

Michelene (Micki) T. H. Chi

Curriculum Vitae

January 3, 2022

PERSONAL DATA

Birth Place: Chiang-Mai, Thailand
Immigrant: From Indonesia, with mother and brothers
Citizenship: Naturalized U.S. citizen at age 16

Home Address

1050 E Driftwood Dr.
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EDUCATION

1970 B.Sc. in Mathematics, Carnegie-Mellon University
1975 Ph.D. in Psychology, Carnegie-Mellon University
Thesis: *The Development of Short-term Memory Capacity*
Mentors: Prof. Herbert Simon (Nobel Laureate in Economics),
Prof. David Klahr, Prof. Patricia Carpenter

RESEARCH AND TEACHING POSITIONS

1970-1974 NIE Trainee, supervised by Prof. David Klahr, Cognitive Developmental Group, Dept. of Psychology, Carnegie Mellon University.

1974-1975 Post-Doctoral Trainee, The Experimental Group, supervised by Profs. Mike Posner & Steve Keele, Department of Psychology, University of Oregon

1975-1977 Post-Doctoral Fellow, supervised by Prof. Robert Glaser, Learning Research and Development Center (LRDC), University of Pittsburgh

1977-2008 Research Associate to Senior Scientist
LRDC, University of Pittsburgh

1982-1990 Assistant to Associate to Full Professor, Department of Psychology, University of Pittsburgh

1990-2008 Professor of Psychology,
Department of Psychology, University of Pittsburgh

1994-1998 Cognitive Program Chair, Department of Psychology, University of Pittsburgh

1996-2001 Adjunct Faculty Member, Section of Medical Informatics,
University of Pittsburgh Medical Center

2008-2010 Professor, Psychology in Education, Graduate School of Education,
Arizona State University (ASU)

2010-2012 Professor, Dept. of Psychology, College of Liberal Arts and Sciences, ASU

2012-2013 Foundation Professor, MLF Teachers College, ASU

2013-2015 Director, Learning Sciences Institute, ASU

2013 – present Director, Learning and Cognition Lab, MLF Teachers' College, ASU

2015 - present Dorothy Bray Endowed Professor of Science and Teaching, ASU

2018 - present Regents' Professor, ASU

HONORS (Post Ph.D.)

Prestigious Prizes

- 2018 The David E. Rumelhart Prize, from the Cognitive Science Society, for significant contribution to the theoretical foundations of human cognition, funded by Robert J. Glushko and Pamela Samuelson Foundation.
- 2020 The Harold W. McGraw Jr. Prize in Education, for pioneering research in the learning sciences to promote active and engaged student learning.

Significant Honors, Awards and Recognition

- 1977-1982 Spencer Fellowship, awarded by the National Academy of Education, for promising research and professional development contributing to the theory and practice of education.
- 1982 Boyd R. McCandless Young Scientist Award, presented by Division 7 of APA, for distinguished theoretical contribution and programmatic research efforts in the field of developmental psychology
- 2001 Cited in Carnegie-Mellon University's Centennial Magazine as one of its 87 most successful undergraduates
- 2006 Chancellor's Distinguished Research Award, Senior Category, for "innovative research of landmark impact in several research areas", University of Pittsburgh
- 2013 Faculty Achievement Award, for excellence in defining edge research/creative activities, Professional Application, ASU
- 2013 Sylvia Scribner Award, AERA, Division 3. The award recognizes the self-explanation program of work that has significantly influenced thinking and research in the field of learning and instruction.
- 2014 Wickenden Award, from the American Society for Engineering Education, for a paper that shows "the highest standards of scholarly research in engineering education published in the *Journal of Engineering Education*" in 2013.
- 2014 MLF Teachers College Outstanding Research Achievement with Impact Award
- 2015 Edward Lee Thorndike Career Achievement Award for Distinguished Contribution to Education, American Psychological Association, in recognition for original, scientific, and empirically-based research that contributes significantly to knowledge, theory, or practice in educational psychology.
- 2016 The AERA Career Award for Distinguished Contributions to Research in Education is the premier acknowledgment of outstanding achievement and success in education research. It is designed to publicize, motivate, encourage, and suggest models for education research at its best.
- 2018 Conferred the title "Regents' Professor", the highest faculty honor, reserved for 3% of professors with exceptional achievements with national and international distinction, ASU.

2018 Inaugural Best Paper Award, the International Society of the Learning Sciences, for the Chi, Kang & Yaghmourian 2017 paper published in the *Journal of the Learning Sciences*.

Honorary Fellowships and Scholar (all elected or invited)

1986 Fellow, Division 7, American Psychological Association

1992 Fellow, Association for Psychological Science

1996 - 1997 Resident Fellow, Center for Advanced Study in the Behavioral Sciences, Stanford, CA

2002 - 2005 Fellow, Center for Philosophy of Science, Univ. of Pittsburgh

2003 One of the 7 inaugural Fellows, Cognitive Science Society

2010 Fellow, National Academy of Education

2013 Fellow, American Educational Research Association (AERA)

2016 Centennial Knowledge Forum Scholar, AERA, one of 32 scholars selected by a crowdsourcing method to engage with policy leaders in a forum about educational research.

2016 Fellow, American Academy of Arts and Sciences

2021 The William James Fellow, Association for Psychological Science (APS), in recognition of a lifetime of significant intellectual contributions to the fields of learning science, cognitive science, and education.
<https://www.psychologicalscience.org/members/awards-and-honors/fellow-award>.

SCHOLARLY IMPACT

1993 Chi, Feltovich & Glaser (1981), (Publication #15 in the reference list) was identified as a Citation Classic.

2000 Chi (1997) (Publication #65), was noted in the editorial of the *Journal of the Learning Sciences* (Kolodner, 2000, p. 2), as one of its “most cited papers” on methodology.

2000 Highlighted in “Reach for the Stars,” a basic research poster session that showcased the research careers of distinguished scholars, AERA.

2002 Chi (1978) (Publication #12) was voted as the 7th “Most Fascinating Studies in Child Psychology,” as surveyed by the Society for Research in Child Development, published in their Oct. newsletter.

2006 Two papers (#15 & #41) were ranked 1st and 7th most highly cited papers published in *Cognitive Science*, (from Goldstone’s 2006 Editor’s report).

2007 Noted by the journal *Auditing: A Journal of Practice and Theory*, as one of its most frequently cited authors.

- 2007 Self-explanation is one of the seven robust principles recommended for classroom implementation, published in a practice guide (Pashler, et al., 2007) in the What Works Clearinghouse (IES).
- 2014 Menekse, Stump, Krause & Chi (Publication #110) received the William Elgin Wickenden Award from the American Society for Engineering Education, recognizing it as representing “the highest standards of scholarly research in engineering education published in the *Journal of Engineering Education*.”
- 2016 Selected by the American Educational Research Association (AERA) as a Knowledge Forum Scholar to give a talk on my ICAP research as part of their “Ed-Talk” video series. <https://www.youtube.com/watch?v=uC-9lViDGL0&feature=youtu.be>
- 2016 Cited as the third of 10 most influential scholars in education research in a report by John T. Bruer, called *Mapping education research and judging influence*, Vol 1, #17, May 2016, Brookings Institution study. <https://www.brookings.edu/wp-content/uploads/2016/07/influence-in-research2.pdf>
- 2016 “Commonsense conceptions of emergent processes: Why some misconceptions are robust” (2005, Publication #88) was listed as one of the most cited papers on science education in the Web of Science database, ranked first under the subcategory, “Student’s thinking about science”.
- 2017 Chi, M. T. H. (2009). Active-Constructive-Interactive: A conceptual framework for differentiating learning activities. *Topics in Cognitive Science*, 1, 73-105. (Publication #100) was the #1 most downloaded paper from the publisher’s website, at 3521 times, as of Sept. 2017.
- 2017 Seminal Papers in Educational Psychology: Paul A. Kirschner’s report from a crowd sourced survey asking colleagues in the community *What article or articles do you feel are seminal articles our field that every (young) research should be aware of?* Two papers: Chi (1997, Publication #65) on Quantifying qualitative analyses of verbal data, and Chi Feltovich & Glaser (1981, Publication #15), *Categorization and representation of physics problems by experts and novices*, were included among the 50.
- 2017 The Chi & Wylie ICAP paper (2014, Publication #118) has been translated and published in Chinese. Titled “Engagement Means Competence: A Summary of the Research and Value of the ICAP Framework” written by QunLi Sheng—a professor at Zhejiang University. The article is published on Open Education Research in Chinese, Volume 23, No. 2, April 2017.
- 2018 Two blogs @ ICAP at Great Britain: One by Grainne Canole, the other by Adam Abdulla.
- 2019 YouTube in French: Vellut, D. (2019). Apprentissage actif ou passif? Élargissez vos horizons avec les 4 modes d’engagement cognitif du modèle ICAP. Louvain Learning Lab. Retrieved from: <https://www.louvainlearninglab.blog/apprentissage-actif-engagement-cognitif-icap-michelene-chi/>
- 2019 Publications #41, #47, #65, #70, #73, #88, #107, #118, #121, #124, and #127, are lead or extended lead articles.

