Anchored Instruction and Situated Cognition Revisited[1]

The Cognition and Technology Group at Vanderbilt[2]

In 1990 an article by our Cognition and Technology Group at Vanderbilt (CTGV) entitled "Anchored Instruction and Its Relationship to Situated Cognition" appeared in the *Educational Researcher.* In it we discussed two programs that we were developing and testing that involved anchoring or situating instruction in the context of information-rich videodisc environments that encouraged students and teachers to pose and solve complex, realistic problems. One of the programs, *The Young Sherlock Program,* focused on literacy and social studies, including history. The other program, *The Jasper Woodbury Problem Solving Series,* focused on mathematical problem solving with links to science, history, social studies, and literature. We noted that both programs were being used and tested in classrooms—generally with students in the fifth and sixth grades.

It has been almost three years since we completed our 1990 article. In the interim we have had the opportunity to expand the scope of our programs (e.g., CTGV, 1991a; CTGV, 1992b; in press a, b, c) and study their uses with large numbers of students in nine different states (e.g., CTGV, in press d, e, f; CTGV, 1992b; Pellegrino, Hickey, Heath, Rewey, Vye, & CTGV, 1991). In the process we have learned a great deal about a number of issues relevant to cognition and instruction and real-world educational change. Much of our learning has come from research sparked by questions that people have asked us about our programs, theory, and data. Our goal in this article is to re-examine our thinking about anchored instruction in light of these three years of experiences. Our discussion is divided into four major sections:

(1) a brief summary of our thinking as it existed in 1990;

(2) a consideration of important questions about anchored instruction that people have asked, and a discussion of our answers to these question in light of the past three years of classroom-based experiences;

(3) issues of learning transfer and assessment; and

(4) a summary of how our experiences during the past three years have affected our thinking about the concept of situated cognition and its implication for theories of learning and instruction.

I. A Brief Summary of Our Thinking as It Existed in 1990

In 1990 the major focus of our work was on the use of video-based anchors that could serve as "macrocontexts" for teaching and learning. The design of these anchors was quite different from the design of videos that were typically used in education. In particular, we argued that most educational videos were essentially lectures supplemented with visual examples and hence reinforced a "transmission" view of instruction which assumes that knowledge is transmitted from expert to novice. In contrast, our goal was to create interesting, realistic contexts that encouraged the active construction of knowledge by learners. Our anchors were stories rather than lectures and were designed to be explored by students and teachers. We referred to them as "macrocontexts" in order to distinguish them from the "microcontexts" that are characteristic of the disconnected sets of "applications problems" typically found at the end of chapters in texts (e.g., CTGV, 1992a). Our overall goal was to use realistic macrocontexts to recreate some of the advantages of in-context learning that are available to young children (e.g., Bransford & Heldmeyer, 1983) and to people participating in apprenticeships (e.g., Brown, Collins, & Duguid, 1989; CTGV, in press g). Computer and videodisc technology made it easy to revisit specific parts of our macrocontexts and explore them from multiple perspectives.

One of the anchored curricula discussed in our 1990 article involved the use of the movies (on videodisc) *Young Sherlock Holmes* and *Oliver.* Students first watched these videos and then explored them from the perspective of a filmmaker who might be checking each one for quality and authenticity. How interesting and causally connected were the major plot and subplots? How authentic were the settings and the actions of the characters in the settings? By tracing causal connections, character motives, and goal-oriented behaviors, students were able to learn a great deal about the structure of stories, about the nature of life in turn-of-the-century Victorian England, and about general guidelines for exploring the quality and authenticity of a wide variety of stories and settings.

The second example of anchored curricula that was discussed in our 1990 article involved the use of specially designed adventures that our center had filmed as part of our *Jasper Woodbury Problem Solving Series.* One example involved a boat trip that challenged students to determine whether Jasper could possibly make it home before sunset without running out of gas. A second adventure challenged students to help Emily find the optimal way to rescue an eagle that had been wounded and was in an area that could not be reached by car. Both of these Jasper adventures involved mathematical concepts of distance, rate, and time, and they were designed to provide links to other aspects of the curriculum such as history, science, and literature.

We noted in our 1990 article that we had created our anchors and corresponding instructional materials in the hope that teachers would find them exciting enough to try in their classrooms. We were just beginning our collaborations with teachers and were optimistic that they were going to yield important information about cognition, instruction, and processes of educational change. During the past three years, our opportunities for collaboration with teachers and students have far exceeded our initial expectations and have helped us identify strengths and weaknesses in our original ideas. For example, we now have six Jasper adventures rather than two and have had the opportunity to use them with hundreds of students. In addition, the *Young Sherlock* project continues in classrooms of teachers initially involved six years ago, as well as in new middle schools, and even in a school for the deaf, where a curriculum was built around a closed-captioned *Sherlock.*

Our goal in the remainder of this paper is to summarize some of the lessons we think we have learned since 1990. In Section II and Section III, we respond to questions that we have been asked about anchored instruction during the past three years. In Section IV, we summarize the major changes in thinking about situated cognition that we have experienced during the past three years and suggest some issues for future research.

II. Some Questions Frequently Asked About Anchored Instruction

Our goal in this section is to provide answers to some of the questions asked of us during the past three years. Some of the questions come from educational theorists, teachers, students, administrators and parents; others come from new members of our center who have added valuable perspectives to our work. We divide our questions into two sub-sections: Questions about instruction and questions about learning, transfer and assessment.

2.1 In the 1990 article you described the content and design of your video-based macrocontexts (anchors) but spent little time discussing the kinds of teaching and learning activities that you envision in the classroom. Is your claim that the appropriate teaching and learning activities emerge automatically as a function of the design of your anchors?

During the past several years we have attempted to (a) clarify the design principles that underlie the choice and development of anchors (e.g., CTGV, 1991a; McLarty, Goodman, Risko, Kinzer, Vye, Rowe, & Carson, 1990) and (b) discuss their relationship to the teaching and learning activities that take place in the classroom (e.g., CTGV, 1992a). We discuss the relationship between design principles and teaching and learning from the perspective of Gibson's (1977) notion of "affordances." Gibson noted that different features of the environment afford activities for particular organisms, such as "walk-onable," "climbable," "swimmable," and so forth. Similarly, different types of instructional materials afford different kinds of learning activities (Jenkins, 1979; Shaw, Turvey, & Mace, 1982; Greeno, Smith, & Moore, in press). An important point about affordances is that they make various activities possible but do not guarantee them. So the teaching and learning activities that accompany our anchors are not automatic consequences of their design.

