

## References

- Aguirre, J. & Erickson, G. (1984). Students' conceptions about the vector characteristics of three physics concepts. *Journal of Research in Science Teaching*. Vol. 21, No. 5. pp. 439–457.
- Ainley, J. (1999). Perceptions of Teachers' Questioning Styles. In A. Borbás (Ed.) *Proceeding of XII Annual Conference of the International Group for the Psychology of Mathematics Education*, 2, 92–99, Veszprém, Hungary.
- Appleby, J., Cox, W. (2002). The Transition to Higher Education. In P. Kahn & J. Kyle (Eds), *Effective Learning & Teaching in Mathematics & its Applications*, Kogan Page Ltd: London.
- Barnard, T. & Tall, D. O. (1997). Cognitive Units, Connections and Mathematical Proof, *Proceedings of PME 21*, Lahti, Finland, 2, 41–48.
- Barnard, T. & Tall, D. O. (2001). A Comparative Study of Cognitive Units in Mathematical Thinking, *Proceedings of the 25<sup>th</sup> Conference of the International Group for the Psychology of Mathematics Education*, 2, 89–96, Amersfoort, The Netherlands.
- Belmont, J.M., & Butterfield, E.C. (1977). The instructional approach to developmental cognitive research. In R.V. Kail, Jr., & J.W. Hagen (Eds.), *Perspectives on the development of memory and cognition*, (pp. 437–481). Hillsdale, N.J.: Erlbaum.
- Berry, J. & Graham, T. (1992). Sixth Form Students Intuitive Understanding of Mechanics Concepts: Part 2, *Teaching Mathematics and its Applications*, 11 (3), 106–111.
- Beth, E.W. & Piaget, J. (1966). *Mathematical Epistemology and Psychology*, (W. Mays, trans.), Reidel: Dordrecht (originally published 1965).
- Biggs, J. & Collis, K. (1982). *Evaluating the Quality of Learning: the SOLO Taxonomy*. New York: Academic Press.
- Blackett, N. (1990). *Developing Understanding of Trigonometry in Boys and Girls using a Computer to Link Numerical and Visual Representations*, unpublished Ph.D. Thesis, University of Warwick.
- Breidenbach, D., Dubinsky, E., Hawks, J. & Nichols, D., (1992). Development of the Process Conception of Function, *Educational Studies in Mathematics*, 23 247–285.
- Brumby, M. N. (1982). Consistent differences in Cognitive Styles Shown for Qualitative Biological Problem Solving, *British Journal of Educational Psychology*, 52, 244–257.
- Bruner, J. S. (1961). The Act of Discovery. *Harvard Education Review*, 31, 21–32.
- Bruner, J. S. (1966), *Towards a Theory of Instruction*. Cambridge, Mass.: Harvard University Press.
- Chae, Soo Duck (2002), *Imagery and construction of conceptual knowledge in computer experiments with period doubling*. Unpublished PhD thesis, University of Warwick.
- Clement, J. (1982). Students' preconceptions in introductory mechanics. *American Journal of Physics*, 50, 66–71.
- Cohen, L., Manion, L., Morrison, K. (2000) *Research methods in education*, 5<sup>th</sup> Edition, Routledge: London.

## References

---

- Cottrill, J., Dubinsky, E., Nichols, D., Schwingendorf, K., Thomas, K., Vidakovic, D. (1996). Understanding the Limit Concept: Beginning with a Coordinated Process Scheme. *Journal of Mathematical Behavior*, 15 (2), 167–192.
- Crick, F. (1994). *The Astonishing Hypothesis*. London: Simon & Schuster.
- Davis, P. J. & Anderson, J. A. (1979). Non-analytic Aspects of Mathematics and their Implication for Research and Education, *SIAM Review* 21, 112–117.
- Denzin, N. K. (1970). *The Research Act in Sociology: a Theoretical Introduction to Sociological Methods*. London: Butterworth.
- Dewey, R.B. (1988). *Jak myslimy?* Warszawa: PWN (Polish translation of *How we think*, first published in USA, 1910).
- Dreyfus, A., Jungwirth, E. & Eliovitch, R. (1990). Applying the "Cognitive Conflict" strategy for conceptual change - some implications, difficulties, and problems. *Science Education*, 74 (5) 555-569.
- Driver, R. (1989). Changing conceptions. In P. Adey, J. Bliss, J. Head, & M. Shayer (Eds.), *Adolescent development and school science*. New York: Falmer Press.
- Driver, R., & Oldham, V. (1986). A constructivist approach to curriculum development in science, *Studies in Science Education*, 13, 105–122.
- Dubinsky, E. (1991). Reflective Abstraction in Advanced Mathematical Thinking, In D. O. Tall (Ed.), *Advanced Mathematical Thinking* (pp. 95–123). Dordrecht: Kluwer Academic Publishers.
- Dubinsky, E. & McDonald, M: (2001). APOS: A Constructivist Theory of Learning in Undergraduate Mathematics Education Research. In D. Holton et al. (Eds.), *The Teaching and Learning of Mathematics at University Level: An ICMI Study*, Kluwer Academic Publishers, 273–280.
- Fischbein, E. (1993). The interaction between the formal, the algorithmic and the intuitive components in a mathematical activity. In R. Biehler, R. W. Scholz, R. Strasser, & B. Winkelmann (Eds.), *Didactics of mathematics as a scientific discipline*, (pp. 231-245). Netherlands, Dordrecht: Kluwer.
- Fischbein, E., Tirosh, D. & Melamed, U. (1981). Is it possible to measure the intuitive acceptance of a mathematical statement? *Educational Studies in Mathematics* 12, 491–512.
- Gilbert, J.K., & Watts, D. M. (1983). Concepts, misconceptions and alternative conceptions: changing perspectives in science education. *Studies in Science Education*, 10, 61–98.
- Ginsburg, H. (1977). Learning to Count. Computing with Written Numbers. Mistakes. In Ginsburg, H., *Children's Arithmetic: How They Learn It and How You Teach It*, (pp. 1–29, 79–129). NY: Van Nostrand Reinhold.
- Ginsburg, H. (1981), The Clinical Interview in Psychological Research on Mathematical Thinking: Aims, Rationales, Techniques, *For The Learning Mathematics*, 1 (3), 57–64.
- Graham, T., Berry, J. (1997). A hierarchical model of the development of student understanding of force, *International Journal of Mathematics Education in Science & Technology*, 28 (6), 839–853.
- Graham, T., Boardman, S., Eaton, G., Parramore, K., Williamson, R., (2000). Mechanics 1, *Advancing Maths for AQA*, Heinemann Educational Publishers, Oxford, OX2 8EJ.

