

Developmental Perspectives on Teaching and Learning Thinking Skills

Editor: D. Kuhn



KARGER

Developmental Perspectives on Teaching and Learning Thinking Skills

Volume Editor

Deanna Kuhn, New York, N.Y.

2 figures and 3 tables, 1990

KARGER

Basel · München · Paris · London · New York · New Delhi · Bangkok · Singapore · Tokyo · Sydney

Contributions to Human Development

Library of Congress Cataloging-in-Publication Data

Developmental perspectives on teaching and learning thinking skills /
volume editor, Deanna Kuhn.

(Contributions to human development; v. 21)

Includes bibliographical references and index.

1. Thought and thinking – Study and teaching. 2. Cognition in children.

I. Kuhn, Deanna. II. Series.

LB1590.3.D49 1990

370.15'2 – dc20

ISBN 3–8055–5205–X

All rights reserved.

No part of this publication may be translated into other languages, reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, recording, microcopying, or by any information storage and retrieval system, without permission in writing from the publisher.

- © Copyright 1990 by S. Karger AG, P.O. Box, CH– 4009 Basel (Switzerland)
Printed in Switzerland by Thür AG Offsetdruck, Pratteln
ISBN 3–8055–5205–X

Developmental Perspectives on Teaching and Learning Thinking Skills

Contributions to Human Development

Vol. 21

Series Editor

Deanna Kuhn, New York, N.Y.

KARGER

Basel · München · Paris · London · New York · New Delhi · Bangkok · Singapore · Tokyo · Sydney

Contributors

- Baron, Jonathan, Department of Psychology, University of Pennsylvania,
Philadelphia, PA 19104-6196 (USA)
- Brown, Ann L., Education in Math, Science and Technology, Tolman Hall,
School of Education, University of California, Berkeley, CA 94720 (USA)
- Campione, Joseph C., Education in Math, Science and Technology, Tolman Hall,
School of Education, University of California, Berkeley, CA 94720 (USA)
- Damon, William, Department of Education, Brown University,
Providence, RI 02912 (USA)
- Fischer, Kurt W., Department of Human Development, Graduate School of Education,
Harvard University, Cambridge, MA 02138 (USA)
- Gardner, Howard, Harvard Project Zero, Graduate School of Education,
Harvard University, Cambridge, MA 02138 (USA)
- Glaser, Robert, Learning Research and Development Center, University of Pittsburgh,
Pittsburgh, PA 15260 (USA)
- Kitchener, Karen Strohm, School of Education, University of Denver,
Denver, CO 80208 (USA)
- Krechevsky, Mara, Harvard Project Zero, Graduate School of Education,
Harvard University, Cambridge, MA 02138 (USA)
- Kuhn, Deanna, Teachers College, Columbia University, PO Box 119,
New York, NY 10027 (USA)
- Okagaki, Lynn, Department of Psychology, Yale University, PO Box 11A Yale Station,
New Haven, CT 06515 (USA)
- Schauble, Leona, Learning Research and Development Center, University of Pittsburgh,
Pittsburgh, PA 15260 (USA)
- Sternberg, Robert J., Department of Psychology, Yale University, PO Box 11A,
Yale Station, New Haven, CT 06515 (USA)

Contents

Contributors	VIII
D. Kuhn	
Introduction	1
Identifying and Analyzing Thinking Skills	2
Examining the Understanding of Thinking	4
The Determining Role of Context	5
Thinking as a Social Activity	5
The Development of Thinking Skills	6
Defining Educational Goals	7
References	8
L. Schauble, R. Glaser	
Scientific Thinking in Children and Adults	9
Children's Exploration of the Race Cars Microworld	11
College Adults' Exploration of the Race Cars Microworld	15
Undergraduates' Exploration of a Microeconomics Laboratory	18
Conclusions: Age Differences in Scientific Thinking	21
Implications for Education	25
Acknowledgements	26
References	26
J. Baron	
Harmful Heuristics and the Improvement of Thinking	28
Actively Open-Minded Thinking	29
Heuristics and Biases	31
Where Do Harmful Heuristics Come from?	33