Our anchors are designed to promote, but not to guarantee, the kinds of activities that are emphasized by constructivist approaches to learning (e.g., Cobb, Yackel, & Wood, 1992; Resnick & Klopfer, 1989; Scardamalia & Bereiter, 1991). We describe these activities in CTGV (1991a, 1992a) and contrast them to the types of learning activities promoted by other types of materials. In reading and language arts, for example, students usually jump from story to story rather than have the time to develop in-depth expertise in a particular area (e.g., Bransford *et al.*, 1990). In mathematics, traditional word problems typically provide the goal and only those numbers needed to solve the problem; hence they afford little more than computational selection (e.g., CTGV, in press e); Porter, 1989). In contrast, the Jasper adventures afford students opportunities to create problem structure as they solve the problem, potentially leading to more opportunities for group interactions that support generative learning. The types of learning activities that the Jasper materials are designed to support are consistent with recommendations suggested by the NCTM Commission on Standards for School Mathematics (1989).

In one of our articles (CTGV, 1992a) we contrast several different models of teaching that people have suggested for our Jasper series and we discuss why, in our view, one is superior to the others. Many of the issues considered in these teaching models are included in discussions of subsequent questions that are considered below.

2.2 What are some of the special challenges involved in teaching anchored curricula?

One of the greatest challenges that anchored curricula pose for teachers derives from the need to change their role from a "provider of information" to a coach and often a fellow learner. For example, students are encouraged to identify their own questions, goals, and issues that arise as they explore anchors. In the Sherlock program, different students might choose to explore a variety of issues relevant to the *Young Sherlock* and *Oliver* anchors—issues such as the Egyptian culture that is mentioned in the movie, the nature of schooling in Victorian England, the rights of children in Victorian England, and so forth. In the Jasper program, students may choose to pursue a unique solution path that they feel is promising and, after solving the adventure, explore a related topic, such as endangered species or principles of flight. In order to encourage and support student-generated learning, teachers must be flexible; they cannot follow a fully scripted lesson plan. In addition, teachers cannot be experts in each topic that students choose to pursue, so they must often become learners along with their students. This can be difficult for many teachers, especially when children are accustomed to classroom cultures in which the teacher normally functions as "expert" rather than as "guide" and "learner."

A challenge for us is to help teachers change the culture of their classrooms. One of the prerequisites is to help teachers understand the range of student-generated issues and questions that arise in the context of working with anchored curricula. We therefore attempt to help teachers experience these curricula from the learners' point of view. In Jasper, for example, it is imperative that teachers first go through the experience of solving the adventures themselves. We also attempt to help teachers and students gain access to resources (e.g., electronic databases such as those available in America Online) that allow them to explore topics they want to pursue.

We have suggested to teachers that they allow students to guide the course of their learning to the extent that students are able. In trying to adopt this approach with their students, teachers report that one of the biggest challenges is knowing when students really need guidance versus when students are struggling in a constructive way with a problem or issue. In addition, teachers are quite often uncertain about how to provide guidance that enables students to reconceptualize problems and set themselves on a new and more effective course of problem solving. Teachers struggle with how to assist their students without being overly-directive. These challenges are fundamental, but not unique to teaching with anchored curricula. They are characteristic, we believe, of instruction that is consistent with constructivist principles, and, as such, are general issues that the field will need to explore. Part of our research agenda involves trying to describe what expert teachers do to affect and support these kinds of changes in their classrooms.

The use of our anchored curricula also poses another challenge for teachers: How and where to fit them into their existing curricula and make sure that they meet their needs with respect to system-mandated achievement testing. We say more about these issues in our later discussions of assessment.

2.3 Shouldn't anchors such as Jasper and Young Sherlock be considered as APPLICATION problems rather than as instructional materials? Since students have to already know the relevant concepts in order to solve the problems depicted in the adventures, the function of the anchors seems to be to let them apply what they have already learned.

One of the teaching models that we discuss (e.g., CTGV, 1992a) assumes that one preteaches all the relevant concepts needed to solve a particular adventure and then uses the anchor as a context for applying that knowledge. But that is not the model of teaching and learning that we envision and recommend. As noted earlier, one of our major goals is to highlight uses of knowledge; we use our anchors to help students see the need for new learning and to set important learning goals. The experience of identifying learning goals and then setting out to accomplish them appears to be a very important aspect of adaptation in everyday life (e.g., Barrows, 1985; Williams, in press). We attempt to help students identify learning goals in a context that lets them experience a complete, realistic problem. This is analogous to students in apprenticeship programs having the opportunity to see the "whole task" rather than only artificial pieces of a task (e.g., Brown *et al.*, 1989).

An alternative to preteaching everything is to provide resources and scaffolds that help the students move forward. For example, imagine that students are solving one of the Jasper adventures but do not know how to add and subtract decimals or convert from minutes to hours. Our Jasper teachers often engage in "just in time teaching" by first encouraging students to use their intuitions about how to approach a problem and then providing them with the resources necessary to make progress. Often this involves finding relevant materials in textbooks and other sources of information; in other cases, students are encouraged to learn enough from one another to accomplish their immediate problem-solving goal. After solving a Jasper challenge and seeing the need for new skills and understandings when doing so, teachers and students often jointly formulate goals about areas to work on outside the Jasper context. Thus, if a student becomes aware of the need to better understand decimals and their relationship to fractions, he or she might pursue this issue as a learning goal.

Most of our Jasper teachers provided scaffolds in order to help students deal with complex concepts necessary to successfully solve a challenge. For example, some of our teachers helped students construct and use charts that allowed them to determine how speeds defined as "minutes to go one mile" translate into speeds defined as "miles per hour." Other Jasper teachers have created manipulatives that function as scaffolds. For example, by using twist ties to create simple devices for measuring time and distance, one teacher successfully used the *Rescue at Boone's Meadow* Jasper adventure with students in the first and second grades (CTGV, 1992a).

In our two new Jasper geometry adventures we have provided scaffolds in the form of "embedded teaching." The embedded teaching episodes are a natural part of the adventure stories. They include information such as how to use a compass and bearing guide, how to read a topographical map, and how to use the properties of isosceles right triangles to estimate heights and widths. We included embedded teaching episodes in our geometry adventures because our teachers as well as our students were often almost totally unfamiliar with this information. We attempt to make our embedded teaching episodes as natural a part of the story as possible, and we do not expect students to fully understand the embedded teaching episodes as they initially watch the Jasper adventures. Instead, we view the use of "embedded teaching" as analogous to the use of "embedded data." Students are encouraged to return to relevant teaching episodes when, during the challenge, the need arises to understand the concepts and procedures that the embedded teaching episodes portray.

2.4 Doesn't the concrete nature of the video anchors encourage passive learning and prevent students from developing general representations of problem situations and multiple possible solution paths?

