

Bibliography on Heat and Thermodynamics

revised 6 June 2005

This material is based upon work supported in part by the National Science Foundation under Grant Number DUE-9981140.

1. Aalst, J. (1997). Learning about heat and matter with CSILE: An inquiry into conceptual change. *Occasional paper: Department of Curriculum, Teaching, and Learning, University of Toronto, 1-32.
2. Ackermann, K., Dinter, K., Jaeckel, K. (1986). Untersuchungen von Schuelervorstellungen und Handlungsweisen im Bereich Waermelehre. *In: Mikelskis, H.: Zur Didaktik der Physik und Chemie. Vortraege auf der GDCP-Tagung 1985. Alsbach: Leuchtturm, 203-205.
3. Ahtee, M. (1993). A survey of the Finnish pupils' conceptions about thermal phenomena. *In: Novak, J.: Proceedings of the Third International Seminar on Misconceptions and Educational Strategies in Science and Mathematics. Ithaca, New York: Cornell University (distributed electronically).
4. Akatugba, A., Wallace, J. (1998). Students' understanding of upper and lower fixed points of a thermometer and its influence on their proportional reasoning. *Australian Science Teachers' Journal*, 44(1), 59-65.
5. Edna Albert, "Development of the concept of heat in children," *Sci. Educ.* **62**, 389-399 (1978).
6. B. Andersson, "The experiential gestalt of causation: A common core to pupils' preconceptions in science," *European Journal of Science Education* **2**, 155-171 (1986).
7. B. Andersson, "Pupils' conceptions of matter and its transformations (age 12-16)," *Studies in Science Education* **18**, 53-85 (1990).
8. Andersson, B. (1990). Pupils' conceptions of matter and its transformations (age 12-16). In: Lijnse, P.L., Licht, P., Vos, W. de, Waarlo, A.J.: Relating macroscopic phenomena to microscopic particles: a central problem in secondary science education. Utrecht: CD-ss Press, 12-35.
9. K. Appleton, "Children's ideas about hot and cold. Learning in science project (primary)," Science Education Research Unit (Hamilton, New Zealand, Waikato University), ERIC Document Reproduction Service No. ED 252 407 (1984).
10. K. Appleton, "Children's ideas about temperature," *Research in Science Education* **15**, 122-126 (1985).
11. M. Arnold and R. Millar, "Children's and lay adults' views about thermal equilibrium," *Int. J. Sci. Educ.* **16**, 405-420 (1994).

12. Arnold, M., Millar, R. (1996). Exploring the use of analogy of heat, temperature and thermal equilibrium. *In: Welford, G., Osborne, J., Scott, P.: Research in science education in Europe. London: The Falmer Press, 22-35.
13. M. Arnold and R. Millar, "Learning the scientific 'story': A case study in the learning of elementary thermodynamics," *Sci. Educ.* **80**, 249-281 (1996).
14. Bach, S. (1988). Schuelerprognosen ueber Mischungstemperaturen. *In: Wiebel, K.H.: Zur Didaktik der Physik und Chemie. : Vortraege auf der Tagung f. Didaktik d. Physik/Chemie, September 1987. Nuernberg: Leuchtturm-Verlag, Alsbach, 287-289.
15. Bader, Martin and Hartmut Wiesner (1999). Einführung in die mechanische Energie und in die Wärmelehre: Ein Unterrichtskonzept bewährt sich in der Praxis. Frühjahrstagung des Fachverbands Didaktik der Physik in der Deutschen Physikalischen Gesellschaft (Ludwigsburg 1999).
16. Bader, M., Wiesner, H. (1999). Das "Münchner Unterrichtskonzept" zur Einführung in die mechanische Energie und Wärmelehre. In: *Physik in der Schule* 37.
17. A. C. Banerjee, "Teaching chemical equilibrium and thermodynamics to undergraduate general chemistry classes," *J. Chem. Educ.* **72**, 879-887 (1995).
18. V. Bar and I. Galili, "Stages of children's views about evaporation," *Int. J. Sci. Ed.* **16**, 157-174 (1994).
19. V. Bar and A. S. Travis, "Children's views concerning phase changes," *Journal of Research in Science Teaching* **28**(4), 363-382 (1991).
20. Barak, J., Gorodetsky, M., Chipman, D. (1995). Effect of qualitative thermodynamic approach to teaching energy on system oriented understanding of biology. *In: Finley, F., Allchin, D., Rhees, D., Fifield, S.: Proceedings. Third international history, philosophy, and science teaching conference. Minneapolis: University of Minnesota, 87-96.
21. Barker, Vanessa and Robin Millar, "Students' reasoning about basic chemical thermodynamics and chemical bonding: what changes occur during a context-based post-16 chemistry course?," *Int. J. Sci. Educ.* **22**, 1171-1200 (2000).
22. Roger Barlet and Géraldine Mastrot, "L'algorithmeisation-refuge, obstacle à la conceptualisation; L'exemple de la thermochimie en 1^{er} cycle universitaire," *Didaskalia* **17**, 123-159 (2000).
23. H. Beall, "Probing student misconceptions in thermodynamics with in-class writing," *J. Chem. Educ.* **71**, 1056-1057 (1994).
24. Ben-Zvi, Ruth (1999). Non-science oriented students and the second law of thermodynamics. *International Journal of Science Education* **21**, 1251-1267.

