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# Action Research and Critical Rationalisationism: A Virtuous Marriage

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# ACTION-RESEARCH AND CRITICAL RATIONALISM: A VIRTUOUS MARRIAGE

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## ABSTRACT

*The increasing influence of socio-organizational issues in information systems poses serious challenges to the applicability of most traditional research approaches, since the mechanisms from which they derive their rigor and validity become more and more unrealistic in the new contexts. Indeed, traditional problem decomposition, standardization of procedures, and rigorous quantitative measurement under the control of independent researchers often lose sense in such contexts. We analyze action-research as an alternative approach, bearing in mind that its adoption requires careful consideration of the epistemological foundations that legitimate its use. In particular, we address the legitimacy of generalizing from the researcher's findings, bearing in mind Karl Popper's critical rationalism, to conclude that a virtuous relationship exists between critical rationalism and the mechanisms from which action-research draws its rigor and validity.*

## 1. INTRODUCTION

We have been witnessing a dramatic evolution in the way information systems support organizations. Once merely devoted to the automation of unambiguous repetitive tasks, information systems now deeply influence the very business models on which companies rest, affecting all actors at all levels. Project issues, once confined to the merely technical, are now dominated by complex socio-organizational concerns, making conventional information systems design approaches quite inadequate (Avison & Fitzgerald, 1999; Baskerville, Fitzgerald, Fitzgerald, & Russo, 1995). To complicate matters even further, the research methodologies traditionally used to develop new approaches also became inadequate, since the principles from which they derived their rigor and validity – problem decomposition, standardization of procedures and collection of rigorous quantitative measures under the control of independent researchers – also ceased to apply in the new contexts. This has brought to the information systems arena what Kurt Lewin had described as "the limitations of studying complex real social events in a laboratory, [and] the artificiality of splitting out

single behavioral elements from an integrated system" (Foster, 1972) in (Checkland & Holwell, 1998). Indeed, it is now increasingly acknowledged that studying new information systems design methodologies, or alterations to existing ones, is impossible from a socio-organizational viewpoint without intervening in the real word to test the techniques (Baskerville, 1999; Baskerville & Wood-Harper, 1996).

A research study under such conditions, and the additional need to take the responsive and flexible posture required to grant that the knowledge gathered in practice informs the developing theory, raises a whole new set of difficulties.

To start with, going out in the field compromises any attempt to exert control over the variables that affect the study – a common approach in traditional laboratory experiments – since in such rich environments it is not even possible to acknowledge every relevant variable, much less control them on an individual basis.

The usual requirement of researcher independence also becomes compromised, both by the need of direct involvement to provoke the changes to be studied, and by the individual perception of the results, seldom objective or quantifiable.

The ability to repeat experiences as a way to confirm results presented by others, or as a way to try out different alternatives for the same initial conditions, is, almost always, utterly impossible. On one hand, due to the presence of human beings, the research setting is not statically waiting for its governing laws to be "discovered". It is, rather, in a state of permanent (re)construction (Checkland & Holwell, 1998), strongly contrasting with the stability of phenomena studied in the natural sciences, such as those resulting from gravity or magnetism. On the other hand, the very changes provoked by the researcher in such a setting are irreversible, and affect it forever.

Several authors have delved into the topic of finding research approaches capable of answering those challenges, pointing to action-research as a suitable alternative (Avison, Lau, Myers, & Nielsen, 1999; Baskerville, 1999; Baskerville & Wood-Harper, 1996; Checkland & Holwell, 1998; Galliers & Land, 1987; Lau, 1999; Salmela, Lederer, & Reponen, 2000). As (Baskerville & Wood-Harper, 1996) put it, action-research is "one of the few research approaches that we can legitimately employ to study the effects of specific alterations in systems development methodologies in human organizations".

