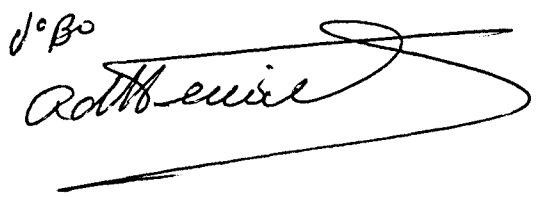
UNIVERSITAT AUTÒNOMA DE BARCELONA

Departament de Pedagogia Aplicada

TESI DOCTORAL

ESTRATÈGIES, DIFICULTATS I ERRORS EN ELS APRENENTATGES DE LES HABILITATS ESPACIALS

NÚRIA GORGORIÓ



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Bibliografia general.

Allen, G.L, Kirasic, K.C., Beard, R.L., (1989): 'Children's expressions of spatial knowledge.' *Journal of Experimental Child Psychology* **48**, pp. 114–130.

Audibert, G., (1985): *Une problématique en géométrie dans l'espace.* IREM, USTL, Montpellier.

Audibert, G., Keita, B., (1987): 'La perspective cavalière et la représentation de l'espace.' *Actes du Colloque CNRS GRECO Didactique et acquisition des connaissances scientifiques,* Sèvres, Centre National de la Recerche Scientifique, pp. 78–92.

Azcárate, C., (1990): *La velocidad: Introducción al concepto de derivada,* Tesi Doctoral. Universitat Autònoma de Barcelona.

Balacheff, N., (1990): 'Beyond a psychological approach: the psychology of mathematics education.' *For the Learning of Mathematics,* Nov. 1990, **10**(3), pp. 2–8.

Balchin, W.G.W., (1972): 'Graphycacy.' *Geography* **57**(3).

Baldy, R., (1986a): 'Comparaisons de dessins de volumes en perspective cavalière par des sujets adultes de bas niveau de formation.' *Archives de Psychologie* **54**, pp. 271–285.

Baldy, R., (1986b): 'Difficultés de lecture de dessins de volumes en perspective cavalière.' *Le Dessin Technique: Apprentissage, Utilisation, Évolution,* Actes du colloque international organisé par l'equipe de la recherche coopérative sur pro-

gramme: RCP 722/CRNS, Paris.

Baldy, R., (1988): 'De l'espace du dessin à celui de l'objet. Une activité de mises en correspondance entre des dessins en perspective cavalière et des objets réels.' *Educational Studies in Mathematics* **19**, pp. 43–57.

Baldy, R., Chatillon, J.F., (1985): 'La reconnaissance de dessins d'objets en perspective cavalière, les procédures développées par des adultes migrants dans des exercices de recherche de formes.' *Le Travail Humain* **48**(3), pp. 307–320.

Baracs, J., Pallascio, R., (1981): 'Le développement de la Perception Spatiale.' *Processus de geómétrisation et de visualisation. Les Actes de la 33ème rencontre de la CIEAEM*, Pallanza, pp. 37–49.

Bart, W.M., Baxter, J., Frey, S., (1980): 'The relationships of spatial ability and sex to formal reasoning capabilities.' *The Journal of Psychology* **104**, pp. 191–198.

Battista, M.T., Grayson, H.W., Talsma, G., (1982): 'The importance of spatial visualization and cognitive development for geometry learning in preservice elementary teachers.' *Journal for Research in Mathematics Education* **13**(5), pp. 332–340.

Battista, M.T., (1990): 'Spatial visualization and gender differences in high school geometry.' *Journal for Research in Mathematics Education* **21**(1), pp. 47–60.

Battista, M.T., Clements, D.H., (1991): 'Using spatial imagery in geometric reasoning.' *Arithmetic Teacher* **39**, pp. 18–21.

Bautier, T.J., Boudarel, F., Colmez, F., Parzysz., B., (1987): 'Représentation plane des figures de l'espace.' *Actes du Colloque CNRS GRECO Didactique et acquisition des connaissances scientifiques,* Sèvres, Centre National de la Recerche Scientifique.

Ben-Chaim, D., (1985): 'Adolescent girls' and boys' ability to communicate a description of a 3-dimensional building.' *Proceedings of the Tenth International Conference of Psychology for Mathemtics Education,* London, pp. 75–80.

Ben-Chaim, D., Lappan, G., Houang, R.T., (1985): 'Visualizing rectangular solids made of small cubes: analyzing and effecting students perfomance.' *Educational Studies in Mathematics* **16**, pp. 389–409.

Ben-Chaim, D., Lappan, G., Houang, R.T., (1986): 'Development and analysis of a spatial visualization test for a middle school boys and girls.' *Perceptual and Motor Skills* **63**, pp. 659–669.

Ben-Chaim, D., Lappan, G., Houang, R.T., (1988): 'The Effect of Instruction on Spatial Visualization Skills of Middle School Boys and Girls.' *American Educational Research Journal* **25**, pp. 51–71.

Ben-Chaim, D., Lappan, G., Houang, R.T., (1989a): 'Adolescents' ability to communicate spatial information: Analyzing and affecting students' performance.' *Educational Studies in Mathematics* **20**, pp. 121–146.

Ben-Chaim, D., Lappan, G., Houang, R.T., (1989b): 'The Role of Visualization in the Middle School Mathematics Curriculum.' *Focus on Learning Problems in Mathematics,* Winter Edition 1989, **11**(1), pp. 49–60. Center for Teaching/Learning Mathematics.

Bessot, D., (1983): 'Problemes de représentation de l'espace.' *Bulletin Inter IREM* **23**, *Enseignement de la géométrie.*

Bessot, A., Eberhard, M., (1986): 'Adaptation de la perspective à une situation complexe par des élèves de 9–12 ans.' *European Journal of Pshychology of Education* **1**(2), pp. 83–96.

Bessot, A., Eberhard, M., (1987): 'Représentations graphiques d'assemblages de cubes et finalités des situations.' *Actes du Colloque CNRS GRECO Didactique et acquisition des connaissances scientifiques,* Sèvres, Centre National de la Recerche Scientifique.