2021 Google Scholar Page: Total citations ~63,300, h-index 78, i10 index 125
<http://scholar.google.com/citations?user=AlW99VQAAAAJ&hl=en>

Invited Keynote or Plenary Speaker at Conferences (titles given below starting on p. 17)

- 1993 Keynote: The 10th International Conference on Machine Learning
- 1995 Keynote: The 17th Annual Conference of the Cognitive Science Society
- 1999 Keynote: Annual meeting of the American Society for Engineering Education, St. Louis, June.
- 2003 Keynote: The 10th European Association for Research on Learning and Instruction, Padova, Italy.
- 2006, 2007 Lead discussant on Transfer (2006) and Expertise (2007), at the National Science Foundation meetings, Oct. 2006, 2007.
- 2008 Keynote: The VI European Meeting in Conceptual Change, Turku, Finland
- 2010 Lead speaker: Communication Analysis Workshop, Tempe, AZ
- 2011 “Highlighted Session Speaker” at International Conference on Computers in Education, for the sub-conference track Computer-supported Collaborative Learning, Chiang-Mai, Thailand, Nov.
- 2012 Mastering Leadership Conference, sponsored by Pearson, Scottsdale, March.
- 2014 Sylvia Scribner Award Address, AERA, April.
- 2014 Plenary speaker on “Conceptual Change Across Domain: Science,” for the Conceptual Change Sig on *Generic and Specific Issues in Conceptual Change in Science*, Bologna, Italy, August.
- 2015 Featured speaker at the “Rice Workshop on Personalized Learning,” April.
- 2015 Award address: E.L. Thorndike Career Achievement Award, American Psychological Association, in recognition for original, scientific, and empirically-based research that contributes significantly to knowledge, theory, or practice in educational psychology, July.
- 2016 Public Scholarship Ed-Talk, presented at a Presidential Session on *Challenging Common Sense Conceptions of Learning*, Feb.
- 2016 Keynote speaker: “*Counter-intuitive Findings and Implications for Teaching from the Sciences of Learning*.” Snell Conference: Practicing the Art and Science of Teaching, Center for the Art and Science of Teaching, Oct.
- 2017 Invited as a featured scholar in the Wisconsin Ideas in Education Series (WIES) at the University of Wisconsin-Madison to present a talk titled: “*ICAP: A theoretical framework for how to engage students to promote deeper learning*,” Feb.
- 2017 Plenary speaker on “*Teaching Emergence: An Attempt at Differentiating Science Concepts of Processes*” at the National Association for Research in Science Teaching (NARST) conference for *Challenges in Learning Science Concepts*. April.
- 2017 Special presentation, at AERA Presidential Session on *Acquired Wisdom. Lessons Learned by Distinguished Researchers* with the session paper:
- 2017 AERA award address, presented at the Distinguished Contributions to Research in Education Award session: *Translating ICAP on Student Engagement into Practice*.

- 2017 Keynote at the TRUSE (Transforming Research in Undergraduate STEM Education) conference on STEM education hosted at St. Thomas University with the talk, “ICAP: How to Promote Deeper Active Learning Engagement”
- 2017 Keynote speaker at the National Conference on Technology-Enhanced Learning hosted by the National University of Singapore. Keynote titled, “Implications of ICAP, a Theory of Student Engagement, for Technology-enhanced Practices”.
- 2018 Keynote speaker, “Conceptual change in understanding collective causality versus cumulative causality,” at the 2nd Interdisciplinary REASON Spring School hosted by the Munich Center of the Learning Sciences in Munich, Germany, March 2018.
- 2018 Workshop speaker, at the 2nd REASON Spring School hosted by the Munich Center of the Learning Sciences, Munich, Germany, March 2018.
- 2018 Keynote speaker, “Teachers Translating a Theory of Cognitive Engagement into Practice,” at the 11th Annual Subway Summit hosted by Columbia University, Teachers’ College, New York, NY, June 2018.
- 2018 Keynote speaker, “How to Promote Deeper Learning by Engaging Students Cognitively” at the College of Developmental and Educational psychology, Key Laboratory of Modern Teaching Technology, Ministry of Education Shaanxi Normal University in China
- 2018 Keynote speaker, “ICAP: How to Promote Deeper Learning by Engaging Students Cognitively,” at the 6th Computational Behavior Science Summit—Behavioral Data Analysis and Application in Wuhan, China
- 2018 Colloquium: “Why is it Important for Students to be *Constructive* While Learning?” presented to the Graduate College, Central China Normal University in Wuhan, China
- 2018 Colloquium: “ICAP: How to Promote Deeper Learning by Engaging Students Constructively.” Talk presented to the Tsinghua Institute of Education at Tsinghua University
- 2019 Plenary speaker, “ICAP: How to Promote Deeper Learning by Engaging Students Cognitively” at the Chicago Symposium Series on Excellence in Teaching Mathematics and Science at Northern Illinois University, Naperville, IL, Feb.
- 2019 Rumelhart Prize Address, “Translating the ICAP Theory of Cognitive Engagement into Practice” at the 41st Annual Conference of the Cognitive Science Society at Montreal, Canada July.
- 2019 Plenary speaker, “ICAP: How to Promote Deeper Learning by Engaging Students Constructively and Co-constructively” at the Annual Conference of the International Association for Medical Education in Vienna, Austria, August.
- 2019 Keynote speaker, “ICAP-A Framework for Active Learning,” presented at the curriculum retreat of Penn State Medical School, Hershey, PA, October.
- 2019 Simon Initiative Distinguished Lecture, “ICAP: How to Promote Deeper Learning by Engaging Students Cognitively,” Carnegie-Mellon University, Pittsburgh, November.
- 2020 Plenary speaker, “ICAP: How to promote deeper learning by engaging students cognitively” at the 42nd Annual National Institute on the Teaching of Psychology (NITOP) in St. Pete Beach, Florida, January, 2020.

- 2021 Zoom lecture about ICAP for teachers, administrators, people in business, researchers and students, at the workshop Agents for Bridging Learning Research and Educational Practice, supported by Uchida Yoko, invited by Mutsumim Imai, Japan, Nov.

EXTERNAL FUNDING

Grants awarded since arriving at Arizona State University in 2008

- Using a Cognitive Framework of Differentiated Overt Learning Activities (DOLA) for Designing Effective Classroom Instruction in Materials Science and Nanotechnology. **M.T.H. Chi (P.I.)** & S. Krause (co-P.I.) (Materials Science Engineering), NSF Engineering Education Program, Award No. 0935235, \$400,000, Sept. 1, 2009 to Aug. 31, 2012.
- Comprehension SEEDING: Comprehension through Self-Explanation, Enhanced Discussion, and Inquiry Generation. Rodney D. Nielsen (P.I.) (Boulder Language Technologies, CO) and **M.T.H. Chi (co-P.I.)**, Institute of Education Science (R305A110811), 2011-2014. Budget for ASU sub-award to Chi, \$409,003. (Coeus Award No. 024969-001).
- Learning from Observing Learning with Dynamic Simulations. **M.T.H. Chi (P.I.)**, The Spencer Foundation Major Grant Program, Award No. 200800196, \$500,000, 2008-2012.
- Developing Guidelines for Optimizing Levels of Students' Overt Engagement Activities. **M.T.H. Chi (P.I.)**, & Roy Levy (co-P.I.), Institute of Education Science, (R305A110090), \$1,399,212. (Coeus Award No. 024405-001). 2011-2014
- Learning from Dialog versus Monolog Videos. **M.T.H. Chi (P.I.)**, & Sara Brownell (co-PI), National Science Foundation, \$249,995, April 1, 2016 to March 31, 2019.
- Developing and Revising Instructional Activities to Optimize Cognitive Engagement. **M.T.H. Chi (P.I.)**. Institute of Education Sciences, \$1,456,185. (R305A150432) Aug. 16, 2015 to Aug. 15, 2019.
- *Teaching the Crosscutting Concept of Emergent Cause-and-Effect to Overcome Misconceptions*. **M.T.H. Chi (P.I.)**. Institute of Education Sciences, \$1,456,431. (R305A150336) Aug. 16, 2015 to Aug. 15, 2021.

Currently Active Grants

- *Improving Online Learning from Tutorial Dialog Videos*. **M.T.H. Chi (P.I.)** & Yi-chun Hong (co-P.I.). NSF IUSE Proposal 1915150. \$600,000. Oct. 1, 2019 to Sept. 30, 2021
- *Teaching How to Learn: Promoting Self-regulated Learning in STEM Classes*. \$370,640 (USD) from Australian Research Council DP190102366, 20188-2022. S. Vosniadou, Chief Investigator (CI), M. Lawson, CI, L. Graham, CI, C. Dignath van Ewijk, Partner Investigator, **M. Chi, Partner Investigator**. This grant supports international collaboration with funds for M. Chi to travel to Australia.

RESEARCH PROJECTS

Differentiating Active Engagement: The ICAP Project

ICAP is a science of learning theory that defines active learning in terms of a set of four differentiated physical or overt modes of engagement that students can undertake while learning in a variety of instructional contexts across a variety of content domains. Thus, ICAP provides a framework to differentiate students' physical activities when interacting with instruction. Moreover, based on the conjectured learning processes underlying each mode, the four modes predict different levels of learning.

Thus, ICAP provides operational definition for cognitive engagement based on the processes of physically interacting with instruction, such as taking notes, copying notes, drawing diagrams, and so forth.

The operational definition of cognitive engagement based on physical interactions can be translated into simple heuristics that instructors can easily adopt and use, for designing lessons, evaluating assessment questions and digital tools, coding videos, and so forth. Professional development modules can be provided for K-12 as well as college faculty.