Overgeneralization Error	38
The Development of Biases	43
Conclusion	44
Acknowledgements	45
References	45

K.S. Kitchener, K.W. Fischer

A Skill Approach to the Development of Reflective Thinking . . .	48
The Nature of Higher-Order Reasoning Skills	49
Key Ideas in Skill Theory	53
Functional and Optimal Levels of Reflective Judgment	56
Educational Implications of the Skill Approach	59
Acknowledgements	60
References	61

L. Okagaki, R.J. Sternberg

Teaching Thinking Skills: We're Getting the Context Wrong . . .	63
Context Matters	64
Effect of Context on Children's School Performance	66
Effect of the School Context on Children's Thinking	72
Making School an Effective Context for Teaching Thinking Skills	74
Acknowledgements	76
References	77

M. Krechevsky, H. Gardner

Approaching School Intelligently: An Infusion Approach	79
A New Conception of Intelligence	80
The Practical Intelligence for School (PIFS) Project	82
Conclusions	92
Acknowledgements	93
References	93

W. Damon

Social Relations and Children's Thinking Skills	95
Interactional Diversity and Developmental Outcome	96
Varieties of Adult-Child Learning Interactions	97
Varieties of Peer Interaction and Their Diverse Contributions to Children's Learning	102
Conclusions	105
References	106

A.L. Brown, J.C. Campione

Communities of Learning and Thinking, or a Context by

Any Other Name 108

Higher-Order Thinking Skills in Reading 110

Fostering Reading Comprehension via Reciprocal Teaching 111

Reciprocal Teaching of Coherent Content 113

Reciprocal Teaching in the Context of an Intentional Learning Environment 115

A Context by Any Other Name 122

A Community of Learning 123

Acknowledgements 124

References 125

Subject Index 127

Introduction

Deanna Kuhn

The concern that schools are not doing what they should to educate our youth has never been greater. While some of this concern is focused on students' lack of knowledge in basic subject matter areas of science, mathematics, social studies, and literature, of even greater and increasing concern is the fact that students who progress through our school systems seem not to have acquired the ability to think well. They exhibit at best weak ability to consider alternatives and weigh evidence, reaching independent judgments that they are able to justify in a reasoned way. These are abilities clearly requisite to participation in a rational society, and, arguably, to a fulfilled individual life as well.

Educators over the last decade have shown tremendous interest and investment in developing new curricula, and reforming existing curricula, to promote the development of thinking skills. We would expect these efforts on the part of educators to be supported and enriched by a knowledge base provided by researchers in cognitive and developmental psychology regarding the nature of thinking and its development. The premise underlying the present volume is that in general educators have not had the benefit of this support to the extent they might or should have. The reasons that this has been so I have speculated about previously [Kuhn, 1989a]. Some likely reasons include (a) the tendency of cognitive and developmental researchers until recently to study thinking in forms and contexts removed from those that occur in school or everyday activities, and (b) a focus on the products rather than the process of thinking and knowing. Other trends more specific to developmental psychology of the last decade, but having a similar effect, are (c) a focus on the organization of knowledge within specific knowledge domains, rather than forms of thinking that

extend across domains, and (d) emphasis on identification of cognitive competencies in their earliest, most implicit forms, rather than the explicit forms of knowing of concern to educators.

The focus of the present volume, however, is a forward-looking one, emphasizing the fact that this situation has clearly begun to change. The following chapters all illustrate that those who wish to promote the acquisition of thinking skills can and should benefit from the knowledge and understanding that researchers in cognitive and developmental psychology have achieved. In this introduction I identify five broad respects in which current psychological research provides fundamental insight into teaching and learning thinking skills. Each of the five is well reflected in the chapters that follow.

Identifying and Analyzing Thinking Skills

The first and clearly most fundamental kind of knowledge that psychological research stands to provide is the identification and analysis of thinking skills. Educational programs typically have based their efforts on one or another intuitively-based taxonomy of thinking skills, with little theoretical or empirical justification of why it is this specific set of skills that should be the object of educational efforts. To justify their implementation, on even an experimental basis, thinking skill programs should be informed by psychological knowledge regarding the nature of the thinking strategies that underlie both the faulty and sound thinking that people are observed to use.