Bishop, A.J., (1973): 'Use of structural apparatus and spatial ability: a possible relationship.' *Research in Education* **9**, pp. 43–49.

Bishop, A.J., (1974): 'Visual Mathematics.' *Proceedings of the ICMI-IDM Regional Conference on the Teaching of Geometry,* IDM, Bielefeld, Alemanya, pp. 165–189.

Bishop, A.J., (1979): 'Visualising and Mathematics in a pre-technological culture.' *Educational Studies in Mathematics* **10**, pp. 136–146.

Bishop, A.J., (1980a): 'Spatial abilities and mathematics education. A review.' *Educational Studies in Mathematics* **11**, pp. 257-269.

Bishop, A.J., (1980b): *Spatial and Mathematical Abilities —A Reconciliation,* comunicació presentada a 'Conference on Mathematical Abilities at the University of Georgia', Athens, June 12–14, 1980.

Bishop, A.J., (1983): 'Space and Geometry' en R. Lesh, M. Landau, (Eds.), *Acquisition of Mathematics Concepts and Processes.* Academic Press Inc., Orlando, Florida, USA, pp. 175–203.

Bishop, A.J., (1985): 'The social construction of meaning: a significant development for mathematics education?' *For the Learning of Mathematics,* Feb. 1985, **5**(1), pp. 24–28.

Bishop, A.J., (1986): 'What are some obstacles to learning geometry.' en R. Morris (Ed.) *Studies in Mathematical Education. Teaching of Geometry,* UNESCO, Vol. 5, pp. 141–160.

Bishop, A.J., (1989): 'Review of Research on Visualization in Mathematics Education.' *Focus on Learning Problems in Mathematics,* Winter Edition, **11**(1). Center for Teaching/Learning Mathematics, pp. 7–16.

Bliss, J., Ogborn, J., (1979): 'The analysis of qualitative data.' *Eureopean Journal of Science Education* **1**(4), pp. 427–440.

Bliss, J., Monk, M., Ogborn, J., (Eds.), (1983): *Qualitative data analysis for Educational Research. A guide to uses of systemic networks.* Croom Helm, Londres i Camberra.

Bloom, B.S., Hastings, J.T., Madaus, G.F., (1975): *Evaluación del aprendizaje. III.* Troquel, Buenos Aires.

Bonnafé, F., (1987): 'Quelques hypothèses et résultats sur l'enseignement de la géométrie de l'espace à partir de la représentation en perspective cavalière.' *Bulletin de l'Association des Professeurs de Mathématiques de l'Enseignement Public* **363**, pp. 151–164.

Booth, L., (1984): *Algebra: children's strategies and errors.* Windsor: NFER-NELSON, Londres.

Braconne, A., Dionne, J.J., (1987): 'Secondary shool students' and teachers' understanding of demonstration in geometry' en J.C. Bergeron, N. Herscovics i C. Kieran (Eds.), *Proceedings of the Eleventh International Conference for the Py-*

chology of Mathematics Education **3**, Université de Montréal, Montréal, Canada, pp. 109–116.

Brandon, P.R., Newton, B.J., Hammond, O.W., (1987): 'Children's Mathematics Achievement in Hawaii: Sex Differences Favoring Girls.' *American Educational Research Journal* **24**(3), pp. 437–461.

Bright, G.W., Behr, M.J., Post, T., Wachsmuth, I. (1988): 'Identifying fractions on number lines.' *Journal for Research in Mathematics Education* **19**, pp. 215–232.

Brinkmann, E.H., (1965): 'Programed instruction as a technique for improving spatial visualization.' *Journal of Applied Psychology* **50**(2), pp. 179–184.

Brown, C.A., (1988): 'Secondary school results for the Fourth NAEP Mathematics Assesment.' *Mathematics Teacher* **81**, pp. 337–347.

Burden, L.D., Coulson, S.A., (1981): *Processing of Spatial Tasks.* M. Ed. Thesis, Monash University, Melbourne.

Burger, W.F., Shaughnessy, J.M., (1986): 'Characterizing the Van Hiele Levels of Development in Geometry.' *Journal for Research in Mathematics Education* **17**(1), pp. 31–48.

Burton, L., (Ed.), (1986): *Girls into Maths Can Go,* Rinehart and Winston, Londres.

Burton, L., Cooper, M., Leder, G., (1986): 'Representations of three-dimensional figures by mathematics teachers in-training.' *Proccedings of the Tenth Conference for the Pychology of Mathematics Education* **1**, University of London, Institute of Education, Londres, pp. 81–86.

Butler, D.L., (1982): 'Predicting the perception of three dimensional objects from the geometrical information in drawing.' *Journal of Experimental Psychology, Human Perception and Performances* **8**(5), pp. 674–692.

Campedelli, M.G., (1984): 'Quali prospettive per l'insegnamento della Geometria?' *Cultura, educazione, scuola,* oct. 1984, pp. 16–19.

Caplan, P.J., MacPherson, G.M., Tobin, P., (1985): 'Do sex-related differences in spatial abilities exist? A multilevel critique with new data.' *American Psychologist* **40**(7), pp. 786–799.

Casey, M.B., Pezaris, E., Nuttall, R.L., (1992): 'Spatial ability as a predictor of math achievement: The importance of sex and handedness patterns.' *Neuropsychologia* **30** pp. 35–45.

Cheung, K.C., (1989): 'Gender differences in the junior secondary (grade 7) mathematics curriculum in Hong Kong.' *Educational Studies in Mathematics* **20**, pp. 97–103.

Clements, D.H., Battista, M.T., (1989): 'Learning of geometric concepts in a Logo environment.' *Journal for Research in Mathematics Education* **20**, pp. 450–467.

Clements, D.H., Battista, M.T., (1990): 'The effects of Logo on children's conceptualization of angle and polygons.' *Journal for Research in Mathematics Education* **21**, pp. 356–371.

Clements, D.H., Battista, M.T., (1992): 'Geometry and spatial reasoning.' en D.A. Grouws (Ed.), *Handbook of research on mathematics teaching and learning,* Macmillan, New York, pp. 420–464.