In the remainder of the paper we discuss this research methodology. This is done on the basis of the reflection we have conducted when supporting its use to establish a new information systems development approach presented elsewhere (Cunha & Figueiredo, 2000), (Cunha & Figueiredo, 2001). In particular, we analyze issues pertaining to the rigor and validity of results and to the ability to generalize from findings obtained through action-research by examining them under the light of Karl Popper's critical rationalism.

In the following section we briefly review the origins and generic characteristics of action-research. In section 3 we analyze the mechanisms used by this methodology to ensure the rigor of the research process and the validity of the results. The ability to generalize from findings is the subject of section 4. Section 5 sums up with some final considerations.

## 2. ORIGINS AND GENERIC CHARACTERISTICS OF ACTION-RESEARCH

Previous authors (Baskerville, 1999; Baskerville & Wood-Harper, 1996) have described action-research as originating, in the 1940s, from two distinct strands of action-based social psychology: The work of Kurt Lewin, who developed a field-theory version of action-research, and the endeavors of the Tavistock Clinic (later the Tavistock Institute), that used a similar but independent approach to study psychological and social disorders among veterans of battlefields and prisoner-of-war camps. Since, before World War II, these psychological syndromes had reduced expression, "scientists did not understand enough about the complex causes of such social illness to formulate any confidence in any universal treatments. Each case appeared somehow 'different'" (Baskerville & Wood-Harper, 1996).

This was the context for the emergence of social action: "Scientists intervened in each experimental case by changing some aspect of the patient's being or surroundings. Since scientists and therapists were one, the scientists were participants in their own research. The effects of the actions were recorded and studied. In this manner, a body of knowledge was developed about successful therapy for the illness (*cf.* (Rapoport, 1970))" (Baskerville & Wood-Harper, 1996).

The recognition that human activities are systematic, and that action-researchers intervene in social systems, also hold close links to systems theory (Susman & Evered, 1978). Equally relevant are the developments that led to (and permeated) Peter Checkland's *Soft Systems Methodology* (SSM) (Checkland, 1981).

According to (Baskerville, 1999), action-research was explicitly introduced to the information systems community, as a pure research methodology, by (Wood-Harper, 1985).

The exact characterization of action-research varies significantly from author to author. We may, however, line up a few points that bear consensus (Dick, 2000):

- It acts on an existing situation with the dual aim of improving it and expanding the knowledge on the subject.
- It possesses a cyclic nature: a number of steps are performed repeatedly. The cycle varies with the author but, at least, it includes the steps in Figure 1.
- It admits the participation of the research subjects, although this condition is not unanimously considered as mandatory.
- It possesses a reflexive nature: a critical reflection on the research process itself as well as on the results obtained is an important part of each cycle.
- It is predominantly qualitative, although quantifications are possible in some situations.

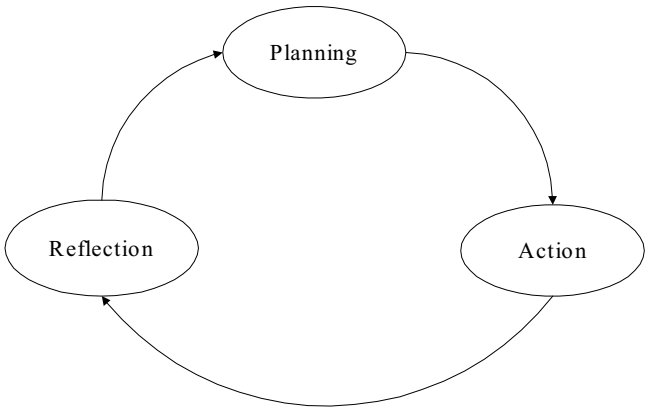


Figure 1 – Simplified action-research cycle (adapted from (Dick, 1992))

The simplified cycle of Figure 1 is useful to understand the philosophy that underlies action-research: an intervention is planned – (Planning) – the corresponding action is taken – (Action) – inducing change that, hopefully, leads to an improved situation; finally, a critical analysis of the results is carried out, which, in principle, leads to a better understanding of that same situation. This, in turn, makes possible the adjustments that lead to subsequent cycles – (Reflection). Action-research studies can, thus, depart from a fuzzy situation and converge to a clear solution as knowledge is built up from one cycle to the next. This contrasts with the need to depart from clearly stated research questions, typical of traditional research approaches.