25. Benbetka, M. (1996). Alltagsvorstellungen als Bedingungen zur Gestaltung eines Konzepts fuer die Behandlung der Waermelehre im Anfangsunterricht. *In: Behrendt, H.: Zur Didaktik der Physik und Chemie: Probleme und Perspektiven. Alsbach/Bergstrasse: Leuchtturm-Verlag, 353-355.
26. Berge, O.E., Hauke, B. (1983). Schueler aeussern sich ueber Energie. *Naturwissenschaften im Unterricht - Physik/Chemie 31, 352-355 #g6,P,M,EN
27. Berger, R., Wiesner, H. (1997). Zum Verstaendnis grundlegender Begriffe und Phaenomene der Thermodynamik bei Studierenden. *In: Deutsche Physikalische Gesellschaft, Fachverband Didaktik der Physik: Didaktik der Physik. Berlin: Technische Universitaet Berlin, Institut fuer Fachdidaktik Physik und Lehrerbildung, 736-741 #g6,P,T,EN
28. Bhaskar, R. and H.A. Simon, "Problem Solving in Semantically Rich Domains: An Example from Engineering Thermodynamics," *Cog. Sci.* 1:193-215 (1977).
29. Hong Kwen Boo, "Students' understandings of chemical bonds and the energetics of chemical reactions," *Journal of Research in Science Teaching*, 35, 569-581 (1998).
30. Hong-Kwen Boo and J. R. Watson, "Progression in high school students' (aged 16-18) conceptualizations about chemical reactions in solution," *Sci. Educ.* **85**, 568-585 (2001).
31. Brand, K.-J., Brauner, R. (1978). Auffassungen, Vorstellungen und Begriffe von Kindern im Zusammenhang mit Phaenomenen der Waermelehre. *Naturwissenschaften im Unterricht - Physik/Chemie 26, 105-116 #g6,P,T
32. Brook, A., Briggs, H., Bell, B., Driver, R. (1984). Aspects of secondary students' understanding of heat: Full report. *Leeds: University of Leeds, Centre for Studies in Science and Mathematics Education.
33. Brook, A., Briggs, H., Bell, B., Driver, R. (1984). Aspects of secondary students' understanding of heat: Summary report. *Leeds: University of Leeds, Centre for Studies in Science and Mathematics Education.
34. Bryant, R.J., Marek, E.A. (1993). Students' declarative and procedural knowledge of heat. *Paper presented at the annual meeting of the National Association for Research in Science Teaching, Atlanta, Georgia, April 15-19.
35. Cachapuz, A.F., Martins, I.P. (1987). High school students' ideas about energy of chemical reactions. *In: Novak, J.: Proceedings of the 2. Int. Seminar "Misconception and Educational Strategies in Science and Mathematics, Vol.III. Ithaca: Cornell University, 60-68.

36. Cachapuz, A.F., Martins, I.P. (1988). Learning chemical thermodynamics at school: the use of noninteractive views to interpret energy changes. *Biennial Conference on Chemical Education, Purdue University, 12.
37. Calvelli, G. , Capitanio, M. , Di Blasi Burzotta, R. , Furlan, D. , Merlo, A. (1996). Teaching the changes of state of matter in the primary school. *In: Michelini, M. , Jona, S. , Cobai, D.: Teaching the science of condensed matter and new materials. Udine: Forum, 429-433 #g6,P,T
38. Carlton, Kevin (2000). Teaching about heat and temperature. *Physics Education* **35**, 101-105.
39. E. Carson, "A study in undergraduate learning in physical chemistry," In: Psillos, D.: *European Research in Science Education II*. Thessaloniki: Art of Text S.A., 341-345 (1995).
40. A. Cervantes, "Los conceptos de calor y temperatura: una revisión bibliográfica," *Enseñanza de las Ciencias* **5**, 66-70 (1987).
41. Chang, Jin-Yi, "Teachers college students' conceptions about evaporation, condensation, and boiling," *Sci. Educ.* **83**, 511-526 (1999).
42. Douglas Clark and Doris Jorde, "Helping students revise disruptive experientially supported ideas about thermodynamics: visualizations and tactile models," *J. Res. Sci. Teach.* **41**, 1-23 (2004).
43. Elizabeth Engel Clough and Rosalind Driver, "Secondary students' conceptions of the conduction of heat: bringing together personal and scientific views," *Phys. Educ.* **20**, 176-182 (1985).
44. María I. Cotignola, Clelia Bordogna, Graciela Punte, and Osvaldo M. Cappannini, "Difficulties in learning thermodynamic concepts: Are they linked to the historical development of this field?," *Science and Education* **11**, 279-291 (2002).
45. J. F. Cullen, Jr., "Concept learning and problem solving: The use of the entropy concept in college chemistry," Ph.D. dissertation, Cornell University, (UMI, Ann Arbor, MI, 1983), UMI #8321833.
46. Dall'Alba, G. (1988). Cognitive learning strategies and outcomes in a heat transfer experiment. **Research in Science Education* **18**, 123-133 #g7,P,T
47. de Berg, K.C., "Students' Thinking in Relation to Pressure - Volume Changes of a Fixed Amount of Air: the Semi-quantitative Context," *Int. J. Sci. Educ.* **14**:295-303 (1992)

48. de Berg, K.C. (1995). Student understanding of the volume, mass, and pressure of air within a sealed syringe in different states of compression. *Journal of Research in Science Teaching 32, 8, 871-884 #g6,P,M
49. W. deVos and A. Verdonk, "A new road to reactions, part 3: Teaching the heat effect of the reaction," J. Chem. Ed. **63**, 972-974 (1986).
50. Dibar Ure, M.C. and D. Colinvaux, "Developing Adults' Views on the Phenomenon of Change of Physics State in Water," Int. J. Sci. Educ. 11:152-160 (1989).
51. Duit, R. (1983). Is the second law of thermodynamics easier to understand than the first law ?. *In: Marx, G.: Entropy in the school. Proceedings of the 6th. Danube Seminar on Physics Education. Budapest: Roland Eoetvoes Physical Society, 87-97 #g6,P,EN,ENT
52. Duit, R. (1986). Untersuchungen zum Erlernen des Energiebegriffs. *In: Duit, R.: Der Energiebegriff im Physikunterricht. Kiel: IPN, 168-255 #g6,P,EN
53. Duit, R. (1986). Waermevorstellungen. *Naturwissenschaften im Unterricht - Physik/Chemie 34, 13, 30-33 #g6,P,
54. Reinders Duit, and Sofia Kesidou, "Students' understanding of basic ideas of the second law of thermodynamics," Res. Sci. Educ. **18**, 186-195 (1988).
55. Reinders Duit, and Sofia Kesidou, "Students' conceptions of basic ideas of the second law of thermodynamics," paper presented at the Annual Meeting of the National Association for Research in Science Teaching (Atlanta, GA, April 8-11, 1990). ERIC_No: ED317434 (1990).
56. C. Duprez and M. Meheut, (2001). About some learning difficulties in thermodynamics at university level. In D. Psillos, Kariotoglou, P. , Tselfes, V. , Bisdikian, G. , Fassoulopoulos, G. , Hatzikraniotis, E. , Kallery, M., *Proceedings of the Third International Conference on Science Education Research in the Knowledge Based Society, Vol. 2*. Thessaloniki, Greece: Aristotle University of Thessaloniki: 724-726
57. Jazlin V. Ebenezer and Duncan M. Fraser, "First year chemical engineering students' conceptions of energy in solution processes: phenomenographic categories for common knowledge construction," Sci. Educ. **85**, 509-535 (2001).
58. Engel, E. (1981). Investigating pupils' understanding of aspects of pressure. *In: Jung, W., Pfundt, H., Rhoeneck, C. von: Proceedings of the international workshop on "Problems Concerning Students' Representation of Physics and Chemistry Knowledge". Ludwigsburg: Paedagogische Hochschule, 214-233 #g6,P,M
59. Engel, E.(1982). The development of understanding of selected aspects of pressure, heat and evolution in pupils aged between 12-16 years. Unpublished Ph.D. thesis, University of Leeds, Leeds.

