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Expert Knowledge and Expert Thinking in Teaching: A Response to Floden and Klinzing

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*In their article "What Can Research on Teacher Thinking Contribute to Teacher Preparation? A Second Opinion" (*Educational Researcher, *June/July, 1990), Floden and Klinzing contend that teacher education would be improved if it were informed by research on practicing teachers's expertise. We do not disagree. However, other questions must be answered if such reforms are to be effective: What is expertise in teaching? How is expertise communicated? Who are the experts? This article attempts to address these questions and further the discussion of expert thinking in teaching.*

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In their article "What Can Research on Teacher Thinking Contribute to Teacher Preparation? A Second Opinion"(this issue), Floden and Klinzing suggest that if research on what expert teachers know included an examination of a teacher's "schemata," teacher educators would have better information to go on as they try to prepare novices for work in classrooms. We would not disagree that teacher education would be improved if it were informed by research on practicing teachers's expertise. Yet this argument points to additional questions which need to be addressed if such reforms are to be effective: What is expertise in teaching? How is expertise communicated from experts to novices? How do we decide who is an expert?

Floden and Klinzing assume that essential elements of what expert teachers know can be identified by researchers who study the relationship between teacher thinking and pupil learning by averaging out the ways in which successful teachers think in large numbers of particular situations, just as process–product researchers did for teacher behaviors. The patterns in teacher thinking that are distilled from this work would then become content for teacher education, and teacher educators would be responsible for helping learners to apply this content to particular situations. This argument assumes that what is most important about expertise can be distilled, and once distilled, can be acquired by others in such form as to be useful in practice.

Expertise, Teacher Thinking, and Knowledge Use in Practice

In the research reviews that Floden and Klinzing call "pessimistic," we asserted that research on teacher thinking led us to the conclusion that teaching is a complex act requiring the moment-by-moment adjustment of plans to fit continually changing and uncertain conditions. We characterized the knowledge teachers use in making those adjustments as contextual, interactive, and speculative. What we were trying to say might have been clearer if we had said instead that the way in which teachers acquire and use knowledge is contextual, interactive, and speculative. We did not, and would not now, argue that teachers do not also have and use knowledge of general tendencies and associations; rather we wish to raise questions about where expert teachers *get* that knowledge, and how where they get it might be related to their capacity to *use* it.

We see two potential problems with the approach to research on teaching and its application to teacher education advocated by Floden and Klinzing. First, schematas may not be the most appropriate way to represent the knowledge that expert teachers actually use in practice. Second, knowledge about expert teachers's schematas, acquired by novices in academic settings like university courses, might not be transportable to the situations in which they face practical problems. Floden and Klinzing propose that teacher educators address these problems by giving prospective teachers the opportunity to discuss how general tendencies in expert teachers's thinking are determined by researchers. This suggests that such an analytic discussion of empirical research methods would have a positive affect on a novice's attempt to use general principles in practice. Our reading of the research on teacher thinking and of the more current literature on knowledge acquisition and use suggests that we might want to consider more radical adjustments to the form in which expert knowledge is shared with novices. We might also want to broaden the research agenda beyond distilling schemata from an expert teacher's thinking.

Questions About Whether Schemata Capture What Experts Know

In the phase of cognitive research referred to as the "knowledge structures" program (Greeno, 1987), psychologists

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assumed that what guided actions were the schemata, or knowledge structures that reside in individual minds. Psychologists set themselves the task of defining these structures for various academic and practical tasks, with the idea that novices could be taught the knowledge structures that experts use, and thus become experts themselves.[1] More recent cognitive studies begin with defining expertise from the perspective of knowledge use in practice, leading to the speculation that the acquisition and use of expert knowledge might be more tightly bound to particlar contexts than was earlier assumed. The notion that expertise is contextual entered the theories of cognitive scientists as they tried to describe the nonformal knowledge of unschooled but highly skilled practitioners in various domains, while concurrently examining social theories about the relationship between language and the development of thought (Brown, Collins, & Duguid, 1989; Cole & Griffin, 1980; Greeno, 1989a, 1989b; Pea, 1988; Stigler & Baranes, 1988). Studies of practical problem solving have led to questions about whether knowledge of principles, acquired in academic settings, is of much use to practitioners when they come face to face with particular problems (e.g., Carraher, Carraher, & Schliemann, 1985; Lave, 1988; Rogoff & Lave, 1984). Related work questions the extent to which expert practitioners actually hold knowledge in the form of distilled abstract principles, suggesting that the knowledge they use would by more adequately described in terms of a case-by-case response to the particulars of the problems they are attempting to solve (Dreyfus & Dreyfus, 1986; Perkins, 1989).