Some authors propose more detailed cycles and additional recommendations regarding the context of application of action-research. According to (Baskerville, 1999; Baskerville & Wood-Harper, 1996),

one of the most prevalent approaches is that proposed by (Susman & Evered, 1978), which includes five phases applicable within a previously agreed framework (Figure 2).

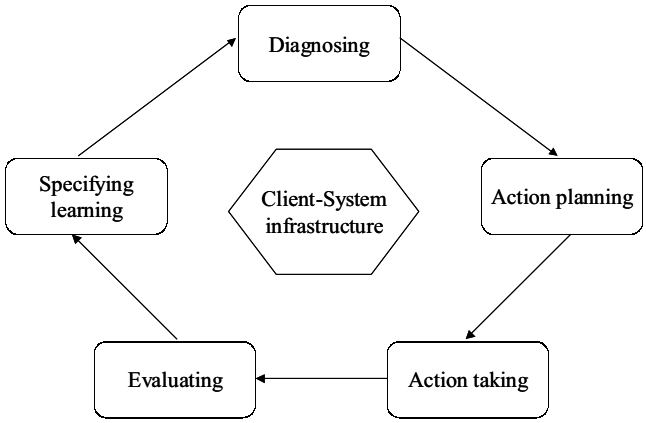


Figure 2 – Action-research process proposed by (Susman & Evered, 1978)

A striking aspect of this proposal is the request to establish a client-system infrastructure for the research process prior to its initiation. Indeed, given the applied nature of action-research, work is normally conducted, at least in part, at some client organization (for long action-research projects that span multiple projects, some stages may take place out of the client's premises, but they are still carried out on behalf of a client). This makes it necessary to clarify the terms of the intervention, namely on issues pertaining to mutual responsibilities, authority, sanctions, scope, entry and exit of the researchers, and leeway to disseminate knowledge obtained during the process. The importance of carefully negotiating the role of the researcher in the context of intervention is also mentioned by (Checkland & Holwell, 1998).

The basic sequence of action-research expressed in the simplified cycle of Figure 1 – planning, action, reflection – gives way, in the model of Susman and Evered, to the five steps of Figure 2:

- Diagnosing: identification of the problematic situation. Involves interpretation of a complex organizational problem, not through reduction and simplification, but rather in a holistic fashion (Baskerville, 1999). A first theoretical framework will stem from this step.
- Action planning: specification of the actions to adopt in order to solve or relieve the problematic situation. The previously established theoretical framework plays an important role in the identification of the actions to take.
- Action taking: implementation of the devised actions, causing change to occur and, in principle, leading to an improved situation.
- Evaluating: assessment of the outcomes of the actions taken, after the completion of the previous step. This involves a critical analysis of the results in light of the theoretical framework and of the practical effects that were achieved.
- Specifying learning: identification and description of findings, based on the information resulting form the previous step, thus adding to the body of knowledge on the subject. Although, from a formal point of view, this stage appears last, it is indeed a permanent activity.

As we previously mentioned, collaboration between researchers and subjects from the client organization is not unanimously accepted as mandatory in action-research, so we did not stress this issue in the above descriptions.

## 3. WHAT GROUNDS FOR RIGOR AND VALIDITY?

If one considers using action-research, it is critical to understand how to assure rigor and validity, especially since the procedures are very different from those used in the more positivistic methodologies we are accustomed to. If fact, rigor and validity are frequently associated with the decomposition of a complex problem into simpler parts, the standardization of the research procedures and the collection of quantitative measures, obtained in carefully planned experiences controlled by independent researchers. However, as we have seen before, the impossibility of meeting such criteria in socio-organizational settings was the very reason that motivated the search for distinct research methodologies.