## References

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- Gray, E. M. & Tall, D. O. (1994). Duality, ambiguity and flexibility: A proceptual view of simple arithmetic. *Journal for Research in Mathematics Education*, 25, 2, 115–141.
- Gray, E. M. & Tall, D. O. (2001). Relationships between embodied objects and symbolic procepts: an explanatory theory of success and failure in mathematics. In Marja van den Heuvel-Panhuizen (Ed.) *Proceedings of the 25th Conference of the International Group for the Psychology of Mathematics Education 3*, 65–72.
- Heslop, N., Brodie, D., Williams, J. (2000). *Science, Pupil's Book*, Hodder & Stoughton, London.
- Hiebert, J. & Carpenter, T. P. (1992). Learning and Teaching with Understanding. In D. Grouws, (Ed.), *Handbook of Research on Mathematics Teaching and Learning* (pp. 65–97). New York:
- Hiebert, J. & Lefevre, P. (1986). Procedural and Conceptual Knowledge. In J. Hiebert, (Ed.), *Conceptual and Procedural Knowledge: The Case of Mathematics* (pp. 1–27).
- Howson, A. G. (Ed.) (1973). Developments in mathematical education. *Proceedings of the Second International Congress on Mathematical Education*: Cambridge University Press.
- Jagger, J. M. (1988). A Report on a Questionnaire to Test Students' Understanding of Mechanics, *Teaching Mathematics and Its Applications*. Vol. 7, No. 1, pp. 35–41.
- Jaworski, B. (1994). Being mathematical in a mathematical community. In Michelle Selinger (Ed.), *Teaching Mathematics* (Open University Postgraduate Certificate of Education), Routledge, London.
- Kant, I. (1781)(translated J. M. D. Meiklejohn, 1934). *Critique of Pure Reason*. London: J. M. Dent & Sons, Ltd.
- Kerslake, D. (1986). *Fractions: Children's Strategies and Errors, A Report of the Strategies and Errors in Secondary Mathematics Project*, NFER-NELSON Publishing Company Ltd., Berkshire.
- Kilpatrick, J. (1985), Reflection and recursion, *Educational Studies in Mathematics* 16, 1–26.
- Krutetskii, V.A. (1976). *The Psychology of Mathematical Abilities in Schoolchildren*, The University of Chicago Press.
- Lakoff, G. & Johnson, M. (1980). *Metaphors we live by*. Chicago: Chicago University Press.
- Lakoff, G. & Johnson, M. (1999). *Philosophy in the Flesh*. New York: Basic Books.
- Lakoff, G. (1987). *Women, Fire, and Dangerous Things*, University of Chicago Press, Chicago.
- Lakoff, G., Núñez, R. E (2000). *Where Mathematics comes from*. Published by Basic Books.
- Lave, J. & Wenger, E. (1991). *Situated Learning. Legitimate peripheral participation*, Cambridge: University of Cambridge Press.
- Lawler, R. W. (1981) The Progressive Construction of Mind. *Cognitive Science*, 5, 1–30.
- Locke, J. (1985). An essay concerning human understanding. In *Modern philosophical thought in Great Britain, Part I*, Gogut-Subczynska I., ed., Wydawnictwa Uniwersytetu Warszawskiego, 32–39.

