Balancing Change and Understanding in Literacy Research through Formative Experiments

David Reinking and Janet Watkins
University of Georgia

There is a pervasive, albeit little-discussed, tension within the community of educational research, in general, and literacy research, in particular. That tension, which has much to do with the rationale for formative experiments, was made explicit to us several years ago by a colleague who conducts basic literacy research from a distinctly psychological perspective. She was presenting her work to a group of doctoral students in a literacy education seminar. She had requested the opportunity to do so in preparation for a forthcoming conference talk to an audience comprised mainly of teachers. Her concern was that her basic psychological research might not be interesting or relevant to classroom teachers, and she was seeking an opportunity to hone her presentation in that direction by presenting first to doctoral students whose backgrounds and interests were more closely connected to classroom practice. In explaining her purpose to the students she began by saying something like this: "Literacy researchers tend to be more interested in changing the world, while educational psychologists like me tend to be more interested in understanding how the world works."

Her comment suggests that educational research is a somewhat schizophrenic enterprise that entails either a passionate commitment to making things tangibly better for students, teachers, and society and a more dispassionate commitment to research as a rigorous exercise in seeking deep understandings. We do not think our colleague wanted to push that generalization too far and neither do we. Pitting a change-the-world orientation against an understand-the-world orientation risks creating a false dichotomy because these perspectives are clearly not mutually exclusive. Most literacy researchers claim, at some point, to be seeking both goals simultaneously. Indeed, our colleague's presentation illustrated that she was quite capable of seeing how her research originating primarily from an understand-the-world perspective might have implications for changing the world of instructional practice.

Nonetheless, preferred research methodologies and orientations tend to nudge those who adopt them more in one direction than in another. This tendency can be seen at the level of our entire field, as well as at the level of the individual researcher. For example, prior to the late 1980s the scientific, experimental paradigm was virtually the only option for serious researchers, which tilted our collective orientation towards theory-driven understanding based on presumably objective

National Reading Conference Yearbook, 47, pp. 461–471.

findings derived from quantitative data. Today, when many more methodological options are used and accepted, an individual researcher's preferred approach to research is more likely to reflect his or her personal leanings toward changing versus understanding the world. In fact, some have gone so far as to reify research methodologies in ways that are at least tangentially related to this tension. For example, we recall hearing Lincoln (1990) describe quantitative methods as "rape-oriented" and qualitative methods as "lover-oriented." Although this statement may be extreme, it reflects the soul searching and debate in many quarters today concerning how educational research should be conceptualized and conducted. To some extent, the heated debates about paradigms, methodologies, and epistemologies, what has been referred to as the "paradigm wars," have a strong undercurrent of the change- versus understanding-the-world tension.

A formative experiment, as an approach to literacy research, brings this tension to the forefront because positive change in educational outcomes is the primary focus of formative experiments. Yet, those who conduct formative experiments realize that they must draw on all of their resources as researchers for the deep understandings needed to effect positive change in teaching and learning that takes place in the complex environments of classrooms and schools.

In the past several years we have collected a set of quotes that promote perspectives on educational research that are especially in tune with formative experiments, although the writers were not addressing formative experiments in particular when they made these statements. We offer a few of them here in the hope that they might serve as an efficient way to identify the issues to which formative experiments respond especially well:

> Education is not in need of research to find out how it works. It is in need of creative invention to make it work better. (Ebel, 1982, p. 18)
>
> The study of how educational interactions work can never be far removed from the task of engineering them to work better. (Newman, Griffin, & Cole, 1989, p. 147)
>
> [The major aim of educational research] has to do with the improvement of educational practice so that the lives of those who teach and learn are themselves enhanced. We try to understand in order to make our schools better places for both children and adults who share their lives their. (Eisner, 1993, p. 10)
>
> Viewing research findings as something to be handed down as technical information ignores the reality that teachers must make strategic decisions about when to apply findings, how to adapt them to certain situations and even when it might be appropriate to ignore the findings altogether. (Duffy, 1994, p. 19)
>
> Classroom life, in my judgment, is too complex an affair to be viewed or talked about from any single perspective. Accordingly, as we try to grasp the meaning of what school is like for students and teachers, we must not hesitate to use all of the ways of knowing at our disposal. (Jackson, 1990, pp. xxi–xxii)

