Carnegie Mellon University
Research Showcase @ CMU

Department of Psychology | Dietrich College of Humanities and Social Sciences

2000

Perspectives on Learning, Thinking, and Activity

John R. Anderson
Carnegie Mellon University

James G. Greeno

Lynne Reder
Carnegie Mellon University, cherdema@andrew.cmu.edu

Herbert A. Simon
Carnegie Mellon University

Follow this and additional works at: http://repository.cmu.edu/psychology

Published In

.

This Article is brought to you for free and open access by the Dietrich College of Humanities and Social Sciences at Research Showcase @ CMU. It has been accepted for inclusion in Department of Psychology by an authorized administrator of Research Showcase @ CMU. For more information, please contact research-showcase@andrew.cmu.edu.

Version: 1/5/2000

Perspectives on Learning, Thinking, and Activity

John R. Anderson, James G. Greeno, Lynne M. Reder, and Herbert A. Simon

Abstract

We continue the discussion of cognitive and situative perspectives by identifying several important points on which we judge the perspectives to be in agreement: (1) Individual and social perspectives on activity are both fundamentally important in education; (2) Learning can be general, and abstractions can be efficacious, but they sometimes aren't; (3) Situative and cognitive approaches can cast light on different aspects of the educational process, and both should be pursued vigorously; (4) Educational innovations should be informed by the available scientific knowledge base and should be evaluated and analyzed with rigorous research methods.

We have been involved recently in an exchange concerning the relative merits of the situative and cognitive research approaches, especially with respect to the contributions they can make to improvement of education (Anderson, Reder & Simon, 1996; 1997; Greeno, 1997). There is more to be said in the exchange, and continuing the exchange could serve to sharpen significant issues further. Continuing in the format of debate, however, would obscure some important points of agreement between us about education and research. We write this brief commentary to summarize this consensus and to consider briefly its implications for the kinds of research and development that will advance both approaches especially in their contributions to the public discourse about educational problems.

Individual and social perspectives on activity are both fundamentally important in education.

It is sometimes asserted or suggested that the situative perspective accords too little importance to individuals because it emphasizes participation in social practice; and it is sometimes asserted or suggested that the cognitive perspective neglects processes of social interaction because it emphasizes individual development in the acquisition of intellectual skills. In our view, both perspectives, as part of the liberal tradition, can find, albeit with varying emphases and degrees of success, ways of paying respect to the importance of human individuality, the importance of social practices, and the importance of education to the development of individual identity and to the advancement of a fair, just, caring, and productive society.

The cognitive approach should not be read as denying the value of learning in group activity, and the situative approach should not be read as denying the value of learning by individuals working by themselves. The difference between the perspectives involves different ways of focusing on learning activity, but both perspectives provide accounts of learning that can occur in groups and in solitary activity. Both perspectives provide important insights into the processes of effective performance and learning, and neither is limited either to activity by groups or to individuals acting alone.

For example, people who play musical instruments in an orchestra practice both in groups and by themselves. The cognitive perspective considers these as different learning contexts in which different aspects of skill are acquired by individuals—the skills of performing in ensemble and of individual technical accomplishment. The situative perspective considers these as different aspects of a learning practice in socially organized musical activity—the group's learning the coordinated activity of ensemble playing and individuals' learning to interact more effectively with the physical instruments that they play as they prepare to contribute more effectively to the ensemble.

Athletics is another domain that illustrates the complementary relation between the perspectives. For example, soccer players learn by playing games and scrimmages as teams, by working in smaller groups on passing and blocking drills, and by working alone on dribbling and shooting. Cognitive and behavioral analyses of learning in athletics, such as Fitts's (1962), emphasize the growth of individual skills and identify stages in that development. A cognitive or behavioral analysis could treat an individual's ability to coordinate his or her activities with those of teammates as a component of the individual's skill. Situative analyses of athletic activity, such as Heath's (1991), emphasize ways in which activities are organized so that a team develops an identity as a cooperating unit and individuals develop their skills and their identities as learners and as skilled performers who contribute to the team's success.

The cognitive and situative perspectives also provide valuable complementary analyses of school learning. For example, in mathematics education the cognitive perspective provides important analyses of information structures in conceptual understanding and procedures that are needed for students to succeed in the tasks emphasized in most mathematics curricula (e.g., Anderson, 1983; Greeno, 1978). The situative perspective provides important analyses that emphasize students' participation in socially organized activities of learning, including patterns of classroom discourse and the opportunities to learn how to participate in the learning practices that their classrooms support (e.g., Lampert, 1990). It might be thought that the cognitive and situative perspectives have different implications for the design of learning environments and teaching, such that some learning environments are cognitive and others are situative. We believe this is not the case. Although learning systems that have been designed with emphasis on individual cognition differ from those that have been designed with emphasis on participation in social practices, we believe that this is a temporary result of the incomplete state of both theoretical programs. A more complete cognitive theory will include more specific explanations of differences

between learning environments, considered as effects of different contexts, and a more complete situative theory will include more specific explanations of individual students' proficiencies and understandings, considered as their participation in interactions with each other and with material and socially constructed conceptual systems.