60. Engelhardt, P., Jung, W., Wiesner, H. (1975). Welche Beziehungen sehen Studenten zwischen Begriffen aus der Mechanik bzw. Thermodynamik?. *In: Dahncke, H.: Zur Didaktik der Physik und Chemie. Hannover: Schroedel, 249-258 #g5,g6,P,M,T
61. Eraetuuli, M. (1984). Wie koennen sich die finnischen Schueler der Schuljahre 7 bis 9 die alltaeglichen Phaenomene der Waermelehre erklaren ?. *Helsinki: University of Helsinki, Department of Teacher Education #g6,P,T
62. Eraetuuli, M. (1987). Welche Vorstellungen haben finnische Schueler von den alltaeglichen Phaenomenen der Waermelehre. *Helsinki: University of Helsinki/Department of Teacher Education #g6,P,T
63. Erickson, Gaalen L., An Analysis of Children's Ideas of Heat Phenomena. Ed.D. Dissertation, University of British Columbia (1975).
64. Erickson, G.L., "Children's Conceptions of Heat and Temperature," Sci. Educ. 63:221-230 (1979).
65. Erickson, G.L., "Children's Viewpoints of Heat: A Second Look," Sci. Educ. 64:323-336 (1980).
66. Gaalen Erickson, "Part A: An overview of pupils' ideas [on heat and temperature]," in *Children's Ideas in Science*, edited by Rosalind Driver, Edith Guesne, and Andrée Tiberghien, (Milton Keynes, Open University Press, 1985), pp. 55-66.
67. Fedra, R.-D. (1989). Ausschaerfung und Weiterentwicklung von vorwissenschaftlichen Vorstellungen beim Erlernen des 2. Hauptsatzes der Thermodynamik. *Kassel: Gesamthochschule Kassel #g6,g7,P,T,EN,IRR,AT,CSC,OCI
68. Fedra, R.-D. (1989). Schuelervorstellungen zum Energieverbrauch und ihre Aufarbeitung im Physikunterricht der Sekundarstufe II. *In: Kuhn, W.: Didaktik der Physik. Vortraege auf der Physikertagung 1989 in Bonn. Giessen: Deutsche Physikalische Gesellschaft, Fachausschuss Didaktik der Physik, 298-306 #g6,P,T,EN,OCI
69. Fedra, R.-D. (n.d.). Styropor ist warm und Eisen ist kalt - Sinnestaeuschung oder physikalische Realitaet ?. *Polykop. Gesamthochschule Kassel #g2,g6,P,T
70. Fedra, R.-D., Schoen, L. (1989). Sinneswahrnehmungen und Physik. *Physik und Didaktik, 104-123 #g2
71. Janez Ferbar, "Words and their meaning in teaching thermodynamics," in *Thinking Physics for Teaching*, edited by Carlo Bernardini, Carlo Tarsitani, and Matilde Vicentini (Plenum, New York, 1995), pp. 249-260.

72. Fleischer, F. (1991). Lernschwierigkeiten bei Behandlung von Grundbegriffen der Thermodynamik. *Physik in der Schule 29, 4, 140-144 #g6,P,T
73. P. Frenkel and S. Strauss, "The development of the concept of temperature when assessed via three developmental models," (Working paper no. 46), Tel-Aviv University (Israel), Unit on Human Development and Education. ERIC Document Reproduction Service No. ED 267 968 (1985).-
74. Fritzsche, K. (1998). Grundbegriffe der Waermelehre aus Schuelervorstellungen entwickelt. *Kiel : IPN Kiel #g6,g7,P,T,LPRO
75. Hans U. Fuchs, "Thermodynamics: a 'misconceived' theory," in *Proceedings of the Second International Seminar "Misconceptions and Educational Strategies in Science and Mathematics,"* edited by J. Novak, Vol.III, pp. 160-167.
76. Gale, C.I. (1993). The influence of microcomputer-based labs on children's conceptions of temperature and temperature change. *In: Novak, J.: *Proceedings of the Third International Seminar on Misconceptions and Educational Strategies in Science and Mathematics.* Ithaca, New York: Cornell University (distributed electronically) #g7,P,T
77. H. Goldring and J. Osborne, "Students' difficulties with energy and related concepts," *Phys. Educ.* **29**, 26-31 (1994).
78. M. F. Granville, "Student misconceptions in thermodynamics," *J. Chem. Educ.* **62**, 847-848 (1985).
79. Gréa, Jean and Jérôme Viard. (1995). From language to concept appropriation in physics. In: *Thinking Physics for Teaching*, edited by Carlo Bernardini, Carlo Tarsitani, and Matilde Vicentini, pp. 97-106. New York, Plenum.
80. Thomas J. Greenbowe and David E. Meltzer, "Student learning of thermochemical concepts in the context of solution calorimetry," *Int. J. Sci. Educ.* **25**, 779-800 (2003).
81. Guesne, E., McDermott, L.C. (1983). Students' conceptions and learning in the fields of light and heat. *Research on Physics Education. Proceedings of the first international workshop. La Londe les Maures, Rapports d'Ateliers, Workshop No. 6, 577-579.
82. Guesne, E., Tiberghien, A., Delacôte, G. (1978). Méthods et resultats concernant l'analyse des conceptions des élèves dans differents domaines de la physique. Deux exemples: les notions de chaleur et lumiere. *Revue Française de Pedagogie 45, 25-36 #g6,P,T,O
83. U. Haber-Schaim, "The role of the second law of thermodynamics in energy education," in *Proceedings of the International Conference on Energy Education* (Rhode Island, University of Rhode Island, Office of Energy Education and College of Continuing Education, 1981), pp. 97-99.