Misunderstanding Acausal Processes: The PAIR-C project

PAIR-C is a new theory that explains why students have persistent misconceptions about the cause-effect relations of scientific processes, such as diffusion and natural selection. PAIR-C conjectures that many of these misconceived kind of science processes have an “acausal” underlying structure. An acausal process is one in which the visible pattern one sees are *not* caused by an antecedent incidence(s) or agents’ actions, but rather, the pattern one sees simply emerged from the collective summing of all the interactions of the agents participating in the process. For example, although the V-shape formation of airplanes at an air show is created by the lead pilot in telling the other pilots what positions to fly in, the similar V-shape formation of geese flocking is not dictated by a leader goose. The V-pattern merely emerges from the vector summing of the locations and directions of all the geese’s interactions over time.

I have identified the dimensions and characteristics of acausal processes, and noticed that the characteristics are diametrically opposite of the characteristics for causal processes, suggesting that they are ontologically distinct. My hypothesis is that misconceptions occur when a student incorrectly uses a more familiar causal schema to explain the cause-effect relations of these acausal or emergent kind of processes.

The goal of this project was to develop a module that can teach the underlying acausal structure, and see whether students, having learned about acausal structure, can enhance their understanding of acausal kind of science processes. Our results show that understanding acausal structure cannot be achieved by a short instructional context, such as 2-3 hours. However, it does enhance understanding of acausal processes that align closely with the acausal structure we taught, such as the process of diffusion, but more complicated processes, such as natural selection, may require that we expand our underlying structure.

New Format of Presenting Instructional Materials for Online Learning: The Dialog-Monolog project

The NSF-funded Dialog-Monolog video project introduces a new paradigm for online learning that was developed and tested in several lab studies, undertaken several years ago. The idea is to use tutorial dialog videos to get across instructional knowledge and skills, rather than the standard knowledge-telling monolog videos that instructors typically create. The goals of the project are (1) to test these novel instructional video formats in authentic college science classrooms, and (2) to explain how the dialog format mediate student achievement. We found significant learning benefits of dialog videos in authentic large college science classrooms. The results from this project could have compelling implications for developing digital materials to facilitate STEM learning, in terms of new ways to deliver content to college students.

PUBLICATIONS [The publications with citations above 500 are indicated with their Google counts. Postdocs and students’ names are underlined.]

Edited Books

1. Chi, M. T. H. (Ed.). (1983). *Trends in memory development research*. (Vol. 9). Basel: NY: S. Karger.
2. Chi, M. T. H., Glaser, R., & Farr, M. (Eds.). (1988). *The nature of expertise*. Hillsdale, NJ: Erlbaum. **[Google citations: 4004]**
3. Durso, F. T., Nickerson, R. S., Schvaneveldt, R. W., Dumais, S. T., Lindsay, D. S., Chi, M. T. H. (Eds.) (1999). *Handbook of Applied Cognition*. England: John Wiley & Sons.

Papers

4. Chi, M. T. H., & Chase, W. G. (1972). Effects of modality and similarity on context recall. *Journal of Experimental Psychology*, 96, 219-222.
5. Chi, M. T. H., & Klahr, D. (1975). Span and rate of apprehension in children and adults. *Journal of Experimental Child Psychology*, 19, 434-439.
6. Chi, M. T. H. (1975). *The development of short-term memory capacity*. Doctoral dissertation, Carnegie-Mellon University, Pittsburgh, PA.
7. Chi, M. T. H. (1976). The representation of knowledge. *Contemporary Psychology*, 21, 784-785. (Review of Norman and Rumelhart's *Exploration in cognition*.)
8. Chi, M. T. H. (1976). Short-term memory limitations in children: Capacity or processing deficits? *Memory & Cognition*, 4, 559-572.
9. Chi, M. T. H. (1977). Age differences in memory span. *Journal of Experimental Child Psychology*, 23, 266-281.
10. Kail, R. V., Chi, M. T. H., Ingram, A. L., & Danner, F. W. (1977). Constructive aspects of children's reading comprehension. *Child Development*, 48, 684-688.
11. Chi, M. T. H. (1977). Age differences in the speed of processing: A critique. *Developmental Psychology*, 13, 543-544.
12. Chi, M. T. H. (1978). Knowledge structures and memory development. In R. Siegler (Ed.), *Children's Thinking: What Develops?* (pp. 73-96). Hillsdale, NJ: Erlbaum.
Reprinted in: (1993) *Worlds of Childhood Reader*, Wozniak R (ed.), 232-239. **[Google citations: 1,722]**
13. Chi, M. T. H. (1979). The growth and development of knowledge. *Contemporary Psychology*, 24, 760-761. (Review of P. Ornstein (Ed.), *Memory Development in Children*.)
14. Chi, M. T. H., & Glaser, R. (1980). The measurement of expertise: Analysis of the development of knowledge and skill as a basis for assessing achievement. In E. L. Baker & E. L. Quellmalz (Eds.), *Design, Analysis, and Policy in Testing and Evaluation* (pp. 37-48). Beverly Hills, CA: Sage Publications. (Abstract also published in *Evaluation Comment*, 1978, 5, 9.)
15. Chi, M. T. H., Feltovich, P., & Glaser, R. (1981). Categorization and representation of physics problems by experts and novices. *Cognitive Science*, 5, 121-152. (a citation classic) **[Google citations: 8,286]**
16. Chi, M. T. H. (1981). Sources of memory development. *Proceedings of the North American Society for the Psychology of Sport and Physical Activity* Annual Conference.
17. Chi, M. T. H. (1981). Knowledge development and memory performance. In M. Friedman, J. P. Das, & N. O'Conner (Eds.), *Intelligence and Learning* (pp. 221-230). New York, NY: Plenum Press.
18. Chase, W. G., & Chi, M. T. H. (1981). Cognitive skill: Implications for spatial skill in large-scale environments. In J. Harvey (Ed.), *Cognition, Social Behaviors, and the Environment* (pp. 111-136). Hillsdale, NJ: Erlbaum.

19. Chi, M. T. H., Glaser, R. & Rees, E. (1982). Expertise in problem solving. In R. Sternberg (Ed.), *Advances in the Psychology of Human Intelligence* (Vol. 1, pp. 7-76). Hillsdale, NJ: Erlbaum. **[Google citations: 3,571]**
20. Chi, M. T. H., & Gallagher, J. D. (1982). Speed of processing: A developmental source of limitation. Special Issue, H. Lee Swanson (Ed.), *Topics in Learning and Learning Disabilities*, 2, 23-32.
21. Chi, M. T. H. (1983). The role of knowledge on problem solving and consumer choice behavior. In R. P. Bagozzi & A. M. Tybout (Eds.), *Advances in Consumer Research* (Vol. X).
22. Chi, M. T. H. (1983). Knowledge-derived categorization in young children. In D. R. Rogers & J. A. Sloboda (Eds.), *The acquisition of symbolic skills* (pp. 327-334). New York, NY: Plenum Press.
23. Chi, M. T. H., & Koeske, R. (1983). Network representation of a child's dinosaur knowledge. *Developmental Psychology*, 19, 29-39. **[Google citations: 720]**
24. Chi, M. T. H. & Rees, E. (1983). A learning framework for development. In M. T. H. Chi (Ed.), *Trends in memory development research* (Vol. 9, pp. 71-107), Basel, New York, NY: S. Karger.
25. Chi, M. T. H. (1984). Representing knowledge and metaknowledge: Implications for interpreting metamemory research. In F. E. Weinert & R. Kluwe (Eds.), *Learning by thinking* (pp. 239-266). Stuttgart, West Germany: Kohlhammer.
(Also reprinted in F. E. Weinert & R. H. Kluwe (Eds.) (1987). *Metacognition, motivation and understanding* (pp. 211-232). Hillsdale, NJ: Erlbaum.)
26. Chi, M. T. H. (1985). Changing conception of sources of memory development. *Human Development*, 28, 50-56.
27. Chi, M. T. H. (1985). Interactive roles of knowledge and strategies in the development of organized sorting and recall. In S. Chipman, J. Segal, & R. Glaser (Eds.), *Thinking and Learning Skills: Current Research and Open Questions* (Vol. 2, pp. 457-485). Hillsdale, NJ: Erlbaum.
(Abstract reprinted in the Franklin Institute Press, December 1980.)
28. Chi, M. T. H., & Glaser, R. (1985). Problem solving ability. In R. Sternberg (Ed.), *Human Abilities: An Information-processing Approach* (pp. 227-257). San Francisco, CA: W. H. Freeman & Co. **(Google citations: 577).**
29. Gobbo, C., & Chi, M. T. H. (1986). How knowledge is structured and used by expert and novice children. *Cognitive Development*, 1, 221-237.
30. Mitchell, A. A., & Chi, M. T. H. (1986). Measuring knowledge within a domain. In P. Nagy (Ed.), *The Representation of Cognitive Structures* (pp. 85-116). Toronto: Ontario Institute for Studies in Education.
31. Rabinowitz, M. & Chi, M. T. H. (1986). An interactive model of strategic processing. In S. J. Ceci (Ed.), *Handbook of the Cognitive, Social, and Neuropsychological Aspects of Learning Disabilities* (pp. 83-102). Hillsdale, NJ: Erlbaum.
32. Chi, M. T. H., & Ceci, S. J. (1987). Content knowledge: Its role, representation and restructuring in memory development. In H. W. Reese (Ed.), *Advances in Child Development and Behavior* (Vol. 20, pp. 91-