In short, formative experiments are especially well suited to investigating how complex educational environments can be enhanced by determining what works in furthering valued pedagogical goals in a particular context through the collection of diverse data. Put another way, formative experiments are driven primarily by an interest in what could be, yet they acknowledge explicitly that what could be is dependent upon a deep understanding of what is. Formative experiments place high value on conducting research that is socially relevant (Reeves, no date; see http://www.hbg.psu.edu/bsed/intro/docs/dean/) while drawing on a variety of methodologies and data that may be relevant to promoting positive change. Thus, the tension between changing and understanding the world coalesces into a harmonious whole.

What Exactly is a Formative Experiment?

But what exactly is a formative experiment? Before addressing that question, we must highlight a few important disclaimers. First, we wish to emphasize that our explanation represents a somewhat personal view. The literature explaining formative experiments is very thin and our conception is derived as much from our own experience as it is from what others have written. To our knowledge, besides three of our own previous publications on the topic (Baumann, Dillon, Schockley, Alvermann, & Reinking, 1996; Reinking & Pickle, 1993; Reinking & Watkins, 1996), there are only two published sources that attempt to define formative experiment explicitly. Jacob (1992) in a chapter published in *The Handbook of Qualitative Research* devotes only about two pages to formative experiments. The other publication, the one that originally piqued our interest in using this approach, is Newman's (1990) article in *Educational Researcher* where he describes what a formative experiment is and how he and his colleagues employed one to investigate whether computer-based activities might generate more analytical scientific thinking among middle school students.

Our understandings about and definition of formative experiments are admittedly extrapolations of these sources based on our own attempts to put relatively generally stated principles into practice. So, part of our enthusiasm for the NRC session on formative experiments, for which we wrote this paper, is that we expected it to allow us to bring into sharper focus our own understandings of formative experiments.

A related disclaimer concerns how formative experiments compare with other approaches to classroom research. As we explain in a subsequent section, it is relatively easy to distinguish between the types of research questions that can be addressed by formative experiments when compared to general categories such as conventional experiments or qualitative research. However, there are other approaches to research that overlap with the purposes and goals of formative experiments. A formative experiment is related to but not yet clearly distinguishable from approaches to research such as situated evaluation (Bruce & Rubin, 1993), design experiments (Brown, 1992), formative evaluation (Flagg, 1990), and rapid prototyping (Tripp & Bichelmeyer, 1990). Each of these approaches has been identified specifically as approaches aimed at creating positive change. However, each approach lacks one or more characteristics of formative experiments as we conceptualize them: formative experiments are clearly focused on

pedagogical goals; they are theory driven; they transcend quantitative-qualitative debates; and they have some, although minimal, mention in the literature beyond a single individual or study.

We do not believe, however, that some ambiguity and overlap between and among various approaches are critical limitations. This belief is supported by Eisenhart and Borko (1993) who argue that new approaches to classroom research can be justified when sufficiently explained. They state that "the standards for using . . . alternative methodologies in educational research are not routinized in the same way they are for established methodologies; thus their use demands more thought and explanation than might be necessary if conventional procedures were used" (p. 11). Similarly, they argue that approaches to research should be driven by research questions rather than data-collection techniques, which means that "research designs must be modified, combined, and even created in order to address the research questions being studied" (p. 97). Thus, a formative experiment may be conceptualized as a general framework or heuristic that can be blended or modified. Although, the more a technique deviates from the established approaches, the more it is incumbent on a researcher to explain and justify what he or she has done.