Clements, M.A., (1981a): *Spatial ability, visual imagery and mathematical learning,* Comunicació a 'Annual Meeting of the American Educational Research Association,' Los Angeles, Abril 1981.

Clements, K., (1981b): 'Visual Imagery and School Mathematics. Part I.' *For the Learning of Mathematics,* Nov. 1981, **2**(2), pp. 2–9.

Clements, K., (1982): 'Visual Imagery and School Mathematics. Part II.' *For the Learning of Mathematics,* Mar. 1982, **2**(3), pp. 33–38.

Clements, M.A., (1983): 'The question of how spatial ability is defined, and its relevance to mathematics education.' *Zentralblatt für Didaktik der Mathematik,* Feb. 1983, **1**(1), pp. 8–20.

Clements, M.A., (1988): *Sometimes Visualizing Mathematics is not a Good Idea.* Comunicació Sixth International Congress on Mathematics Education, ICME VI, Budapest, juliol/agost 1988.

Clements, M.A., Del Campo, G., (1989): 'Linking Verbal Knowledge, Visual Images, and Episodes for Mathematical Learning.' *Focus on Learning Problems in Mathematics,* Winter Edition 1989, **11**(1), Center for Teaching/Learning Mathematics.

Cohen, H.G., (1987): 'A Longitudinal Study of the Development of Spatial Conceptual Ability.' *Journal of Genetic Psychology* **148**, pp. 71–78.

Cohen, H.G., Akarsu, F., (1991): 'Some considerations of the effects of one's social-cultural milieu on the development of spatial conceptual structures.' *School Science and Mathematics* **91**, pp. 259–264.

Colmez, F., (1984): 'La réprésentation plane en perspective cavalière des objets de l'espace, un problème de geómétrie. Essai d'ingénierie didactique en classe de Première S.' *Actes du Colloque Inter IREM Géométrie.* Journées SMF Marseille. Ed. IREM de Marseille.

Connor, J.M., Serbin, L.A., (1980): *Mathematics, visual-spatial ability, and sex roles.* (Final Report). National Institute of Education (DHEW), Washington DC. (ERIC Document Reproduction Servicces No. ED 205 305)

Cooper, M., Sweller, J., (1989): 'Secondary shool students' representations of solids.' *Journal for Research in Mathematics Education* **20**, pp. 202–212.

Cooper, L.A., (1990): 'Mental representation of three-dimensional objects in visual problem solving and recognition.' *Journal of Experimental Psychology: Learning, Memory and Cognition* **16**, pp. 1097–1106.

Creswell, J.L., Gifford, C., Huffman, D., (1988): 'Implications of Right/Left Brain Research for Mathematics Educators.' *School Science and Mathematics* **88**, pp. 118–131.

Crockroft, W.H., (1982): *Mathematics Counts. Report of the Committee of Enquiry into the Teaching of Mathematics in Schools under the Chairmanship of Dr. W.H. Crockroft,* London: Her Majesty's Stationery Office.

Crowley, M.L. (1987): 'The van Hiele model of the development of geometric thought.' en M.M. Lindquist, A.P. Shulte, (Eds.), *Learning and Teaching Geometry, K–12, Yearbook.* N.C.T.M. Reston, VA, pp. 1–16.

Davey, G., (1993): 'The Solo taxonomy' en A.R. Baturo, (Ed.), *Proceedings of the Third Annual Recent Workshop of Mathematics Teaching and Learning: New directions in research on geometry and visual thinking,* Centre for Mathematics and Science Education, Kelvin Grove Campus, Australia.

Dean, A.L., Scherzer, E., Chabaud, S., (1986): 'Sequential Ordering in Children's

Representations of Rotation Movements.' *Journal for Experimental Child Psychology* **42**, pp. 99–114.

Del Grande, J., (1980): 'Space as a Model for Elementary School Geometry.' *Proceedings ICME IV,* pp. 163–165.

Del Grande, J., (1987): 'Spatial Perception and Primary Geometry.' en M.M., Lindquist i A.P. Shulte, (Eds.), *Learning and Teaching Geometry K–12,* NCTM, Reston, Virginia, pp. 126–135.

Del Grande, J., (1990): 'Spatial sense.' *Arithmetic Teacher,* **37**(6), pp. 14–20.

Del Campo, G., Clements, M.A., (1987): 'Children comunicating mathematics.' *Manual for the professional development of teachers of beginning mathematicians* Catholic Education Office of Victoria, Melbourne, p. 12.

Delaney, K.C., (1979): 'A place for Space.' *Mathematics Teaching,* **86**, Primary Supplement, XVII.

deLange, J.J., (1986): 'Geoemtry in the primary school: what is possible an desirable.' en R. Lesh (Ed.) *Studies in Mathematical Education. Teaching of Geometry,* UNESCO, Vol. 5, pp. 59–79.

Deregowski, J.B., Dziurawiec, S., (1986): 'Some aspects of comprehension of technical diagrams: An intercultural study.' *Le Travail Humain* **49**(1), pp. 443–60.

Dickson, L., Brown, M., Gibson, O., (Eds.), (1984): *Children Learning Mathematics: A teacher's Guide to Recent Research,* Holt, Rinehart and Winston, Oxford.

Diezmann, C., (1993): 'A model for children's interpretation of geometric diagrams.' en A.R. Baturo, (Ed.), *Proceedings of the Third Annual Recent Workshop of Mathematics Teaching and Learning: New directions in research on geometry and visual thinking,* Centre for Mathematics and Science Education, Kelvin Grove Campus, Australia.

Dion, D., Pallascio, R., Papillon, V., (1985a): 'Perception structurale d'objects polyedriques.' *Bulletin AMQ,* Oct. 1985, 10–21.

Dion, D., Pallascio, R., Papillon, V., (1985b): 'Typologie des habilités perceptives d'objects polyedriques.' *Séminaires du CIRADE sur la Représentation,* 8 Nov 1985, Centre Interdisciplinaire de Recherches sur l'Apprentissage et le Develope-

ment en Education, Université de Québec à Montreal, pp. 107–121.