- 142). New York: Academic Press. **(Google citations: 539)**
33. Chi, M. T. H., & Greeno, J. G. (1987). Cognitive research relevant to education. *Psychology and Educational Policy*, 517, 39-57.
 34. Chi, M. T. H. (1988). Children's lack of access and knowledge reorganization: An example from the concept of animism. In F. Weinert & M. Perlmutter (Eds.), *Memory Development: Universal Changes and Individual Differences* (pp. 169-194). Hillsdale, NJ: Erlbaum.
 35. Glaser, R., & Chi, M. T. H. (1988). Overview. In M. T. H. Chi, R. Glaser, & M. Farr (Eds.), *The Nature of Expertise* (pp. xv-xxviii). Hillsdale, NJ: Erlbaum.
 36. Resnick, L., & Chi, M. T. H. (1988). Cognitive psychology and science learning. In M. Druger (Ed.), *Science for the Fun of It* (pp. 24-31). Washington, DC: National Science Teachers Association.
 37. Reiner, M., Chi, M. T. H., & Resnick, L. (1988). Naive materialistic belief: An underlying epistemological commitment. *Proceedings of the Tenth Annual Conference of the Cognitive Science Society* (pp. 544-551). Hillsdale, NJ: Erlbaum.
 38. Chi, M. T. H., & Bassok, M. (1989). Learning from examples via self-explanations. In L. B. Resnick (Ed.), *Knowing, Learning, and Instruction: Essays in honor of Robert Glaser* (pp. 251-282). Hillsdale, NJ: Erlbaum. **(Google citations: 531)**
 39. Reimann, P., & Chi, M. T. H. (1989). Expertise in complex problem solving. In K. J. Gilhooly (Ed.), *Human and Machine Problem Solving* (pp. 161-192). New York, NY: Plenum Press.
 40. Chi, M. T. H., Hutchinson, J., & Robin, A. F. (1989). How inferences about novel domain-related concepts can be constrained by structured knowledge. *Merrill-Palmer Quarterly*, 35, 27-62.
 41. Chi, M. T. H., Bassok, M., Lewis, M., Reimann, P., & Glaser, R. (1989). Self-explanations: How students study and use examples in learning to solve problems. *Cognitive Science*, 13, 145-182. (Lead article) **[Google citations: 4,180]**
 42. Chi, M. T. H. (1989). Assimilating evidence: The key to revision? (Commentary on P. Thagard's Explanatory Coherence paper). *Behavioral and Brain Sciences*, 12(3), 470-471.
 43. Chi, M. T. H. (1991). Memory development. In M.W. Eysenck, A. Ellis, and E. Hunt, & P. Johnson-Laird (Eds.) *The Blackwell Dictionary of Cognitive Psychology* (pp. 218-222). Oxford, England: Basil Blackwell.
 44. Chi, M. T. H. & Bjork, R. (1991). Modelling expertise. In D. Druckman & R. Bjork (Eds.) *In the Mind's Eye: Understanding Human Performance* (pp. 57-79). National Academy Press: Washington, D.C.
 45. VanLehn, K. A., Jones, R. M., & Chi, M. T. H. (1991). Modeling the self-explanation effects with Cascade 3. In K. Hammond & D. Gentner (Eds.), *Proceedings of the Thirteenth Annual Conference of the Cognitive Science Society*. Hillsdale, NJ: Erlbaum.
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<https://doi.org/10.1111/cogs.12626> (Extended lead article).
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126. Menekse, M., & Chi, M.T.H. (2019). The role of collaborative interactions versus individual construction on students' learning of engineering concepts. *European Journal of Engineering Education, 44*(5), 702-725. doi.org/10.1080/03043797.2018.1538324
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130. Chi, M.T.H. (in press). The self-explanation principle in multimedia learning. In R.E. Mayer & L. Fiorella (Eds.), *The Cambridge Handbook of Multimedia Learning: Third Edition*. Cambridge University Press.
131. Chi, M.T.H. (under review). Causal structures for explaining misconceptions of process-concepts. *Cognitive Science*.
132. Chi, M. T. H., Boucher, N., & Ha, J. (in press). The efficacy of learning strategies from the ICAP perspective. In R. Tierney, F. Rizvi, & K. Ercikan (Eds.) *International Encyclopedia of Education* (4th edition).
133. Chi, M. T. H., & Boucher, N. (in press). Applying the ICAP framework to improve classroom learning. In C. E. Overson, C. M. Hakala, L. L. Kordonowy, & V. A. Benassi (Eds), *In their own words: What scholars want you to know about why and how to apply the science of learning in your academic setting*.

Invited Keynotes, Colloquia, Tutorials, Symposia, and Workshops since 1990 (this section includes the titles of the keynote addresses, which are listed on p. 5-6, but excludes conference talks, which are listed only for 2017-2020.)

1990

Colloquium on *The Nature of Self-Explanations*, University of Colorado, January.

Workshop speaker on *Learning and Problem Solving in Students*. The Pittsburgh Area Independent School Teachers Association Annual Conference, Sewickley Academy, Pittsburgh, October.

1991

Workshop speaker on *Construction and revision of mental models during learning*. The Third Biannual Workshop on Cognition and Instruction, Pittsburgh, PA.

1992

Chi, M. T. H., de Leeuw, N., Chiu, M. H., & LaVancher, C. "Self-explanations improve learning." Poster presented at the NATO Advance Study Institute on Psychological and Educational Foundations of Technology-Based Learning Environments. Orthodox Academy, Kalymbari, Greece, July, 1992.

Chair/Discussant of the session on *Capturing and Modeling the Process of Conceptual Change in the Physical Sciences*. At the NATO Advance Study Institute on Psychological and Educational Foundations of Technology-Based Learning Environments. Orthodox Academy, Kalymbari, Greece, July, 1992.

1993

Colloquium speaker: "Self-explanations improve understanding: But do they promote conceptual change?" Presented at the Department of Psychology, Princeton University, Princeton, February.

Colloquium speaker: "Can misconceptions in science be removed?" Graduate Institute of Science Education, National Taiwan Normal University, Taipei, Taiwan, March.

Lecturer: "Self-explanations improve learning." At the Research Center of Cognitive Studies, National Chung Cheng University's conference on math education, Chia-yi, Taiwan, March.

Exhibit: "Constructing knowledge: How talking to yourself may improve learning." Carnegie Science Center, Pittsburgh, May 2-15.

Panel Discussant: "Conceptual change and the acquisition of expertise." *The Third International Workshop on Human and Machine Cognition*, Seaside, Florida, May. (I was the panel member invited to represent the cognitive science view. Other members represented views from A.I., anthropology, situated cognition, and so forth.)

Paper Presenter: "Barriers to conceptual change in learning science concepts: A Theoretical Conjecture." *Cognitive Science Conference*, Boulder, June.

Symposium presenter: "Cascade and self-explanations." For the symposium, *Cognitive models of problem solving*, Cognitive Science Conference, Boulder, June.

Keynote speaker: "The role of self-explanations as a form of knowledge construction." At the *Tenth International Conference on Machine Learning*, Amherst, June. (The Machine Learning conference invites a keynote speaker each year from an outside discipline. Other cognitive psychologists invited in the past were Doug Medin, Mike Posner, and so forth.)

Workshop participant and speaker: "Teaching for understanding." *Harvard Project Zero*, Boston, October.

1994

Invited Speaker: "What is learned in context?". Naturalistic Decision Making Conference, Dayton, Ohio, June.

Symposium speaker: "Stolen knowledge: Knowledge acquired through practice". Third Practical Aspects of Memory Workshop. University of Maryland, College Park, MD, August.

Colloquium speaker. "Self-explaining: An effective general learning skill?" New Mexico State University. Las Cruces, NM, December.

1995

Invited speaker: "Acquisition of concepts of processes." Creative Concepts Conference, Texas A & M University, College Station, Texas, May.

Speaker on "Creating Schools that Develop Expertise in Students." Workshop on The Gifted School. Hosted by OERI and Council for Exceptional Children. Tyson's Corner, Virginia, June.

Keynote speaker: "Revising a mental model as one learns." *The Seventeenth Annual Conference of the Cognitive Science Society*. University of Pittsburgh, Pittsburgh, PA, July.

Keynote speaker: "Self-explaining is the construction of a mental model" at the University of Memphis Conference on Reasoning, Memphis, Tennessee, September.

Invited speaker: "Learning from text by self-explaining." Clarion University, Clarion, PA, Nov.

1996

Workshop participant at Sage Foundation on *Literacy*, New York, April.

1997

Colloquium speaker, "How to Learn More Effectively", presented at Center for Advanced Study in the Behavioral Sciences, February.

Colloquium speaker, "Self-Explaining: A Domain-General Learning Activity". presented to the Education in Math, Science, and Technology group, U.C. Berkeley, March.

Colloquium speaker, "Self-Explaining: A Domain-General Learning Activity". presented to the Center for Research in Mathematics and Science Education, San Diego State University, April.

Colloquium speaker, "Learning Compatible vs Incompatible Concepts: Incrementally versus Conceptual Change", presented to the Department of Psychology, Stanford University, April.