With these disclaimers in mind, we present here what we consider to be the six components of a formative experiment. To conduct a formative experiment, a researcher:

1. Identifies and justifies a valued pedagogical goal. The goal must specify clearly what positive educational change the formative experiment is aimed at bringing about.
2. Specifies an instructional intervention and provides a rationale for why it might have potential to move students towards the pedagogical goal.
3. Collects data to determine what factors in the educational environment enhance or inhibit the specified intervention's effectiveness in achieving the pedagogical goal?
4. Uses the data collected to modify the intervention to achieve the pedagogical goal more efficiently and effectively.
5. Considers what positive or negative effects the intervention is producing beyond those associated with the pedagogical goal.
6. Considers the extent to which the educational environment has changed as a result of the intervention.

These components are listed in an order that correspond roughly to the sequence of events attended to by a researcher who designs and conducts a formative experiment. They also represent one possible framework for reporting the results of a formative experiment. In addition, implicit in these components is an explanation of why this approach to research is referred to as a "formative experiment." It is "formative" particularly in the sense of the fourth attribute, which indicates that iterative adaptations of the intervention occur in light of ongoing data collection. It is an "experiment" in the sense that Schon (1987) argues that a legitimate and useful definition of "experiment" in education is "reflection in action." It is also an experiment, that is more than simply a systematic exercise in implementing an instructional intervention, because it is conceptualized, conducted, and interpreted in relation to a clearly articulated theoretical orientation.

An Example of a Formative Experiment

As we have indicated, our current understanding of formative experiments comes primarily from trying to conduct one based on the relatively broad conceptualizations described most specifically by Newman's (1990) article in the *Educational Researcher*. The relevance of that article to our own work and to creating our motivation to attempt a formative experiment is twofold. First, Newman's work involved the use of computer technology aimed at making a substantive difference in teaching and learning, a goal that we share, especially given the relatively frivolous, trivial, and sometimes pedagogically inappropriate ways computer technology has often been used in schools. Second, his article describing a formative experiment as an approach to research resonated with our own considerable dissatisfaction with the conventional experimental paradigm in a research project completed prior to the publication of his article. The odyssey of that failed experiment is described in an *NRC Yearbook* article (Reinking & Pickle, 1993). No doubt, relevant too is that the Newman article appeared at a time when qualitative approaches to research had gained or almost gained full acceptance among literacy researchers. It is doubtful that both of us would have been as open to a formative experiment much earlier than 1993, because it implies the use of qualitative data, although not exclusively.

In 1993 we proposed a 2-year formative experiment, funded by the National Reading Research Center, that would focus on involving students and their teachers in creating multimedia reviews of books they read independently. We were interested in exploring the relation between multimedia book reviews as a classroom activity and the amount and diversity of students' independent reading. To better understand a formative experiment it may be helpful to compare the research question guiding our investigation with similar questions that we might have selected if we had used conventional experimental or qualitative/ethnographic approaches. For example, if we had conducted a traditional quantitative study, we might have asked, "How does the use of multimedia book reviews compare with writing conventional book reports or some other intervention in terms of the number of books or pages children choose to read?" And a qualitative research study might have pursued a questions such as, "What happens in a classroom when students become involved in creating multimedia book reviews instead of writing conventional book reports?" But a formative research question would be, "How must a multimedia book review activity be implemented in a classroom to achieve the pedagogical goal of increasing the amount and diversity of students' independent reading?

The formative experiment we conducted is described in much greater detail in

a published NRRC research report (Reinking & Watkins, 1996). Here, we will only briefly highlight aspects of that study to illustrate the six attributes of a formative experiment and to make a few observations, based on our experience, about issues that arose in trying to instantiate these attributes in the study (see also Baumann et al., 1996).