84. Hall, G.S., Browne, C.E. (1903). Children's ideas of fire, heat, frost and cold. *Pedagogic Seminar 10, 27-85 #g6,P,T
85. Hamby, M. (1990). Understanding the language: Problem solving and the first law of thermodynamics. *J. Chem. Ed.* 67, 923-924.
86. Harrison, Allan G., Diane J. Grayson, and David F. Treagust. (1999). Investigating a Grade 11 student's evolving conceptions of heat and temperature. *Journal of Research in Science Teaching*, 36, 55-87.
87. Helsdon, R. M., "Teaching thermodynamics," *Physics Education*, 11, 261-262, 1976.
88. Hewson, M. G. and D. Hamlyn, "The influence of intellectual environment on conceptions of heat," *European Journal of Science Education* 6 (1984) 254-262.
89. Hewson, M.G., Hamlyn, D. (1983). The representation and analysis of conceptions of heat. *Research on Physics Education. Proceedings of the first international workshop. La Londe les Maures*, 347-354.
90. Hollon, R.E., Anderson, C.W. (1985). The curricular significance of college students' conceptions of heat and temperature. *Paper presented at the annual meeting of the American Educational Research Association, Chicago #g6,g7,P,T
91. Jara-Guerrero, S. (1993). Misconceptions on heat and temperature. *In: Novak, J.: *Proceedings of the Third International Seminar on Misconceptions and Educational Strategies in Science and Mathematics*. Ithaca, NY: Cornell University (distributed electronically). Ithaca, New York: Cornell University (distributed electronically) #g6,P,T
92. Paul G. Jasien and Graham E. Oberem, "Understanding of elementary concepts in heat and temperature among college students and K-12 teachers," *J. Chem. Ed.* 79, 889-895 (2002).
93. Johnson, P. (1998). Children's understanding of changes of state involving the gas state. Part 1: Boiling water and the particle theory. **International Journal of Science Education* 20, 5, 567-583 #g6,P,AT,T
94. Johnson, P. (1998). Children's understanding of changes of state involving the gas state. Part 2: Evaporation and condensation below boiling point. **International Journal of Science Education* 20, 695-709
95. A. H. Johnstone, J. J. MacDonald, and G. Webb, "Misconceptions in school thermodynamics," *Physics Educ.* 12, 248-251 (1977).
96. Jolls, Kenneth R. (1996). Visualization in classical thermodynamics. 1996 ABET Annual Meeting Proceedings.

97. Jolls, Kenneth R., Michael C. Schmitz and Daniel C. Coy (1991). Seeing is believing: a new look at an old subject. *The Chemical Engineer*, 30 May 1991, 48-52.
98. Jones, M. Gail, Glenda Carter, and Melissa J. Rua (2000). Exploring the development of conceptual ecologies: Communities of concepts related to convection and heat. *Journal of Research in Science Teaching* 37, 139-159.
99. Walter H. Kaper, *Thermodynamica leren onderwijzen*, series CD- β scientific library, no. 27 (Centre for Science and Mathematics Education, Utrecht, 1997)
<<http://130.241.107.83/esera/diss/dissholland2>>
100. Walter H. Kaper and Martin J. Goedhart, “ 'Forms of energy', an intermediary language on the road to thermodynamics? Part I,” *Int. J. Sci. Educ.* **24**, 81-95 (2002).
101. Walter H. Kaper and Martin J. Goedhart, “ 'Forms of energy', an intermediary language on the road to thermodynamics? Part II,” *Int. J. Sci. Educ.* **24**, 119-137 (2002).
102. Karanikas, J. (1995). A constructivist approach to teaching heat to the fourth-year students of the department of primary education. *In: Psillos, D.: *European Research in Science Education II*. Thessaloniki: Art of Text S.A., 432-440 #g7,P,T
103. Kautz, Christian Hans (1999). Identifying and addressing student difficulties with the ideal gas law. Ph.D. Dissertation, University of Washington. UMI#9944136, University Microfilms.
104. Keller, Philip C. and Wendy Weeks-Galindo (1998). Thermochemistry misconceptions among students in a first year college chemistry lab. Paper presented at the Annual Meeting of the National Association for Research in Science Teaching, San Diego, CA, April 19-22, 1998.
105. Kesidou, S. (1988). Schuelervorstellungen zur Irreversibilitaet. *In: Kuhn, W. (Hrsg.): *Didaktik der Physik. Vortraege der Physikertagung 1988 in Giessen*. Giessen: DPG Fachausschuss Didaktik der Physik #g6,P,T,IRR
106. Kesidou, S. (1989). Waermevorstellungen: Extensitaet, Intensitaet, Irreversibilitaet. *In: Kuhn, W.: *Didaktik der Physik. Vortraege auf der Physikertagung 1989 in Bonn*. Giessen: Deutsche Physikalische Gesellschaft, Fachausschuss Didaktik der Physik, 145-150 #g6,P,T,IRR
107. Kesidou, S. (1990). Irreversibilitaetsvorstellungen und Erhaltungsvorstellungen: Ergebnisse einer empirischen Untersuchung. *In: Wiebel, K.H.: *Zur Didaktik der Physik und Chemie: Probleme und Perspektiven. Vortraege auf der Tagung fuer Didaktik der Physik/Chemie in Kassel, September 1989*. Alsbach: Leuchtturm, 269-271 #g6,P,IRR,EN
108. Kesidou, S. (1990). Schuelervorstellungen zur Irreversibilitaet. *Kiel: IPN #g3,g5,g6,P,T,EN,IRR,OCI

109. Kesidou, S., Duit, R. (1991). Irreversibilitaetsideen Schuelervorstellungen im herkoemmlichen Unterricht und im Karlsruher Ansatz. *In: Kuhn, W.: Didaktik der Physik. Vortraege Physikertagung 1991 Erlangen. Giessen: Deutsche physikalische Gesellschaft Fachausschuss Didaktik der Physik, 228-235 #g6,P,EN,T,IRR,OCI
110. Kesidou, S., Duit, R. (1991). Waerme, Energie, Irreversibilitaet- Schuelervorstellungen im herkoemmlichen Unterricht und im Karlsruher Ansatz. *physica didactica 18, 2/3, 57-75 #g6,P,T,EN,AT,OCI
111. Sofia Kesidou and Reinders Duit, "Students' conceptions of the second law of thermodynamics – an interpretive study," J. Res. Sci. Teach. **30**, 85-106 (1993).
112. Sofia Kesidou, Reinders Duit, and Shawn M. Glynn, "Conceptual development in physics: Students' understanding of heat," in *Learning science in the schools: Research reforming practice*, edited by Shawn M. Glynn and Reinders Duit (Erlbaum, Mahwah, NJ, 1995), pp. 179-198.
113. Klopfer, L.E., A.B. Champagne, and S.D. Chaikelin, "The Ubiquitous Quantities: Explorations That Inform the Design of Instruction on the Physical Properties of Matter," Sci. Educ. 76:597-614 (1992).
114. Lewis, Eileen Lob (1991). "The process of scientific knowledge acquisition among middle school students learning thermodynamics." Ph.D. dissertation, University of California, Berkeley. UMI #9203619, University Microfilms.
115. Lewis, Eileen L. et al. (1993). "The effect of computer simulations on introductory thermodynamics understanding," Educational Technology **33**, 45-58.
116. Lewis, E. L. (1996). Conceptual change among middle school students studying elementary thermodynamics. Journal of Science Education and Technology, Vol. 5(1) [March], 3-31.
117. Eileen L. Lewis and Marcia C. Linn, "Heat energy and temperature concepts of adolescents, adults, and experts: Implications for curricular improvements," J. Res. Sci. Teach. **31**, 657-677 (1994).
118. Liew, C.W., Treagust, D. (1995). A predict-observe-explain teaching sequence for learning about students' understanding of heat and expansion of liquids. *Australian Science Teachers Journal 41, 1, 68-71 #g6,P,T