Guest Lecturer, Symbolic Systems, School of Education, Stanford University, June.

Colloquium speaker, "Conceptual Change in Learning Complex Concepts", presented to the Cognitive Science Program, Georgia Tech, November.

1998

Workshop speaker, "Current Research in Medical Education", presented at the Workshop on Formalizing the Informal: A Rationale for the Clinical Teaching of Medical Students and Residents. University of Pittsburgh Medical Center, Center for Continuing Education in the Health Sciences, March.

Presenter, "Learning Concepts of Equilibration Processes", at the Conference on Designing for Science, Learning Research and Development Center, April.

Tutorial speaker: "Discourse in Contexts of Learning ", *Twentieth Annual Conference of the Cognitive Science Society*, Madison, WI, August.

Conference speaker, "Misrepresenting Complex Dynamic Systems as Events: A barrier to Learning Science", *EARLI Second European Symposium on Conceptual Change*. Madrid, Spain, November.

Speaker, "What Makes Human Tutoring Effective?" Circle Seminar Series on Tutoring. Carnegie Mellon University, December.

1999

Speaker, "What makes human tutoring effective?" National Science Foundation, Washington D.C., Jan.

Speaker, "Why are decentralized concepts so hard to learn?" at the UCI Conference on Decentralization. Sponsored by the Institute for Mathematical Behavioral Sciences and the Department of Economics, University of California at Irvine, February.

Speaker, "Assessment of Conceptual Change", presented to the Committee on the Foundation of Assessment, National Academy of Sciences/National Research Council, Board on Testing and Assessment, Irvine, CA, May.

Guest speaker, "Understanding Emergent Versus Causal Mechanisms: Overcoming Obstacles to Learning Science Concepts", along with Jay McClelland, at a Seminar on *How the Brain Learns*, Harrisburg, PA, June.

Keynote speaker: Annual meeting of the American Society for Engineering Education, St. Louis, June.

Colloquium speaker, "Misclassifying Processes as Objects and Emergence as Causality: Why We Misunderstand Many Complex Concepts and Phenomena". NEBARS at University of Connecticut, November.

Workshop speaker on Classroom and Tutorial Discourse. Organizers: Brian MacWhinney, Catherine Snow and Steven Bird. Carnegie Mellon University, Pittsburgh, PA, December.

2000

Speaker, "Emergent versus Causal Schemas", presented at an interactive symposium on Conceptual Change and Complex Causality, organized by David Perkins, American Educational Research Association, New Orleans, April.

Distinguished Lecturer, "Assessment of Learning at Three Different Grain Sizes", presented at the American Society for Engineering Education Conference, St. Louis, June.

Presenter, "How Can We Enhance Students' Learning?" at a workshop of the University of Pittsburgh Medical Complex School of Profusion, Nov. 2000.

2001

"Why do students fail to understand *complex dynamic* type of concepts?" Presented in the symposium *Conceptual change and complex causality: Furthering the conversation*. American Educational Research Association, Seattle, April 2001.

Participant in a Workshop, sponsored by the Russell Sage Foundation, to react to their report on their Literacy Program. New York, NY, June 2001.

2002

Presenter, "Learning through collaborative observation of tutoring" at the CIRCLE Advisory Board Meeting, Pittsburgh, March.

One of the scholars whose work was highlighted at an American Educational Research Association poster session called *Reach for the Stars*. New Orleans, LA, April 2002.

Presenter, "Learning from physics text: Effects of interactive and observed discourse with tutors and peers", at a Symposium on Conceptual Learning from Scientific Text and Discourse, at the Society for Text and Discourse conference. Chicago, IL, June 2002.

Commentary provided for the Graduate Record Exam Symposium, at the Graduate Record Exam Board Meeting, Seattle, June 2002.

Workshop presenter, to help Office of Naval Research shape a new 6.1 ONR program on Cognitive Science and Human Performance. Las Cruces, NM, October 2002.

2003

Distinguished Speaker, "Emergent systems versus Causal Events: Schemas for Overcoming versus Generating Misconceptions in Science", presented for the Cognitive Science Colloquium Series, Department of Psychology, Georgia Tech, Atlanta, Georgia, March 2003.

Keynote speaker, "Emergent versus Commonsense Causal Processes: How Misconceptions in

Science Arise and How They Can Be Overcome,” presented at the 10th European Association for Research on Learning and Instruction, Padova, Italy.

2004

Keynote speaker, “How Students Learn”. Colloquium on Teaching and Learning, Rensselaer Polytechnic Institute, May 2004.

2005

Discussant at the Adaptive Expertise Colloquium, organized by the LIFE Science of Learning Center, VaNTH Engineering Research Centers, and SRI International, Palo Alto, CA, Sept 2005.

2006

Participant at the Santa Fe Institute’s Educational Outreach Workshop on *Complex Dynamic Systems*, Santa Fe, NM, March 2006.

Discussant for the symposium *How to support explanation in the classroom: The role of teachers and tasks*. American Educational Research Association meeting, San Francisco, CA, April 2006.

Lead discussant at the NSF workshop on *Transfer and Expertise*, Arlington, November.

Colloquium speaker, *Learning from Tutoring and Observing Tutoring Collaboratively*, OISE, Toronto, Canada, November 2006.

2007

Participant in the Evolution Challenge Workshop, Las Vegas, NV February.

Lead discussant on *Expertise* at the National Science Foundation meeting, Oct.

A discussant, along with Rich Shavelson, for a Presidential session on “Professional Expertise”, Chicago, IL, April 2007.

2008

“Co-construction from Joint Explaining”. Paper presented at International Conference of the Learning Sciences, Utrecht, Netherlands, June 2008.

Keynote address: “Qualitative misunderstanding of emergent processes.” Presented at the VI European Meeting in Conceptual Change, Turku, Finland, August 16, 2008.

“Qualitative misunderstanding of emergent processes.” Presented to Arts, Media and Entertainment, ASU, Oct 2008.

“Does Qualitative Understanding of Emergent Processes Transfer to Learning Science concepts? A Pilot Intervention.” Presented a colloquium to kick off the colloquium series at Duke University’s Science Center, Nov. 2008.

2009

“What are misconceptions and how might they be overcome?” Brownbag presented to the Applied Psychology Program, Polytechnic Campus, ASU, Feb 2009.

“Ways of optimizing student learning.” Talk presented at K-12, Hendon, VA, May 7, 2009.

“Expert learners.” Talk presented at the 36th Carnegie Cognition Symposium on Expertise June 2, 2009.

“Why are some processes so hard to understand? An instructional module targeted at misconceptions.” Talk presented at the Cognitive Science Symposium on Transfer of Learning.

“Ways to optimize student learning: A learner-centered approach.” Colloquium presented at the Cognitive Science Colloquium Series, Bloomington, Indiana, Oct.

“An instructional module targeted at misconceptions.” Talk presented at the symposium From Child to Scientist: Mechanisms of Learning and Development, Carnegie-Mellon University, Oct

2010

“Using a Cognitive Framework of Differentiated Overt Learning Activities (DOLA) for Designing Effective Classroom Instruction in Materials Science and Nanotechnology,” Michelene T.H. Chi, Stephen Krause & Muhsin Menekse, a poster presented at the NSF-sponsored Awardee Conference, Reston, Va. Jan.

“Dialogue Analyses for Learning.” Paper presented at the *Communication Analyses Workshop*, Tempe, AZ Feb.

Discussant, for IES symposium *Solving Problems in School: Concepts, Procedures, and Instruction to Support Learning*, at the 2010 APS Annual Convention in Boston, May.

“Intelligent Tutoring Systems and Games for STEM instruction.” Invited participant at an ONR-sponsored workshop, UCLA CRESST, Nov.

2011

“Engaging Students with Differential Effectiveness: The ICAP (Interactive>Constructive>Active>Passive) Hypothesis.” Invited presentation at the *Frontiers in Education Workshop*, Pearson, Boston, Feb.

“Misconceived Causal Explanations for Emergent Science Processes.” Invited talk for the symposium *New Approaches to the Problem of Conceptual Change in the Learning of Science and Math*. Presented at the 33rd Annual Conference of the Cognitive Science Society, Boston, July.

“Students’ Self-explanations.” Invited talk for the symposium *Explanation-based mechanisms for learning: An interdisciplinary approach*. Presented at the 33rd Annual Conference of the Cognitive Science Society, Boston, July.

Panel member to discuss explanations for the impact of dialog, in *Socializing Intelligence Through Academic Talk and Dialogue*, Talk title was: “What accounts for the benefits of dialoguing or learning collaboratively, for learning?” Pittsburgh, Sept.

Highlighted session speaker, at the International Conference on Computers in Education, for the sub-conference track Computer-supported Collaborative Learning, Chiang-Mai, Thailand, Nov.

2012

Invited participant at a Gates Foundation M.I.T sponsored workshop on *Quality Matters*. Boston, MA: Jan. 24-25.

“ICAP: A Hypothesis Generated from a Framework for Differentiating Levels of Cognitive Engagement in Active Learning.” Invited talk for *Pearson’s Mastering Leadership Conference*, Scottsdale, AZ: March.

Invited participant in an NSF brainstorming session to discuss the potential synergies of having engineering education researchers’ partner with Engineering Research Centers (ERCs), which are ten-year, \$40M projects, Arlington, VA., March 6, 2012.