Establishing a pedagogical goal. Setting our pedagogical goal was an important but relatively easy step. Simply stated our goal was to increase the amount and diversity of middle-grade students' independent reading. However, specifying a goal, even if it is considered worthwhile, is not enough. We believe it should be incumbent upon researchers conducting formative experiments to justify explicitly the merit of their goal in terms of recognized pedagogical theory and, when possible, existing research. Firmly embedding a formative experiment in the existing theoretical and research literature is one way it can be distinguished from what has been termed "formative evaluation," primarily in the instructional design literature (Flagg, 1990). For example, we used Stanovich's (1986) theoretical notions of the Matthew Effects in reading to justify in part the importance of our pedagogical goal. That is, we have reasonable evidence that the more children read, the better readers they become. Justifying the pedagogical goal in terms of the existing literature also makes a formative experiment into a field-based test of previous theory and research. As an aside, the goal-based foundation of a formative experiment also makes it especially well suited for collaborative research projects between university-based and school-based researchers, especially when teachers are involved in determining what pedagogical goals are important (Allen, Buchanan, Edelsky, & Norton, 1992; Anders, 1996).

Specifying and justifying an intervention. A particular intervention is the heart of a formative experiment because it is the means to accomplish the pedagogical goal, and it too must be justified. In our case, we saw multimedia book reviews as a way of promoting independent reading that might go beyond the limitations of conventional book reports, which, although widely used in the middle grades, has proven to be at best of marginal usefulness in promoting independent reading. For example, Spiegel (1981) argued that the conventional book report may actually produce effects opposite of those intended; that is, many students may read less, by choosing shorter books, and read less diversely, by choosing familiar topics and authors. Likewise, Kirby and Kirby (1985) argued that children take fewer risks when completing literacy tasks as school assignments than they do when using reading and writing for more authentic communicative tasks.

Computer-based activities have been proposed as useful in addressing these limitations. For example, computer technology has been cited in the literature frequently for its potential to engage students in meaningful communicative experiences that involve reading and writing (Bruce & Rubin, 1993; Means et al., 1993; Reinking, 1986). There is also evidence that engaging students in creating multimedia activities can imbue school reading and writing activities with the characteristics of out-of-school reading and writing (Turner & DePinto, 1992).

In our case, the intervention was a novel activity that might replace a ubiquitous but marginally effective existing activity. However, we can also imagine researchers using a formative experiment to implement an established intervention, perhaps one that experimental or observational research has suggested may be useful. A critical aspect of a formative experiment is that the intervention is designed and implemented initially with the mindset that it is a first draft subject to revision, perhaps repeatedly, throughout the experiment.

Collecting data. In a formative experiment data are collected and analyzed systematically and continually to determine whether the intervention is effectively moving students (or teachers, administrators, etc.) toward the pedagogical goal and specifically to determine what factors in the educational environment enhance or inhibit achieving the goal. Implicit in the design of a formative experiment is the establishment of a baseline of performance or activity relative to the pedagogical goal. For example, we were interested in determining the degree and diversity of students' independent reading prior to introducing the intervention. Data must also be gathered and analyzed continuously throughout the experiment to determine if progress is being made, what factors enhance or inhibit progress, and what unexpected outcomes are being observed. Toward these ends we gathered diverse quantitative and qualitative data such as a standardized measure of attitudes toward reading, field observations, focus group interviews, parent questionnaires, and teacher logs. We believe formative experiments naturally transcend debates about quantitative and qualitative methods (neither of which are inherently oriented toward positive change), although they clearly fall into the domain of research that Salomon (1991) has termed "systemic," as opposed to "analytic." Although these two domains of research are complementary in Salomon's view, analytic research investigates the effects of a few variables and is well matched to quantitative methods, and systemic research investigates many interacting variables in complex environments and require qualitative methods.

