

REFERENCES

- [1] Crouch, C. H., Fagen, A. P., Callan, J. P., & Mazur, E. (2004). Classroom demonstrations: Learning tools or entertainment? *Am. J. Phys.*, 72(6), 835-838.
- [2] Ruhl, K. L., Hughes, C. A., & Schloss, P. J. (1987). Using the Pause Procedure to Enhance Lecture Recall. *TESE*, 10(1), 14-18.
- [3] Etkina, E., Heuvelen, A. V., Brookes, D. T., & Mills, D. (2002). Role of Experiments in Physics Instruction — A Process Approach. *Phys.Teach.*, 40, 351-355.
- [4] Bolotin, M. M., Kotlicki, A., & Rieger, G. (2007). Can Students Learn from Lecture Demonstrations? *JCST*, 45-49.
- [5] Bonwell, C. C., & Eison, J. A. (1991). Active Learning: Creating Excitement in the Classroom (Information Analyses - ERIC Clearinghouse Products No. ISBN-1-878380-06-7; ISSN-0884-0040): Association for the Study of Higher Education.; *ERIC Clearinghouse on Higher Education, Washington, D.C.; George Washington Univ.*, Washington, DC, School of Education and Human Development.
- [6] Paosawatanyong, B., & Wattanakasiwich, P. (2010). Implication of physics active-learning in Asia. *Lat. Am. J. Phys. Educ.*, 4(3), 501-505.
- [7] Cummings, K., Marx, J., Thornton, R., & Kuhl, D. (1999). Evaluating innovation in studio physics. *Phys. Educ. Res., Am. J. Phys. Suppl.*, 67 (7), 38-44.
- [8] Tanahounga, C., Chitaree, R., Soankwan, C., Sharmac, M. D., & Johnston, I. D. (2009). The effect of Interactive Lecture Demonstrations on students' understanding of heat and temperature: a study from Thailand. *Res.Sci.Technol.Educ.*, 27(1), 61–74.

- [9] Sharma, M. D., Johnston, I. D., Johnston, H., Varvell, K., Robertson, G., Hopkins, A., et al. (2010). Use of interactive lecture demonstrations: A ten year study. *PHYS. REV. ST PHYS. EDUC. RES.*, 6, 020119-020111-020119.
- [10] Talaeb, P. (2553). Developing Interactive Lecture Demonstration of Thermodynamic Processes. Chiang Mai University Chiang Mai.
- [11] Roth, W.-M., McRobbie, C. J., Lucas, K. B., & Boutonné, S. (1997). Why May Students Fail to Learn from Demonstrations? A Social Practice Perspective on Learning in Physics. *J Res Sci Teach*, 34(5), 509-533.
- [12] Vosniadou, S. (2002). On the nature of naïve physics. Netherlands: Kluwer Academic Publishers.
- [13] Mortimer, E. F. (1995). Conceptual Change or Conceptual Profile Change? *Science & Education* 4, 267-285.
- [14] Chi, M. T. H., & Roscoe, R. D. (2002). The processes and challenges and challenges of conceptual change. Netherlands: Kluwer Academic Publishers.
- [15] Disessa, A. A. (2002). Why “Conceptual ecology” is a good idea. Netherlands: Kluwer Academic Publishers.
- [16] Ivarsson, J., Schoultz, J., & SÄLJÖ, R. (2002). Revisiting children’s understanding of the shape of the earth. Netherlands: Kluwer Academic Publishers.
- [17] Posner, G. J., Strike, K. A., Hewson, P. W., & Gertzog, W. A. (1982). Accommodation of a Scientific Conception: Toward a Theory of Conceptual Change. *SCI. EDUC.* 66(2), 211-227.
- [18] Kuhn, T. S. (1970). The Structure of Scientific Revolutions (Vol. 2): *The University of Chicago press, LTD.*, LONDON.