Researchers traditionally have not focused their investigations on the actual thinking that takes place in school and other natural contexts, as I noted above, and hence they have had little to offer in the way of theoretical or empirical analysis of thinking skills people might be observed to use outside of artificial problem contexts devised for research purposes. This situation has changed dramatically in recent years, however, and there now exists fundamental knowledge of both a theoretical and empirical nature that is of direct relevance to teaching thinking. Cognitive psychologists have contributed a growing body of work on the nature of informal reasoning [Voss et al., in press] that tells us much about the good and poor reasoning that occurs in the thinking people do about real-life, important problems, typically ones that lack simple solutions. Also from modern cognitive psychology comes the conceptual perspective and research pertain-

ing to judgment and decision [Baron, 1985; Kahneman, Slovic, and Tversky, 1982]. This work has had very little impact on thinking skills efforts, and Baron's chapter in this volume well establishes its relevance. What thinking errors do people in fact make commonly? Unless good and faulty thinking are defined in precise, empirically-grounded ways, Baron observes, teaching efforts risk fixing what's not broken.

Developmental psychologists likewise increasingly have turned their attention to situations more like those in which thinking occurs naturally. They have identified not only a range of good and faulty thinking strategies, but also critical information about the course of development of these strategies across the life span. The chapter by Schauble and Glaser in this volume well represents this growing body of knowledge. Schauble and Glaser focus on comparisons of the thinking of elementary school children and adults as they interpret the bearing of new evidence on their existing understandings of how complex multivariable phenomena operate. Their findings converge with those from several other laboratories in establishing that children and adults differ in more than the extent and organization of the knowledge they possess. They differ as well in the thinking strategies they bring to bear in coordinating their existing knowledge with new evidence and revising their beliefs, i.e., in the *process* in terms of which their knowledge is expanded and reorganized [Dunbar and Klahr, 1988; Kuhn, 1989b; Schauble, 1990]. In his chapter, Baron raises the possibility that some thinking errors may become more prevalent with age. In either case – whether changes are progressive or regressive – educational interventions to teach thinking strategies clearly must base their efforts on a thorough understanding of the changes these strategies normally undergo over the life span in the absence of such intervention.

The thinking skills identified and examined by the present authors by no means comprise an exhaustive set. Indeed, the definitional task is an ongoing one, as empirical findings refine conceptualizations which in turn generate new investigations. Though the thrust of their work has to do with the processes by means of which thinking skills are facilitated, in their chapter Brown and Campione perform the important service of expanding our conceptions of what thinking skills include, by reconceptualizing the traditional domain of reading as one in which thinking skills figure prominently.

Identification and analysis of the thinking strategies involved in both sound and faulty thinking are clearly the 'meat and potatoes' that provide a sound base for educational efforts to teach thinking. As the present chapters make clear, the research task extends beyond identification of thinking

skills themselves. Equally important, how do they interrelate? To what degrees are they tied to certain kinds of content? And also of fundamental importance, what course of development do they show naturally? As Kitchener and Fischer stress in their chapter, thinking skills are not simply isolated techniques or bits of procedural knowledge to be passed on from instructor to student in an accumulative fashion. Thinking has organization, coherence, and certain developmental directions, all of which must be well understood by those who wish to facilitate it.

Yet, the chapters in this volume reflect not only the essential foundation that research provides in understanding the nature of thinking skills and their development. They also demonstrate ways in which research can enrich and expand conceptions of additional factors that come into play in teaching and learning thinking skills. Such factors, highlighted by several of the present chapters, bear crucially on the outcome of educational efforts.

Examining the Understanding of Thinking

One additional factor, beyond thinking skills themselves, that research on thinking points to as critically important is people's understanding of thinking. As Kitchener and Fischer emphasize, thinking strategies are interrelated and organized into a system that represents the individual's mode of understanding the world. This system includes understanding of thinking itself. Such understanding may pertain to a particular strategy – when is it appropriately used and what does it buy one? Krechevsky and Gardner provide a number of such examples in their chapter, as does Baron. It is this understanding that weighs heavily in the issue that educators already have discovered as critical – will newly learned strategies transfer to new contexts beyond the one in which they were acquired?

