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Simulation Gaming 1998; 29; 7
DOI: 10.1177/1046878198291002

The online version of this article can be found at:
http://sag.sagepub.com/cgi/content/abstract/29/1/7

Published by:
SAGE Publications
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On behalf of:
Association for Business Simulation & Experiential Learning
International Simulation & Gaming Association
Japan Association of Simulation & Gaming
North American Simulation & Gaming Association
Society for Intercultural Education, Training, & Research

Developing a Scientific Knowledge of Simulation/Gaming

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This article first speculates on why such little progress has been made regarding the effective application of educational simulation/games. It suggests that the field's eclectic foundation has been a virtue for its development but a vice regarding its rigorous assessment. The article then outlines the antecedents for generating a practical and cumulative body of literature, concluding with a number of recommendations as to how the field might accelerate the rate at which its literature accumulates.

KEYWORDS: *eclecticism; effectiveness of simulation/gaming; knowledge; knowledge of simulation/gaming; learning; literature; qualitative research; quantitative research; research methods; science; science of simulation/gaming.*

The instructional simulation/games of today have roots that date back to 5,000 years ago, for example, in the Chinese board game WEI-HAI and the Hindu game of CHATURANGA (Wilson, 1968). In these games, the flanking movements taught by the military thinker Sun-Tzu led to victory. Dice were used to introduce chance elements, and verisimilitude was attempted by using playing pieces that were miniaturized foot soldiers, light cavalry, elephants, and chariots. Although these were often just parlor games, serious games were introduced in the 17th and 18th centuries in the form of war games.

The modern era of simulation/gaming began in the late 1950s through the integration of war gaming, computer science, and operations research

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EDITOR'S NOTE: This article is reprinted, by permission, with small modifications, from a chapter that appeared in the ISAGA Valencia conference proceedings—Garcia Carbonell, A., & Watts, F. (Eds.). (1996). *Simulación ¡ya! El Aprendizaje a través de la Experiencia: El Reto del Cambio* [Simulation Now! Learning Through Experience: The Challenge of Change]. València: Diputació de València. (Available, price $80 + p&p, from Amparo Garcia Carbonell or Frances Watts, ETSI Telecomunicación, Camino de Vera 14, Universidad Politécnica de València, 46022 València, Spain; telephone: +34-6-3877535; fax: +34-6-3877199; e-mail: agarciac@idm.upv.es or fwatts@idm.upv.es)

SIMULATION & GAMING, Vol. 29 No. 1, March 1998 7-19

(Cohen, Dill, Kuehn, & Winters, 1964), supported by new educational theories (Graham & Gray, 1969; Kolb, 1984) that emphasized active rather than passive learning methods and a recognition of the importance of experience—and reflection on that experience—as key parts of the learning process. Accordingly, simulation/games are now a commonly employed teaching method throughout the world (Assa, 1982; Burgess, 1991; Crookall & Arai, 1995; Faria, 1987; McKenna, 1991; Rohn, 1986; Wolfe, 1993).

Knowledge Gaps

Despite this widespread use, one is struck by the gaps in our knowledge about the educational simulation/gaming process or about those elements that contribute to its effective or ineffective use. Reviewing the business simulation/gaming effectiveness literature, which has been in existence for almost 40 years, Wolfe (1990) found that nothing could be stated definitively about the learning effects produced by such practical matters as the simulation's complexity or detail, the sophistication of the concepts being taught, playing duration, instructor involvement in the process, instructor motivations for simulation use, and reasons for choosing a particular simulation for course use. Crookall, commenting on the International Simulation and Gaming Association's (ISAGA's) 25th-anniversary conference, which might have been an occasion for consolidating the educational simulation/gaming field, noted instead that conference practitioners still seemed to be grappling with understanding what the field is and is not and that the same debates were being conducted again and again among colleagues. As noted more formally,

> Such discussions often seem to be conducted as though [the] parties to them were raising the issue for the first time, in other words, as though nothing had been said, let alone written, about the nature or concept of simulation/gaming. (Crookall, 1995, p. 163)

Moreover, those debating the issues "tackle the topic without the rigor and reference[s] that would be required in many other areas" (Crookall, 1995, p. 163).