- [19] Lakatos, I. (1968). Criticism and the Methodology of Scientific Research Programmes. Paper presented at *the Meeting of the Aristotelian Society at 21, Bedford Square, London.*
- [20] Tao, P.-K., & Gunstone, R. F. (1999). The Process of Conceptual Change in Force and Motion during Computer-Supported Physics Instruction. *JRST*, 36(7), 859–882.
- [21] Reinders, D., Treagust, D., & Widodo, A. (2008). Teaching Science for Conceptual Change: Theory and Practice. New York, USA: International Handbook of Research on Conceptual Change.
- [22] Hewson, M. G., & Hewson, P. W. (1983). Effect of instruction using students' prior knowledge and conceptual change strategies of science learning. *JRST*, 20(8), 731-744.
- [23] Nussbaum, J., & Novick, S. (1982). Alternative frameworks, conceptual conflict and accommodation: Toward a principled teaching strategy. *INSTR.SCI.*, 11, 183-200.
- [24] Solomon, J. (1983). Learning about energy: how pupils think in two domains. *EUR. J. SCI. EDUC.*, 5(1), 49-59.
- [25] Cosgrove, M., & Osborne, R. (1985). Lesson frameworks for changing children's ideas. Portsmouth: Learning in Science: The Implications of Children's Science.
- [26] Champagne, A. B., Gunstone, R. F., & L.E., K. (1985). Effecting changes in cognitive structures among physics students. Orlando: Cognitive structure and conceptual change.
- [27] Rowell, J. A., & Dawson, C. J. (1985). Equilibration, conflict and instruction: A new class-oriented perspective. *EUR. J. SCI. EDUC.*, 7(4), 331-344.

- [28] Clement, J., Brown, D. E., & Zietsman, A. (1989). Not all preconceptions are misconceptions: finding 'anchoring conceptions' for grounding instruction on students' intuitions. *INT. J. SCI. EDUC.*, 11, 554-565.
- [29] Stavy, R. (1991). Using Analogy to Overcome Misconceptions About Conservation of Matter. *J. RES. SCI. TEACH*, 28(4), 305-313.
- [30] Carey, S. (1991). Knowledge acquisition: Enrichment or conceptual change? Hillsdale: Lawrence Erlbaum Associates.
- [31] Chinn, C. A., & Brewer, W. F. (1993). The Role of Anomalous Data in Knowledge Acquisition: A Theoretical Framework and Implications for Science Instruction. *REV. EDUC. RES.*, 63(1), 1-49.
- [32] Stepan, J. (2006). Targeting students' science misconceptions physical science concepts using the conceptual change model: Showboard
- [33] Davis, J. (2001). Conceptual Change.
- [34] Arons, A. B., & Miner, T. D. (1990). A guide to introductory physics teaching *Phys. Teach.* , 28, 426.
- [35] McDermott, L. C. (1991). What we teach and what is learned - Closing the gap. *Am. J. Phys.*, 59(4), 301-315
- [36] Vosniadou, S. (1992). Mental Models of the Earth: A Study of Conceptual Change in Childhood. *COGNITIVE. PSYCHOL.*, 24, 535-585.
- [37] Duit, R. (1999). Conceptual change approaches in science education. Amsterdam New perspectives on conceptual change
- [38] Grayson, D. J. (1994). Concept substitution: An instructional strategy for promoting conceptual change. *RES. SCI. ED.*, 24, 102-111.
- [39] Ferrer, L. (2008). Building effective strategies for teaching of science'2008. Manila: Rex Bookstore.

- [40] McDermott, L. C. (1996). *Physics by Inquiry: An Introduction to the Physical Sciences* New York.
- [41] Shaffer, P. S., & McDermott, L. C. (1992). Research as a guide for curriculum development: An example from introductory electricity: Part2: Design of instructional strategies *Am. J. Phys.*, 60(11), 1003-1013.
- [42] Stepan, J., Stevendyche, & Beiswenger, R. (1988). The Effect of Two Instructional Models in Bringing About a Conceptual Change in the Understanding of Science Concepts by Prospective Elementary Teachers. *SCI. EDUC.*, 72(2), 185-195.
- [43] Sharan, S. (1980). Cooperative Learning in Small Groups: Recent Methods and Effects on Achievement, Attitudes, and Ethnic Relations. *REV. EDUC. RES.*, 50(2), 241-271.
- [44] Johnson, D. W., Johnson, R. T., Stanne, M. B., & Garibaldi, A. (2010). Impact of Group Processing on Achievement in Cooperative Groups. *J. SOC. PSYCHOL.*, 130(4).
- [45] Salavin, R. E. (1990). Research on cooperative learning: *Consensus and Controversy Educational Leadership*, 47, 52-54.
- [46] Cohen, E. G. (1994). Restructuring the Classroom: Conditions for Productive Small Groups. *REV. EDUC. RES.*, 64(1), 1-35.
- [47] Miller, G. A. (1955). The Magical Number Seven, Plus or Minus Two Some Limits on Our Capacity for Processing Information. *PSYCHOL. REV.*, 101(2), 343-352.
- [48] Shallice, T. (1988). *From Neuropsychology to Mental Structure*. New York: The press Syndicate of the University of Cambridge.
- [49] Miyake, A., & Shah, P. (1997). *Models of Working Memory* (No. 153-0666). Boulder: University of Colorado.