119. Linn, M.C. and N.B. Songer, "Teaching Thermodynamics to Middle School Students: What Are Appropriate Cognitive Demands?" *J. Res. Sci. Teaching*. 28:885-918 (1991).
120. Linn, Marcia C. and N. B. Songer (1993). "How do students make sense of science?," *Merrill-Palmer Quarterly* **39(1)**, 47-73.
121. Marcia C. Linn, Nancy Butler Songer, Eileen Lob Lewis, and Judy Stern, "Using technology to teach thermodynamics: Achieving integrated understanding," In: Ferguson, D.: *Advanced educational technologies for mathematics and science* (Berlin, Springer-Verlag, 1993), pp. 5-60.
122. Michael Eric Loverude, *Investigation of student understanding of hydrostatics and thermal physics and of the underlying concepts from mechanics*, Ph.D. dissertation, University of Washington, 1999; unpublished.
123. Michael E. Loverude, Christian H. Kautz, and Paula R. L. Heron, "Student understanding of the first law of thermodynamics: Relating work to the adiabatic compression of an ideal gas," *Am. J. Phys.* **70**, 137-148 (2002).
124. Gail R. Luera, Charlotte Otto, and Paul W. Zitzewitz, "A conceptual change approach to teaching energy and thermodynamics to pre-service elementary teachers," *Journal of Physics Teacher Education Online*, **2** (4), 3-8 (May 2005).
125. B. Madeco de Burghi, "*Etude des pre-acquis de l'enfant sur les notions de chaleur et de temperature: application au processus d'enseignement: apprentissage*," thèse de troisième cycle, Université de Paris XI (1981).
126. Magnusson, S., Krajcik, J.S., Borko, H. (1993). The relationship between teacher knowledge and desired representation of content in instruction about heat energy and temperature. *Paper presented at the 1993 Annual Meeting of the National Association for Research in Science Teaching, Atlanta, GA #g8,CTL,P,T
127. Mak, Se-Yuen and K. Young (1987). Misconceptions in the teaching of heat. *The School Science Review* 68, 464-470.
128. C. Ma-Naim, V. Bar, and M. Finkental, "The initiation of thermodynamic theory from the particulate model for preservice teachers," in *Physics Teacher Education Beyond 2000: International Conference Physics Teacher Education Beyond 2000, Selected Contributions* edited by Roser Pinto and Santiago Surinach (Elsevier, Paris, 2001), pp. 301-304.
129. Manthei, U. (1980). Zur genetischen Begriffsdifferenzierung und Begriffspräzisierung. Ergebnisse einer Untersuchung am Beispiel Wärme - Temperatur. *Physik in der Schule 18, 9, 389-398 #g6,P,T
130. Ursula Manthei and Paul T@bert, "Zustandsgr` & und Prozessgr` & erl@tert am Beispiel Energie – Arbeit, W@me, Strahlung," *Physik in der Schule* **19** (7/8), 307-317 (1981).

131. I. P. Martins and A. Cachapuz, "Making the invisible visible: A constructivist approach to the experimental teaching of energy changes in chemical systems. In J. Novak (ed) *Proceedings of the 3rd International Seminar on Misconceptions and Educational Strategies in Science and Mathematics*. Ithaca, N.Y., Misconceptions Trust (1993).
132. Marta Massa, Marta Yanitelli, and Susana Cabanellas, "Difficulties on inferencial process. A study on thermodynamic problems," in: *Developing Formal Thinking in Physics (First International Girep Seminar 2001, Selected Contributions)*, edited by Marisa Michelini and Marina Cobal (Editrice Universitaria Udinese srl, Udine, Italy, 2002), pp. 174-179.
133. C. Méheut, "Designing a learning sequence about a prequantitative kinetic model of gases: the parts played by questions and by a computer simulation," *Int. J. Sci. Ed.* **19** (6), 647-660 (1997).
134. David E. Meltzer, "Student reasoning regarding work, heat, and the first law of thermodynamics in an introductory physics course," in *Proceedings of the 2001 Physics Education Research Conference*, edited by Scott Franklin, Jeffrey Marx, and Karen Cummings (Rochester, NY, 2001), pp. 107-110.
135. David E. Meltzer, "Investigation of students' reasoning regarding heat, work, and the first law of thermodynamics in an introductory calculus-based general physics course," *preprint, 2002*.
136. Mettes, C.T., A. Pilot, and H.J. Roosink, "Linking Factual and Procedural Knowledge in Solving Science Problems: A Case Study in a Thermodynamics Course," *Instruc. Sci.* **10**:333-361 (1981).
137. Mettes, C.T., A. Pilot, H.J. Roosink and H. Kramers-Pals (1981). Teaching and learning problem solving in science, part II: learning problem solving in a thermodynamic course. *J. Chem. Ed.* **58**, 51-55.
138. Moore, R. J. and R. W. Schwenz (1992). The problem with P Chem., *J. Chem. Ed.* **69**, 1001-1002.
139. Guy S. M. Moore, "General, restricted and misleading forms of the First law of thermodynamics," *Phys. Educ.* **28**, 228-237 (1993).
140. Moreira, M.A., Santos, C.A. (1981). The influence of content organization of student's cognitive structure in thermodynamics. **Journal of Research in Science Teaching* **18**, 525-531 #g5,g6,P,T
141. Mortimer, E.F. (1994). The evolution of students' explanations for physical state of matter as a change in their conceptual profile. **In: Lijnse, P.L.: European research in science education - Proceedings of the first Ph. D. Summerschool. Utrecht: CDss Press, Centrum voor ss-Didactiek, 281-287 #g6,P,M*