Symptomatic and central to this lack of accumulation is the fact that, despite many efforts over several years (e.g., Cecchini, 1989; Cecchini & Frisenna, 1987; Crookall, Oxford, & Saunders, 1987; Duke, 1986; Greenblat & Duke, 1981; Klabbers, 1987; Kryukov & Kryukova, 1986; Siebecke, 1989), the educational simulation/gaming field has been unable to create a generally accepted typology, let alone taxonomy, of the nature of simulation/

gaming. This is unfortunate because the basis of any science is its ability to discriminate and classify phenomena within its purview, based on underlying theory and precepts. Without this road map and underlying framework, the field has been stuck, despite its age, at a relatively low level of development (Butler, Markulis, & Strang, 1988).

This article first speculates on why such little progress has been made regarding the effective application of educational simulation/games, noting that the field's eclectic foundation has been a virtue for its development but a vice regarding its rigorous assessment. The article then outlines the antecedents for generating a practical and cumulative body of literature, concluding with a number of recommendations as to how the field might accelerate the rate at which its literature accumulates.

Impediments to Educational Research

The impediments to conducting educational research that is useful and practical to those who teach are numerous and are associated with the field of educational research in general and with the nature of learning in simulation/gaming contexts more specifically. In regard, first, to the supposed value of educational research in general, a historical ambivalence regarding both its efficacy and usefulness has become manifest. As outlined by McCall (1923), enthusiasm for experimental education research reached its apex in the 1920s, following the optimistic thrusts of Thorndike (Thorndike, McCall, & Chapman, 1916). This enthusiasm gave way, however, to pessimism, apathy, and rejection in the 1930s. Many teachers became aware that the direct and practical contributions made by educational experimentation were minimal. Indeed, most educational research was judged to be petty, tedious, equivocal, and unreplicable.

This negative view has persisted to recent times, so much so that the influential and leading work on educational research was compelled in 1963 to defend the use of educational experimentation (D. T. Campbell & Stanley, 1963). It noted that all research is generally tedious and undramatic, and given that many more incorrect than correct responses exist, it should be expected that most experimental results would be perceived to be tedious and inconsequential in the overall scheme. However, only through thorough persistence of the type achieved so well in the biological and physical sciences do D. T. Campbell and Stanley (1963) believe that the educational field will tread a progressive and cumulative path to effective application. Thus, one of the impediments toward building a cumulative literature on simulation/gaming application may be the perception that findings related to educational prac-

tices, even if they are positive, are inconsequential and not worthy of recognition or replication. However, it is dangerous to assume that social science research can emulate research in the hard sciences (Cartwright, 1983; Putnam, 1981a, 1981b; Sharrock & Watson, 1987). Thus, another and deeper impediment (underlying the above-mentioned perception) may be that educational research cannot, ultimately and despite its practitioners' claims, be expected to produce the kinds of results that we crave and that ultimately we blame such research for not producing.

Another factor that has served to frustrate the field's progress has been its eclectic nature. The field often celebrates its interdisciplinary nature (Crookall, 1995) and recognizes its diverse origins. This very nature, however, encourages a lack of independent structure, a lack of recognition by the established disciplines and sciences, and a free-form orientation that often attracts the temporary interest of dilettantes who soon move onto other fancies without leaving much of an imprint.

Although scholars and practitioners who delve into the simulation/gaming field bring with them the insights and skills associated with their home disciplines, they often ignore or fail to appreciate the work that has already been done and documented in the simulation/gaming field's own literature. To create a cumulative literature, these individuals, who know their own literature very well, must also learn and build on the literature of the simulation/gaming field if they are to push the field forward, whether it be in the design, application, or evaluation of simulation/gaming efforts and materials.