To understand the alternative ways to attain rigor and validity, a broader definition on validity must first be recovered – one that is not linked to any particular research methodology. Departing from John Dewey's statement (Dewey, 1916) that what makes a claim scientific is the fact that it is warrantable, (Dick & Swepson, 1994) propose the following reasoning (Dick, 1997):

> "A scientific claim is an assertion, not a fact. What makes it scientific is that […] it is 'warrantable'. [On the other hand,] an assertion is an interpretation of evidence. The evidence is drawn from the data in the study, and from the literature. To be warrantable […] the interpretation must have been reached only after attempts to exclude other interpretations. Further, it must account for the evidence as well as, or better than, the alternative interpretations. The interpretation can only be as good as the evidence on which it is based. The evidence therefore must be an adequate sample of all the evidence which might have been collected."

Several tactics are proposed by a number of authors to ensure rigor in the action-research process, that is, to guarantee the quality of the evidence and, thus, of the assertions that are made based on it (Baskerville, 1999; Baskerville & Wood-Harper, 1996; Checkland & Holwell, 1998; Dick, 1997; Dick, 1999a; Dick, 1999b; Dick & Swepson, 1994; Lau, 1999). An attempted systematization follows:

1. A theoretical framework must be set at the beginning of the process. It is in light of this framework that new knowledge arising from the research will be identified. This condition is fiercely argued as fundamental by (Checkland & Holwell, 1998), with growing support by other authors, according to (Lau, 1999).
2. The use of cycles is strongly encouraged. In each cycle the researcher should try to falsify the emerging interpretation. Using several short cycles allows more opportunities for such. Finally, it is possible to use cycles within cycles, with larger ones spanning whole phases of the research program.
3. Research methodology, as well as the research questions, should be critically analyzed and refined in each cycle.
4. Data collection and interpretation should be a part of each cycle. This allows both to be challenged in latter cycles.
5. In each cycle, the researcher should focus only on agreements and disagreements, ignoring the idiosyncratic data. Apparent agreements should be tested and apparent disagreements explained.
6. Divergent data should be deliberately sought. This increases the chances that any piece of data or interpretation be challenged. Existing literature can also play an important role in this effort.
7. Multiple sources of information should be sought (or different perspectives concerning the same source) in order to create a dialectic. Ways to do this include the use of different data collection methods, different informants, different researchers and redundant data collected near the same informant, among other possibilities.

8. Results from change induced into the research situation should be used as an additional source of information for challenging emerging theories (since the planned actions have been grounded on previous data and interpretations).

## 4. GENERALIZATION: JUST A MATTER APPROACH?

One of the most delicate issues of qualitative research – and, thus, of action-research – is the extent to which the generality of results can be claimed.

It is not uncommon to see authors simply give up on any generality claims based on the fact that their work has examined only a reduced number of instantiations of the problem, as pointed out by (Baskerville & Lee, 1999), who quote:

> "*First and foremost, it should be reaffirmed that the single case research strategy employed here only allows generalizability to a research model, which in turn needs to be tested under a multiple case study design or by other field methods.*" (Brown, C. (1997) "Examining the emergence of hybrid IS governance solutions: Evidence from single case site." *Information Systems Research*, 8 (1), 69-94.)

As the same authors observe, the reasoning underlying such a posture – the greater the number of instantiations of the study, the more general the proposed theory – is a fallacy deeply rooted in positivistic inductionism.

Inductive reasoning has emerged (since its Aristotelic formulation) as a way to free science from tyranny and dogma (Deutsch, 1997), by using the evidence of multiple matching observations to devise and uphold general theories. However, the very principle that inductive inference leads to valid theories is not, itself, empirically warrantable. In fact, any attempt to provide an empiric justification supporting that assertion would have to, ultimately, resort to the inductive principle itself, thus embarking on an infinite recursive reasoning (Baskerville & Lee, 1999).