142. Nachmias, R., R. Stavy and R. Avrams (1990). A microcomputer-based diagnostic system for identifying students' conception of heat and temperature. *Int. J. Sci. Ed.* 12, 123-132.
143. Newell, A. , Ross, K. (1996). Children's conception of thermal conduction - or the story of a woollen hat . **School Science Review* 78, 282, 33-38 #g6,g7,P,T
144. Newman, B., Cosgrove, M., Forret, M. (1988). Being cool in the cool unit or evaluating the learning of refrigeration from scratch. **Research in Science Education* 18, 220-226 #g6,P
145. Nsumbu-A-Nlambu, D.M. (1986). Quelques conceptions d'eleves concernant le concept de chaleur. *In: Giordan, A., Martinand, J.L.: Feuilles d'epistemologie appliquee et de didactique des sciences. Paris: Instaprint, 67-74 #g6,P,T,OCI
146. Nsumbu-A-Nlambu, D.M. (1988). Concept de chaleur quelques conceptions des adolescents savoirs sur le concept et difficultes pedagogiques. *In: Giordan, A., Martinand, J.L.: Communication, education et culture scientifiques et industrielles. Dixiemes Journees Internationales sur l'Education Scientifique. , 291-299 #g6,P,T
147. Nsumbu-A-Nlambu, D.M. (1990). Affirmations de quelques adolescents Zairois (16-17 ans), confrontees avec les hypotheses emises, a propos du concept de chaleur. *In: Giordan, A., Martinand, J.L., Souchon, C.: Actes JIES XII. Chamonix: Centre Jean Franco, 269-275 #g6,P,T
148. Ogborn, J., "The second law of thermodynamics: a teaching problem and an opportunity," *School Science Review*, 201, 57, 654-672, 1976.
149. Osborne, R.J. and M.M. Cosgrove, "Student Conceptions of the Changes of States of Water," *J. Res. Sci. Tchng.* 20:825-838 (1983).
150. Paton, R.C. (1991). Students' deductive reasoning about state changes in a model biosystem. **Journal of Biological Education* 25, 2, 129-134 #g6,B
151. M. A. Pierrard, "*Notions physiques, objets techniques et structures mathematiques à propos de la temperature au cycle moyen,*" thèse de troisième cycle, Université de Paris VII (1982).
152. C. Pisani, "*Utilisation par des adultes de quelques notions de physique comme pression et chaleur. Comparaison avec l'utilisation du physicien,*" thèse de troisième cycle, Université de Paris VII (1982).
153. David B. Pushkin, "The Influence of a Computer-Interfaced Calorimetry Demonstration on General Physics Students' Conceptual Views of Entropy and their Metaphoric Explanations of the Second Law of Thermodynamics," Ph.D. dissertation, Pennsylvania State University, 1995 (UMI, Ann Arbor, MI), UMI #9612815.

154. David B. Pushkin, "Scientific terminology and context: How broad or narrow are our meanings?," *J. Res. Sci. Teach.* **34**, 661-668 (1997).
155. Quílez-Pardo, J., Solaz-Portoléz, J.J. (1995). Students' and teachers' misapplication of Le Chatelier's principle: Implications for the teaching of chemical equilibrium. **Journal of Research in Science Teaching* 32, 9, 939-957
156. Rafel, J., Mans, C. (1987). Alternative frameworks about the learning of changes of state of aggregation of matter: sorting of answers into models. **In: Novak, J.: Proceedings of the 2. Int. Seminar "Misconceptions and Educational Strategies in Science and Mathematics", Vol.III. Ithaca: Cornell University, 392-399 #g6,P,M*
157. Rafel, J., Mans, C., Black, P. (1992). Pupils' conceptions around changes of state of aggregation of matter. **In: Hills, S.: The history and philosophy of science in science education. Proceedings of the international conference on the history and philosophy of science and science teaching. Volume II. Kingston, Ontario: The Faculty of Education, Queens University, 335-346 #g5,g6,P,M*
158. Reif, F. "Thermal physics in the introductory physics course: Why and how to teach it from a unified atomic perspective." *Am. J. Phys.* **67**, 1051-1062 (1999).
159. M. Ribeiro, D. C. Pereira, and R. Maskill, "Reaction and spontaneity: The influence of meaning from everyday language on fourth year undergraduates' interpretations of some simple chemical phenomena." *International Journal of Science Education* **12**, 391-401 (1990).
160. Roberts, I. F. and D. S. Watts (1976). The teaching of thermodynamics at preuniversity level. *Phys. Educ.* 11, 277-284.
161. Maria A. Rodríguez and Mansoor Niaz, "¿Por qué los estudiantes confunden energía calórica y temperatura?," *Journal of Science Education (Revista de Educación en Ciencias)* **2**, 61-64 (2003).
162. Rogan, J.M., "Development of a Conceptual Framework of Heat," *Sci. Educ.* 72:103-133 (1988).
163. Rollnick, M. and M. Rutherford, "African Primary School teachers - What Ideas do They Hold on Air and Air Pressure?," *Int. J. Sci. Educ.* 12(1):101-114 (1990).
164. Rosenquist, M.L., Popp, B.D., McDermott, L.C. (1982). Some elementary conceptual difficulties with heat and temperature. **Paper presented at the national meeting of the American Association of Physics Teachers in San Francisco #g6,P,T,OCI*
165. Rosenquist, M.L., Popp, B.D., McDermott, L.C. (1983). Helping students overcome conceptual difficulties with heat and temperature. **Paper presented at the summer meeting of the American Association of Physics Teachers in Ashland #g7,P,T*

166. K. Ross, "There is no energy in food and fuels – but they do have fuel value," *School Science Review* **75**, 39-47 (1993).
167. Rozier, S. (1987) "Le raisonnement linéaire causal en thermodynamique classique élémentaire. Thesis, University of Paris 7, on request from LDPES.
168. Rozier, S., and L. Viennot, "Students' Reasonings in Thermodynamics," *Int. J. Sci. Educ.* **13**:159-170 (1991).
169. Rozier, S., Viennot, L. (1990). Students' reasoning in thermodynamics. *In: Lijnse, P.L., Licht, P., Vos, W. de, Waarlo, A.J.: Relating macroscopic phenomena to microscopic particles: a central problem in secondary science education. Utrecht: CD-ss Press, 36-49 #g6,P,T,AT
170. Rozier, S., Viennot, L. (1990). Students' reasoning in thermodynamics. *Tijdschrift voor Didactiek der ss-wetenschappen **8**, 1, 3-18 #g6,P,T,AT
171. S. Rubio, J. L. Calvo, M. I. Suero, A. L. Perez-Rodriguez, J. J. Peña and M. Montanero, "Misconceptions about heat and temperature," in: *Thermodynamics and Statistical Physics: Teaching Modern Physics*, edited by Manuel G. Velarde and Francisco Cuadros (World Scientific, Singapore, 1995), pp. 282-286.
172. Russell, T., W. Harlen, and D. Watt, "Children's Ideas about Evaporation," *Int. J. Sci. Educ.* **11**:566-576 (1989).
173. Ryan, C. (1990). Student teachers' concepts of purity and of states of matter. *Research in Science and Technological Education **8**, 2, 171-183 #g6,P,M,C
174. Schaefer, G. (1983). The concept triangle energy-information-order in the heads of our students. *In: Marx, G.: Entropy in the school. Proceedings of the 6th. Danube Seminar on Physics Education. Budapest: Roland Eoetvoes Physical Society, 56-86 #g6,P,INF,EN
175. Schaefer, G. (1984). Information und Ordnung - zwei maechtige Begriffe unserer Zeit. *In: Schaefer, G.: Information und Ordnung. Koeln: Aulis, 9-45
176. M. R. Sciarretta, R. Stilli, and M. Vicentini Missoni, "On the thermal properties of materials: Common sense knowledge of Italian students and teachers," *Int. J. Sci. Ed.* **12**, 369-379 (1990).
177. Sere, M., "Children's Conceptions of the Gaseous State, Prior to Teaching," *Eur. J. Sci. Educ.* **8**:413-425 (1986).
178. M. Shayer and H. Wylam, "The development of the concepts of heat and temperature in 10-13 year olds," *J. Res. Sci. Teach.* **18**, 419-434 (1981).