Although it is understandable that those coming to the field of simulation/gaming from outside would not initially know its literature, progress here has also been impaired by those within the field either not knowing its own literature or not using it intelligently. The influential book by J. P. Campbell, Dunnette, Lawler, and Weick (1970), in its discussion on management education and development techniques, curiously cited only one single simulation/gaming reference and concluded that little had been researched on the ability of management simulation/games to develop and educate managers. At the time that book was being written, at least 10 positive literature citations were available on their effectiveness. Moreover, as late as 1983, Loveluck audaciously stated that business simulation/games had "never been scientifically evaluated" (p. 309) despite the fact that 61 rigorous studies (see, e.g., Greenlaw & Wyman, 1973; Wolfe, 1985) could have been presented. Others such as Neuhauser (1976), rather than appearing to be unaware of the field's research, have been very selective in their recollection and citation of the literature. In Neuhauser's stinging attack on the value of business simulation/games, only 3 of 12 studies available were cited. One

citation supported simulation/gaming, only the negative findings found within a generally positive summary of Harvard's experiences with simulations were presented in the second citation (McKenney, 1963), and the third citation was so troublesome even its authors disclaimed their negative findings (Moffie & Levin, 1968).

Error and Omission

These oversights, omissions, and selective citations may either have been made deliberately by those unfriendly to the pedagogical revolution being advanced or have been the result of the confusing conditions and conclusions associated with any emerging field. Such sins of omission and commission, however, should not occur now that experiential learning has moved into the mainstream. Unfortunately, literature review mistakes are still being made and are being made even by the movement's friends and advocates. An example is the Association for Business Simulation and Experiential Learning (ABSEL), the United States' largest simulation/gaming group, which is 21 years old and an enthusiastic supporter of educational gaming. A review of its 1995 meeting proceedings (Overby & Patz, 1995) found the errors and oversights presented in Table 1. Given conditions such as these, it is understandable that much work is repetitive and confusing.

Pedagogical Research

Another source of the field's lack of development is tied to the nature of pedagogical research, as well as to its importance in the career interests of numerous contributors. Many who have written for the educational simulation/gaming literature lack specific training in educational research (although they may have been exposed to the general methods of research). They also tend to have greater respect for the research produced by the more established disciplines or the discipline for which they were trained. Very few, if any, of those in the simulation/gaming movement have degrees in educational simulation/gaming. Instead, they have gravitated later in their careers to the field or have contributed to the field as an interesting sideline.

Given this lack of career centrality and this dearth of appreciation for research produced by the education field, as well as the attendant problem of obtaining external grants and funding, it is understandable that those conducting research into the efficacy of their practices are unwilling to expend the energy that is needed to conduct solid research. This is especially true given academia's bias toward quantitative research rather than qualitative research, despite the recognition that qualitative methods are often the more

TABLE 1: Errors and Omissions in the 1995 ABSEL Proceedings

Author Statement or Conclusion	*Possible Clarifying, Confounding, or Elaborating Literature Citation*
The authors stated that no relationship existed between a team's simulation performance and the team's learning level.	The literature review failed to cite a 1993 study that found that high-performing, single-member teams learned more than low-performing, single-member teams. Thus, the authors did not recognize that team-member relationships mitigate or influence a team's results.
The authors asserted that teams sensed environmental cues but responded in unexpected ways.	The authors overlooked a 1989 study in which players could not detect particular environmental cues in a simulation's complex demand-creation routine. Accordingly, one cannot expect players to respond to their competitive situation in a definitive fashion.
The article concluded that context and content differences among executives versus students playing simulations cause simulations designed for one group to be ineffective for the other group.	The authors overlooked a 1976 study that found both audiences displayed a great deal of similarity regarding the actions leading to high-performance levels. Accordingly, the same simulation can be used for both groups, given a similar learning agenda.
The study concluded that a correct strategy in a business simulation will always be correct if the simulation's basic competitive environment remains the same.	The authors disregarded a 1993 finding that a company's correct strategy works best when it is implemented well. Thus, strategy alone does not lead to company success in a business simulation.
In reviewing the external validity literature, the authors allowed the debate to remain equivocal.	In reviewing the debate on gaming's external validity, the authors failed to cite an additional 5-year follow-up study performed in 1993. This later study affirmed external validity.
The author concluded that simulation players cannot detect invalid algorithms in simulations, and therefore that simulation complexity is a mixed and often negative blessing.	The author's literature review failed to state that the ability to detect algorithmic errors depends on the function's instrumentality. Students in one study could detect an error in the simulation's deterministic production function but could not detect it in its relatively indeterminate demand function. The author's review also failed to cite a 1978 study that found that learning levels increased with simulation complexity. Therefore, complexity has virtue if knowledge acquisition is the simulation administrator's main objective.
The authors stated that research has shown that outdoor-based experiential training is an effective training tool.	The authors failed to cite a 1986 meta-analytic study that found little organizational value for outdoor-based training.