Dootlittle, A.E., Cleary, T.A., (1987): 'Gender-Based Differential Item Performance in Mathematics Achievement Items.' *Journal of Educational Measurement* **24**, pp.157–166.

Dreyfus, T., (1991): 'On the status of visual reasoning in mathematics and mathematics education.' *Proceedings of the Fifteenth International Conference for the Psychology of Mathematics Education,* Vol I, pp. 33-48.

Dreyfus, T., Eisenberg, T., (1986): 'On the aesthetics of mathematical thought.' *For the Learning of Mathematics* **6**(2), pp. 2–10.

Dufresne, M.L., Duquesne, C., Gueritte-Hess, B., (1983): 'La Géométrie et l'espace.' *Cahiers enfance inadapteé,* Maig 1983, pp. 20–23.

Eccles, J., (1985): 'Model of students' mathematics enrollment decisions' en E. Fennema, (Ed.), (1985): 'Explaining sex-related differences in mathematics: Theoretical models.' *Educational Studies in Mathematics,* **16**(3), pp. 311–314.

Eisenberg, T., Dreyfus, T., (1989): 'Spatial Visualization in the Mathematics Curriculum.' *Focus on Learning Problems in Mathematics,* Winter Edition 1989, **11**(1), Center for Teaching/Learning Mathematics, pp. 1–5.

Eliot, J., Smith, I.M., (1982): *An International Directory of Spatial Tests,* NFER-NELSON.

Ericson, K.A., Simon, H.A., (1980): 'Verbal reports as data.' *Psychological Review* **87**(3), pp. 215–251.

Ericson, K.A., Simon, H. A., (1984): *Protocol analysis: Verbal report as data,* MIT Press, Cambridge, Massachussets.

Ethington, C.A., (1990): 'Gender differences in mathematics: An international perspective.' *Journal for Research in Mathematics Education* **21**(1), pp. 74–80.

Ethington, C.A., (1992): 'Gender differences in a psychological model of mathematics achievement.' *Journal for Research in Mathematics Education* **23**, pp. 166–181.

Ethington, C.A., Wolfle, L.M., (1986): 'A Structural Model of Mathematics Achi-

evement for Men and Women.' *American Educational Research Journal* **23**, pp. 65–75.

Fagot, B., (1978): 'The influence of sex of child on parental reactions to toddler children.' *Child Development* **49**, pp. 459–465.

Feingold, A., (1988): 'Cognitive gender differences are disappearing.' *American Psychologist* **23**(2), 95–103.

Fennema, E., (1974): 'Mathematics learning and the sexes.' *Journal for Research in Mathematics Education* **5**, pp. 126–139.

Fennema, E., (1979): 'Women and girls in mathematics. Equity in mathematics education.'*Educational Studies in Mathematics* **10**, pp. 389–401.

Fennema, E., (1980): 'Sex-related differences in mathematics achievement: Where and why.' en L.H. Fox, L. Brody, D. Tobin, (Eds.), *Women and the mathematical mystique,* John Hopkins University Press, Baltimore, USA, pp. 76–93.

Fennema, E., (Ed.), (1985): 'Explaining sex-related differences in mathematics: Theoretical models.' *Educational Studies in Mathematics* **16**(3), pp. 303–320.

Fennema, E., Carpenter, T.P., (1981): 'Sex-Related Differences in Mathematics: Results from National Assessment.' *Mathematics Teacher* **74**, pp. 554–559.

Fennema, E., Peterson, P., (1985): 'Autonomous learning behavior: A possible explanation of sex-related differences in mathematics.' *Educational Studies in Mathematics* **16**, pp. 309–310.

Fennema, E., Peterson, P.L., Carpenter, T.P., Lubinsky, C.A., (1990): 'Teachers' attributions and beliefs about girls, boys, and mathematics.' *Educational Studies in Mathematics* **21**, pp. 55–69.

Fennema, E., Sherman, J.A., (1977): 'Sex-related differences in mathematics achievement, spatial visualization, and affective factors.' *American Educational Research Journal* **14**, pp. 51–71.

Fennema, E., Sherman, J.A., (1978): 'Sex-related differences in mathematics achievement and related factors: A further study.' *Journal for Research in Mathematics Education* **9**, pp. 189–203.

Fennema, E., Tartre, L., (1985): 'Sex-related differences in mathematics: Results from national assessment.' *Mathematics Teacher* **74**, pp. 554–559.

Fennema, E., Walberg, H., Marrett, C., (1985): 'Introduction' en E. Fennema, (Ed.), (1985): 'Explaining sex-related differences in mathematics: Theoretical models.' *Educational Studies in Mathematics* **16**(3), pp. 303–304.

Ferrrini-Mundy, J., (1987): 'Spatial Training for Calculus Students: Sex Differences in Achievement and in Visualization Ability.' *Journal for Research in Mathematics Education* **18**, pp. 126–140.

Fielker, D., (1979): 'Strategies for teaching geometry to younger children.' *Educational Studies in Mathematics* **10**, pp. 85–133.

Fielker, D., (1981): 'Communicating mathematics is also a human activity.' *For the Learning of Mathematics* **2**(1), pp. 3–7.

Fisher, N., (1978): 'Visual influences of figure orientation on concept formation in geometry' en R. Lesh (Ed.) *Recent Research Concerning the Development of Spatial and Geometric Concepts.* ERIC/SMEAC, Columbus, Ohio, pp. 305–321.

Fox, L.H., Brody, L., Tobin, D., (Eds.), (1980): *Women and the mathematical mystique.* John Hopkins University Press, Baltimore, USA.

Freeman N.H., Cox M.V., (Eds.), (1985): *Visual order: the nature and development of pictorial representation,* The University Press, Cambridge.

Freudenthal, H., (1971): 'Geoemtry between the devil and the deep sea.' *Educational Studies in Mathematics* **3**, pp. 413–435.

Freudenthal, H., (1973): *Mathematics as an educational task,* Reidel Publication Company, Dordrecht, Holanda.