Adapting the intervention in light of data. Implicit in the conduct of a formative experiment is the assumption that, like all teaching, plans laid in the abstract do not always work perfectly in the complex world of educational practice. Good teachers are always looking for explanations of why a particular instructional activity is working or not and what might allow it to work better, and they adjust accordingly. A formative experiment involves the same process although it is based on more systematic and rigorous data collection—that is, deeper understandings. For example, in our NRRC project we discovered that poor readers in one classroom were not becoming involved in creating multimedia book reviews. Through systematic data collection we became convinced that their lack of involvement was due to the fact that a component of the intervention was a database of student book reviews that could be searched by other students, teachers, and parents. The fact that they could enter into the database only books well below grade level served to advertise more publicly their reading difficulties. The solution, which was a teacher's idea that arose during a focus group discussion,

was to encourage all students in the class to consider entering easy books for the lower-grade children who would eventually use the data base.

Unanticipated effects. We believe an important aspect of conducting a formative experiment is that a researcher must be especially attuned to unanticipated effects of the intervention—that is, effects that not only were not anticipated at the outset but that are not directly related to the pedagogical goal. For example, in the NRRC project, we discovered that the intervention had interesting effects on students' writing, which were unrelated to the goal of increasing the amount and diversity of students' independent reading. When students were involved in the multimedia book review activity, they attended more to the mechanical details of their writing, which was readily noticed and valued by their teachers. Another unanticipated effect was the increase in parental involvement in school-based activities through the teachers' request for parental assistance in some aspects of the project. Likewise, the project had unanticipated positive effects in contributing to the professional development of teachers by encouraging some to pursue a graduate program focusing on literacy and technology.

Changes in the educational environment. Because the rationale for conducting formative experiments is to promote positive improvements in education, it is important to consider the deeper, longer term effects of an intervention beyond its transient, short-term effects. This aspect of formative experiments might be put in Piagetian terms. Was the intervention only assimilated (i.e., leaving the overall environment relatively unaffected) or was it accommodated (i.e., transforming the educational environment as a whole). We were interested in determining if teachers viewed independent reading, instructional uses of the computer, the teaching of reading, and so forth differently. We found that in some cases the answer was "yes" and in some cases "no." But, the process of analyzing these different outcomes led to some important insights. We found, for example, that the degree to which the intervention transformed literacy instruction seemed to be a function of how teachers represented their own technological expertise. Teachers who saw themselves or began to see themselves as open to and knowledgeable about the computer were more likely to see its transformative potential. Conducting formative experiments in general and seeking such insights in particular highlights that formative experiments require a substantial investment of time and energy on the part of the researcher.

The Strengths and Limitations of Formative Experiments in Literacy Research

Formative experiments are especially well suited to studying instructional interventions aimed at achieving well-defined instructional goals. Compared to conventional experiments, which must seek to control all but a few of the many interacting variables that may affect instructional interventions, formative experiments acknowledge the complexity of educational environments and seek deep understandings within that complexity. Thus, they have exceptional ecological validity. Compared to conventional qualitative and ethnographic approaches to

research, formative experiments seek not just to describe what is but to document carefully how what is can be transformed into what could be. Although qualitative and ethnographic research can provide important insights into the complexity of interventions in classrooms, those are data that might be applied to generating more useful and effective interventions and implementations. Few researchers to date have chosen to use their data in these ways. The repute of Heath's (1983) work is the exception that proves the rule.

Formative experiments, then, fill a useful, and currently neglected, niche in the spectrum of research methods and the purposes those methods address in the field of literacy. In filling that niche, they have strong intuitive appeal on several levels. First, they lessen the tension between changing and understanding the world as discussed at the outset of this paper, although it is clear that they still are firmly rooted in the applied rather than the basic side of the research continuum.