179. Shepherd, D.L., Renner, J.W. (1982). Student understandings and misunderstandings of states of matter and density changes. *School Science and Mathematics 82, 8, 650-665 #g6,P,M,OCI,DIM
180. T. R. Shultz and M. Coddington, "Development of the concepts of energy conservation and entropy," J. Exp. Child Psych. **31**, 131-153 (1981).
181. Josip Slisko and Dewey I. Dykstra, Jr., "The role of scientific terminology in research and teaching: Is something important missing?," J. Res. Sci. Teach. **34**, 655-660 (1997).
182. Solomon, J. (1982). How children learn about energy – or does the first law come first? Sch. Sci. Rev. 63(224), 415-422.
183. Songer, Nancy Butler (1989). Promoting integration of instructed and natural world knowledge in thermodynamics. Ph.D. Dissertation, University of California, Berkeley. UMI#9029025. University Microfilms.
184. Songer, Nancy Butler and Marcia C. Linn (1991). "How do students' views of science influence knowledge integration?," Journal of Research in Science Teaching **28**, 761-784.
185. Erich Starauschek, "Wärmelehre nach dem Karlsruher Physikkurs – Ergebnisse einer empirischen Studie," Physik und Didaktik in Schule und Hochschule **1**(1), 12-18 (2002). < http://www.phydid.de/beitraege/Starauschek_PhyDid_1_2002.pdf >
186. Erich Starauschek, "Wärmelehre mit der Entropie – Welchen Nutzen bringt sie Schülerinnen und Schülern?," Praxis der Naturwissenschaften – Physik in der Schule 8/52, 35-41 (2003).
187. Stavy, R., "Children's Conception of Gas," Int. J. Sci. Educ. 10:553-560 (1988).
188. Stavy, R., "Children's Conception of Change in the State of Matter: From Liquid (or Solid) to Gas," J. Res. Sci. Tching. 27:247-266 (1990).
189. Stavy, R. (1994). States of matter - pedagogical sequence and teaching strategies based on cognitive research. *In: Fensham, P., Gunstone, R., White, R.: The content of science. London: The Falmer Press, 221-236 #g6,g7,P,M,AT
190. Stavy, R. (1996). Children's conceptions of the states of matter. *In: Michelini, M. , Jona, S. , Cobai, D.: Teaching the science of condensed matter and new materials. Udine: Forum, 81-94 #g6,P,C,AT
191. Stavy, R., Berkovitz, B. (1980). Cognitive conflict as a basis for teaching quantitative aspect of the concept of temperature. *Science Education 64, 5, 679-692 #g6,g7,P,T
192. Ruth Stavy and Dina Stachel, Children's conception of changes in the state of matter: From solid to liquid. Archives de Psychologie **53**, 331-344 (1985).

193. Stavy, R., Stachel, D. (1985). Children's ideas about "solid" and "liquid". *European Journal of Science Education 7, 407-421 #g6,P,M
194. Sidney Strauss and Ruth Stavy, (1983). Educational-developmental psychology and curriculum development: The case of heat and temperature. *In: Helm, H., Novak, J.D.: Proceedings of the International Seminar "Misconceptions in Science and Mathematics". Ithaca, N.Y.: Cornell University, 292-303 #g6,g7,P,T
195. Summers, M. (1983). Teaching heat - an analysis of misconceptions. School Science Review 64, 229, 670-676.
196. Swan, M., Jones, O.E. (1980). Comparison of students' percepts of distance, weight, height, area and temperature. *Science Education 64, 3, 297-307 #g6,P,T,M
197. Tarsitani, Carlo and Matilde Vicentini (1996). "Scientific mental representations of thermodynamics," Science and Education 5, 51-68.
198. Melonie Anne Teichert, "I. Singlet Photodissociation of ketene: The Effects of K-Conservation. II. Promoting Understanding of Thermodynamics: The Role of Student Explanation and Integration of Ideas," Ph.D. dissertation, University of California, Berkeley (UMI, Ann Arbor, MI, 1999), UMI #9931421.
199. Melonie A. Teichert and Angelica M. Stacy, "Promoting understanding of chemical bonding and spontaneity through student explanation and integration of ideas," J. Res. Sci. Teach. 39, 464-496 (2002).
200. Terpstra, K.J., van Sprang, H.F., Verdonk, A.H. (1989). "Hoe WARM het was en hoe ver...." - Op weg naar warmte als thermodynamisch begrip in 5-VWO ?. *Tijdschrift voor Didactiek der ss-wetenschappen 7, 1, 3-26 #g6,T,P,EN,OCI
201. Peter Lynn Thomas, *Student conceptions of equilibrium and fundamental thermodynamic concepts in college physical chemistry*, Ph.D. dissertation, University of Northern Colorado (UMI, Ann Arbor, MI, 1997), UMI # 9729078.
202. P. L. Thomas and R. W. Schwenz, "College physical chemistry students' conceptions of equilibrium and fundamental thermodynamics," J. Res. Sci. Teach. 35, 1151-1160 (1998).
203. Thomaz, M.F., Malaquias, I.M., Valente, M.C., Antunes, M.J. (1993). An attempt to overcome alternative conceptions related to heat and temperature. *In: Novak, J.: Proceedings of the Third International Seminar on Misconceptions and Educational Strategies in Science and Mathematics. Ithaca, New York: Cornell University (distributed electronically) #g7,P,T