Freudenthal, H., (1983): *Didactical phenomenology of mathematical structures,* Reidel Publication Company, Dordrecht, Holanda.

Fuys, D., Geddes, D., Tischler, R., (1988): *The van Hiele model of thinking in geometry among adolescents. Monograph number 3.* NCTM, Reston, VA, USA.

Gabel, D.L., Enochs, L.G., (1987): 'Different Approaches for Teaching Volume and Students Visualization Ability.' *Science Education* **71**(4), pp.591–597.

Gallagher, S.A., Johnson, E.S., (1992): 'The effect of time limits on performance of mental rotations by gifted adolescents.' *Gifted Child Quarterly* **36**, pp. 19–22.

Gaulin, C., (1984): 'Actividades geométricas en la EGB.' *Actas IV Jornadas JAEM,* Tenerife, Sep. 1984, pp. 27–40.

Gaulin, C., (1985): 'The need for emphasizing various graphical representations of 3-dimensional shapes and relations.' *Proceedings of the Ninth International Conference for the Pychology of Mathematics Education,* Vol II: Plenary Addresses and Invited Papers, pp. 53–71.

Gaulin, C., Puchalska, E., (1987): 'Coded graphical representations: A valuable but neglected mean of communicating spatial information in geometry' en I. Wirszup i R. Streit, (Eds.), *Development in school mathematics education around the world. Applications-oriented curricula and technology-supported learning for all students*, NCTM, Reston, USA. pp. 514–539.

Ginsburg, H., (1981): 'The clinical interview in psychological research on mathematical thinking: Aims, rationales, techniques.' *For the Learning of Mathematics* **1**(3), pp. 4–11.

Goddijn, A., Kindt, M., (1985): 'Space geometry doesn't fit in the book' en L. Streefland, (Ed.), *Proceedings of the Ninth International Conference for the Psychology of Mathematics Education* **1**, State University of Utrecht, Utrecht, Holanda, pp. 171–182.

Greer, B., (1981): 'Cognitive psychology and mathematical thinking.' *For the Learning of Mathematics* **1**(3), pp. 19–26.

Grouws, D.A., (Ed.), (1992): *Handbook of research on mathematics teaching and learning.* Macmillan, New York.

Guay, R.B., McDaniel, E.D., Angelo, S., (1978): 'Analytic factors confounding spatial ability measurement' en R.B. Guay, E.D. McDaniel, (Eds.), *Correlates of performance on spatial aptitude tests,* Lafayette, IN: Purdue Univesity (USArmy Research Institute for the Behavioral and Social Sciences). Final Report, pp. 116–128.

Gutiérrez, A., (1993): 'Children's ability for relating to different plane representations of 3D solids' en A.R. Baturo, (Ed.), *Proceedings of the Third Annual Recent Workshop of Mathematics Teaching and Learning: New directions in research*

on geometry and visual thinking, Centre for Mathematics and Science Education, Kelvin Grove Campus, Australia.

Gutiérrez, A., Jaime, A., (1987): 'Estudio de las características de los niveles de Van hiele' en J.C. Bergeron, N. Herscovics, C. Kieran (Eds.) *Proceedings of the Eleventh International Conference for the Psychology of Mathematics Education,* Vol III, University of Montréal, Montréal, Canada, pp. 131–137.

Gutiérrez, A., Jaime, A., Frotuny, J.M., (1991): 'An alternative paradigm to evaluate the acquisition of the Van Hiele levels.' *Journal for Research in Mathematics Education* **22** (3), pp. 237–251.

Hall, C.W., Hoff, C., (1988): 'Gender Differences in Mathematical Performance.' *Educational Studies in Mathematics* **19**, pp. 395–401.

Hanna, G., (1986):' Sex Differences in the Mathematics Achievement of Eighth Graderes in Ontario.' *Journal for Research in Mathematics Education* **17**, pp. 231–237.

Hanna, G., (1989): 'Mathematics achievement of girls and boys in grade eigth: Results from twenty countries.' *Educational Studies in Mathematics* **20**, pp. 225–232.

Harper, L., Sanders, K., (1975): 'Preschool children's use of space: Sex differences in outdoor play.' Developmental Psychology **11**, p. 119.

Harris, L.J., (1980): 'Sex differences in spatial ability' en M. Kinsbourne, (Ed.), *Hemispheric asymmetries of the brain,* Cambridge University Press, Cambridge.

Harris, L.J., (1981): 'Sex related variations in spatial skill' en L.S. Liben, A.H. Patterson, N. Newcombe, (Eds.) *Spatial Representation and Behavior Across the Life Span: Theory and Application,* New York, Academic Press, pp. 83–125.

Hart, K., (1987): 'Strategies and Errors in Secondary Mathematics.' *Mathematics in School* **16**, pp. 14–17.

Hemmings, R., Last, D., Rodgers, L., Sturgess, D., Tahta, D., (1978): *Leapfrog-Teachers'Handbook,* Central Independent Television plc.

Herbert, J., (Ed.), (1986): *Conceptual and procedural knowledge: The case of mathematics.* Lawrence Erlbaum Associates, Hillsdale, N.J., USA.

Hermelin, B., O'Connor, N., (1986): 'Spatial Representations in Mathematically and Artistically Gifted Children.' *British Journal of Educational Psychology* **56**, pp. 150–157.

Hershkowitz, R., (1987): 'The acquisition of concepts and misconceptions in basic geometry - or when "A little learning is a dangerous thing"' en J.D. Novak, (Ed.), *Proceedings of the Second International Seminar: Misconceptions and Educational Strategies in Science and Mathematics,* Vol. III, Cornell University, Ithaca, N.Y., USA, pp. 238–251.

Hershkowitz, R., (1989): 'Visualization in Geometry: Two Sides of the Coin.' *Focus on Learning Problems in Mathematics,* Winter Edition 1989, **11**(1), Center for Teaching/Learning Mathematics, pp.61–76.