Learning can be general, and abstractions can be efficacious, but they sometimes aren't.

It is sometimes asserted that the situative perspective is inconsistent with findings that learning can be general across situations or that students can benefit from instruction that involves abstract concepts and representations. On the other hand, it is sometimes asserted that the cognitive perspective ignores the relation between learning in school and activities of work and other social participation outside of school. In our view, the existence of general learning and beneficial abstraction is not an issue that separates the perspectives, nor is the importance of relating the individual to the classroom and the outside world something that distinguishes between the perspectives.

Research in both the cognitive and situative perspectives has provided significant information and understanding of conditions in which learning has general effects in human performance. Regarding generality, the cognitive approach has provided analyses of information structures in well-defined tasks that explain amounts of transfer between tasks in quantitative detail (e.g., Singley & Anderson, 1989). The situative approach has contributed studies of transitions between practices, showing that individuals with previous experience in different practices learn and perform in new practices in ways that reflect those previous activities, both from school learning to nonschool learning and from nonschool to school learning (e.g., Beach, 1995; Lave, Smith & Butler, 1988; Saxe, 1990). Cognitive research has shown that learning to use specific representational forms can facilitate transfer between specific tasks (Bassok & Holyoak, 1989; Novick & Hmelo, 1994), and situative research has shown that formal

representations learned in school can play an important role in the ways that school learning influences nonschool practices (Beach, 1995; Saxe, 1990).

We agree that it is essential to develop a better understanding of relations between what is taught in classrooms and the capabilities children have and should develop in their present and future nonschool lives. Developing abilities to perform well in school tasks should not be justified as a self-contained activity whose only function is to keep children occupied in a child care function and to prepare them for future years of school. Part of what children must prepare for is to participate effectively in social practices in their communities and work situations. It is important to study these practices and perform cognitive and situative analyses of what is required to succeed in these and other situations. Science cannot, by itself, decide the goals of education for the whole society. As processes must be consistent with goals, it follows that science can inform the educational process only to the extent that it understands what society expects school learning to prepare children for, and that understanding needs to be developed in an increased research effort.

Situative and cognitive approaches can cast light on different aspects of the educational process, and both should be pursued vigorously.

Cognitive and social science research is providing increasing understanding of processes of learning, conceptual development, problem solving, reasoning, and communication. Cognitive and situative perspectives view these processes differently, with cognitive analyses attributing the processes to individuals and situative analyses attributing them to systems that include individuals (Greeno, Collins, & Resnick, 1996; Greeno and MMAP, 1998), and in the present state of our theoretical understanding, both perspectives are needed.

Situative approaches provide analyses focused on coordination of actions of individuals with each other and with material and informational systems. These

approaches can inform us about ways that the organization of classrooms and other learning environments provide affordances for productive learning. In the situative perspective, learning by individuals is considered as progress along trajectories of participation, which can involve acting more effectively in contributing more centrally to the functions of communities and in developing their identities as learners and knowledgeable people (e.g., Hutchins, 1995; Lave & Wenger, 1991; Wenger, in press).

Cognitive approaches provide analyses about the ways in which knowledge must be structured and about the structures of knowledge in learners' minds that will be available to support task performance and to transfer to new situations, and about the kinds of learning experience that will lead to the acquisition of knowledge and skill and its structuring in these ways. Cognitive studies that attend to social interactions can inform us about ways in which the learner's social environment influences learning and about opportunities for interactive learning that exploit human communication as a means for both motivating and stimulating thought (e.g., Okada & Simon, 1997).

Proponents of cognitive and situative approaches do propose alternative explanations for phenomena and develop alternative methods to evaluate the explanatory concepts and principles that constitute the scientific domain. To some extent, these alternatives are developed separately, as scientific knowledge and understanding are developed within each perspective. However, the alternatives also are compared, contested, and sometimes merged in a process that moves toward more coherence in the scientific account of learning and cognition.

Educational innovations should be informed by the available scientific knowledge base and should be evaluated and analyzed with rigorous research methods; and the advancement of education requires continued research efforts on a large scale.

Most emphatically, we agree that the development of educational interventions should be informed by the growing bodies of research in cognitive and social science.

This research is providing increasing understanding of processes of learning, conceptual development, problem solving, reasoning, communication and social participation. Alternative educational practices, including prospective innovations as well as currently prevalent practices, should be evaluated and analyzed using appropriate methods that are developed in conjunction with that research.