This work is complemented and informed by studies of how expertise is acquired and used in various professions. Particularly relevant to understanding expertise in teaching are studies of the work of managers, whose job it is to get other people to change (e.g., Isenberg, 1984; Kotter, 1982; Zuboff, 1988). These studies have found that managing the actions and purposes of other people involves learning to think in ways that are highly responsive to the social details of particular problem situations and integrated with action. The similarity between teaching and other personnel managing professions has been recognized for decades (Bidwell, 1965; Parsons, 1959), and its status as a "people-changing profession" is receiving renewed attention (Bereiter & Scardamalia, 1989; Brown, 1989; Cohen, 1988; Jackson, 1988).

Arguments about the situated nature of cognition, like arguments about the existence of schemata, are theoretical attempts to explain the relationship between knowledge and expertise. The theory of situated cognition suggests that all knowledge is a joint construction of mind and the situation in which the mind finds itself confronted with a problem (Clancey, in press; Greeno, 1989a, 1989b; Suchman, 1987; Winograd & Flores, 1986). Psychologists are now claiming that the theory of situated cognition goes farther toward explaining the phenomenon of expertise than the theory of knowledge structures, particularly where expertise makes use of knowledge about how to use language and how to shape social interactions.

The Relationship Between Research on Expertise And Teacher Education

This developing view of expertise in cognitive science follows many of the same thematic lines that we pursued in our examination of the research on teacher thinking available in 1986 and 1987. It underscores the argument that simply knowing how experts structure their thinking about a problem tells us little about how they *use* those knowledge structures in practice. More importantly for connecting research on teacher thinking and teacher education, it cautions us to pay attention to how experts *acquire* whatever knowledge might be said to characterize their thinking about the problems of practice. In a recent paper, Greeno (1990) constructed a metaphor for learning to become an expert that is relevant here. He characterized the domain of knowledge that belongs to experts in a field as an environment in which there is located a collection of resources for knowing, understanding, and reasoning. Knowing, in this image, means actively making use of the resources that are available in the environment and being able to find them when you need them. One needs to be able to "get around" in the territory, as well as have a sense of where there is to go.[2]

Our current reading of cognitive theory and of the research on teacher thinking does not lead to supporting the extreme of personal relativism that Floden and Klinzing criticize, but it does lead to suggesting that the conventional academic pattern of producing general principles from particular cases and delivering those principles to novices may not be the most appropriate form for teacher education to take. This is not to say that research on expert teachers's schemata is not worth doing, if only to give teacher educators a clearer idea of what teacher education ought to be aiming toward. And we would concur with Floden and Klinzing that such studies of expertise could be of use to assessment efforts as well.

Problems With Novices Learning From Experienced Teachers: Who Is an Expert?

In current student teaching arrangements, novices do learn from experienced teachers, not because these teachers articulate their schemata, or because they have been identified by researchers as experts, but because the novices construct their own schemata for making sense of what works in the classrooms where they interact with people *they* assume to be experts. As current work in cognitive psychology would lead us to suspect, learning about teaching in the classroom is much more effective than learning about it in university courses (Ball, 1988; Feiman-Nemser & Buchmann, 1985; Lortie, 1975). As teacher educators with a vision of what a better education for children might be like, we have rejected the idea of turning students over to practicing classroom teachers for initiation to the status quo, and perhaps that is a good decision. Experience does not constitute expertise. Yet if we reject the equation of experience with expertise, we are left with the difficult question of how to decide who is an expert.

This question could be framed in many ways, from the abstract arguments of analytic philosophers about the elements that should determine judgments of quality in the work of teaching to the political arguments that revolve around who has the power and authority to decide what constitutes good teaching that have burdened the project of developing a national system for recognizing professional competence (see Leinhardt, 1990). Leaving aside the thorny but certainly relevant questions of whether judgments about what is good teaching depend on the production of desirable learnings, and of what learnings are desirable and how they might be measured, we will give only a small and quite localized (by subject) example of what we might be getting ourselves into as we try to cull the expert from the experienced in teaching to improve the content of teacher education.