## References

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- Mason, J. (1994). *Researching from the inside in mathematics education: locating an I-You relationship, extended version, IP5*. Milton Keynes: Centre for Mathematics Education, Open University.
- Mason, J. (1996). *Qualitative Research*, London: Sage, 93–4.
- National Council of Teachers of Mathematics (1991). *Professional standards for the teaching of mathematics*, Reston, VA.
- Oppenheim, A. N. (1992) *Questionnaire Design and Attitude Measurement*. London: Heinemann.
- Palmer, D. H. & Flanagan, R. B. (1995). Readiness to Change The Conception That “Motion Implies Force”: A Comparison of 12-Year-Old and 16-Year-Old Students.
- Pegg, J. & Tall, D. O., (2003). Fundamental Cycles of Cognitive Growth. In Anne D. Cockburn & Elena Nardi (Eds), *Proceedings of the 26th Conference of the International Group for the Psychology of Mathematics Education*, 4, 41–48. Norwich: UK.
- Piaget, J. (1970), *Genetic Epistemology* (E. Duckworth, trans.), Columbia University Press, New York.
- Piaget, J. (1985), *The Equilibration of Cognitive Structures*. Cambridge MA: Harvard.
- Pines, A. L., West, L.H. T. (1986). Conceptual understanding and science learning: An interpretation of research within a sources-of-knowledge framework. *Science Education*, 70, 583–604.
- Pinto, M. M. F. (1998). *Students' Understanding of Real Analysis*. PhD Thesis, Warwick University.
- Pledger, K. et al, (1996). *London GCSE Mathematics, Higher Course*. London: Heinemann.
- Posner, G. J., Strike, K. A., Hewson, P. W., & Gertzog, W. A. (1982). Accommodation of scientific conceptions: Toward a theory of conceptual change. *Science Education*, 66 (2), 211–227.
- Rosch, E. (1987). In Lakoff, G. *Women, Fire, and Dangerous Things*, University of Chicago Press, Chicago.
- Royce, J. R., Coward, H., Egan, E., Kessel, F. and Moss, L. (1978). *Psychological epistemology: A critical review of the empirical literature and theoretical issues*. Genetic Psychology Monograph 97, p.5–353.
- Sadanand, N., & Kess, J. (1990). Concepts in force and motion. *The Physics Teacher*, 28, 530–533.
- Schacter, D. (1996). *Searching for memory, the brain, the mind, and the past*. New York: Basic Books, 1996.
- Sfard, A. (1992). Operational origins of mathematical objects and the quandary of reification—the case of function. In Guershon Harel & Ed Dubinsky (Eds.), *The Concept of Function: Aspects of Epistemology and Pedagogy*, MAA Notes 25, (pp. 59–84). Washington DC: MAA.
- Sfard, A. (1991). On the dual nature of mathematical conceptions: reflections on processes and objects as different sides of the same coin, *Educational Studies in Mathematics*, 22, 1–36.
- Sierpinska, A. (1990). Some remarks on Understanding of Mathematics. *For the Learning of Mathematics*, 10 (3). 23–36.

## References

---

- Sierpinska, A. (1995). Mathematics: 'in context', 'pure', or 'with applications'?, *For the Learning of Mathematics* 15 (1), 2–15.
- Skemp, R. R. (1971). *The Psychology of Learning Mathematics*. Penguin, Harmondsworth, Middlesex, England.
- Skemp, R. R., (1976). Relational understanding and instrumental understanding, *Mathematics Teaching*, 77, 20–26.
- Skemp, R.R. (1979). *Intelligence, Learning, and Action: A foundation for theory and practice in education*, Chichester: John Wiley.
- Swanson, D. Schwarz R., Ginsburg, H. & Kossan, N. (1981) The Clinical Interview: Validity, Reliability and Diagnosis, *For the Learning of Mathematics*, 2, 31–38.
- Tall, D. O. & Vinner, S. (1981). Concept image and concept definition in mathematics, with particular reference to limits and continuity. *Educational Studies in Mathematics*, 12, 151–169.
- Tall, D. O., Gray, E. M., Bin Ali, M., Crowley, L., DeMarois, P., McGowen, M., Pitta, D., Pinto, M. M. F., Thomas, M. O. J., & Yusof, Y. (2001). Symbols and the Bifurcation between Procedural and Conceptual Thinking, *Canadian Journal of Science, Mathematics and Technology Education* 1, 81–104.
- Thurston, W. P. (1990). Mathematical Education, *Notices of the American Mathematical Society*, 37 (7), 844–850.
- Van Hiele, P. (2002). Similarities and Differences between the Theory of Learning and Teaching of Skemp and the Van Hiele Levels of Thinking. In D. O. Tall & M. O. J. Thomas (Eds), *Intelligence, Learning and Understanding in Mathematics: A Tribute to Richard Skemp*, (pp. 27-47), Post Pressed: Flaxton.
- Watson, A. (2002). Embodied action, effect and symbol in mathematical growth. In A. D. Cockburn & E. Nardi (Eds), *Proceedings of the 26th Annual Conference of the International Group for the Psychology of Mathematics Education*, 4, 370–377. Norwich, UK.
- Watson, A., Spyrou, P., & Tall, D. O. (2003). The Relationship between Physical Embodiment and Mathematical Symbolism: The Concept of Vector. *The Mediterranean Journal of Mathematics Education*, 1(2), 73–97.