At present, we researchers have different messages to offer concerning educational policy and practice that arise from our focusing on different aspects of educational processes. As long as this is true, it is crucial that we make clear in debates over educational policy and practice that none of our research findings support simplistic policies: As researchers, we neither endorse the view that all currently prevalent practices should be maintained nor that sweeping (or even moderate) changes in school instruction should be adopted. To argue for either of these positions, in our opinion, would misrepresent the state of knowledge in educational research, which includes findings that show merit, as well as weakness, in a wide variety of school learning practices.

The moral? Let us get on with the task of making deep and solid inquiries into learning processes, using the best methods we can bring to bear to advance scientific knowledge and understanding of learning from the variety of research perspectives that are available. A high priority should be given to research that progresses toward unifying the diverse perspectives within which we currently work, both because this is scientifically important and because it will increase the usefulness of our findings for informing public debates about educational policy and practice. This scientific work can be productively competitive, as scientific work often is, depending on formulation of strong hypotheses and claims by the proponents of multiple perspectives and theories, as well as strong challenges to those claims and critical evaluation of the significance of evidence that is presented. But a goal toward which this competitive process can progress is a more inclusive and unified view of human activity in which dichotomies

such as individual vs. social, thinking vs. acting, and cognitive vs. situative will cease to be terms of contention and, instead, figure in coherent explanatory accounts of behavior and in useful design principles for resources and activities of productive learning. As we progress toward this goal, let us use what we learn through this research—from all of the productive perspectives—to inform those who are responsible for forming policy concerning school instruction, so that our children will not be the victims of well-intentioned but ill-informed educational practices.

References

Anderson, J. R. (1982). Acquisition of cognitive skill. *Psychological Review, 89,* 396-406.

Anderson, J. R., Reder, L. M., & Simon, H. A. (1996). Situated learning and education. *Educational Researcher, 25*(4), 5-11.

Anderson, J. A., Reder, L. M., & Simon, H. A. (1997). Situative versus cognitive perspectives: Form versus substance. *Educational Researcher, 26*(1), 18-21.

Bassok, M. & Holyoak, K. J. (1989). Interdomain transfer between isomorphic topics in algebra and physics. *Journal of Experimental Psychology: Learning, Memory and Cognition, 15,* 153-166.

Beach, K. (1995). Activity as a mediator of sociocultural change and individual development: The case of school-work transition in Nepal. *Mind, Culture, and Activity, 2,* 285-302.

Fitts, P. (1962). Factors in complex skill training. In R. Glaser (Ed.), *Training research and education* (pp. 177-197). Pittsburgh PA: University of Pittsburgh Press.

Greeno, J. G. (1978). A study of problem solving. In R. Glaser (Ed.), *Advances in instructional psychology* (vol. 1). Hillsdale NJ: Lawrence Erlbaum Associates.

Greeno, J. G. (1997). On claims that answer the wrong questions. *Educational Researcher, 26*(1). 5-17.

Greeno, J. G., Collins, A. M., & Resnick, L. B. (1996). Cognition and learning. In D. C. Berliner & R. C. Calfee (Eds.), *Handbook of educational psychology* (pp. 15-46). New York: Macmillan.

Greeno, J. G. & the Middle-school Mathematics through Applications Project Group (1998). *American Psychologist, 53,* 5-26.

Heath, S. B. (1991). "It's about winning!" The language of knowledge in baseball. In L. B. Resnick, J. M. Levine, & S. D. Teasley (Eds.), *Perspectives on socially shared cognition* (pp. 101-124). Washington, DC: American Psychological Association.

Hutchins, E. (1995). *Cognition in the wild.* Cambridge, MA: MIT Press.

Lampert, M. (1990). When the problem is not the question and the solution is not the answer: Mathematical knowing and teaching. *American Educational Research Journal, 17,* 29-64.

Lave, J., Smith, S., & Butler, M. (1988). Problem solving as everyday practice. In R. I. Charles & E. A. Silver (Eds.), *The teaching and assessing of mathematical problem solving* (pp. 61-81). Reston, VA: National Council of Teachers of Mathematics.

Lave, J. & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation.* Cambridge, England: Cambridge University Press.

Novick, L. & Hmelo, C. E. (1994). Transferring symbolic representations across non-isomorphic problems. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 20,* 1296-1321.

Okada, T., & Simon, H. A. (1997). Collaborative discovery in a scientific domain. *Cognitive Science, 21,* 109-146.

Saxe, G. (1990). *Culture and cognitive development: Studies in mathematical understanding.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Singley, M. K. & Anderson, J. R. (1989). *The transfer of cognitive skill.* Cambridge, MA: Harvard University Press.

Wenger, E. (in press). *Communities of practice: Learning, meanings, and identity.* Cambridge, England: Cambridge University Press.