As a fifth-grade mathematics teacher, Lampert has been puzzling over how to interpret two disparate and seemingly contradictory views of expertise that are associated with different lines of research on good mathematics teaching. Both of these lines of research are more than tangential to the problem of what research on teacher thinking can contribute to teaching and teacher education. Leinhardt has done several studies of expert mathematics teaching at the elementary school level in which, among other things, she tried to get at the differences between the schemata that underlie expert action and the schemata that are used by novices (e.g., Leinhardt, in press, Leinhardt & Smith, 1985). One of the much-touted findings of this research is that experts are able to cover a much larger modal number of problems with their students in each class period than novices. Leinhardt attributes this difference to the cohesiveness and flexibility with which experts are able to move through the agenda of a lesson in contrast to novices's more fragmented activity.

Contrast this with the findings of the large-scale study by Stevenson, Lee, & Stigler (1986) comparing mathematics teaching and learning in Japan, China, and the US. If one takes student achievement as the measure of teacher expertise (as Leinhardt does), the Japanese teachers in this study are clearly the most expert. But what do they do? One, maybe two or three problems in each class period! Given similar measures of expertise, these two lines of work produce very different pictures of expert mathematics teaching, and by extrapolation, they have quite different implications for teacher education. There are, of course, many reasons why things are different in Japanese classrooms, but what can we learn from this discrepancy about finding content for teacher education in studies of the work of expert teachers?

Changing Institutional Arrangements

Our proposal that teacher education take account of not only the content of expert teachers's thinking but also the conditions under which they think and use knowledge does not solve the problem of who gets to be called an expert and why. Changing the institutional arrangements in which novices learn from experts might contribute to our thinking about how to define expertise. It also might complicate matters even further by suggesting that an additional quality of expertise is the capacity to guide the professional growth of novices in desirable directions. Nonetheless, we remain optimistic that research on teacher thought and action in the context of practice will be of value to teachers and teacher educators.

This research and the discourse that has grown up around it has prompted teachers, teacher educators, and policymakers to ask and answer new questions about their practices and to use new methods in examining and reflecting on teaching. Reforms such as the use of case methods in professional preparation, school-based teacher education, professional development schools, and mentoring programs could all be thought of as attempts to alter the arrangements whereby novices come in contact with experts's knowledge in the name of paying more attention to how good teachers think in the contexts in which they do their work. These practical experiments suggest that making productive use of research on teacher thinking will make the reform of teacher education even more difficult, but recognizing the difficulties in this work should not be confused with pessimism.

Notes

[1]For an example of attempts to do this for teaching, see Leinhardt and Greeno, 1986, and Leinhardt, 1986.

[2]A similar metaphor for expert cognition has been developed by Spiro, et al. (1987), following the work of Wittgenstein (1953), to characterize the acquisition of knowledge in "ill-structured disciplines."

References

Ball, D. (1988). Unlearning to teach mathematics. *For the Learning of Mathematics, 8*(1), 40–48.

Bereiter, C., & Scardamalia, M. (1989). Intentional learning as a goal of instruction. In L.B. Resnick (Ed.), *Knowing, learning, and instruction: Essays in honor of Robert Glaser* (pp. 361–392). Hillsdale, NJ: Lawrence Erlbaum.

Berman, P., & McLaughlin, M. W. (1978). *Federal programs supporting educational change. Vol. VIII: Implementing and sustaining innovations.* Santa Monica, CA: Rand Corporation.

Bidwell, C. E. (1965). The school as a formal organization. In J. G. March (Ed.), *Handbook of organizations* (pp. 972–1002). Chicago: Rand McNally & Co.

Brown, A. L. (1989). Motivation to learn and understand: On taking charge of one's own learning. *Cognition and Instruction, 5*(4), 311–321.

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher, 18*(1), 32–42.

Carraher, T., Carraher, D., & Schliemann, A. (1985). Mathematics in the streets and in the schools. *British Journal of Developmental Psychology, 3*, 21–29.

Clancey, W. J. (in press). The frame of reference problem in the design of intelligent machines. In K. VanLehn (Ed.), *Architectures for intelligence.* Hillsdale, NJ: Lawrence Erlbaum.

Cohen, D. K. (1988) *Teaching practice: Plus ca change...* East Lansing, MI: National Center for Research on Teacher Education.

Cole, M., & Griffin, P. (1980). Cultural amplifiers reconsidered. In D.R. Olson (Ed.), *The social foundations of language and thought: Essays in honor of Jerome S. Bruner* (pp. 343–364). New York: Norton.