Another, simpler, way of exposing the problems of inductive reasoning is to resort to Bertrand Russel's anthropomorphic metaphor of the chicken (Deutsch, 1997):

> "The chicken noticed that the farmer came every day to feed it. It predicted that the farmer would continue to bring food every day. Inductivists think that the chicken had 'extrapolated' its observations into a theory, and that each feeding time added justification to that theory. Then one day the farmer came and wrung the chicken's neck".

One clearly notices how the inducted reasoning was wrong. However, the problems with inductive reasoning are deeper. In fact, from the same evidence, it is possible to formulate theories that are diametrically opposite. In the case of the above metaphor we could devise the following "theories":

> The farmer feeds me because he is my friend.

or

> The farmer feeds me because he is fattening me up for slaughter.

This shows how the validity of inductivism, as a means to reach scientific theories, can be challenged, at least in the absence of additional control mechanisms.

To conclude this analysis on the invalidity of inductivism, *per se*, as a legitimate approach to devise scientific theories, it is important to note, as (Lee, 1999) does, that frequently used statistical inference is a concept different from induction. What it acknowledges is not that a larger sample size increases the chances that the inferred proposition is true, but rather that it enhances the level of confidence.

The above discussion serves to show that a significant number of researchers tend to use a scientifically incorrect reasoning to conclude that the results of their work are not general, or generalizable.

We propose that, when using action-research, authors should find support for the epistemological legitimacy of their research on the roots of Critical Rationalism, by Karl Popper (Lecomte, 2000): fasifiability and verifiability. In arguing the falsifiability of a theory as a key criterion for its scientificity, Karl Popper radically changed, in regard to the traditional positivistic epistemology, the perspective under which research approaches should be considered. For a theory to be scientifically valid it will have to be simultaneously falsifiable and not yet falsified. In other words, it must lend itself to verification or confrontation with facts than may eventually show it as illegitimate, and will only remain scientifically valid as long as its illegitimacy is not proved. In Poppers's view, experimental observations play a decisive role, not in proving, by successive confirmations, that a theory is true, as argued by positivistic inductionism, but to systematically try to prove the theory as false. As long as that falsity is not proved, and as long as the research approach systematically searches for that proof, the theory is considered scientifically valid.

According to Popper, scientific progress does not stem from an accumulation of observations, but from the rejection of less satisfying theories and their replacement by better ones (Popper, 1982). This provisional status of scientific theories, if reflected with exactitude in the words used to express it, forces us to consider that we cannot accurately say that a certain theory is "true", but rather "plausible" (meaning tendencially true); nor can we say that its validity is "proved", but rather "corroborated". This is the acceptation under which, in this paper, we use the term "validity", just to grant it a more familiar tone.

This Popperian view of the construction of science – this paradigm of science, to use Thomas Khun's terminology – has profound implications on the research methodologies to be adopted and on the methods to be chosen to go with them. Actually, if what we mean is to ensure a systematic confrontation of provisional "trues" and their gradual replacement by new ones that resist the criterion of falsifiability, the desirable research approach should include ways to enable such a dialectic. It can be noted that the eight procedures previously described to ensure the rigor of the research process and the validity of results in action-research do fit well the Popperian principles.

It is important to stress, however, that, although the Popperian criteria frontally oppose inductionism, they do not reject the whole positivist approach. Actually, the fact that inductivism *per se* cannot be used to devise valid theories does not mean that it cannot be used to propose provisional conclusions, as long as the research methodology through which they are attained includes ways of systematically trying to falsify them. The same can be said of positivistic approaches based on the ontological hypothesis of deductivism, concerned with the formulation of theories that explain the situations in plausible ways that are better than previous explanations.

Although recognizing that the "falsifiability criterion" is a progress over inductivist approaches, some authors still criticize Popper's proposals, essentially, they say, because they do not provide any indications on how to approach the process of scientific discovery itself, leaving it, at best, as a subject for psychologists and sociologists alone, as if there were no canons of reasoning allowing us to discover new, better, theories (Harré, 1972). It is our view that, in the context of the new socio-organizational challenges of information systems, action-research can be used as the instrument to fill such a gap, since it includes a number of clear-cut practices that fit well the underlying philosophy of the Popperian approach.