- [50] Viennot, L. (1995). A multidimensional approach to characterise a conceptual 'state' in students: The role played by questions. *Eur. Res. in Sci. Educ.* 2, 178-187.
- [51] Niedderer, H. (Ed.). (2001). *Physics Learning as Cognitive Development*. Bremen.
- [52] Galil, i., & Hazan, A. (2000). The influence of an historically oriented course on students' content knowledge in optics evaluated by means of facets-schemes analysis. *Phys. Educ. Res., Am. J. Phys. Suppl.*, 68(7), 3-15.
- [53] Liao, S.-Y. (2012). The Application of Piaget and Bruner's Cognitive-Developmental Theory in Children's Dance Teaching. *InJAE*, 164-197.
- [54] DiSessa, A. A. (1993). Toward an Epistemology of Physics. *Cognition. Instruct.*, 10, 105-225.
- [55] Prince, M. (2004). Does Active Learning Work? A Review of the Research. *J. Engr. Education*, 93(3), 223-231.
- [56] Sahin, A., & Kulm, G. (2008). Sixth grade mathematics teachers' intentions and use of probing, guiding, and factual questions. *J. Math. Teacher. Educ.*, 11, 221-241.
- [57] Ilaria, D. R. (2002). Questions That Engage Students in Mathematical Thinking. Paper presented at the Proceedings of the Annual Meeting [of the] North American Chapter of the International Group for the Psychology of Mathematics Education, Athens.
- [58] Zohrabi, M. (2013). Mixed Method Research: Instruments, Validity, Reliability and Reporting Findings. *TPLS.*, 3(2), 254-262.
- [59] Engelhardt, P. V. (2009). An Introduction to Classical Test Theory as Applied to Conceptual Multiple-choice Tests. *PER.*, 2(1), 1-40.

- [60] Chandrasegarana, A. L., Treagust, D. F., & Mocerinob, M. (2007). The development of a two-tier multiple-choice diagnostic instrument for evaluating secondary school students' ability to describe and explain chemical reactions using multiple levels of representation. *CHEM. EDUC. RES. PRACT.*, 8(3), 293-307.
- [61] Tan, K.-C. D., & Treagust, D. F. (1999). Evaluating students' understanding of chemical bonding. *Sch. Sci. Rev.*, 81(294), 75-84.
- [62] Rollnick, M., & Mahooana, P. P. (1999). A quick and effective way of diagnosing student difficulties: two tier from simple multiple choice questions. *S. Afr. J. Chem.*, 52(4), 161-164.
- [63] Odom, A. L., & Barrow, L. H. (1995). Development and Application of a 'Ifro-Tier Diagnostic Test Measuring College Biology Students' Understanding of Diffusion and Osmosis after a Course of Instruction. *J. RES. SCI. TEACH.*, 32(1), 45-61.
- [64] Tan, K. C. D., Goh, N. K., & Treagust, D. F. (2002). Development and Application of a Two-Tier Multiple Choice Diagnostic Instrument to Assess High School Students' Understanding of Inorganic Chemistry Qualitative Analysis. *J. RES. SCI. TEACH.*, 39(4), 283-301.
- [65] Tüysüz, C. (2009). Development of two-tier diagnostic instrument and assess students' understanding in chemistry. *SCI. RES. ESSAYS.*, 4(6), 626-631.
- [66] ŞAHİN, Ç., & ÇEPNİ, S. (2011). Development of a Two Tiered Test for Determining Differentiation in Conceptual Structure related to "Floating-Sinking, Buoyancy and Pressure" Concepts. *TUSED.*, 8(1), 79-110.
- [67] Caleon, I., & Subramaniam, R. (2010). Development and Application of a Three-Tier Diagnostic Test to Assess Secondary Students' Understanding of Waves. *INT. J. SCI. EDUC.*, 32(7).