Dreyfus, H. L., & Dreyfus, S. E. (1986). *Mind over machine.* New York: Free Press.

Feiman-Nemser, S., & Buchmann, M. (1985). Pitfalls of experience in teacher preparation. *Teachers College Record, 87*(1), 53–65.

Greeno, J. G. (1987). Mathematical cognition: Accomplishments and challenges in research. In T. A. Romberg, & D. M. Stewart (Eds.), *The monitoring of school mathematics: Background papers. Volume 2: Implications from psychology: Outcomes of instruction* (pp. 3–26). Madison: Wisconsin Center for Education Research.

Greeno, J. G. (1989a). A perspective on thinking. *American psychologist,* 44, 134-141.

Greeno, J. G. (1989b). Situations, mental models, and generative knowledge. In D. Klahr & K. Kotovsky (Eds.), *Complex information processing: The impact of Herbert A. Simon.* Hillsdale, NJ: Lawrence Erlbaum.

Greeno, J. G. (1990). *Number sense as situated knowledge* in a conceptual domain (Report No. IRL90-0014). Palo Alto, CA: Institute for Research on Learning.

Isenberg, D. J. (1984). How senior managers think. *Harvard Business Review, 62*(6), 80–90.

Jackson, P. W. (1988). *The practice of teaching.* New York: Teachers' College Press.

Kotter, J. P. (1982). *The general managers.* New York: Free Press.

Lave, J. (1988). *Cognition in practice: Mind, mathematics, and culture in everyday life.* Cambridge, MA: Cambridge University Press.

Leinhardt, G. (1986, April). *Math lessons: A contrast of novice and expert competence.* Paper presented at the Annual Meeting of the American Educational Research Association, San Francisco, CA.

Leinhardt, G., & Greeno, J. (1986). The cognitive skill of teaching. *Journal of Educational Psychology, 78*(2), 75–95.

Leinhardt, G., & Smith, D. A. (1985). Expertise in mathematics instruction: Subject matter knowledge. *Journal of Educational Psychology, 77*(3), 247–271.

Leinhardt, G. (in press). The development of an expert explanation: An analysis of a sequence of subtraction lessons. *Cognition and Instruction.*

Leinhardt, G. (1990). Capturing craft knowledge in teaching. *Educational Researcher, 19*(2), 18–25

Lortie, D. C. (1975). *Schoolteacher: A sociological study.* Chicago: University of Chicago Press.

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dissemination of research related to education of the deaf. Dues: $5.00. *Contact:* Ila Parasnis, NTID at RIT, One Lomb Memorial Drive, Rochester, NY 14623.

Research on Learning and Instruction in Physical Education
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Parsons, T. (1959). The school class as a social system: Some of its functions in American society. *Harvard Educational Review, 29,* 297–318.

Pea, R. (1988). Putting knowledge to use. In R.S. Nickerson & P.P. Zodhiates (Eds.), *Technology and education: Looking toward 2020* (pp. 169–212). Hillsdale, NJ: Lawrence Erlbaum.

Perkins, D. (1989) Are cognitive skills context-bound? *Educational Researcher, 18* (1), 16–25.

Rogoff, B., & Lave, J. (Eds.).(1984). *Everyday cognition: Its development in social context.* Cambridge, MA: Harvard University Press.

Spiro, R. J., Vispoel, W. L., Schmitz, J. G., Samarapungavan, A., & Boerger, A.E. (1987). *Knowledge acquisition for application: Cognitive flexibility and transfer in complex content domains* (Tech. Rep. No. 409). Champaign: University of Illinois, Center for the Study of Reading.

Stevenson, H. W., Lee, S.Y., & Stigler, J. W. (1986). Mathematics achievement of Chinese, Japanese, and American children. *Science, 231,* 693–699.

Stigler, J. W., & Baranes, R. (1988). Culture and mathematics learning. *Review of Research in Education, 15,* 253–306.

Suchman, L. (1987). *Plans and situated actions.* New York: Cambridge University Press.

Winograd, T., & Flores, F. (1986). *Understanding computers and cognition: A new foundation for design.* Norwood, NJ: Ablex.

Wittgenstein, L. (1953). *Philosophical investigations.* New York: Macmillan.

Zuboff, S. (1988). *In the age of the smart machine.* New York: Basic.