What has been said about the construction of knowledge has serious implications on how generalizations should be made. According to (Baskerville & Lee, 1999), information systems researchers should keep three points in mind:

- First, and most important, information systems researchers should not give up claims to generality on the basis that their work examines a reduced number of instantiations. This attitude presumes and reinforces the fallacy underlying inductivism;
- Second, information systems researchers should describe the particular empirical conditions for which the results were obtained. This is useful because, the theory being general, it is natural to

expect it to hold in other situations that share the same circumstances. Moreover, as it happens with other disciplines, future efforts to enhance the generality of the theory can target additional settings for which the validity of the theory is questioned, instead of just repeating the experiment under the same or random conditions. Generality of the theory can thus be extended or maintained according to results of such experiments;

- Third, generality should be argued in a way useful for everyday practice. If a researcher shows that a theory holds under certain circumstances, then a practitioner can try to apply it in a similar context. If the researcher simply gives up any claim for generality, then transfer of knowledge from academia becomes aborted.

Fulfilling the second point is not easy, though. In fact, if in a research process we recognize our ignorance of many of the variables involved, and argue that many others are influenced by very complex interrelations, it is hard to identify, in a pertinent and complete way, the relevant empirical conditions to report. In information systems development, for instance, issues such as culture, hidden power relationships or preconceptions of individuals clearly serve to illustrate this difficulty. It is important to stress, however, that this is not a handicap of non-positivistic approaches alone. In fact, in traditional laboratory experience, researchers can only exert control over known variables, without any assurance that different ones (not considered) are not affecting the results. This reality is patent in the way scientific theories are continuously replaced by "better" ones. A common example is the replacement of Newton's Laws by Einstein's, which in turn have been questioned by quantum physics.

## 5. CONCLUSION

The positivist paradigm has been dominating most scientific research. However, its principles are not universally applicable across all situations. Namely, in information systems research, whenever socio-organizational settings must be taken into account, researchers must often find alternative methodologies, since, in these situations, the traditional procedures to ensure rigor and validity – problem decomposition, standardization of procedures and collection of rigorous quantitative measures under the control of independent researchers – are no longer feasible.

Paradoxically, the very distinct characteristics that allow alternative methodologies to approach the new research situations are also the source of some suspicion, no doubt due to judgments that are made based on the positivistic mental framework we are accustomed to.

We have discussed such an alternative methodology – action-research – paying considerable attention to the mechanisms used to ensure the rigor of the process and the validity of the results, attempting to relate these issues to the epistemological foundations that support them, namely Karl Popper's Critical Rationalism. These considerations on how knowledge is built have also been taken as a basis for reflection on how generalizations can be made when using such a type of research approach.

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## REFERENCES

Avison, D., Lau, F., Myers, M., and Nielsen, P. A. (1999). Action Research. *Communications of the ACM,* 42 (1), 94-97.

Avison, D. E., and Fitzgerald, G. (1999). Information Systems Development. In *Rethinking Management Information Systems* (W. L. Currie and B. Galliers Eds.), Oxford University Press, New York.

Baskerville, R., Fitzgerald, B., Fitzgerald, G., and Russo, N. (1995). Beyond Systems Development Methodologies: Time to Leave the Lamppost? In *Proceedings of the IFIP 8.2 Conference, Information*

*Technology and Changes in Organizational Work* (G. Walsham, W. Orlikowski, and M. Jones Eds.), p. 235-238, Cambridge University, UK.

Baskerville, R., and Lee, A. S. (1999). Distinctions among Different Types of Generalizing in Information Systems Research. In *New Information Technologies in Organizational Processes: Field Studies and Theoretical Reflections on the Future of Work* (O. Ngwenyama, L. Introna, M. Myers, and J. I. DeGross Eds.), p. 49-65, Kluwer Academic Publishers, New York.