Teachers, too, seem to have a natural affinity to formative experiments once they understand them because formative experiments parallel the process of good teaching. Interestingly, however, in our experience we found that teachers had difficulty letting go of the conventional experimental paradigm in conceptualizing a formative experiment. For example, they seemed apologetic to us when the intervention did not seem to be working. We had to work hard to convince them that in a formative experiment things in one sense get more interesting when the intervention is not working. (We had to remind ourselves of this perspective on occasion as well.) However, as this limitation suggests, formative experiments provide an excellent opportunity to develop close working relationships with teachers in the context of a research project. It invites collaborative relationships between university researchers and classroom teachers that naturally avoid some of the ethical dilemmas often associated with such collaborations with other methods (Allen, Buchanan, Edelsky, & Norton, 1992; Anders, 1996). For example, several of the teachers in our 2-year study presented papers at professional meetings in conjunction with this project, either with the university researchers or on their own, something that none of them had done prior to the project.

Administrators, parents, and policy-makers too have an intuitive understanding of formative experiments. Formative experiments are socially relevant because they are aimed at promoting specific pedagogical goals typically understood and valued by these constituencies. Some literacy researchers employing approaches and addressing questions that are more in the realm of understanding the world can make cogent cases for how their findings are relevant to improving literacy. But, those who conduct formative experiments have much less to explain to those outside the literacy research community.

Within the community of literacy researchers, formative experiments tend to make moot many of the current methodological debates. Formative experiments do not rule out any methodology in service of its goal to achieve change through deep understandings. They transcend the quantitative versus qualitative debates that have been referred to as the "paradigm wars" (Salomon, 1991). They do so in part because they do not demand a narrow epistemological purity that is often at the heart of such debates. Philosophically, formative experiments are more closely

aligned with a pragmatic view of literacy research (Cherryholmes, 1993), and thus, they avoid becoming enmeshed in the epistemological debates associated with other methods.

However, formative experiments do entail some troublesome limitations, at least for the time being. Foremost, they are not widely known and do not have well-established protocols for how they should be designed, conducted, and reported. Neither are they clearly distinguishable from other approaches that have been cited in the literature. Under almost any circumstance they require high levels of commitment in terms of time and energy on the part of the researcher, although perhaps no more so than ambitious qualitative or ethnographic studies. The issue of generalizability of findings is also an important issue, but again no more so perhaps than with qualitative and ethnographic research. In fact, replicability, which is certainly an aspect of generalizability, makes more intuitive sense in a formative experiment when compared with the typical qualitative study. In fact, as we studied the implementation of multimedia book reviews across several schools and classrooms, we discovered relevant factors that cut across all of the contexts and others whose importance and influence became clear by analyzing why they made a difference in one setting but not another.

Despite some limitations, formative experiments seem to represent an approach to research that merits more attention by literacy researchers. The papers presented at the NRC symposium of which this one was a part will, we hope, increase attention to formative experiments, pin down more precisely how they might be conceptualized, and extend the dialogue about their potential to balance the tension between seeking change and generating deep understandings in literacy.

References

Allen, J., Buchanan, J., Edelsky, C., & Norton, G. (1992). Teachers as "they" at NRC: An invitation to enter the dialogue on the ethics of collaborative and non-collaborative classroom research. In C. K. Kinzer & D. J. Leu (Eds.), *Literacy research, theory, and practice: Views from many perspectives.* Forty-first yearbook of the National Reading Conference(pp. 357–366). Chicago: National Reading Conference.

Anders, P. (1996). The ethics of collaborative research. In L. Baker, P. P. Afflerbach, & D. Reinking (Eds.), *Developing engaged readers in school and home communities* (pp. 271–285). Hillsdale, NJ: Erlbaum.

Baumann, J. F., Dillon, D. R., Schockley, B. B., Alvermann, D.E., & Reinking, D. (1996). Perspectives in literacy research. In L. Baker, P. P. Afflerbach, & D. Reinking (Eds.), *Developing engaged readers in school and home communities* (pp. 217–245). Mahwah, NJ: Erlbaum.

Brown, A. L. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. *Journal of Learning Sciences, 2,* 141–178.