TABLE 2: The Traditional Mode of Educational Research

1. All groups or course sections must be identical, offered at the same time and during the same semester.
2. All course material must be delivered in exactly the same manner using the same syllabus, with identical class interactions and atmosphere being present.
3. All groups or course sections must be created randomly, and all groups must contain more than 30 subjects to allow the assumption of a normal sampling distribution. Given complete randomization, no pretest is required. If a pretest is given, all groups must have identical means and standard deviations on the pretest.
4. All groups must be unaware that an experiment or evaluation is being conducted.
5. Any control group(s) must receive a placebo.
6. All subjects must make every effort to score as high as possible on all tests and/or instruments or measures that are administered or taken.
7. High intercorrelations must exist between the course's subject matter, the educational innovation's content, and the objective measurement of the innovation's effect.
8. The difficulty level of the test or instrument must allow a wide performance range. No more than one zero score or one 100 or perfect score can exist.
9. All tests must be administered in the same fashion and under ideal testing conditions.

appropriate, understanding the nature and effect of simulation/gaming. Research that is classically acceptable, or that emulates the experimental conditions obtained in the physical sciences, is impossible to duplicate in realistic educational situations (Cartwright, 1983; Putnam, 1981a, 1981b; Sharrock & Watson, 1987).

Cooke (1986) has presented the nature of an education research design in the classical mode summarized in Table 2. The requisites of this design are, quite simply, impossible to achieve, especially in the area of educational simulation/gaming, given its open-ended and experiential nature. (Also impossible are the numerous, controlled, educational research designs presented by Stone, 1982.)

Antecedents for Meaningful Research

Although the factors just cited may be reasons why the field has not progressed as fast as it could, meaningful educational research must be conducted if we are to create identifiable value for (a) those exposed to our methods and (b) those who underwrite and fund our work. An interesting series of studies by J. P. Campbell, Daft, and Hulin (1982) is of value at this point. Their work involved interviews of those who had made significant contributions to the management literature, in the eyes of their peers, to delineate factors that led them to produce their best research studies versus

TABLE 3: Factors Leading to Significant Research

1. Significant research resulted from the investigator's involvement in the physical and social world. This came about through making contacts and looking for wide exposure to diverse experiences. Significant research was often the result of a chance convergence of ideas and activities from several sources.
2. Significant research came from investigator interest, resolve, and effort. Much effort was expended to convert difficult research problems into tangible empirical results that were clear and useful, particularly as important research is not convenient and is frustrated by expediency.
3. Significant research was based on an intuition that the research idea was important. This sense of importance generated enthusiasm and commitment that carried the project over discouragements and propelled it to its successful conclusion.
4. The research project was associated with intellectual rigor. Much effort was expended on its theoretical development and subsequent clarification.
5. Significant research reached into the intangible real world and returned with something that was clear, tangible, and understood. The good research project took a problem that was unclear or was in dispute and brought it into resolution.
6. The significant research study focused on real problems. The important research dealt with the real world, and the findings had relevance to all concerned.

factors that resulted in studies that were not outstanding or that were of only marginal value. The authors found multiple factors that often eventually led to a significant piece of research. These are summarized in Table 3.