Another, broader kind of understanding is of the nature of thinking and knowledge more generally. It is the development of this understanding that Kitchener and Fischer address in their chapter. Like the development of thinking itself, this understanding progresses in an organized, rather than haphazard, fashion. The details of the sequence described vary, but research from a number of independent sources, originating with Perry [1970], points to a similar progression in the epistemological understanding of processes of thinking and knowing [Kitchener and King, 1990; Kuhn, forthcoming]. Individuals initially believe that even complex judgments about difficult issues can be made with certainty, given sufficient

information or expertise. Many subsequently shift from this absolutist stance to a relativist one in which nothing is known for certain, as all knowledge depends on the personal, subjective perspective of individuals, who often disagree; as a result, all perspectives on a problem are equally valid. Only later is the acceptance of uncertainty integrated with the recognition that multiple perspectives or judgments are nevertheless subjectable to a process of inquiry and evaluation that can show some to be more correct than others. Even though all of the research shows them to be a minority, it is only individuals whose epistemological understanding is of the latter sort for whom the skills of thinking assume real significance. It is only for them that knowing is the product of a process of reasoned argument. It is as important, then, for educators to promote progress toward this evaluative conception of thinking and knowing as it is to foster the thinking skills that are necessary to practice it.

The Determining Role of Context

A third kind of knowledge that research on thinking provides is the crucial relevance of the environmental contexts in which thinking takes place. Their role is examined in the chapter by Okagaki and Sternberg. Certain contexts elicit and reward certain kinds of thinking. Hence, it is not enough to teach a set of thinking skills without the learner's understanding the relations between these skills and the cognitive and social demands of the various environmental contexts that make up the learner's sphere of experience. To do so is to expend the effort of both teacher and learner to learn skills with no sense of whether the learner will ever have occasion to use them. As both the chapters by Okagaki and Sternberg and by Krechevsky and Gardner emphasize, the school context, though a common one, is a very specialized context. It calls for metacognitive understanding of the specialized forms of thinking that it promotes, and, as Okagaki and Sternberg show, transfer from school to non-school contexts may be especially difficult.

Thinking as a Social Activity

A fourth kind of knowledge provided by research on thinking also has to do with context. It highlights the fact that the contexts in which teaching and learning thinking skills occur are most often social ones. The idea that

social factors affect cognitive functioning is a familiar one. Less common is the proposal made both by Damon in his chapter and by Brown and Campione in theirs that thinking processes may themselves reflect the social activities in which the thinker engages. As Damon phrases it, over the course of development 'children's thinking tends to replicate the procedural logic of the social communications in which they participate'. This is a very productive idea if taken seriously, for in addition to linking the interpersonal and individual planes, as Damon notes, it suggests a way to externalize the internal thinking strategies we would like to foster within the individual, both for the research objective of analysis and the practical objective of facilitation. The correspondence between mental and social activities is perhaps easiest to see among young children and the parent or teacher who guides their developing skill, and it is here that it has most often been explored. But, increasingly, it is being recognized that the correspondence is fully as rich and productive to examine in the case of more complex cognitive skills shown by older children, as Damon's and Brown and Campione's chapters document, and even in the argumentative reasoning central to what we regard as critical thinking among adolescents and adults [Kuhn, forthcoming].

The Development of Thinking Skills

The conception of thinking as a social activity suggests but does not dictate a model of how thinking skills develop. Many social-cognitive theorists lean toward a Vygotskian [1978] model in which cognition expressed in social forms is interiorized as individual thought, while others would favor the more Piagetian view of parallel, but coordinated, development on the individual and social planes [Piaget, 1950]. The question of process brings us finally to a fifth kind of knowledge that research on thinking stands to contribute, one as fundamental as the kind described first, devoted to identifying thinking skills, and that is understanding of the process by means of which thinking skills develop.