204. Thomaz, M.F., Malaquias, I.M., Valente, M.C., Antunes, M.J. (1995). An attempt to overcome alternative conceptions related to heat and temperature. *Physics Education* 30, 19-26.
205. Tiberghien, A. (1980). Un exemple de restructuration de l'organisation conceptuelle à l'occasion d'un enseignement concernant la notion de chaleur. In: *Compte-rendus des Deuxièmes Journées Internationales sur l'Education Scientifique*. Chamonix, France.
206. Tiberghien, A., Modes and conditions of learning – an example: The learning of some aspects of the concepts of heat. In: W. F. Archenhold et al., (eds.), *Proceedings of an International Seminar on Cognitive Development Research in Science and Mathematics*, Leeds, University of Leeds Printing Service, pp. 288-309 (1980).
207. A. Tiberghien, "Critical review on the research aimed at elucidating the sense that the notions of *temperature and heat* have for students aged 10 to 16 years," in Delacôte, G., A. Tiberghien, and J. Schwartz (Eds.), *Research on Physics Education, Proceedings of the First International Workshop*, La Londe Les Maures, France (Éditions du CNRS, Paris, 1983) 75-90.
208. Andrée Tiberghien, "Part B: The development of ideas [on heat and temperature] with teaching," in *Children's Ideas in Science*, edited by Rosalind Driver, Edith Guesne, and Andrée Tiberghien, (Milton Keynes, Open University Press, 1985), pp. 67-84.
209. Andrée Tiberghien, "Learning and teaching at middle school level of concepts and phenomena in physics: The case of temperature," in *Learning and Instruction: European research in an international context, Volume 2.2*, edited by H. Mandl, E. de Corte, N. Bennett, H. F. Friedrich (Oxford : Pergamon Press, 1990), pp. 631-648.
210. Tiberghien, A., Barboux, M. (1980). Difficulté de l'acquisition de la notion de température par les élèves de 6ième. In: *Compte-rendus des Cinquièmes Journées Internationales sur l'Education Scientifique*. Chamonix, France.
211. Tiberghien, A., Delacôte, G. (1976). Conception de la chaleur des enfants de 10 à 12 ans. *In: GIREP: Proceedings of GIREP. Paris: Taylor and Francis #g6,P,T,OCI
212. A. Tiberghien and G. Delacôte, "Résultats préliminaires sur la conception de la chaleur," in *Physics Teaching in Schools: Proceedings of the 5th Seminar of GIREP*, edited by G. Delacôte (London, Taylor & Francis Ltd, 1978), pp. 275-282.
213. Towns, Marcy Hamby and Edward R. Grant (1997). " 'I believe I will go out of this class actually knowing something': Cooperative learning activities in physical chemistry," *Journal of Research in Science Teaching* 34, 819-835.
214. Triplett, G. (1973). Research on heat and temperature in cognitive development. **Journal of Children's Mathematical Behavior* 1, 2, 27-43 #g6,P,T,OCI

215. R. Tytler, "A comparison of year 1 and year 6 students' conceptions of evaporation and condensation: dimensions of conceptual progression," *Int. J. Sci. Educ.* 22(5), 447-468 (2000).
216. van Roon, P.H. (1992). "Work" and "heat" in teaching thermodynamics. *In: Schmidt, H.-J.: Empirical research in chemistry and physics education. Dortmund, Hongkong: The International Council of Association for Science Education, 135-148 #g6,P,T,OCI
217. P. H. van Roon, H. F. van Sprang, and A. H. Verdonk, " 'Work' and 'heat': on the road towards thermodynamics," *Int. J. Sci. Educ.* 16, 131-144 (1994).
218. Viennot, L. (1998). Experimental facts and ways of reasoning in thermodynamics: Learners' common approach. *In: Tiberghien, A. , Jossem, E., Barojas, J.: Connecting research in physics education. Ohio: ICPE Books, 1-10.
219. Viennot, L., Rozier, S. (1994). Pedagogical outcomes of research in science education: Examples in mechanics and thermodynamics. *In: Fensham, P., Gunstone, R., White, R.: The content of science. London: The Falmer Press, 237-254 #g6,g7,P,M,T
220. J. W. Warren, "The teaching of the concept of heat," *Phys. Educ.* 7, 41-44 (1972).
221. J. W. Warren, "Teaching thermodynamics," *Phys. Educ. [Letters]* 11, 388-389 (1976).
222. Watts, M., Gilbert, J.K. (n.d.). Appraising the understanding of science concepts: "Heat". *Guildford: Educational Studies #g6,P,T,OCI
223. Wiesner, H. (1985). Untersuchungen von Vorstellungen von Primarstufenschuelern ueber Begriffe und Phaenome aus der Waermelehre. *In: Mikelskis, H.: Zur Didaktik der Physik und Chemie. Vortraege auf der Tagung fuer Physik/Chemie 1984. Alsbach: Leuchtturm, 242-244 #g6,g7,P,T
224. H. Wiesner and J. Claus, "Temperatur und Temperaturvergleich. Bericht hber Unterrichtsversuche zur W@melehre," *Sachunterricht und Mathematik in der Primarstufe* 13, 200-205 (1985).
225. Wiesner, H., Stengl, D. (1984). Vorstellungen von Schuelern der Primarstufe zu Temperatur und Waerme. **Sachunterricht und Mathematik in der Primarstufe* 12, 445-452.
226. Wisner, M. (1987). The use of MBL, simulations, and kinetic molecular models to teach thermal physics. *Paper presented at the annual meeting of the American Educational Research Association.
227. Marianne Wisner, "Use of history of science to understand and remedy students' misconceptions about heat and temperature," in *Software Goes to School: Teaching for*

Understanding with New Technologies, edited by David N. Perkins, Judah L. Schwartz, Mary Maxwell West, and Martha Stone Wiske (Oxford, New York, 1995), pp. 23-38.

228. Wiser, M., Kipman, D. (1988). The differentiation of heat and temperature: An evaluation on the effect of microcomputer models on students' misconceptions. Paper presented at the annual meeting of the American Educational Research Association, New Orleans
229. Wiser, M., Kipman, D., Halkiadakis, L. (1988). Can models foster conceptual change? The case of heat and temperature. Technical Report, 1-35; ERIC Accession No. ED303365.
230. Wiser, M. and S. Carey, "When heat and temperature were one," in: Gentner and Stevens (Eds.), *Mental models* (Erlbaum, Hillsdale NJ, 1983) 267-297
231. Shelley Yeo and Marjan Zadnik, "Introductory thermal concept evaluation: Assessing students' understanding," *Phys. Teach.* **39**, 496-504 (2001).
232. Mark W. Zemansky, "The use and misuse of the word "heat" in physics teaching," *Phys. Teach.* **8**, 295-300 (1970).
233. Zimmermann, M.L. (1982). Quelques représentations d'élèves à propos de la chaleur. Actes des Journées Internationales sur l'Éducation Scientifique Volume IV
234. Zimmermann, M.L. (1990). Concept de chaleur. Geneve: Université de Genève