In applying these findings to the educational simulation/gaming field, we can prepare ourselves for beginning useful research projects by being involved with those who are teaching in the classroom and are delivering knowledge through various media. We must expose ourselves to new ways of teaching, and we should subject ourselves to methods that challenge or question our own, favorite methods. If our research projects are to be successful, we must have the time and energy to plan and conduct it properly. We must also be enthusiastic about the project and utterly committed to its successful completion. Trying to "fit in" a study into our spare time, using a conveniently obtained instrument on a group of students that just happen to be available, or delegating the study's less glamorous elements to others tends to lead to the dissipation of energy and the creation of inconsistency and mistakes.

Although the hypothetical study's initial ideas and links may be fuzzy and contradictory, it is amply clear that much time must be spent examining the available literature and relevant findings. This process would clarify a real-world teaching problem, discover inconsistencies in the literature itself, and also ensure that new ground is being covered.

Contributing to a Science of Simulation/Gaming

Although the above conclusions were drawn from a group of highly successful researchers, what can a newcomer to the field of educational simulation/gaming do? Although obvious in some instances, we have found the following activities to be useful.

Literature Review

Thoroughly review the literature that is relevant to your research idea. Arguably, the foremost, traditional source is *Simulation & Gaming: An International Journal of Theory, Practice, and Research* (Sage Publications). Some of the other traditional journals and conference proceedings dedicated to or including articles on educational simulation/gaming are the following:

- *Developments in Business Simulation and Experiential Exercises* (ABSEL proceedings);
- ISAGA proceedings (Sage Publications, Pergamon, Springer-Verlag, etc.);
- *Journal of Educational Technology Systems*;
- *Journal of Educational Technology*;
- *Simulation and Gaming Yearbook* (SAGSET proceedings, replacing the journal *Simulation/Games for Learning*);
- *Social Science Computer Review*.

Recent and detailed literature guides to simulation/gaming have been published, three of which are Crookall (1990, 1995) and Dukes and Matthews (1993). Of course, much literature on simulation/gaming is published in other, subject-specific journals, such as *Geography Teacher*, *Journal of Management Education*, *Journal of Marketing Education*, and *Teaching Sociology*.

Electronic Communication

Also consult bibliographical databases, Web sites, and discussion lists associated with the field's various organizations, simulations, and assorted activities. Some of these are available on CD-ROM (e.g., PsychLit or ERIC), and others can be consulted via the Internet. Electronic sources are continually evolving, and a list here would quickly become outdated. However, using Internet search engines (e.g., Excite, Lycos) or asking for help in a discussion forum (e.g., ABSEL-L or ISAGA-L) will lead the diligent researcher to a resource.

Discussion and Conferences

Discuss with authors their findings and what misgivings they had or have about their own research. Ask them what they would do next with your research ideas to test the importance of your own project as a contribution to the field's literature. Discuss your ideas with colleagues and students, and look for new methodologies that may generate new insights into old problems and issues.

Present your ideas and tentative findings at conferences and symposia. The societies and conferences most directly associated with educational simulation/gaming are ABSEL, the Japanese Association for Simulations and Games (JASAG), ISAGA, the Society for Active Learning (SAGSET), and the North American Simulation and Gaming Association (NASAGA). All these groups seek to help those who are new to the field, and some have special sessions dedicated to new entrants.

Research and Study

Collaborate with others more entrenched in the field. This method will help you to uncover leads and the literature while also helping you to understand the professional culture that surrounds the educational simulation/gaming field. Replicate inconclusive studies or retest interesting hypotheses that have been examined in flawed studies. As has been presented in this article, the field is replete with unfortunate works of this nature, and a real service would be served through efforts such as these.

Create your own databases of work already accomplished, publish updates of literature reviews that are already published, or work on specialized literature reviews (e.g., simulation/gaming in public speaking or intercultural simulation/games). Through this method, you would familiarize yourself with the literature while generating an understanding of its major themes, redundancies, and vacant spots.

Enroll in certificate or degree programs related to the field. Two programs are currently available. One is at the University of Michigan (United States) and another at the Université de Paris Nord, Villetaneuse (France).

Summary

The simulation/gaming literature has progressed relatively slowly in regard to the validity of its various practices. This relative lack of progress can be attributed to its eclectic nature, which draws to it practitioners with

diverse backgrounds, research orientations, and professional languages. Progress also has been hampered by the low status given to educational research and by skepticism about the real impact of educational research findings on the practice of good teaching. Those who have written in the field have not always received specific training in either educational research or educational simulation/gaming methods.