Baskerville, R. L. (1999). Investigating Information Systems with Action Research. *Communications of the Association for Information Systems,* 2, Article 19.

Baskerville, R. L., and Wood-Harper, A. T. (1996). A Critical Perspective on Action Research as a Method for Information Systems Research. *Journal of Information Technology,* 3 (11), 235-246.

Checkland, P. (1981). *Systems Thinking, Systems Practice*. John Wiley and Sons, Chichester.

Checkland, P., and Holwell, S. (1998). *Information, Systems and Information Systems: making sense of the field*. John Wiley & Sons, Chichester.

Cunha, P. R., and Figueiredo, A. D. (2000). Information Systems Design Under a Different Light. In *Proceedings of the Americas Conference on Information Systems* (H. M. Chung Ed.), p. 1184-1191, Association for Information Systems, Long Beach, California, USA.

Cunha, P. R., and Figueiredo, A. D. (2001). Information Systems Development as Flowing Wholeness. In *Proceedings of the IFIP WG8.2 Conference 2001*), p. 29-48, Kluwer Academic Publishers, Boise, Idaho, USA.

Deutsch, D. (1997). *The Fabric of Reality*. Penguin Books, London.

Dewey, J. (1916). *Democracy and Education: an introduction to the philosophy of education*. Macmillan, New York.

Dick, B. (1992) You want to do an action research thesis? How to conduct and report action research, http://www.imc.org.uk/imc/coursewa/doctoral/bobda.htm

Dick, B. (1997) Rigour and relevance in action research, http://www.scu.edu.au/schools/gcm/ar/arp/rigour.html.

Dick, B. (1999a) Qualitative action research: improving rigour and economy, http://www.scu.edu.au/schools/gcm/ar/arp/rigour2.html.

Dick, B. (1999b) Sources of rigour in action research: addressing the issues of trustworthiness and credibility., http://www.scu.edu.au/schools/gcm/ar/arp/rigour3.html.

Dick, B. (2000) A beginner's guide to action research, http://www.scu.edu.au/schools/gcm/ar/arp/guide.html.

Dick, B., and Swepson, P. (1994) Appropriate validity and its attainment within action research, http://elmo.scu.edu.au/schools/sawd/arr/sofsys2.html.

Foster, M. (1972). An introduction to the theory and practice of action research in work organizations. *Human Relations,* 25 (6), 529-556.

Galliers, R. D., and Land, F. F. (1987). Choosing Appropriate Information Systems Research Methodologies. *Communications of the ACM,* 30 (11), 900-902.

Harré, R. (1972). *The Philosophies of Science*. Oxford University Press, Oxford.

Lau, F. (1999). Toward a framework for action research in information systems studies. *Information Technology & People,* 12 (2), 148-175.

Lecomte, J. (2000). Karl Popper: Science et Raison Critique. In *Philosophies de Notre Temps* (J.-F. Dortier Ed.), Éditions Sciences Humaines, Auxerre.

Lee, A. S. (1999). Researching MIS. In *Rethinking Management Information Systems* (W. L. Currie and B. Galliers Eds.), p. 7-27, Oxford University Press, Inc., New York.

Popper, K. (1982). *Unended Quest: An Intellectual Autobiography*. Open Court Publishing Company, La Salle, Illinois.

Rapoport, R. (1970). Three dilemas of action research. *Human Relations,* 23, 499-513.

Salmela, H., Lederer, A. L., and Reponen, T. (2000). Information systems planning in a turbulent environment. *European Journal of Information Systems,* 9, 3-15.

Susman, G., and Evered, R. (1978). An assesment of the scientific merits of action research. *Administrative Science Quarterly,* 23 (December), 582-603.

Wood-Harper, A. T. (1985). Research Methods in Information Systems: Using Action Research. In *Research Methods in Information Systems* (E. Mumford, R. A. Hirschheim, G. Fitzgerald, and A. T. Wood-Harper Eds.), p. 169-191, North-Holland, Amesterdam.