- [68] Treagust, D. F. (1995). Diagnostic assessment of students' science knowledge (Vol. 1). Mahwah, NJ: Lawrence Erlbaum Associates.
- [69] Kamcharean, C., & Wattanakasiwich, P. (2013). A Two-tier Multiple Choice Questions to Diagnose Thermodynamic Misconception of Thai and Laos Students. Paper presented at the *The 12th Asia Pacific Physics Conference*, Chiba, Japan
- [70] Bao, L., & Redish, E. F. (2006). Model analysis: Representing and assessing the dynamics of student learning. *PHYS. REV. ST PHYS. EDUC. RES.*, 2, 010103-010101-010116.
- [71] Wattanakasiwich, P., & Ananta, S. (2009). Model Analysis: A Quantum Approach to Analyze Student Understanding. *Chiang Mai J. Sci.*, 36(1), 24-32.
- [72] JAIRUK, U. (2007). The use of interactive lecture demonstrations in force and motion to teach high school-level physics. Mahidol University, Bangkok.
- [73] Sokoloff, D. R., & Thornton, R. K. (1996, 31 Jul-3 Aug 1996). Using interactive lecture demonstrations to create an active learning environment. Paper presented at the *The Changing Role of Physics Departments in Modern Universities*, College Park, Maryland (USA).
- [74] Auparay, N. (2013). Room Temperature Seebeck Coefficient Measurement of Metals and Semiconductors. Oregon State University, Oregon State.
- [75] Lundstrom, M. (2011). Near-equilibrium Transport: Fundamentals and Applications Lecture 4: Thermoelectric Effects: Physical Approach (pp. 1-57): Purdue University.
- [76] Wu, C. (2015). Thermoelectric Effect [Electronic Version] from http://www.efunda.com/designstandards/sensors/thermocouples/thmcple_theory.cfm.

- [77] Winder, E. J., Ellis, A. B., & Lisensky, G. C. (1996). Thermoelectric Devices: Solid-State Refrigerators and Electrical Generators in the Classroom. *J. CHEM. EDUC.*, 73(10), 940-946.
- [78] Chen, A. (2015). Thermoelectric module TEC1-12708 [Electronic Version] from <http://hebeiltd.en.made-in-china.com/>.
- [79] Talanquer, V. (2006). Reclaiming the Central Role of Equations of State in Thermodynamics. *J. CHEM. EDUC.*, 83(1), 127-131.
- [80] C., A. T., & Fajardo, F. (2012). Dependence of some mechanical properties of elastic bands on the length and load time. *Eur. J. Phys.*, 33, 771-784.
- [81] Pellicer, J., Manzanares, J. A., Zúñiga, J., & Utrillas, P. (2001). Thermodynamics of Rubber Elasticity. *J. CHEM. EDUC.*, 78(2).
- [82] Savarino, G., & Fisch, M. R. (1991). A general physics laboratory investigation of the thermodynamics of a rubber band. *Am. J. Phys.*, 59(2), 141-145.
- [83] Roundy, D., & Rogers, M. (2013). Exploring the thermodynamics of a rubber band. *Am. J. Phys.*, 81(1), 20-23.
- [84] Denardo, B., & Masada, R. (1990). Rubber hysteresis experiment. *Phys. Teach.*, 28, 489-491.
- [85] G´u´emez, J., Fiolhais, C., & Fiolhais, M. (2007). Physics of the fire piston and the fog bottle. *Eur. J. Phys.*, 28, 1199-1205.
- [86] Zemansky, M. W. (1909). Kelvin and Caratheodory *Math. Ann*, 67(355), 914-920.
- [87] Redlich, O. (1968). Fundamental Thermodynamics Since Caratheodory. *REV. MOD. PHYS.*, 40(3), 556-563.
- [88] Gilmore, R. (1983). Le Chatelier reciprocal relations and the mechanical analog *Am. J. Phys.*, 51(8), 733-743.