If one simply views or reads about our video anchors, it is easy to get the impression that the experience for students is relatively passive and extremely concrete, and that a single solution is emphasized. Teachers who have worked with us on the Jasper series have had to deal with this perception—parents and other community members have often expressed concern that the use of video-based anchors provides experiences that are too concrete, passive, and TV-like (CTGV, in press e).

We have found that the best way to understand the problem-solving and communication experiences for the students is to actively engage in the activities that the video anchors afford. In our Sherlock project, these activities include (a) noticing aspects of the video that suggest relevant issues for further inquiry; (b) identifying sources of information relevant to these issues (usually through library or database searches; (c) reading the relevant information and taking it back to one's work group; and (d) communicating the results from the work groups to other members of the class. In Jasper, the activities include (a) considerations of multiple possible solution plans; (b) defining the sub-goals necessary to accomplish each plan; (c) identifying relevant data and separating it from irrelevant data; (d) calculating appropriate answers in order to evaluate various plans; and (e) communicating one's reasoning with other members of one's work group and class. When one actually works in the context of a Sherlock or Jasper problem, it becomes clear that there are multiple possible solutions to any problem—possibilities that result in interesting, in-depth discussions by students. In Jasper, the potential for multiple solutions increases as the adventures in the series increase in difficulty.

Jasper teachers who have worked with us have solved their public relations problems with parents and community members by inviting them into the classroom to solve one of the adventures and letting the students function as experts who helped when the adults got too far off track. Thanks to the insights of the teachers, we have tried this approach with a variety of groups, including business leaders, principals, superintendents, and other teachers. The results have consistently been outstanding; the adults are impressed by the complexity of the challenges and by the expertise of the students who act as guides.

One of the major goals of our instruction is to help students develop representations of their experiences that set the stage for positive transfer. For example, in Sherlock, students discuss general principles for writing effective and coherent stories, rather than focus only on the concrete story represented in the *Young Sherlock* video (Kinzer, Risko, Goodman, McLarty, & Carson, 1990; Kinzer & Risko, 1990). In Jasper, students learn to represent multiple solution paths, to summarize data, and to discuss general characteristics of various topics (e.g., trip planning, business planning, measurement). Because there are two adventures for each major topic (i.e., two on trip planning, two on business plans, two on uses of geometric principles for measurement), students' discussions of similarities and differences help them focus on general characteristics rather than only on specific details (see Bransford & Vye, 1989; Gick & Holyoak, 1983; Greeno *et al.*, in press, for discussions of the importance of noticing the structure of situations that can facilitate adaptation to new contexts later on). As noted later in our discussion of transfer (Section 3.3), we have also developed materials that encourage students to revisit the original adventures from new perspectives and engage in "what if" thinking about the effects of particular changes in parameters.

Each Jasper adventure includes a video-based resolution and solution in order to provide closure to the experience. Some people have expressed disappointment (others have expressed shock) that we include a video solution. We added these because students almost always ask to see how others approached the problem. Our materials for teachers emphasize that there are many possible solutions and that the one shown on the videodisc is not necessarily the best one. In our later adventures, the actors who present our video solutions emphasize that many different solutions are possible, depending on one's initial assumptions. Students are encouraged to compare their solutions with the ones on the video and evaluate the strengths and weaknesses of each approach. We eventually want to collect video cases of students presenting their own solutions and discussing the assumptions that underlie them. These will serve as resources that can be shown after students in a class have solved an adventure and presented their own solutions to the rest of the class.

2.5 *Why do you advocate organizing instruction around anchors rather than around hands-on projects that students actually complete?*

We view anchors as effective ways to get things started, not as final endpoints of instruction. One of the major activities we want to encourage is student-generated projects. A number of our Sherlock sites have published newsletters and multimedia programs that have become favorite resources for other students (Kinzer, 1989, 1991a).

Similarly, many of our Jasper sites have completed projects that relate to the adventures that the students solved in class. Several of our Jasper classes used their trip-planning skills from early Jaspers to plan for an educational trip, and then used ideas from the business planning adventures to create their own business plans to raise money for the trip (e.g., CTGV, in press e).

There are several advantages to first organizing curricula around anchors and then progressing to hands-on projects. First, it is usually more manageable for teachers to organize instruction around anchors than to find all the resources necessary to accomplish actual community-based projects. The opportunity to begin with information-rich anchors represents a step toward changing teaching and learning practices in the classroom that is less abrupt than a change to projects per se.

The opportunity to first work through one or more anchored adventures also helps equalize the preparation of the students for the projects that they eventually undertake. There are often wide variations in the degree to which students have had the kinds of experiences that facilitate work on a classroom project such as planning for a complex trip or generating a well conceived business plan and then carrying it out.

Anchors also provide a common ground of shared knowledge that facilitates active participation by students as well as other members of the community. In Sherlock, it is exciting to have the opportunity to hear about a variety of student-initiated projects that, while all different, share a common origin. Students or groups of students often focus on an issue from a macrocontext that was not noticed as a potential issue by others in the class. Once the issue is pointed out, it is usually seen as important and interesting to pursue.

The use of anchors also facilitates communication among students and other community members. In our earlier discussion of how teachers dealt with parents who worried that Jasper was too much like television (Section 2.4), we noted how anchors can be used to help parents and other community members understand what it is like to solve the kinds of complex problems that the students are working on. Parents and other community leaders who share an anchor with students also often notice areas where they can supply additional information. For example, in several classes parents have watched a Jasper adventure such as the one about the ultralight and invited students on a field trip to see an actual ultralight.

An important issue with respect to projects is the degree to which all students learn in ways that optimally prepare them for the future. Anchors can provide a basis for sensitive formative assessments that help ensure that all students learn as much from projects as is possible (e.g., CTGV, 1992b). We say more about this later on.

2.6 Do you think that your design for videodisc anchors is more effective than using computer-based simulations as anchors?

We certainly believe that simulations can provide effective anchors for instruction. We did not begin this way for several reasons. One is that we did not have the collective expertise necessary to create sophisticated computer-based simulations. A second reason is that we wanted to create tools that were "teacher friendly" and "budget friendly." In our experience it was much easier to help teachers become comfortable with videodisc players controlled by a hand-held remote control device or a barcode reader than it was to help them feel comfortable with computers. In addition, most schools did not have the kinds of computers necessary to run sophisticated simulations, and it was much more expensive to purchase and maintain computers than videodisc players. So we began with video-based simulations rather than ones that were computer based.