Invited participant in a workshop on *Optimal Teaching Workshop*, UC San Diego, May.

“Two Approaches to Enhancing Learning: Dialogue Videos and Engagement Activities.” Talk presented at the 2012 University/Microsoft Research Summer Institute, titled *Crowdsourcing Personalized Online Education*, Suncadia, WA: July.

“Two Kinds and Four Sub-types of Misconceived Knowledge, Ways to Change it, and the Learning Outcomes.” Colloquium to be presented to the Mathematics and Science Education Ph.D. Program, UC San Diego: Oct.

“Two Kinds and Four Sub-types of Misconceived Knowledge, Ways to Change it, and the Learning Outcomes.” Colloquium to be presented to the joint Cognitive Science and the Learning Sciences program, Northwestern University, Nov.

2013

“Overcoming misconceptions for conceptual understanding,” presented at the *Improving Middle School Science Instruction Using Cognitive Science*, A National Conference, sponsored by IES’s National R & D Center for Cognition and Science Instruction Conference, Washington, DC: May 21-22.

“Using the ICAP hypothesis to Design Instruction and Student Assignments.” Talk presented at the 2013 Gordon Research Conference on Chemistry Education Research and Practice, Newport, RI, June.

“Why are dialogues better instructional materials than monologues?” Paper presented at the symposium *Trends in Support for the Analysis of Collaborative Learning, Part 1: Support*, organized by Nikol Rummel & Tamara Van Gog, Ruhr-Universitat Bochum: Aug. 2013.

2014

“ICAP: Differentiating four levels of engagement for active learning.” Presented at *How to Actively Engage Your Students: A Workshop on Active Learning*. Arizona State University: March.

“Differentiating 4 Modes of Engagement in Active Learning: From theory to practice.” Sylvia Scribner Award lecture, AERA, April.

“Generic and Specific Issues in Conceptual Change in Science,” Plenary panel presentation at the *Conceptual Change Sig* meeting at Bologna, Italy: August, 2014.

Invited participant at IES annual meeting, Sept. 2014.

Plenary speaker on “Conceptual Change Across Domain: Science,” Conceptual Change Sig meeting of the European Association for Research on Learning and Instruction, Bologna, Italy: August, 2014.

2015

“Modeling and correcting students’ misunderstanding for conceptual domains (especially in

science).” Featured speaker at the Rice Workshop on Personalized Learning, Houston, TX: April 1.

“Differentiating four modes of engagement in active learning.” Colloquium speaker at the Learning Sciences Research Institute, University of Illinois at Chicago Circle: April 3.

Invited presentation on a panel on how fundamental principles of cognitive science, technology and data impact K-12 teaching and learning to the Carnegie Corporation of New York, NY: June 15.

Thorndike Award Address: “ICAP: A theoretical framework for ways of engaging students to promote deeper learning.” Presented at the American Psychological Association, July.

One of 32 outstanding scholars of education selected to participate in the AERA Scholars Retreat. Santa Fe, NM: October 1-4.

“Teaching the crosscutting concept of emergent cause-and-effect to overcome misconceptions.” Paper presented at the Conference on Complex Systems ’15. Tempe, AZ: September 29.

“Ways to enhance your understanding while you are learning.” Talk presented at Penn State University to their instructors and professors. State College, PA: October 19.

“Differentiating four modes of engagement for active learning: The ICAP framework.” A university-wide talk sponsored by the Schreyer Institute for Teaching Excellence, Penn State University, State College, PA: October 20.

“Engaging students cognitively in active learning.” Talk presented at the AERA Coordinated Committee Meeting. Washington, DC: October 23.

“Robust misconceptions: What are they and how to overcome them.” Colloquium speaker at the Human Development Department Colloquia at Columbia University. New York, NY: November 3.

2016

Public Scholarship Ed-Talk, presented at the AERA Presidential Session on *Challenging Common Sense Conceptions of Learning*. Feb.

“ICAP: A theoretical framework for active learning.” Presented to the Education Development Center (EDC), Inc. New York, NY. Feb. 24.

Centennial colloquium speaker, “ICAP: A theoretical framework for active learning.” at 100th Anniversary Colloquium Series at Carnegie Mellon University Psychology Department. Pittsburgh, PA: April 19.

Poster presented at the Modeling and Model-Based Reasoning in STEM Conference at Purdue University titled, “Misconceptions in STEM are Misrepresentations of One Kind of Processes as Another Kind”. Lafayette, Indiana. August 26th.

Presented at the EnFUSE Symposium hosted by the NSF’s division of undergraduate education with the talk titled “Learning from Dialog versus Monolog Videos”. April. D.C.

Invited participant on an NSF-funded workshop to promote collaboration between cognitive science and discipline-based education research on STEM learning. Washington D.C. September, 2016.

Keynote speaker: “Counter-intuitive Findings and Implications for Teaching from the Sciences of Learning.” Snell Conference: Practicing the Art and Science of Teaching, Center for the Art and Science of Teaching, ASU, Oct.

2017

(For 2017-2021, also include below are conference presentations by myself, my students, postdocs, and my collaborators, with presenters' names shown. Students & postdoc names are underlined.)

Chi, M.T.H. "*ICAP: A theoretical framework for how to engage students to promote deeper learning*," at the Strengthening Institutional Linkages Initiative Faculty Development Seminar, MLFTC, ASU, Jan.

Chi, M.T.H. Featured scholar in the Wisconsin Ideas in Education Series at the University of Wisconsin, "*ICAP: A theoretical framework for how to engage students to promote deeper learning*." Madison, Feb.

Chi, M.T.H. Brown Bag: "*Translating ICAP on Student Engagement into Practice*," Presented to the Graduate School of Education, Rutgers, Feb.

Chi, M.T.H. Brown bag presentation at the University of Pittsburgh's Discipline-Based Science Education Research Center (dB-SERC) on: "*ICAP titled: ICAP: A Theoretical Framework for Active Learning to Promote Deeper Understanding*." Pittsburgh, March.

Chi, M.T.H. Plenary speaker, "*Teaching Emergence: An attempt at differentiating science concepts of processes*." National Association for Research in Science Teaching, Baltimore, April.

Chi, M.T.H. Presentation at Presidential Session on *Acquired Wisdom: Lessons Learned by Distinguished Researchers*, AERA, April.

Chi, M.T.H. Award address for the Distinguished Contributions to Research in Education Award: "*Translating ICAP on Student Engagement into Practice*", AERA, April.

Bowers, N., Jordan, M., & Chi, M.T.H., presented a paper at AERA at the *Everyday Science* session titled, "Identifying Ontological Difficulties in Causal Explanation of Everyday Science". May.

Adams, J. & Chi, M.T.H. presented a paper presented at AERA 2017 titled, "How Should Collaborative Pairs Be Grouped?"

Bruchok, C. & Zillmer, N. & Chi, M.T.H. presented a poster titled, "Teaching Teachers to Differentiate Learning Behaviors: Translating Learnings from Interactive>Constructive>Active>Passive Into Professional Development," at AERA .

Stump, G., Li, N. & Chi, M.T.H. presented a poster titled, "Utilization of the Interactive, Constructive, Active, and Passive Framework to Analyze Student Learning," at AERA, May.

Chi, M.T.H. Keynote speaker at the TRUSE conference on STEM education, hosted by St. Thomas University, "*ICAP: How to promote deeper active learning engagement*."

Chi, M.T.H. Keynote speaker, "*Implications of ICAP, a Theory of Student Engagement, for Technology-enhanced Practices*," presented at the National Conference on Technology-enhanced Learning, hosted by the National University of Singapore, Nov.

Chi, M.T.H. Colloquium speaker, "*ICAP: How to promote deeper active learning engagement*," National Institute of Education, Singapore, Nov.

2018

Adams, J., & Chi, M. T. H. (2018, February). Fostering Collaboration in Engineering Classrooms. Poster presented at the 2018 ASU Learning Innovation Showcase, Tempe, AZ.

Caplan, M. R., & Chi, M. T. H. (2018, February). Dialogue vs monologue videos in engineering classrooms. Poster presented at the 2018 ASU Learning Innovation Showcase, Tempe, AZ.

Ding, L., & Chi, M. T. H. (2018, February). Using monologue- and dialogue-videos in an authentic flipped college-level biology course: A 2-year study. Poster presented at the 2018 ASU Learning Innovation Showcase, Tempe, AZ.

Lai, P., & Chi, M. T. H. (2018, February). Emergence thinking for understanding science. Poster presented at the 2018 ASU Learning Innovation Showcase, Tempe, AZ.

Morris, J. A., & Chi, M. T. H. (2018, February). Developing and revising instructional activities to optimize cognitive engagement. Poster presented at the 2018 ASU Learning Innovation Showcase, Tempe, AZ.

Keynote. Chi, M.T.H. "*Conceptual change in understanding collective versus cumulative causality.*" Presented at the 2nd Interdisciplinary REASON Spring School, Munich Center for the Learning Sciences, Munich, Germany, March.

Workshop speaker, Chi, M.T.H. "*Principles and methods of coding qualitative data.*" Presented at the 2nd Reason Spring School, Munich, Germany.

Keynote speaker, Chi, M.T.H. "*Teachers translating a theory of cognitive engagement into practice,*" The Subway Summit conference, Teachers' College, Columbia University, June.