Bruce, B. C., & Rubin, A. (1993). *Electronic quills: A situated evaluation of using computers for classroom writing.* Hillsdale, NJ: Erlbaum.

Cherryholmes, C. H. (1993). Reading research. *Journal of Curriculum Studies, 25,* 1–32.

Duffy, G. G. (1994). How teachers think of themselves: A key to mindfulness. In J. N. Mangieri & C. Collins (Eds.), *Creating powerful thinking in teachers and students: Diverse perspectives.* Fort Worth, TX: Harper Collins.

Ebel, R. (1982). The future of educational research. *Educational Researcher, 11*(8), 18–19.

Eisenhart, M., & Borko, H. (1993). *Designing classroom research: Themes, issues, and struggles.* Boston, MA: Allyn & Bacon.

Eisner, E. W. (1993). Forms of understanding and the future of educational research. *Educational Researcher, 22*(7), 5–11.

Flagg, G. N. (1990). *Formative evaluation for educational technologies.* Hillsdale, NJ: Erlbaum.

Heath, S. B. (1983). *Way with words: Language, life, and work in communities and classrooms.* Cambridge, MA: Harvard University Press.

Jackson, P. W. (1990). *Life in classrooms.* New York: Teachers College Press.

Jacob, E. (1992). Culture, context, and cognition. In M. D. Lecompte, W. L. Millroy, & J. Preissle (Eds.), *The handbook of qualitative research in education* (pp. 293–335). San Diego, CA: Academic.

Kirby, D. R., & Kirby, K. (1985). The reading-writing connection. In L. W. Searfoss & J. E. Readence (Eds.), *Helping children learn to read* (pp. 338–353). Englewood Cliffs, NJ: Prentice Hall.

Lincoln, Y. S. (January, 1990). *Methodology and ethics: The interaction effect.* Keynote address at the meeting of the Qualitative Interest Group (QUIG), Athens, GA.

Means, B., Blando, J., Olson, K., Morocco, C. C., Remz, A. R., & Zorfass, J. (1993). *Using technology to support educational reform.* Washington, DC: U.S. Department of Education.

Newman, D. (1990). Opportunities for research on the organizational impact of school computers. *Educational Researcher, 19*(3), 8–13.

Newman, D., Griffin, P., & Cole, M. (1989). *The construction zone: Working for cognitive change in school.* Cambridge, England: Cambridge University Press.

Reinking, D. (1986). Six advantages of computer-mediated text for reading and writing instruction. *Reading Instruction Journal, 29,* 8–16.

Reinking, D., & Pickle, J. M. (1993). Using a formative experiment to study how computers affect reading and writing in classrooms. In D. J. Leu & C. K. Kinzer (Eds.), *Examining central issues in literacy research, theory, and practice.* Forty-second yearbook of the National Reading Conference (pp. 263–270). Chicago: National Reading Conference.

Reinking, D., & Watkins, J. (1996). *A formative experiment investigating the use of multimedia book reviews to increase elementary students' independent reading* (Research Report No. 55). University of Georgia and University of Maryland: National Reading Research Center.

Salomon, G. (1991). Transcending the qualitative-quantitative debate: The analytic and systemic approaches to educational research. *Educational Researcher, 20*(6), 10–18.

Schon, D. A. (1987). *Educating the reflective practitioner.* San Francisco: Jossey-Bass.

Spiegel, D. L. (1981). *Reading for pleasure: Guidelines.* Newark DE: International Reading Association.

Stanovich, K. (1986). Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly, 21,* 360–407.

Tripp, S. D., & Bichelmeyer, B. (1990). Rapid prototyping: An alternative instructional design strategy. *Educational Technology Research and Development, 38*(1), 31–44.

Turner, S. V., & Depinto, V. M. (1992). Students as hypermedia authors: Themes emerging from a qualitative study. *Journal of Research on Computing in Education, 25*(2), 187–199.