Hershkowitz, R., (1990): 'Psychological aspects of learning geometry' en P. Nesher, J. Kilpatrick, (Eds.), *Mathematics and cognition. A research synthesis by the international group for the Psychology of Mathematics Education,* ICMI Study Series, Cambridge University Press, pp. 70–95.

Hershkowitz, R., (1993): '"Seeing geometry": with the eye? with the mind's eye?' en A.R. Baturo, (Ed.), *Proceedings of the Third Annual Conference of Mathematics Teaching and Learning: teaching geometry and visual thinking,* Centre for Mathematics and Science Education, Kelvin Grove Campus, Australia.

Hershkowitz, R., Vinner, S. (1983): 'The role of critical and non-critical attibutes in the concept image of geometrical concepts' en R. Hershkowitz, (Ed.), *Proceedings of the Seventh International Conference for the Psychology of Mathematics Education,* Weizmann Institute of Science, Rehovot, Israel, pp. 223–228.

Hershkowitz, R., Vinner, S., (Eds.), (1987): *Geometry working group report from the tenth conference and some subsequent reactions.* Report presented at the Eleventh International Conference for the Psychology of Mathematics Education, University of Montreal, Montreal, Canada.

Hershkowitz, R., Markovitz, Z., (1992): 'Conquer math concepts by developing visual thinking.' *Arithmetic Teacher* **39**(9), pp. 38–41.

Hilton, P., (1984): 'Current trends in mathematics and future trends in mathematics education.' *For the Learning of Mathematics* **4**(1), pp. 54–56.

Hilton, P., (1985): 'Algorithms are not enough.' *College mathematics* **16**(1), pp.

8–9.

Hilton, P., (1988): 'The role of geometry in the mathematics curriculum.' *Zentralblatt für Didaktik der Mathematik* **88**(2), pp. 67–71.

Hilton, P., Pedersen, J., (1982): *Fear no more: An adult approach to mathematics.* Addison Wesley, Menlo Park, California., USA.

Hilton, P., Pedersen, J., (1983): 'Approximating any regular polygon by folding paper.' *Mathematics Magazine* **56**, pp. 141–155.

Hilton, P., Pedersen, J., (1985): 'Folding regular star polygons and number theory.' *Mathematical Intelligencer* **7**, pp. 15–26.

Hilton, P., Pedersen, J., (1986): 'A role for untraditional geometry in the curriculum.' *Kolloquium Mathematik-Didaktik der Universität Bayreuth.*

Hilton, P., Pedersen, J., (1987): 'Discovering, modifying and solving problems: A case study from the contemplation of polyhedra.' *Teaching and Learning*, NCTM, pp 47–72.

Hoffer, A., (1977): *Geometry and Visualization. Mathematics Resource Project.* University of Oregon, Creative Publication Inc., Palo Alto.

Hoffer, A., (1981): 'Geometry is more than proof.' *Mathematics Teacher,* NCTM, **74**(1), pp.11–18.

Hoffer, A., (1983): 'Van Hiele Based Research' in R. Lesh, M. Landau, (Eds.), *Acquisition of Mathematics Concepts and Processes,* Academic Press Inc., Orlando, Florida, USA, pp. 205–227.

Hoz, R., (1981): 'The effects of rigidity on school geometry learning.' *Educational Studies in Mathematics* **12**, pp. 171–190.

Janvier, C., (Ed.), (1987): *Problems of representation in the teaching and learning of mathematics.* Lawrence Erlbaum Associates, Hillsdale, N.J., USA.

Johnson, E.S., Meade, A.C., (1987): 'Developmental patterns of spatial ability: An early sex difference.' *Child Development* **58**, pp. 725-740.

Kalichman, S.C., (1989): 'Sex roles and sex differences in adult spatial perfor-

mance.' *Journal of Genetic Psychology* **150**, pp. 93–100.

Kaput, J.J., (1989): 'Supporting Concrete Visual Thinking in Multiplicative Reasoning: Difficulties and Opportunities.' *Focus on Learning Problems in Mathematics,* Winter Edition 1989, **11**(1), Center for Teaching/Learning Mathematics.

Keita, B., (1986): 'La perspective dans le dessin de l'étudiant en physique.' *Le Dessin Technique: Apprentissage, Utilisation, Évolution,* Actes du colloque international organisé par l'equipe de la recherche coopérative sur programme: RCP 722/CRNS, Paris.

Kent, D., Hedger, K., (1980): 'Growing tall.' *Educational Studies in Mathematics* **11**, pp. 137–179.

Kersh, M.E., Cook, K.H., (1979): *Improving mathematics ability, an attitude, a manual.* Seattle: Mathematics Learning Institute, University of Washington.

Kerslake, D., (1986): *Fractions: children's strategies and errors.* Windsor: NFER-NELSON.

Khoury, H.A., Behr, M., (1982): 'Student performance, individual differences and modes of representation.' *Journal for Research in Mathematics Education* **13**(1), pp. 3–15.

Kimura, D., (1993): 'Cerebro de varón y cerebro de mujer' en D. Fischbach, (Ed.), *Mente y cerebro,* pp. 83–90.

Kiser, L., (1987): 'Spatial-Visual Ability: Can Computer Visualization Facilitate Achievement?' *Educational Technology* **27**, pp. 36–40.

Koman, M., Kurina, F., Ticha, M., (1986): 'Some problems concerning teaching geometry to pupils aged 10 to 14' en R. Morris, (Ed.), *Studies in Mathematical Education. Teaching of Geometry,* UNESCO, Vol. 5, pp. 81–96.

Krainer, K., (Ed.), (1991): *Consequences of a low level acting and reflecting in geometry learning: Findings of interwiews on the concept of angle,* Programm Committee, the Fifteenth International Conference for the Psychology of Mathematics Education, Genova, Itàlia.

Krutekskii, V.A., (1976): *The psychology of mathematical abilities in schoolchildren,* University of Chicago Press, Chicago.

Kuyk, W., (1982): 'A Neuropsychodynamical Theory of Mathematics Learning.' *For the Learning of Mathematics* **3**(1), pp. 16–23.