Progress toward the conduct of meaningful educational research has many antecedents. Those who make significant research contributions do so in an environment of high investigator activity and exposure with frequent interactions and contact with the real world rather than initially operating in solitude and isolation. The genesis of ideas that motivate significant research comes from the simultaneous convergence of several activities or interests. Intuition plays a great role. Rather than being guided by logical, esoteric analysis, significant research is often guided by what "seemed to be right," by a hazy-yet-enthusiastic sense of moving in the right direction. Much commitment and intrinsic interest is also involved in the process.

A large number of guiding sources are available to those who wish to contribute to a cumulative art and science of simulation and gaming application. These sources entail an immersion into the field's literature through its numerous journals, books, and conference proceedings; discussions with those who have contributed to its literature, replicating or elaborating past studies; and even enrolling in degree or short-term certificate programs dedicated to educational/gaming.

References

Asa, I. (1982). Management simulation games for education and research: A comparative study of gaming in the socialist countries. *Simulation & Games*, *13*(4), 379-412.

Burgess, T. F. (1991). The use of computerized management and business simulation in the United Kingdom. *Simulation & Gaming*, *22*(2), 174-195.

Butler, R. J., Markulis, P. M., & Strang, D. R. (1988). Where Are We? An analysis of the methods and focus of the research on simulation gaming. *Simulation & Games*, *19*(1), 3-26.

Campbell, D. T., & Stanley, J. C. (1963). *Experimental and quasi-experimental designs for research*. Chicago: Rand McNally.

Campbell, J. P., Daft, R. L., & Hulin, C. L. (1982). *What to study: Generating and developing research questions*. Beverly Hills, CA: Sage.

Campbell, J. P., Dunnette, M. D., Lawler, E. E., & Weick, K. E. (1970). *Managerial behavior, performance, and effectiveness*. New York: McGraw-Hill.

Cartwright, H. (1983). *How the laws of physics lie*. Cambridge, UK: Cambridge University Press.

Cecchini, A. (1989, July). *Games into Russian dolls: An attempt to realize a nested classification of games*. Paper presented at the 1989 ISAGA Conference, Weimar, East Germany.

Cecchini, A., & Frisenna, A. (1987). Gaming simulation: A general classification. *Simulation/Games for Learning*, *17*(2), 60-73.

Cohen, K. J., Dill, W. R., Kuehn, A. A., & Winters, P. R. (1964). *The CARNEGIE TECH MANAGEMENT GAME: An experiment in business education*. Burr Ridge, IL: Irwin.

Cooke, E. F. (1986). The dilemma in evaluating classroom innovations. In A. C. Burns & L. Kelley (Eds.), *Developments in business simulation and experiential exercises* (pp. 110-114). Stillwater: Oklahoma State University.

Crookall, D. (1990). Learning more about simulation/games. In D. Crookall & R. Oxford (Eds.), *Simulation, gaming, and language learning*. New York: Harper & Row.

Crookall, D. (1995). Simulation/gaming: A guide to the literature. In D. Crookall & K. Arai (Eds.), *Simulation and gaming across disciplines and cultures: ISAGA at a watershed* (pp. 151-177). Thousand Oaks, CA: Sage.

Crookall, D., & Arai, K. (Eds.). (1995). *Simulation and gaming across disciplines and cultures: ISAGA at a watershed*. Thousand Oaks, CA: Sage.

Crookall, D., Oxford, R. L., & Saunders, D. (1987). Towards a reconceptualization of simulation: From representation to reality. *Simulation/Games for Learning*, *17*(3), 147-171.

Duke, R. D. (1986). Certificate in gaming/simulation studies program description. *Simulation & Games*, *17*(3), 414-420.

Dukes, R. L., & Matthews, S. (1993). *Simulation and gaming and the teaching of sociology* (5th ed.). Washington, DC: American Sociological Association.