- [89] Wattanakasiwich, P., Taleab, P., Sharma, M. D., & Johnston, I. D. (2013). Development and Implementation of a Conceptual Survey in Thermodynamics. *IJISME*, 21(1), 29-53.
- [90] Wattanakasiwich, P. (2008). Assessing Student Conceptual Understanding of Force and Motion with Model Analysis. *CMU. J.Net. Sci.*, 7(2).
- [91] Sokoloff, D. R., & Thornton, R. K. (1996, 31 Jul-3 Aug 1996). Using interactive lecture demonstrations to create an active learning environment. Paper presented at the The Changing Role of Physics Departments in Modern Universities, College Park, Maryland (USA).
- [92] Mazzolini, A. P., & Daniel, S. (2014). The Use of Active Learning Methods in Introductory Electronics Deliver Positive Learning Outcomes, Yet Some Academics Still Resist Change. Paper presented at *the Proceedings of the 12th Asia Pacific Physics Conference*.
- [93] Kamcharean, C., & Wattanakasiwich, P. (2012). Students' understanding of Isobaric process. Paper presented at *the Asean Plus Three Graduate Research Congress*, Chiang Mai
- [94] Christensen, W. M., Meltzer, D. E., & Ogilvie, C. A. (2009). Student ideas regarding entropy and the second law of thermodynamics in an introductory physics course. *Am. J. Phys.*, 77 (10), 907-917.
- [95] Kesidou, S., & Duit, R. (1993). Students' Conceptions of the Second Law of Thermodynamics-An Interpretive Study. *J. RES. SCI. TEACH.*, 30(1), 85-106.
- [96] Bodner, G. M. (1991). I have found you an argument: The conceptual knowledge of beginning chemistry graduate students. *J. CHEM. EDUC.*, 68, 385-388.

- [97] Thomaz, M. F., Malaquias, I. M., Valente, M. C., & Antunes, M. J. (1995). An attempt to overcome alternative conceptions related to heat and temperature. *Phys. Educ.*, 30, 19-26.
- [98] David, E. M. (2004). Investigation of students' reasoning regarding heat, work, and the first law of thermodynamics in an introductory calculus-based general physics course. *Am. J. Phys.*, 72 11.
- [99] Rozier, a. S., & Viennot, L. (1991). Students' reasonings in thermodynamics. *INT. J. SCI. EDUC.*, 13(2), 159-170.
- [100] Thomas, P. L., & Schwenz, R. W. (1998). College Physical Chemistry Students' Conceptions of Equilibrium and Fundamental Thermodynamics. *J. RES. SCI. TEACH.*, 35(10), 1151-1160.
- [101] Granville, M. F. (1985). Student Misconceptions in Thermodynamics. *J. CHEM. EDUC.*, 62(10).
- [102] Johnstone, A. H., Macdonald, J. J., & Webb, G. (1995). Misconceptions in school thermodynamics. *Phys. Educ.*, 30, 19-26.
- [103] Odom, A. L. (1995). Development and Application of a 'Ifro-Tier Diagnostic Test Measuring College Biology Students' Understanding of Diffusion and Osmosis after a Course of Instruction. *J. RES. SCI. TEACH.*, 32(1).
- [104] Kautz, C. H., Heron, P. R. L., Loverude, M. E., & McDermott, L. C. (2005). Student understanding of the ideal gas law, Part I: A macroscopic perspective. *Am. J. Phys.*, 73(11).
- [105] Tipler, P. A., & G., M. (1997). Physics for scientists and engineers 4th edition New York
- [106] Brook, A., H., B., B., B., & R., D. (1985). Aspects of secondary students' understanding of heat.

- [107] Leinonen, R. e. a. (2009). Students' pre-knowledge as a guideline in the teaching of introductory thermal physics at university *Eur. J. Phys.* , 30, 593-604
- [108] Lin Ding, & Beichner, R. (2009). Approaches to data analysis of multiple-choice questions. *PHYS. REV. ST PHYS. EDUC. RES.*, 5.
- [109] Bland, M. J., & Altman, B. G. (1997). Statistics notes Cronbach's alpha *BMJ*, 314.
- [110] LANDIS, J. R., & KOCH, G. G. (1977). The Measurement of Observer Agreement for Categorical Data. *BIOMETRICS* 33, 159-174.
- [111] David, E. M. (2004). Investigation of students' reasoning regarding heat, work, and the first law of thermodynamics in an introductory calculus-based general physics course. *Am. J. Phys.*, 72(11), 1432-1446.

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved