	adult education	discusses status and concerns about using simulation-games for training and development
Jones, K (1989) Running or stumbling through simulations. *Simulation/Games for Learning*, 19(4), 160-167		discussion	not able to determine	describes differences between simulation and other interactive learning events; defines simulation and games in both USA and Britain
Keys, B and Wolfe, J (1990) The role of management games and simulations in education and research *Journal of Management*, 16(2), 307-336.		theory, literature review, discussion	adult education, management	defines terms and parameters for management gaming, reviews history of business gaming, examines studies on management gaming effectiveness, reviews models of learning, reviews literature that deals with management games and simulations, looks at trends and developments
Keys, B (1976) A review of learning research in business gaming Proceedings, ABSEL: 173-184.		literature review	adult education, business	review of learning research in business gaming to clarify existing incongruencies that exist in the literature
Klein, R D and Fleck, R A. (1990) International business simulation/gaming: An assessment and review *Simulation and Gaming*, 21(2), 147-165.		literature review	business	reviews gaming literature to identify gaming's strengths and weaknesses to determine roles that simulations can play in international business pedagogy
Klein, J and Freitag, E (1991). Effects of using an instrumental game on motivation and performance *Journal of Educational Research*, 84(5), 303-308	MANOVA, ANOVA	research	adult education	effects of a content-specific board game as measured by Keller's motivational scale

Gaming Articles	Statistical Analysis	Category	Environment	Comments/Purpose
Koran, L.J. and McLaughlin, T.F. (1990). Games or drill: Increasing the multiplication skills of students. *Journal of Instructional Psychology*, 17(4), 222-230.	ANOVA	research	elementary education	suggests using gaming as a motivator
Kowitz, G.T. and Smith, J.C. (1989). Conflict and gaming in instruction and performance. *Performance and Instruction*, 28(2), 28-32.		discussion	not able to determine	discusses role of conflict and control in gaming and its use in instruction and game theory
Kryukov, M.M. and Kryukova, L.I. (1986). Toward a simulation games classification and game dialogue types. *Simulation and Games*, 17(3), 393-402.		theory	not able to determine	proposes a game classification based on the "game image" existing in the minds of the participants
Laughery, K.R. (1984) Teaching humans game-playing skills. *Simulation and Games*, 15(2), 187-212.	ANOVA	research	military	explores reverse-role training and mentions measures of strategy
Laveault, D. and Corbeil, P. (1990). Assessing the impact of simulation games on learning: A step-by-step approach. *Simulation/Games for Learning*, 20(1), 42-54.		discussion	adult education	discusses micro-development sequence of how learning takes place in a simulation game
Lepper, M.R. and Chabay, R. W. (1985). Intrinsic motivation and instruction: Conflicting views on the role of motivational processes in computer-based education. Special issue: Computers and education. *Educational Psychologist*, 20(4), 217-230.		theory, discussion	not able to determine	discusses theoretical controversies and policy debates concerning using computers; argues that conflicting views underlie differences of opinions about costs and benefits, importance of styles of teaching, and alternative strategies
Lin, S. and Lepper, M.R. (1987). Correlates of children's usage of videogames and computers. *Journal of Applied Social Psychology*, 17(1), 72-93.	correlation	research	elementary education	to see if there is a relationship between videogame use and aggressiveness, sociability, academic performance, computer use
Livingston, L.A. (1991). The effect of color on performance in an instructional gaming environment. *Journal of research on computing in education*, 24 (2), 246-53.	descriptives, ANCOVA, ANOVA	research	adult education	discusses impact of color on retention, memory load; color appears to be a distracting variable
Logan, J.W., Olson, M.W. and Lindsey, T.P. (1989). Lessons from champion spellers. *Journal for the education of the Gifted*, 13(1), 89-96.		discussion	elementary education	discusses different strategies champion spellers use to learn competition words and their intrinsic motivation
Madden, G. and McGowin, C. (1989). The effect of the inner game method versus the progressive method on learning motor skills. *Journal of Teaching in Physical Education*, 9(1), 39-48.	ANOVA	research	adult education	compared effect of two methods of instruction for teaching volleyball; did not find any difference
Malone, T.W. (1981). Toward a theory in intrinsically motivating instruction. *Cognitive Science*, 4, 333-369.	ANOVA, correlation, ANCOVA	research, theory	not able to determine	discusses studies of computer games and promotes a theory which includes challenge, fantasy, and curiosity
Malouf, D B. (1987). The effect of instructional computer games on continuing student motivation. *Journal of Special Education*, 21(4), 27-38.	ANOVA, t-test	research	secondary education	investigated effects of computer games on motivation and found that the game resulted in significantly higher levels of continuing motivation
Marsh, C.J. (1981). Simulation games and the social studies teacher. *Theory into Practice*, 20(3), 187-193.		discussion	secondary education	discusses simulation gaming and merits for social studies teachers, types and formats of S/G, prep activities and skills and teacher strategies for eliciting support from colleagues, principals, and parents
Martin, A. (1988) Out of the screen: Computers and Simulation. *Simulation/Games for Learning*, 18(1), 21-29		discussion	not able to determine	different ways computer intervention in simulation exercises are explored
McClure, R.F. and Mears, F G (1986). Videogame playing and psychopathology. *Psychological Reports*, 59(1), 59-62.	ANOVA	research	secondary education, other	videogame playing is seen as a social activity and not a serious achievement activity
Miesing, P. and Preble, J.F. (1985). Group processes and performance in a complex business simulation *Small Group Behavior*, 16(3), 325-338.	factor analysis	research	business, higher education	reports processes on team performance using a simulation as an experimental laboratory
Norris, D and Niebuhr, R E. (1980). Group variables and gaming success. *Simulation and Games*, 11(3), 301-312.	correlation	research	business	game performance as a product of group characteristics
Oxford, R. & Crookall, D (1988). Simulation/gaming and language learning strategies. *Simulation/Gaming*. 19(3), 349-352.		discussion	other	discusses learning strategies of learners and the relationship to simulation/gaming