Because specific educational influences interact in often complex ways with developmental change that is occurring as a result of more general forms of experience, the study of process is a difficult one, but researchers are increasingly coming to agree that the method must be a microgenetic one in which the change process is observed over an extended period of time. The chapters by Schauble and Glaser and by Brown and Campione

illustrate such approaches. Whether thinking skills can be taught explicitly or must be constructed by learners themselves through their own activities, a contrast that Damon probes, is unresolved. What the social perspective discussed above makes clear, however, is that in any successful learning context the relationship between teacher and learner must be a collaborative one. Therefore, what the learners themselves contribute to the interaction must continually be attended to. Significantly, many of the questions that researchers debate are the same ones that concern educators: Should teaching be implicit and practice-based or explicit? Should it occur in the context of or distinct from academic subject matter? The fact that several of the present authors have devised their own experimental programs to explore these questions and others testifies to the integral relations that must exist between research and practice in the teaching and learning of thinking skills – a set of close and productive relations that the present volume shows are increasingly coming to be realized.

Defining Educational Goals

In concluding, it is worth noting that the researchers who seek to enhance our understanding of thinking and its development are collaborating with educators in what is likely the most significant educational enterprise of all – defining the objectives we wish education to accomplish. The traditional role of psychologist collaborating with the educator has been one of psychologist as technologist, advising the educator regarding how to achieve curriculum objectives, once these objectives have been stipulated by the educator. If the educator's objectives are identified as the mastery of thinking skills, the psychologist might assist by developing instructional methods or by designing research to evaluate outcomes. But in the latter task we encounter a paradox, for often the criterion of success in such evaluations has been improved school performance, whether or not achievement in school involves the skills that are promoted by the thinking skills curriculum being evaluated.

The direction of this relationship arguably should be the reverse. Rather than the success of the thinking skills program being measured by existing school curriculum, the nature of the thinking skills identified as important to effective thinking should shape the content of the school curriculum. In this case, the researcher's role becomes central, shifting from implementer to definer of educational goals. To further clarify and

delineate the nature of the thinking competencies that we want education to impart to our youth is an enterprise that both researchers and educators can involve themselves in, with the knowledge that no educational endeavor is of greater importance to education as a field or to our society's future.

References

- Baron, J. (1985). *Rationality and intelligence*. New York: Cambridge University Press.
- Dunbar, K., & Klahr, D. (1988). Developmental differences in scientific discovery strategies. In D. Klahr & K. Kotovsky (Eds.), *Complex information processing: The impact of Herbert A. Simon* (Proceedings of the 21st Carnegie-Mellon Symposium on Cognition, pp. 104–144). Hillsdale NJ: Erlbaum.
- Kahneman, D., Slovic, P., & Tversky, A. (Eds.). (1982). *Judgment under uncertainty: Heuristics and biases*. New York: Cambridge University Press.
- Kitchener, K.S., & King, P.M. (1990). The reflective judgment model: Ten years of research. In M.L. Commons, C. Armon, L. Kohlberg, F.A. Richards, T.A. Grotzer, & J.D. Sinnott (Eds.), *Adult development 3: Models and methods in the study of adolescent and adult thought*. New York: Praeger.
- Kuhn, D. (1989a). Making cognitive development research relevant to education. In W. Damon (Ed.), *Child development today and tomorrow*. San Francisco: Jossey-Bass.
- Kuhn, D. (1989b). Children and adults as intuitive scientists. *Psychological Review*, 96, 674–689.
- Kuhn, D. (forthcoming). *The skills of argument*.
- Perry, W. (1970). *Forms of intellectual and ethical development in the college years*. New York: Holt, Rinehart & Winston.
- Piaget, J. (1950). *The psychology of intelligence*. London: Routledge & Kegan Paul.
- Schauble, L. (1990). Belief revision in children: The role of prior knowledge and strategies for generating evidence. *Journal of Experimental Child Psychology*, 49, 31–57.
- Vygotsky, L.S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge MA: Harvard University Press.
- Voss, J., Perkins, D., & Segal, J. (in press). *Informal reasoning and education*. Hillsdale NJ: Erlbaum.