In recent years we have been fortunate to work with colleagues who have the expertise necessary to create sophisticated computer simulations. We are currently designing and testing several of them to accompany the first two Jasper adventures. One simulation, designed by Susan Williams, allows students to change parameters of Jasper's boat in order to help it win a race against a second boat.[3] Students must make predictions about their changes and explain what will happen before they can run a simulation of the race. Williams asks for predictions and explanations before running the simulation because many simulations prompt trial and error learning rather than reasoned decision making (Bransford, Stein, Delclos, & Littlefield, 1986).

A second simulation, designed by Gautam Biswas and Thad Crews, prompts students to make qualitative predictions about ways to rescue the eagle featured in the Jasper adventure *Rescue at*

Boone's Meadow. In the simulation, students can use a variety of options to carry out their rescue—options such as multiple routes and multiple forms of transportation, including a car, ultralight airplane, or travel by foot. Students then quantify their reasoning, see a simulation of their plan, and receive feedback on qualitative and quantitative aspects of the plan. They then have the chance to rethink their solutions and try again.

We believe that the use of simulations in conjunction with the Jasper adventures will have a number of advantages. One is that the simulations appear to be highly motivating and excellent for engaging students in "what-if thinking" (we discuss the importance of this type of thinking later in this article). A second advantage of the simulations is that they help students learn to organize their work in a systematic manner. Our simulation programs also keep track of the thinking of students (or groups of students) and hence provide a powerful vehicle for formative assessment and empirical research.

2.7 Does anchored instruction encourage cooperative learning?

One of the goals of anchored instruction is to help create environments that are conducive to cooperative learning. Teachers who have worked with us have been enthusiastic about this aspect of anchored instruction for several reasons. One is that the problems depicted in our anchors are complex, hence any individual student is unlikely to be able to solve them completely, so collaboration becomes a necessity. Another reason for teachers' enthusiasm stems from the fact that the visual nature of the anchors makes it easier for students to contribute even if they are not good readers. Almost every teacher with whom we have worked has relayed compelling stories about ways that anchored curricula help less successful students make contributions to groups and, in the process, gain respect from their peers (e.g., Bransford, Vye, Kinzer, & Risko, 1990; CTGV, in press d, e).

To say that anchored curricula can facilitate cooperative learning is not to say that our experience with groups has always been ideal. As others have noted (e.g. Goldman, Cosden, & Hine, 1992; Salomon & Globerson, 1989), groups do not always function effectively, and many of ours are no exception. Studies by Barron (1991) have allowed us to begin to better understand group problem solving in an anchored context and to assess its effects on both individual and group transfer. In general, we find that students like working in groups and, in some but not all cases, the opportunities to work in groups leads to superior individual transfer (Barron, 1991). Thanks to the opportunity to work with Jim Voss and Mary Means from the University of Pittsburgh, we are also beginning to study the nature of the arguments that students generate in group settings. In addition, studies by Schwartz & colleagues (Schwartz, Garcia-Mila, & Black, 1992) are helping us clarify the effects of group interactions on problem representations. Overall, our studies of group problem solving are helping us develop ways to facilitate cooperative learning by providing instruction and helping students adopt particular roles. We eventually plan to create videos that provide contrasting models of efficient versus inefficient group interactions—models that should help students improve their cooperative learning skills.

III. Some Questions Frequently Asked About Learning, Transfer, and Assessment

3.1 In the 1990 article you said little about issues of assessment. Is your goal to produce higher scores on student achievement tests?

We note in several articles that our primary goal has not been to increase scores on typical tests of student achievement because most of these tests focus on isolated bits of skill and knowledge (CTGV, 1992a, b); Goldman, Pellegrino, & Bransford, in press; Resnick & Resnick, 1991). Our primary goal has been to help students improve their abilities to accomplish goals that are more holistic—goals such as beginning with a general indication of a problem, generating the sub-goals necessary to solve it, and then doing so. Additional goals include effectively communicating one's ideas and arguments to others and effectively critiquing arguments that others present. We have designed a number of assessment measures that attempt to assess progress toward these goals (e.g., see CTGV, 1992b; Goldman with CTGV, 1991; Goldman, Vye, Williams, Rewey, & Pellegrino, 1991).

Some of our assessment measures are discussed later in this article. For present purposes, we emphasize that, in our large-scale implementations of anchored curricula, we have used not only our own measures of complex problem solving but also held ourselves accountable for scores on standardized achievement tests. Our *hope* has been that we could show impressive gains on assessments of complex problem solving, while not causing our students to lose ground on achievement tests. Our *fear* has been that the time taken from the traditional curriculum in order to do Jasper would cause a decline in scores on standardized tests. So far our fear has not been realized and, in some cases, we have even found significant advantages for our experimental groups on standardized achievement measures (Pellegrino *et al.*, 1991).

For those teachers and school systems who need to increase their scores on standardized tests as well on the kinds of performance measures that we emphasize, it is possible to provide information about ways to use anchored curricula to achieve specific goals. For example, imagine that students need to understand concepts of measurement such as perimeter, area, and volume. By indexing appropriate scenes from Jasper adventures, we can help teachers target these specific concepts.

3.2 *What kinds of studies have you conducted to assess whether the anchored approach leads to better learning and transfer than more traditional approaches?*

Key issues in any comparison study include the nature of the instruction that one calls "traditional" and the alignment of one's instruction and one's tests (e.g., Bransford, Franks, Morris, & Stein, 1979). If the "traditional instruction" that is provided is of especially poor quality, and if tests are more aligned with instruction in one's experimental group than one's control group, it is often less-than-illuminating to show that one group of students performed better than the control group.

We have conducted several studies that are designed to measure complex problem solving, while also attempting to ensure that both the experimental and control groups receive the same basic content in their instruction and differ only in the degree to which their instruction was anchored. In Sherlock, for example, experimental and control groups both received instruction on the story elements needed to write well-developed stories, but the experimental group received all of this instruction in the context of the Sherlock anchor whereas control students received the same instruction in the context of a variety of different stories.

Advantages of anchored over non-anchored lessons were found on story writing, vocabulary usage, and the acquisition of relevant knowledge of history (e.g., see Bransford, Kinzer, Risko, Rowe, & Vye, 1990; Risko, Kinzer, Vye, & Rowe, 1990; Kinzer, McLarty, & Martin, 1989; Risko & Kinzer, 1989; Kinzer, 1991b). In Jasper our experimental and control groups both received instruction in the same basic concepts involving distance, rate, and time calculations, but the Jasper groups encountered these in the context of solving an overall Jasper problem, whereas the control students encountered them in the typical format of one- and two-step word problems, where each word problem involved different entities (e.g., a boat, car, airplane, etc.). Data indicate that transfer to complex problem solving was much better when students had the opportunity to work in the context of solving a holistic Jasper problem that included a number of interrelated sub-problems, rather than simply working on sets of unrelated one- and two-step word problems that covered the same content. These data are discussed in CTGV (in press f); Goldman with CTGV (1991); Goldman *et al.* (1991); and Van Haneghan, Baron, Young, Williams, Vye, & Bransford (1992).