Labinowicz, E., (1985): *Learning from children,* Addison-Wesley, Menlo Park, Canada.

Laborde, C., (1985): 'Quelques problèmes d'enseignement de la géométrie dans la scolarité obligatoire.' *For the Learning of Mathematics* **5**(3), pp. 27–34.

Lafortune, L., (Ed.), (1989): *Quelles Difdérences?* Les éditions du remue-ménage. França.

Lahrizi, H., (1984): *Étude de l'habilité à visualiser des rélations géométriques dans trois dimensions chez les élèves et les élèves-professeurs au Maroc,* Thèse, Université Mohamed V, Rabat, Maroc.

Lakoff, G. (1987): *Women, fire and dangerous things,* University of Chicago Press, Chicago, USA.

Lappan, G., Phillips, E., Winter, M., (1984): 'Spatial Visualization.' *Mathematics Teacher* **77**(8), pp. 618–625.

Lawson, M.J., Kirby, J.R., (1981): 'Training in Information Processing Algorithms.' *British Journal of Educational Psychology* **51**, pp. 321–335.

Lean, G.A., (1981): An Investigation of the Spatial and Mathematical Ability Constructs. Unpublished M. Phil. thesis, University of Cambridge.

Lean, G. A., Clements, M. A., (1981): 'Spatial ability, visual imagery and mathematical performance.' *Educational Studies in Mathematics* **12**(3), pp. 1–33.

Leder, G.C., (1980): 'Bright girls, mathematics and fear of success.' *Educational Studies in Mathematics* **11**, pp. 411–422.

Leder, G.C., (1985): 'Sex-related differences in mathematics: An overview.'*Educational Studies in Mathematics* **16**, pp. 304–309.

Leder, G.C., (1986a): 'Mathematics: Stereotyped as a Male Domain?' *Psychological Reports* **59**, pp.19–22.

Leder, G.C., (1986b): 'Success in Mathematics: The View from the Media.' *Aus-*

tralian Mathematics Teacher **42**, pp. 19–22.

Leder, G.C., (1986c): *Gender Linked Differences in Mathematics Learning: Further Explorations,* presentat a Research Presession to the NCTM 64th Annual Meeting, Washington, D.C., Abril 1986.

Leinhardt, G., Seewald, A.M., Engel, M., (19879): 'Learning what's taught: Sex differences in instruction.' *Journal of Educational Psychology* **79**(4), pp. 432–459.

Leinhardt, G., Zaslavsky, O., Stein, M.K., (1990): 'Functions, Graphs, and Graphing: Tasks, Learning, and Teaching.' *Review of Educational Research,* Spring 1990, **60**(1), pp. 1–64.

Lesh, R., (Ed.), (1978): *Recent Research Concerning the Development of Spatial and Geometric Concepts.* ERIC/SMEAC, Columbus, Ohio.

Lesh, R., (Ed.), (1986): *Studies in Mathematical Education. Teaching of Geometry,* UNESCO, Vol. 5.

Lesh, R., Landau, M., (Eds.), (1983): *Acquisition of Mathematics Concepts and Processes,* Academic Press Inc., Orlando, Florida, USA.

Lesh, R., Mierkiewicz, D., (1978): 'Perception, imagery , and conception in geometry' en R. Lesh, D. Mierkiewicz, (Eds.), *Recent research concerning the development of spatial and geometric concepts,* ERIC/SMEAC, Columbus, Ohio, pp. 7–28.

Liben, L.S., (1981): 'Spatial representation and behaviour: multiple perspectives' en L.S. Liben, A.H. Patterson, N. Newcombe, (Eds.), *Spatial Representation and Behaviour across the Life Span,* New York, Academic Press, pp. 3–36.

Liben, L.S, Patterson, A.H., Newcombe, N., (Eds.), (1981): *Spatial Representation and Behaviour across the Life Span,* New York, Academic Press.

Light, P., (1983): 'The use of communication task to investigate depiction of spatial relationships in young children's drawing' en D.R. Rogers i J. A. Sloboda, (Eds.), *The Acquisiton of Symbolic Skills,* NATO Conferences Series, Serie III: Human Factors, Plenum Press, N.Y, pp. 47–51.

Linn, M.C., Petersen. A.C., (1985): 'Emergence and characterization of gender differences in spatial ability: A meta-analysis.' *Child Development* **56**, pp. 1479–

1498.

Litwiller, B.H., Duncan, D.R., (1987): 'Geometric counting problems' en M.M. Lindquist, A.P. Shulte, (Eds.), *Learning and Teaching Geometry, K–12, Yearbook,* N.C.T.M. Reston, Virginia. pp. 210–221.

Lohman, D.F., (1979a): 'Spatial Ability: a Review and Reanalysis of the Correlational Literature' en *Technical Report n. 8. Aptitude Research Project,* School of Education, Stanford University, October 1979.

Lohman, D.F., (1979b): 'Spatial Ability: Individual Differences in Speed and Level' en *Technical Report n. 9. Aptitude Research Project,* School of Education, Stanford University, October 1979.

Longley, W.R., (1930): 'The Teaching of Geometry' en *Fith Yearbook,* N.C.T.M., Teacher's College, New York.

Lovell, K., (1961): *The growth of Basic Mathematical and Scientific Concepts in Children,* University of London Press, Londres.

MacFarlane Smith, I., (1964): *Spatial Ability: Its Educational and Social Significance,* University of London Press, London.

Maines, D.R., (1985): 'Preliminary notes on a theory of informal barriers for women in mathematics' en Fennema, E., (Ed.), (1985): 'Explaining sex-related differences in mathematics: Theoretical models.' *Educational Studies in Mathematics* **16**(3), pp. 314–317.

Mandler, J.M., (1976): 'Some Problems in the Definition and Measurement of Imagery.' *Child Development* **47**, pp. 888–889.

Mansfield, H., (1993a): 'Constructing ideas in geometry' en A.R. Baturo, (Ed.), *Proceedings of the Third Annual Recent Workshop of Mathematics Teaching and Learning: New directions in research on geometry and visual thinking,* Centre for Mathematics and Science Education, Kelvin Grove Campus, Australia.