Faria, A. J. (1987). A survey of the use of business games in academia and business. *Simulation & Games*, *18*(2), 207-224.

Graham, R. G., & Gray, C. F. (1969). *Business games handbook*. New York: American Management Association.

Greenblat, C. S., & Duke, R. D. (1981). *Principles and practices of gaming-simulation*. Beverly Hills, CA: Sage.

Greenlaw, P. S., & Wyman, F. P. (1973). The teaching effectiveness of games in collegiate business courses. *Simulation & Games*, *4*(3), 259-293.

Klabbers, J.H.G. (1987). A user oriented taxonomy of games and simulations. In D. Crookall, C. S. Greenblat, A. Coote, J.H.G. Klabbers, & D. Watson (Eds.), *Simulation-gaming in the late 1980s*. Oxford, UK: Pergamon.

Kolb, D. (1984). *Experiential learning: Experience as the source of learning and development*. Englewood Cliffs, NJ: Prentice Hall.

Kryukov, M. M., & Kryukova, L. (1986). Toward a simulation games classification and game dialogue types. *Simulation & Games, 17*(3), 393-402.

Loveluck, C. (1983). The construction, operation, and evaluation of management games. In B. Taylor & G. Lippitt (Eds.), *Management development and training handbook* (pp. 307-327). London: McGraw-Hill.

McCall, W. A. (1923). *How to experiment in education*. New York: Macmillan.

McKenna, R. J. (1991). Business computerized simulation: The Australian experience. *Simulation & Gaming*, *22*(1), 36-62.

McKenney, J. L. (1963). An evaluation of a decision simulation as a learning environment. *Management Technology*, *3*(1), 56-67.

Moffie, D. M., & Levin, R. I. (1968). Experimental evaluation of a computerized management game. *The Atlanta Economic Review*, *18*(11), 7-11.

Neuhauser, J. J. (1976). Business games have failed. *Academy of Management Review*, *1*(4), 124-129.

Overby, J. D., & Patz, A. L. (Eds.). (1995). *Developments in business simulation and experiential exercises* (Vol. 22). Madison, WI: Omnipress.

Putnam, H. (1981a). *Meaning and the moral sciences*. London: Routledge, Kegan Paul.

Putnam, H. (1981b). *Reason, truth and history*. Cambridge, UK: Cambridge University Press.

Rohn, W. E. (1986). The present state and future trends in management games for management development in Germany. *Simulation & Games, 17*(3), 382-392.

Sharrock, W. W., & Watson, D. R. (1987). "Power" and "realism" in simulation and gaming: Some pedagogic and analytic observations. In D. Crookall, C. S. Greenblat, A. Coote, J.H.G. Klabbers, & D. Watson (Eds.), *Simulation-gaming in the late 1980s*. Oxford, UK: Pergamon.

Siebecke, R. (1989, July). *Classification of games and central information file*. Paper presented at the 1989 ISAGA Conference, Weimar, East Germany.

Stone, E. F. (1982). Research design: Issues in studies assessing the effects of management education. In R. D. Freeman, C. L. Cooper, & S. A. Stumpf (Eds.), *Management education: Issues in theory, research and practice* (pp. 87-132). Chichester, UK: Wiley.

Thorndike, E. L., McCall, W. A., & Chapman, J. C. (1916). Ventilation in relation to mental work. *Teacher's College Contributions to Education* (No. 78). New York: Columbia University.

Wilson, A. (1968). *The bomb and the computer: Wargaming from ancient Chinese mapboard to atomic computer*. New York: Delacorte.

Wolfe, J. (1985). The teaching effectiveness of games in collegiate business courses: A 1973-1983 update. *Simulation & Games*, *16*(3), 251-288.

Wolfe, J. (1990). The evaluation of computer-based business games: Methodology, findings, and future needs. In J. W. Gentry (Ed.), *The guide to experiential learning* (pp. 279-300). New York: Nichols.

Wolfe, J. (1993). A history of business teaching games in English-speaking and post-Socialist countries: The origination and diffusion of a management education and development technology. *Simulation & Gaming*, *24*(4), 446-463.

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