In addition to studies that attempt to teach the same basic content in an anchored versus non-anchored manner, we have conducted large-scale assessment studies that compare our anchored approach with traditional curricula that are being taught in various schools. In these latter studies we do not have control over the content taught in the comparison classes, but we do have the advantage of "authentic" comparison classes and large numbers of student and teacher participants. Both attitude and problem solving data relevant to our broad-scale assessments have been positive and the results have been consistent across gender and ethnicity (CTGV, 1992b; Pellegrino *et al.*, 1991).

3.3 *To what extent are anchored curricula creating the kinds of learning that leads to broad transfer?*

One of the major concerns about situating instruction in specific contexts is that students' understanding and application of these concepts will stay welded to the context (e.g., Saxe, 1988).

Our experiences during the past three years suggest that, while this is a potential danger of any attempt to situate instruction in a particular setting, it is not necessarily fatal with respect to transfer. Our overall approach is to help students develop representations of experiences that facilitate the probability that transfer will occur (e.g., Bransford, Vye, Adams, & Perfetto, 1989). There are several different kinds of transfer that we are trying to promote.

Transfer to New Analogous Problems: One measure of transfer that we have used involves the construction of new problems that are directly analogous to ones solved earlier. For example, students might first explore concepts of distance-rate-time in the context of our first Jasper adventure, *Journey to Cedar Creek.* They might then be asked to solve a problem that has an identical structure but involves different content, such as new vehicles (a houseboat rather than a cruiser) with new characteristics (fuel consumption and capacity, etc.), and new settings (different parts of the river with different distances among docks). Our data indicate that students who work with Jasper adventures show marked improvement in their abilities to solve similar adventures that are directly analogous to the original (CTGV, in press f); Van Haneghan *et al.*, 1992; Goldman with CTGV, 1991; Goldman *et al.*, 1991).

Transfer to Partially Analogous Problems: We have also assessed students' transfer from the first trip planning adventure to the second one—*Rescue at Boone's Meadow* (Goldman with CTGV, 1991). This represents an interesting transfer situation because part of the second Jasper adventure is analogous to the first one (the part involving the need to consider distance-rate-time of a vehicle) but part of it is novel (the part involving "optimization" of plans by considering multiple possible vehicles, pilots and routes). Our data indicate strong transfer for the part of the second Jasper adventure that is analogous to the first one. In contrast, we found no effect of having worked on the first adventure for the optimization part of the second adventure. These findings were expected, since experiences with the first Jasper adventure did not prepare students to deal with issues of optimization. It is important to note that our experiment involved no instruction with respect to the second Jasper adventure—it was simply used as a transfer problem. Once students have learned to solve the second adventure and, in the process, have the opportunity to discuss multiple possible solutions, we expect to find transfer to new problems involving optimization.

Transfer to "What If" Perturbations of the Original Problem: We have also begun to explore an aspect of transfer that has received little attention in the experimental literature. It involves the ability to envision the effects of changes in particular elements of an overall problem structure. For example, we have asked students who have solved *Journey to Cedar Creek* to respond to "what if" questions, such as "What if everything about Jasper's trip remained constant except that his cruiser had cruised at a speed of 9 rather than 8 miles per hour?"; or "What if the temporary fuel tank held 10 rather than 12 gallons?" In cases such as these, declarative knowledge about the products of previous computations can set the stage for effective qualitative reasoning as well as for quantitative shortcuts. For example, if one knows that Jasper makes the trip home in three hours when cruising at 8 miles per hour, it is clear that he can make it home in less than three hours at a cruising speed of 9 miles per hour (assuming that everything else is constant, such as the amount of fuel burned per hour). A student who understands this problem structure will also realize that, at 9 miles per hour cruising speed, Jasper will burn less gasoline. Other types of what-if questions allow clear quantitative shortcuts. Thus, if the cruiser cruised at 16 rather than 8 miles per hour, Jasper should make it home in 1/2 the time, or 1-1/2 hours (the original trip took 3 hours).

Our studies indicate that, prior to any instruction on "what if" thinking, fifth and sixth grade Jasper students spontaneously attempt to make use of previous declarative knowledge when attempting to solve "what if" problems. However, they often have difficulty knowing which aspects of their previous knowledge should remain intact and which needs to be changed (see CTGV, in press f; Williams, Bransford, Vye, Goldman, & Carlson, 1992). These data suggest that students do not understand the relationships among variables of the original Jasper problem as well as one would like. So we think that an emphasis on "what if" thinking will deepen problem understanding and help them develop flexible knowledge representations. As an illustration, consider the fact that the optimal solution for rescuing the eagle in *Rescue at Boone's Meadow* involves an indirect route to the eagle and back because of fuel and payload constraints. Now imagine a new problem that change parameters of the original problem (e.g., the fuel capacity of the ultralight) in a manner that makes a direct rescue possible. A student who blindly applied the original indirect solution in this new setting would be "functionally fixed" (Duncker, 1945) rather than flexible. Our "what if" analog questions are designed to promote flexible transfer by helping students re-think optimal solutions in light of key changes in parameters.

Transfer Outside the Classroom Context: An important aspect of transfer involves the degree to which students spontaneously make connections between activities in a particular class and those in other classes or outside of school. In some of our earlier research (Bransford, Hasselbring, Barron, Kulewicz, Littlefield, & Goin, 1988) we worked with students in a summer mathematics program that was held on the Vanderbilt campus. We noticed a number of instances where students spontaneously made use of information from the classroom in their everyday activities. Most notably, students had worked with a videodisc anchor (*Raiders of the Lost Ark*) that prompted them to use standards (e.g., the height of Indiana Jones) to measure other objects (e.g., the width of the pit in the cave; the length of the airplane). They spontaneously attempted to use similar techniques to estimate the height of objects on the campus, such as the height of buildings, flagpoles, and trees. Similarly, in our Sherlock project, we saw many instances in which vocabulary targeted for the experimental class was spontaneously used in other classes and in interviews about other content areas. In addition, students spontaneously generated coherent plot structures across multiple story writing activities (e.g., Kinzer, McLarty, & Martin, 1989; Kinzer, Risko, Vye, & Sherwood, 1988).