Chi, M. T. H. (2018, June). *Concrete definition of beneficial collaborative dialogues.* Poster to be presented at the 13th International Conference of the Learning Sciences, London, United Kingdom.

Ding, L., Adams, J., Stephens, M. D., Brownell, S., & Chi, M. T. H. (2018, June). *Failure to replicate using dialogue videos in learning: Lessons learned from an authentic course.* Paper to be presented at the 13th International Conference of the Learning Sciences, London, United Kingdom.

Chi, M. T. H. (2018, July). How students engage to learn. Paper to be presented at the 40th Annual Meeting of the Cognitive Science Society, Madison, WI.

Chi, M.T.H. Invited paper, "*Learning the underlying structures of causal and acausal processes*" presented at the symposium Learning-to-learn from novice to expertise: New challenges and approaches for one of the oldest topics of cognitive science. Symposium organized by Perez, R., Gray, W. D (2018, July) at the 40th Annual Meeting of the Cognitive Science Society, Madison, WI.

2019

Chi, M. T. H. Plenary speaker, "ICAP: How to Promote Deeper Learning by Engaging Students Cognitively" in the Chicago Symposium Series on Excellence in Teaching Mathematics and Science at Northern Illinois University, Naperville, IL, Feb. 22, 2019.

Chi, M. T. H. Rumelhart Symposium, "Translating the ICAP Theory of Cognitive Engagement into Practice" for the Rumelhart Prize Awardee at the 41st Annual Conference of the Cognitive Science Society at Montreal, Canada July 27th, 2019.

Chi, M. T. H. Plenary speaker, "ICAP: how to promote deeper learning by engaging students constructively and co-constructively" at the Annual Conference of the International Association for Medical Education in Vienna, Austria, August, 2019.

Chi, M. T. H. Plenary speaker, "ICAP-A Framework for Active Learning" presented at the curriculum retreat of Penn State Medical School, Hershey, PA, October.

Chi, M. T. H. Plenary speaker at the Simon's Initiative, "ICAP: How to Promote Deeper Learning by Engaging Students Cognitively", hosted by the Provost's office, Carnegie Mellon University, November 12th, 2019.

VanBibber, B., Lai, P., Ding, L., Adams, J., & Chi, M. T. H. (2019). *Student learning of emergent science using the PAIR-C framework*. Paper accepted to be presented at NARST, Portland, OR.

2020 (Covid cancelled many in-person conferences)

Chi, M.T.H. Plenary speaker, "ICAP: How to promote deeper learning by engaging students cognitively" at the 42nd Annual National Institute on the Teaching of Psychology (NITOP) in St. Pete Beach, Florida, January, 2020.

Su, M., Cho, J., Vanbibber, B., Ha, J., & Chi, M. (2020). Diagnosis of Misconceptions with Coherent Underlying Structure in Learning Diffusion. In Gresalfi, M. and Horn, I. S. (Eds.), *The Interdisciplinary of the Learning Sciences, 14th International Conference of the Learning Sciences (ICLS) 2020*, Volume 4 (pp. 2321-2324). Nashville, Tennessee: International Society of the Learning Sciences.

Cullicott, C., Semken, S., Chi, M., & Boucher, N. (2020). "Compel Them to Engage with the Content:" Upgrading an Undergraduate Geology Course Using ICAP. In Gresalfi, M. and Horn, I. S. (Eds.), *The Interdisciplinary of the Learning Sciences, 14th International Conference of the Learning Sciences (ICLS) 2020*, Volume 4 (pp. 2361-2362). Nashville, Tennessee: International Society of the Learning Sciences.

Cullicott, C. E., Semken, S., Chi, M., & Boucher, N (2020, December 1-17). Aligning Place-Based Geoscience Teaching with the ICAP Framework of Cognitive Engagement for Enhanced Active Learning [Conference presentation]. American Geophysical Union Fall Meeting, San Francisco, CA, United States.

Ha, J., Su, M., Chi, M., & Cullicott, C. (2020). Misunderstandings of Teachers Applying ICAP Theory into Practice. In Gresalfi, M. and Horn, I. S. (Eds.), *The Interdisciplinary of the Learning Sciences, 14th International Conference of the Learning Sciences (ICLS) 2020*, Volume 4 (pp. 2407-2408). Nashville, Tennessee: International Society of the Learning Sciences.

2021 (Covid cancelled many in-person conferences)

Su, M., Cho, J. Y., Chi, M. T. H., Boucher, N., Vanbibber, B (2021). Designing Simulation Module to Diagnose Misconceptions in Learning Natural Selection. In de Vries, E., Hod, Y., & Ahn J. (Eds.). *Proceedings of the 15th International Conference of the Learning Sciences - ICLS 2021*. Bochum, Germany: International Society of the Learning Sciences.

Cullicott, C., Semken, S., Chi, M. T. H., & Boucher, N. (2021) Enhancing active learning in a place-based geoscience course using the ICAP Theory of Cognitive Engagement [Poster presentation]. *Geological Society of American Abstracts with Programs*, 53(6). Doi: 10.1130/abs/2021AM-367458

SERVICES (EXTERNAL)

Advisor or Consultant on Executive Committees, Boards, etc. (listing since 2007 only)

Participated in a panel meeting on 21st Century Skills, Sponsored by the Spencer and Russell Sage Foundations, New York, May, 2007.

A member of a 3-member visiting team to participate in the self-study process at Teachers College, Columbia University, for their Psychology and Education Program, December, 2007.

A member of the Executive Committee of the Pittsburgh Science of Learning Center, 2004-2009.

Consultant: “Adaptive Simple Sequencing Instruction Support Toolkit”, SBIR Phase II, Intelligent Automation, Inc. July 2007.

Mentoring Spencer postdoctoral fellows at the National Academy of Education, at the Keck Center, Washington, Feb. 2011.

A member of the Standing Review Committee, National Academy of Education, 2011-2014.

Co-chaired the inaugural conference on Learning@Scale, sponsored by ACM, 2013-2014.

Contributor to the Transregional Collaborative Research Center 318 “Constructing Explainability” at the University of Paderborn and University of Bielefeld, 2021.

A Member of Advisory Boards (since 2008 only)

Advisory board for a grant by Ronald L. Miller P.I. (Professor of Chemical Engineering, Colorado School of Mines) “Developing ontological schema training methods to help students develop scientifically accurate mental models of engineering concepts.” NSF Engineering Education Program. 2006-2011.

Advisory board for two grants (IES and NSF), to Wayne Ward and Ron Cole, Boulder Language Technologies, to improve science learning in third, fourth and fifth grades through spoken dialog interaction with a virtual tutor (2008-2011)

Advisory board for the Center for Advanced Technology in the Schools (CATS), Led by Jim Stigler from UCLA Psychology, Greg Chung and Eva Baker of UCLA Center for Research on Evaluation, Standards, and Student Testing (CRESSST). The Center will combine research on cognitive psychology, assessment, and games in the area of middle school learning (2008-2011).

Advisory board for an NSF grant on Cumulative Learning using Embedded Assessment Results (CLEAR), Marcia Linn and Chad Dorsey, co-P.I.s, Berkeley, CA. (2009-2012)

Advisory board for a NSF funded project Transfer of Perceptually Grounded Principles, Rob Goldstone and Sam Day, Indiana University (2009-2011).

Advisory board for a CAREER Award, The Role of Conceptual Change in Knowledge Acquisition, Andrew Shtulman, Dept. of Psychology, Occidental College, Awarded 2010-2015.

Advisory board on College Ready Work, for the Bill and Melinda Gates Foundation, (2010-2013).

Advisory board for an NSF grant, An Integrated Model of Cognitive and Affective Scaffolding for Intelligent Tutoring Systems, by Dr. James Lester (Dept. of Computer Science), North Carolina State University, Awarded 2010.

Advisory board for an NSF Career Award, In-class Peer Tutoring, by Dr. Shane Brown, Dept of Civil & Environmental Engineering, Washington State University, 2010-2015.

Advisory board for an NSF Career award, A Cognitive Science of Explanation, Tania Lombrozo, Dept. of Psychology, UC Berkeley. 2011-2016.

Advisory Board for an NSF Career Award, A Rational Analysis of How Teachers' Examples Constrain Learning and Inference. Dr. Patrick Shafto, Dept. of Psychology, University of Louisville, 2012-2017.

Advisory Board for NSF REESE project Digital Games as Analogical Sources for Science Learning, Wendy Martin, Center for Children and Technology/Education Development (2014-2016).

Re-imagining Video-based Online Learning, Dr. Joanne Lobato, Dept. of Mathematics and Statistics, San Diego State University, 2014-2016.

Advisory board for NSF funded project: Learning by Teaching a Synthetic Peer: Investigating the effect of tutor scaffolding for tutor learning. Drs. Noboru Matsuda, Ken Koedinger, William Cohen, Human-computer Interaction Institute, Carnegie-Mellon University, 2013-2016.

Advisory Board for MIT's Online Education Policy Initiative, the initiative is supported by the Carnegie Foundation and the National Science Foundation, Nov. 2014-2016.

Advisory meeting at the meeting on the Science of Learning & Development (SoLD) hosted by the Chan Zuckerberg Initiative, June, 2017.

Advisory board for an IES funded project called CourseMirror (PI: Muhsin Menekse), School of Engineering, Purdue University, 2018.