Statements from the teachers in our nine-state Jasper implementation project consistently mentioned parent reports about their children making connections between everyday activities and Jasper (CTGV, in press e). For example, several parents noted that their children began asking questions about the fuel capacity and efficiency of their car when they stopped at a gas station; others noted that children became interested in different units of measurement, etc. And teachers noted that students referred to Jasper in other settings. A commonplace event was to label complex, everyday problems that arose as "Jasper problems." One example of a Jasper problem involved the failure of a substitute lunchroom staff to correctly anticipate the meals it needed to prepare. When something was labeled as a Jasper problem students understood that it was complex and would probably take time to figure out (CTGV, in press d, e).

Positive comments from teachers and parents about connection-making are gratifying, but it is difficult to know how to interpret them. For example, there is no measure of missed opportunities where students could have made connections to classroom experiences but failed to do so. Therefore, we have begun to develop some "spontaneous connection-making" studies that provide a better measure of students' behavior. In a study that we have completed but not yet analyzed, we showed Jasper and non-Jasper students a series of videos and print materials that we asked them to evaluate as possible instructional materials for other students. For example, one video followed a novice pilot who was taking his first solo flight. Data embedded in the video about the range and other properties of the plane and trip were analogous to data available in *Rescue at Boone's Meadow*, so there were opportunities to notice similarities between this adventure and the pilot's solo flight.

We told students that we wanted to have them help us evaluate various sets of educational materials, and we asked them to tell us what came to mind as they saw the materials. Although the data are not analyzed, the impression we are getting is that few students spontaneously made connections between these events and the Jasper materials. However, when they were then explicitly asked to make the connections they could do so in considerable detail.

More detailed analysis of our connection-making data will be used to devise classroom-based activities that can help students develop knowledge representations and habits of mind that facilitate the degree to which they spontaneously make connections between in-class and out-of-class activities. For example, Bransford and Vye (cf., Bransford, Sherwood, Vye, & Rieser, 1986) were able to increase the degree to which college students spontaneously thought about concepts taught in the classroom after they had left the classroom. They did this by explicitly asking students to imagine concept-relevant situations that they were likely to encounter in other aspects of their college life, such as other classes, their dormitory, the lunchroom, and talking on the phone to family and friends.

Transfer as Efficient Learning: An important index of transfer is the degree to which one set of experiences helps one *learn* to adapt to new settings (Brown, Bransford, Ferrara, & Campione, 1983; Greeno *et al.*, in press). The ability to learn efficiently is different from the ability to solve a new set of problems without any opportunity to learn. Thus, person A may perform no better than person B when asked to solve a new set of problems that are presented in a typical static test of transfer. However, when given appropriate resources to consult, person A may be more efficient at *learning* to solve these problems than person B.

We are just beginning to attempt to assess the degree to which students in anchored curricula are able to learn new information more efficiently. In a study that we have conducted but are still in the processes of analyzing, Jasper students and comparison students both received instruction in how to solve one of the Jasper business plan adventures. The Jasper students had worked previously with our two trip planning adventures, but these are quite different in content from the business planning adventure. We are attempting to assess the efficiency of learning of the Jasper group that had worked on the trip planning adventure in comparison to the group that had not. To the extent that Jasper students have learned to work cooperatively and to set and achieve learning goals, we expect to find evidence of transfer in the sense of efficiently learning to solve the new business planning adventure.

3.4 In your 1990 article you discuss authenticity in the context of both Sherlock and Jasper and note that the authenticity of the first two Jasper adventures lies in their similarity to what an experienced "trip planner" would do rather than to the activities of an experienced mathematician. Have you tried to create anchors that lead to an exploration of the domain of mathematics per se?

A number of people have commented that our Jasper series seems to be better for teaching problem solving than for teaching mathematics. These comments, plus data we have collected on student understanding, have prompted us to augment our Jasper materials in ways that will help students think about issues of mathematics in more depth. The major change in the materials is that we now include on each Jasper videodisc a set of analog and extension problems. Some of the problems are designed to facilitate the kinds of "what if" thinking about the original adventures that we discussed earlier (see Section 3.3). Others are designed to strengthen students' understanding of key mathematical concepts that are relevant to the Jasper adventures.

The idea of deepening students' mathematical understanding can be illustrated with our Jasper statistics adventure, *The Big Splash*, that involves the creation of a business plan. In the story, Chris needs a good estimate of his income from a proposed booth at his school's fun fair. He decides to design a questionnaire and administers it to a random sample of his classmates (every sixth student in the cafeteria line). Students working with the adventure have to use the data Chris collects to create their business plan, hence they get some exposure to the concept of representative samples. But the danger exists that students understand this concept only procedurally (i.e., that you obtain representative samples by asking every sixth person).

We have designed analog and extension problems to accompany *The Big Splash*. These allow students to think about and evaluate other ways that Chris could have attempted to guarantee a representative sample. For example, Chris might have administered his questionnaire to one-half of the students in his homeroom, to every fifth student on Monday morning, etc. As students discuss these possibilities, they begin to develop an understanding of sampling that is conceptual rather than merely procedural. Other extension problems help students explore concepts such as variability and risk. Our initial experiences with analogs and extensions indicate that they lead to the emergence of mathematical discourse about important concepts and assumptions relevant to the adventures.

Our Jasper analog and extension problems still fall short of helping students develop a deep understanding of the structure of mathematics and the nature of mathematical inquiry as it is practiced by mathematicians (e.g., see Lampert, 1990; Schoenfeld, 1988, 1989). Our current goal with the Jasper series is not to replace the standard mathematics curricula but, instead, to supplement it in a way that motivates students to explore mathematics in more detail. At the same time, in our materials for teachers we continually attempt to add connections between the Jasper adventures and the structure of mathematics as a discipline.

3.5 Do visual anchors produce learning and transfer that is superior to verbal ones?

In our 1990 article we noted that anchors need not always be visual. Since then, one of the members of our group (Williams, in press) has conducted an in-depth review of the literature on case-based and problem-based learning as it is used in areas such as medicine, law, and business (e.g., Barrows, 1985). Williams notes that these approaches use materials that are almost exclusively verbal, and data indicate that they can be quite effective in helping students develop well-organized sets of knowledge plus learn to set and pursue their own learning goals. By the same token, it is clear that the people involved in these curricula are highly selected according to criteria that include a heavy emphasis on verbal skills.

We maintain our belief that there are good reasons for often preferring visual rather than purely verbal materials—especially for students whose levels of achievement often do not match the level found in medical, law, and business students. One reason for preferring visual materials is that students who are poor readers have a chance to participate in class discussions. This is a benefit of video-based anchors that almost every teacher we have worked with has mentioned (e.g., CTGV, in press d, e). It is also easier to communicate complex, novel information in formats that are rich in visual information. In addition, since there is more to notice in visually rich environments, there is more of an opportunity for different groups of students to focus on different issues within the same anchor (e.g., Bransford, Vye, Kinzer, & Risko, 1990). One of the best ways to compare the differences between verbal and visual anchors is to attempt to solve one of the Jaspers by relying only on the script versus on the video. In the script version it is much harder to know where to return to find the relevant data needed for the problem solution.