Advisory board for NSF funded CAREER Award for project on "CS-Climate", Kristy Boyer, Computer Science, University of Florida (2020-2022)

Advisory Board for advising research by ActionLab, EdPlus, ASU's Online School (2020-2022)

Advisory Board for McGraw Hill's panel on the Learning Sciences (2020-2022)

Advisory Board for a proposal for a collaborative research center on *Explainable AI Systems*, submitted by the Universities Bielefeld and Paderborn, to the German Research Foundation (DFG), 2021.

National Committees

1979-1981	Elected Secretary of Division C, American Educational Research Association
1980-1984	Cognition, Emotion and Personality Research Review Panel, National Institute of Mental Health
1985-1986	Cognition and Survey Research Committee, Social Sciences Research Council
1989-1990	Publications Committee, Governing Council of the Society for Research in Child Development
1989-1991	Committee on Techniques for Enhancing Human Performance, National Research Council, National Academy of Sciences
1992-1993	GRE External Advisory Committee on Reasoning in Context, Educational Testing Service
1993-1999	Board of Governors, Cognitive Science Society
2001	Review Panel for ROLE (Research On Learning and Education) Proposals
2001	Guest speaker on the GRE Board, Educational Testing Service
2005-2006	Dissertation Selection Committee, the Spencer Foundation
2005-2007	IES Math and Science Review Panel
2007-2009	Fellows Selection Committee, Cognitive Science Society
2007-2008	Reviewer for Fellow Selection, Center for Advanced Study in the Behavioral Sciences
2010-2012	Member of the review panel for Spencer's Small Grant program.
2012	Member of the Selection Committee for this Inaugural Year for the AERA Div. C Early Career Award
2011-2013	Member of the Standing Review Committee of the National Academy of Education
2013-2015	Fellows Selection Committee, Cognitive Science Society
2014-2017	Chair of the Research Advisory Committee, AERA
2017-2018	Participant in the Science of Learning and Development (SoLD) meeting of the Chan-Zuckerberg Initiative
2015-2020	Selection committee, Sylvia Scribner Award

Editorial Boards

1985-1990	Cognitive Development
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1987-1992	Human Development
1990-1998	Journal of the Learning Sciences
1993-1995	Cognition and Instruction
1993-1995	Co-Editor of Lawrence Erlbaum Series: Human and Machine Expertise
1993-1996	Behavioral Research in Accounting
1993-1995	Cognitive Science (Senior Editor)
1996-1997	Cognitive Science
2000-2003	Journal of the Learning Sciences
Current:	Routinely review for many journals but not accepting any editorial positions.

SERVICE (major ones only)

Within ASU

2000-2001	Ad Hoc Tenure Review Committees (at the University Level)
2000-2002	Selection Committee (to select faculty members for the University level Ad Hoc Tenure Review committees)
2004-2007	Member of the Executive Committee of the Pittsburgh Science of Learning Center
2007-2008	Chancellor's Distinguished Research Award Committee
2013-2014	Director of the Arizona State University Learning Sciences Institute
2020	Tenure and promotion committee (5 candidates), MLFTC
2020	President Crow's provost search committee
2020	Created a 32 power point slides that gives a short summary of ICAP--specifically targeted at tips for online learning, given to teachers who attend the Remote Summit. <i>REMOTE: The Connected Faculty Summit</i> is hosted by ASU on July 13 and 14th (2021) and will showcase best practices, techniques, and tools to provide actionable insights to Higher Education faculty around the concept of "the best of online education."
2020-2022	Ad Hoc Tenure Review Committee
2021	Regents Professor Selection Committee

National and International: Major Conferences Organized

1982	The Nature of Expertise, Pittsburgh, PA
2008	Talk, Dialogues, and Learning (also included organizing a festschrift for L. Resnick), Pittsburgh, PA
2014	Co-chaired the inaugural conference on Learning@Scale, Atlanta, March, 2014

TEACHING and MENTORING

Mentoring

I frequently mentor external postdocs and graduate students, such to the Spencer postdoctoral and pre-doctoral fellow, sponsored by National Academy; or talk to junior faculty and graduate students about academic careers, organized by conferences, such as for AERA's Division C Faculty Mentorship Program.

Dissertation committee for non-ASU and international students

I often serve on the dissertation committee for non-ASU students. Three recent examples are:

- Toi Sin Arvidsson, a Ph.D. student at Teachers' College, Columbia University, 2018;
- Christina Augsburg, Visiting student from University of Augsburg, 2017
- Imogen Henrich, a Ph.D. student at School of Education, University of Southern California, 2021

Teaching at ASU

2017	DC1791: Proposal Writing Seminar, MLFTC, ASU.
2018	DCI 790: Reading and Conference, DCI 792: Research, MLFTC, ASU.
2020	DCI 691: Improving Teaching and Learning, MLFTC, ASU

Postdocs Mentored and their current position

Paul Feltovich (1978-80), Senior Research Scientist, Florida Institute for Human and Machine Cognition

Mitch Rabinowitz (1980-82), Professor, Dept. of Psychology, Fordham University

Camilla Gobbo (1983-84), Professor emeritus, Dept. of Psychology, Padova University, Italy

Matthew Lewis (1984-85), Executive Vice President, Interactive Video Technologies

Miriam Bassok (1985-87), Prof., Dept. of Psychology, Univ. of Washington

Peter Reimann (1984-88), Professor, University of Sydney, Australia

Jean Hutchinson (1986-88) Professor, Department of Geological Sciences and Geological Engineering,
Queen's University

Miriam Reiner (1988-89) Head of the Virtual Reality and NeuroCognition lab at the Technion-Israel Institute
of Technology.

Joanne Striley (1988-89) Professor, Department of Teacher Education, Michigan State University

Mei-Hung Chiu (1990-91), Professor and chair, Graduate Institute of Science Education, National Taiwan
Normal University.

Takeshi Okada (1994-95), Professor, Graduate School of Education and Interfaculty Initiative in Information
Studies, The University of Tokyo, Japan

Michel Ferrari (1996-1998), Associate Professor, Ontario Institute for Studies in Education, Toronto

Cindy E. Hmelo (1996-1998), Professor & Director of Institute, School of Education, Indiana University

Judith McQuaide (1998-1999), Senior Researcher Manager, National Education Association

Takeshi Yamauchi (1998-2000), Associate Professor, Dept. of Psychology, Texas A&M

Heisawn Jeong (1998-2000) Professor in Cognitive Science and Learning Sciences, Hallym University, Korea

Randy Engle (2001-2003), Assistant Professor, Berkeley School of Education (deceased)

Marguerite Roy (2001-2003), Research Analyst, Medical Council of Canada

Agnieszka Kosminska Kristensen (2003-2005).

Scotty Craig (2005-2007). Associate Professor, Arizona State University

Kirsten Butcher (2005-2007). Associate Professor, University of Utah

Jing-Wen Lin (2007). Faculty, Department of Science Education, National Taipei University of Education,
Taiwan

Paul E. Hand (2009-2010)

Kasia Muldner (July 1, 2010-2012), Associate Professor, Carleton University

Glenda Stump (June 1, 2010-2012; 2014-15). Education Research Scientist, Open Learning, MIT

Ruth Wylie (Dec. 1, 2011), Associate Director, Science of the Imagination Institute, ASU.

Seokmin Kang (July 16, 2012-2015), Teaching faculty, Hallym University, Korea

Kathleen McEldoon (2013-2015), Deputy Director of Research, Tennessee State Board of Education

Matt Lancaster (2012-2014), Assistant Professor, Department of Psychology, Lourdes University

Susan Trickett (2013-2014), Knowledge Management Specialist, Denver Public Schools

Na Li (2013-2016), Assistant Professor, Shenzhen Institute of Advanced Technology (SIAT), Chinese
Academy of Sciences (CAS), visiting scholar at University of Southern California

Emily Bogusch (2014-2015), Mathematics Teacher (11th /12th grade), Phoenix Coding Academy, Phoenix,
Arizona.

Nicole Zillmer (2016), Director of Research, Authentic Connections, Arizona State University

Elon Langbeheim (2016), Assistant Professor, Ben Gurion University

Polly Lai (2017-2020), Lecturer, Learning and Teacher Development, Queensland Institute of Technology,
Australia

Joshua Morris (2017-2019), Assistant Professor, College of Education and Human Services, University of
Illinois

Lu Ding (2017-2019) Instructional Designer, Faculty Development and Innovation Center, Eastern Illinois
University

Soojeong Jeong (2019-2020), Instructor, Utah State University

John Cho (2019-2021)

Yingxiao Qian (2019-2021)

Graduate Students

Christopher Roth (M.S. 1983);

Gao Man (M.S., School of Education, 1986)

Rebecca Leas (Ph.D., 1992; Department of Physical Education). Professor at Clarion University of Pennsylvania.

Jeffrey Sampler (Ph.D., 1992; Katz Graduate School of Business)

James Slotta (Ph.D., 1997), Endowed Chair, Professor, Ontario Institute of Education.

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Floris Blankenstein—A visiting student from Maastricht University, Holland

Rachel Lam (Education), Ph.D. 2012

Dongchen Xu (Psychology), M.S. 2015

Christi Bruchok (Education), 2015-2016

Joshua Adams (Education), 2014-2019

Man Su (Science Education), current

Jesse Ha (Science Education), current

Catherine Cullicott (Science Education), current

Jongchan Park (Science Education), current