Many people have asked us why we have not conducted studies to compare verbal and visual versions of our anchors. The reason is simple: Teachers are reluctant to try the materials when they are in verbal form. They are much too cumbersome for most of the students in the class. One can, of course, use storyboard depictions of the adventures rather than purely verbal formats, and we have experimented with this format in an informal manner. One of our concerns with an exclusive reliance on storyboard formats is that they need to include the data necessary to solve the problem, and the data are therefore right in front of the students during problem solving. Under these conditions, students' thinking seems to be driven by looking at the data rather than by attempting to understand the problem qualitatively and then searching the videodisc for the relevant data. Computer-based implementations of storyboard formats may help us promote qualitative thinking followed by a search for relevant data. The simulations discussed earlier (see section 2.6) are also helpful in this regard.

Despite our emphasis on advantages of video-based anchors, we also embrace the goal of helping students learn to deal with purely verbal materials. In much of our work on literacy, we begin with visual support and gradually help students accommodate to information communicated in a purely verbal form (e.g., Bransford, Sharp, Vye, Goldman, Hasselbring, Goin, O'Banion, Livernois, Saul, & the CTGV, 1992; CTGV, 1991b; Sharp, Bransford, Vye, Goldman, Kinzer, & Soraci, 1992).

IV. Some Effects of Our Experiences on Thoughts About Situated Cognition

Our goal in this final section of the article is to briefly discuss how our experiences during the past three years have affected our thinking about the concept of situated cognition and its implications for theories of learning and instruction. We divide our discussion into three parts. First, we note how our experiences have helped us appreciate the need to take a broader view of "situatedness" than we took in our 1990 article. Second, we discuss some implications of a situated view of learning and transfer that have become clearer to us as we have conducted our research. Finally, we briefly describe a new project that we are undertaking that attempts to use distance learning technologies to create "learning communities" that support the kinds of learning that should prepare students for life.

4.1 A Broader View of "Situatedness"

For many of us in the CTGV, an especially important change in our thinking has involved a deeper appreciation of the need for a broader view of "situatedness" than was discussed in our 1990 article. Our emphasis in 1990 was on situating instruction in the context of our video-based anchors or macrocontexts. We still believe that anchors can play an important role in helping change the nature of the teaching and learning activities that take place in classrooms, but we now better understand the need to explicitly consider the cultural contexts in which we situate our anchors. This is not a new idea (e.g., Brown, Collins, & Duguid, 1989; Schoenfeld, 1988, 1989), but our experiences have helped us understand others' discussions of this issue in more depth. For example, we now better understand that teachers and students who begin to work with anchored curricula usually face the challenge of changing the culture of their classrooms. In our initial attempts to work with teachers on the Jasper project, we seriously underestimated the amount of time it would take for them to successfully change the culture from one of teacher as "teller" to teacher as coach and fellow learner. We also learned that it is best to begin with a simple technology such as a videodisc player with a hand-held remote control device or barcode reader; more sophisticated computer technologies can be introduced later. In addition, it is important to provide planning time and support for technology. Without this support, teachers face the risk of losing valuable learning time for their students when the equipment does not work (e.g., CTGV, in press e).

We have also seen first-hand the importance of helping teachers obtain school-wide and community-wide support for new projects. We mentioned earlier that many of our teachers invented ways to do this—such as inviting parents and administrators into the classroom to solve Jasper adventures. We have attempted to provide additional support by creating some key assessment instruments that would allow teachers to show others what the students have learned and by creating our *Challenge Series,* discussed in Section 4.3 (e.g., CTGV, 1992b; Pellegrino *et al.*, 1991).

4.2 The Importance of Situated Views of Learning and Transfer

Our experiences during the past three years have also helped us appreciate some of the deeper implications of adopting a situated view of learning and transfer. We like Greeno *et al.*'s (in press) definition of learning, which is "... an improvement in the ability to interact with things and other people in a situation." They note that issues of transfer then involve attempts to understand "... how learning to participate in an activity in one situation can influence (positively or negatively) one's ability to participate in another activity in a new situation."

Situated Views of Learning: Greeno and colleagues' definitions of learning and transfer carry with them the implication that learning may look different in different situations (see Brown *et al.*, 1989; Lave, 1988; Sternberg & Wagner, 1986). With this in mind, it is instructive to note that (a) most experimental research on learning has focused primarily on the kinds of activities involved in typical school settings (e.g., Derry, 1990; Weinstein, 1988; Weinstein, & Mayer, 1985), and (b) a number of authors argue that the cultures of typical classrooms tend to promote learning that is superficial rather than deep (e.g., Bereiter & Scardamalia, 1989; Brown, 1992; Holt, 1964). This means that comprehensive theories of learning need to be based on analyses of a wide variety of settings rather than solely on learning as it currently occurs in schools.

Theorists who emphasize situated cognition have played a key role in analyzing learning and problem solving as it takes place in everyday settings (e.g., Lave, 1988; Rogoff, 1990). One member of our group (Hmelo, 1992) is beginning to systematically compare the principles of learning and instruction that derive from an analysis of classroom-based learning with those derived from analyses of learning in non-school settings. In a school setting, learning is typically teacher-directed whereas in a non-school setting learning must be more self-directed. The kinds of learning strategies typically emphasized in school settings include strategies for figuring out what will be on the test and strategies for taking notes and remembering information from textbooks. In contrast, the emphasis in many non-school settings is on the importance of identifying important problems and opportunities and setting and meeting one's own learning goals (e.g., Berryman, in press; Bransford & Stein, in press; Brown, 1992; Ng & Bereiter, 1991; Williams, in press).

Assessment: A situated view of learning and transfer also has important implications for issues of assessment. A major barrier to educational reform is that teachers and school systems are often held accountable by means of scores on standardized achievement tests (Baron, 1987; Resnick & Resnick, 1991). Students' abilities to interact in such testing situations provides no guarantee that this will help them participate in appropriate activities in new situations such as those involved in independent learning required for their profession or job. So part of the challenge of changing the culture of classrooms is to change the nature of the assessments that serve as indicants of learning. We encountered this issue head-on when we conducted our Jasper implementation project in nine states and needed to be accountable to the schools and businesses who participated (e.g., CTGV, in press d, e). It was important for us to explain that the major purpose of the Jasper program was not to increase students' scores on standardized achievement tests. But we needed some way to assess progress, so we developed assessments that were more consistent with generative skills of problem finding and problem representation that we felt were important for learning in a variety of everyday settings. The topic of new approaches to assessment is becoming one of the major issues of the decade (e.g., Baron, 1987; Goldman *et al.*, in press; Resnick & Resnick, 1991). Theories of situated learning and transfer can play important roles in helping clarifying the interconnections among materials, instruction and assessments that help define the cultures of the classroom, school and community.

The Affordances of Materials, Instruction and Assessment: Like several other theorists, (e.g., Greeno *et al.*, in press; Shaw *et al.*, 1982), we have found it useful to analyze materials, instruction, and assessments from the perspective of Gibson's (1977) notion of affordances. For example, we noted earlier, in section 2.1, that our anchors are designed to support certain types of teaching and learning activities (e.g., an emphasis on problem generation, collaborative learning, effective communication) that often are not supported by traditional sets of materials (e.g., CTGV, 1992b).

As we have gained more experience in classrooms, we have seen the importance of introducing additional materials and practices that can facilitate learning. The most important are those that make thinking visible and hence afford opportunities for elaboration and for repair when necessary. Overall, an emphasis on affordances helps one focus on the usefulness of various practices. For example, there are important differences between providing opportunities for informed self-assessment and simply giving students tests (e.g., Bransford & Stein, in press). For us, a major goal of self assessment is to help students develop flexible rather than brittle knowledge representations. For example, in section 3.3 we discussed some of the advantages of using "what if" analog problems. Our research is helping us understand the kinds of "what if" questions that are most likely to lead to flexible transfer later on.

4.3 Using Distance Learning Technologies to Create Learning Communities

Our group is currently beginning a new project that has emerged from an increased appreciation of the difficulties of changing the culture of classrooms, schools, and communities. We are attempting to use distance learning technologies (e.g., teleconferencing and two-way videoconferencing) to help teachers change the existing cultures of their classrooms by linking them with other classrooms and community members throughout the country who are pursuing a common goal. Our plan is to create public performance arenas that allow students to "test their mettle" and provide opportunities for self-assessment and renewed attempts at learning. Part of our goal is to capture for the academic areas some of the advantages that sports contests or musical performances create for coaches and for music teachers and their students. By facing common challenges posed from outside the classroom, teachers and students are united in their efforts to continually improve.

So far we have created three teleconference-based pilot challenges for a number of our Jasper sites. These challenges let students "test their mettle" by solving problems that require in-depth knowledge of Jasper adventures plus their extensions. In the pilots conducted so far, students called in their problem solutions to a central location and, almost instantly, were able to compare their ideas and solutions to those of peers from around the country. Information about pilot challenges that we have completed is available in CTGV (1992b, in press e; Goldman, *et al.*, in press; Kantor with CTGV, in press).

Our newer version of the challenge series is designed to help students generate their own community-based projects that they will eventually discuss with other classes via teleconferencing and two-way videoconferencing. In this model, Jasper adventures are viewed as resources that students use to help them achieve their overall project goals. Other resources are also provided; we want students and teachers to appreciate the "situated" or distributed nature of intelligence (see especially Pea, in press). Thus, we are giving students and teachers access to resources such as information and tools that can help them improve in a number of areas such as working in groups, thinking with simulations and communicating effectively.

The idea of creating an ongoing challenge series that provides information for formative assessment and helps students and teachers build learning communities is being piloted in Nashville, Tennessee and will eventually extend to other areas of the country and other subject matters. We are hopeful that attempts to use technology to create exciting learning communities will help increase the probability of effective educational change on a broad scale. □

Notes

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Events Calendar

- **Annual Imaging Conference.** The annual show and conference of the Association for Information and Image Management will be held April 5-8, 1993 in Chicago, Illinois. Now in its 42nd year, the event includes more than 80 sessions and some 300 exhibitors dealing with the storage, retrieval, and manipulation of image-based information. Contact: Association for Information and Image Management, Suite 1100, 1100 Wayne Avenue, Silver Spring, Maryland 20910; (301) 587-8202; Fax: (301) 587-2711.

- **Virtual Reality Conference.** The Fourth Annual Virtual Reality Conference and Exhibition will be held May 19-21, 1993 in San Jose, California. The event is to cover the utilization of virtual reality systems in design, entertainment, medicine, and other applications. Contact: Marilyn Reed, Meckler Corporation, 11 Ferry Lane West, Westport, Connecticut 06880; (203) 226-6967; Fax: (203) 454-5480.

- **Language Lab Conference.** The annual meeting of the International Association for Learning Laboratories will be held June 2-5, 1993 at the University of Kansas at Lawrence. Theme of this year's sessions is Defining the Role of the Language Lab. Contact: Dr. John Huy, Director, Garinger Academic Resource Center, KU, 4069 Wescoe Hall, Lawrence, Kansas 66045; (913) 864-4759.

- **Israel Teacher-Education Conference.** An International Conference on Teacher Education will be held June 27 to July 1, 1993 in Tel-Aviv, Israel, sponsored by the MOFET Institute, which specializes in research and development of programs in teacher education. Attendees are to discuss policy-related issues in teacher education brought about by social changes and reforms in education; structures, content, and methods in teacher education; and aspects of teacher professional development. Contact: Efrat Drori, MOFET Institute, 15 Shoshana Persitz Street, Tel-Aviv 161480, Israel; 03-6902406; Fax: 03-6902449.

- **Automated Design Institute.** "Automated Design for Interactive Multimedia" is the theme of the Fifth Annual Instructional Technology Summer Institute to be held at Utah State University in Logan, August 18-21, 1993. Contact: Teresa W. McKnight, Department of Instructional Technology, Utah State University, Logan, Utah 84322; (801) 750-2779; Fax: (801) 750-2693.

- **Telecommunications Conference and Exhibition.** TeleCon XIII, dealing with teleconferencing, business television, and distance learning, will be held November 8-10, 1993 in San Jose, California. Sponsored by Applied Business TeleCommunications, the event attracted some 6,000 attendees in 1992, and more than 8,000 people are anticipated at the exhibition this year; the full conference is expected to draw some 2,000 participants. Contact: Pam Parks, Applied Business TeleCommunications, 409 S. Washington, Stillwater, Oklahoma 74074; (405) 743-0320; Fax: (405) 743-3426.

- **New 1994 Educational Technology Exposition.** The Association for Educational Communications and Technology (AECT) has announced a new annual exhibit to accompany its convention, instead of serving as a cosponsor of the INFOCOMM show. The first International Computing and Instructional Technology Exposition will be held February 17-19, 1994 in Nashville, Tennessee at the Opryland Hotel and Exhibit Hall. Contact: Stan Zenor, AECT, 1025 Vermont Avenue, NW, Suite 820, Washington, DC 20005; (202) 347-7834; Fax: (202) 347-7839.