Mansfield, H., (1993b): 'Thinking about thinking in geometry' en A.R. Baturo, (Ed.), *Proceedings of the Third Annual Recent Workshop of Mathematics Teaching and Learning: New directions in research on geometry and visual thinking,* Centre for Mathematics and Science Education, Kelvin Grove Campus, Australia.

Marriott, P., (1978): "Fractions, now you see them, now yo don't' en D. Williams, (Ed.), *Learning and applying mathematics,* Australian Association of Mathematics Teachers, Melbourne, Australia.

Martin, L., (Ed), (1976a): *Space and Geometry.* ERIC/SMEAC, Columbus, Ohio.

Martin, L., (1976b): 'The Erlanger Program as a model of the child's construction of space' en A. R. Osborne, (Ed.), *Models for learning mathematics. Papers from a research workshop,* Columbus, Ohio. ERIC/SMEAC.

Martin, W.G., (1993a): 'Supporting secondary school students' construction of geometric knowledge' en A.R. Baturo, (Ed.), *Proceedings of the Third Annual Recent Workshop of Mathematics Teaching and Learning: New directions in research on geometry and visual thinking,* Centre for Mathematics and Science Education, Kelvin Grove Campus, Australia.

Martin, W.G., (1993b): 'The role of research in the development of a secondary school geometry curriculum' en A.R. Baturo, (Ed.), *Proceedings of the Third Annual Recent Workshop of Mathematics Teaching and Learning: New directions in research on geometry and visual thinking,* Centre for Mathematics and Science Education, Kelvin Grove Campus, Australia.

Mayberry, J.W., (1983): 'The van Hiele levels of geometric thought in undergraduate preservice teachers.' *Journal for Research in Mathematics Education* **14**, pp. 58–69.

Mayer, R.E., Gallini, J., (1990): 'When an illustration is worth ten thousand words?' *Journal of Educational Psychology* **82**(4), pp. 715–726.

McDonald, J.L., (1989a): 'Cognitive development and the structuring of geometric content.' *Journal for Research in Mathematics Education,* January 1989, **20**, pp. 76–94.

McDonald, J.L., (1989b): 'Accuracy and stability of cognitive structures and retention of geometric content.' *Educational Studies in Mathematics* **20**(4), pp. 425–448.

McCloskey, P., (1979): 'The facilitation of spatial ability and problem solving in adolescent pupils through learning in design.' *Educational Review* **31**(3), pp 259–267.

McGee, M.G., (1979a): 'Human Spatial Abilities: Psychometric studies and environmental, genetic, hormonal, and neurological influences.' *Psychological Bulletin* **86**(5), pp. 889–918.

McGee, M.G., (1979b): *Human Spatial Abilities.* New York. Praeger.

Metzler, J., Shepard, R.N., (1974): 'Transformational studies of the internal representation of three-dimensional objects' en R.L. Solso (Ed.) *Theories in cognitive psychology: The Loyola Symposium,* Erlbaum, Ptomac, MD, pp. 147–201.

Miles, M.B., Huberman, A.M., (1984): *Qualitative data analysisi: A sourcebook of new methods.* Sge Publications. Beverly Hills.

Mitchelmore, M.C., (1976): 'Space and Geometry' en *Papers from a Research Workshop,* ERIC Center for Science, Columbus, Ohio, August 1976.

Mitchelmore, M.C., (1978): 'Developmental stages on children's representation of regular solid figures.' *Journal of Genetic Psychology* **133**, pp. 229–239.

Mitchelmore, M.C., (1980a): 'Prediction of developmental stages in the representation of regular space figures.' *Journal for Research in Mathematics Education,* March 1980, **11**, pp. 83–93.

Mitchelmore, M.C., (1980b): 'Three-dimensional geometrical drawing in three cultures.' *Educational Studies in Mathematics* **11**, pp. 205–216.

Mitchelmore, M.C., (1983): 'Geometry and spatial learning: Some lessons from a Jamaican experience.' *For the Learning of Mathematics* **3**(3), pp. 2–7.

Mitchelmore, M.C., (1985): 'Geometric foundations of children's drawing' en N.H. Freeman i M.V. Cox, (Eds.), *Visual order: the nature and development of pictorial representation,* The University Press, Cambridge, pp. 289–309.

Mitchelmore, M.C., (1992): 'Why do children not use parallels in their drawings of cubes?' *Archives de Psychologie* **55**, pp. 179–194.

Mitchelmore, M.C., (1993a): 'The development of pre-angle concepts' en A.R. Baturo, (Ed.), *Proceedings of the Third Annual Recent Workshop of Mathematics Teaching and Learning: New directions in research on geometry and visual thinking,* Centre for Mathematics and Science Education, Kelvin Grove Campus, Australia.

Mitchelmore, M.C., (1993b): 'Teaching basic angle concepts' en A.R. Baturo, (Ed.), *Proceedings of the Third Annual Recent Workshop of Mathematics Teaching and Learning: New directions in research on geometry and visual thinking,* Centre for Mathematics and Science Education, Kelvin Grove Campus, Australia.

Montangero, J., (1976): 'Recent Research on the Child's Conception of Space and Geometry in Geneva: Research Work on Spatial Concepts at the International Center for Genetic Epistemology' en J. L. Martin, (Ed.), *Space and Geometry: Papers from a Research Workshop,* ERIC/SMEAC, Columbus, Ohio.

Movshovitz-Hadar, N., Zaslavsky, O., Inbar, S., (1987): 'An Empirical Classification Model for Errors in High School Mathematics.' *Journal for Research in Mathematics Education* **18**, pp. 3–14.

Mukhopadhyay, S., (1987): 'On the drawing of solid stimuli: The scaling of responses of rural indians from specific occupational backgrounds.' Poster en Eleventh International Conference for the Psychology of Mathematics Education, University of Montreal, Montreal, Canada.

Nash , S.C., (1979): 'Sex role as a mediator of intellectual functioning' en M.A. Witting i A. C. Petersen, (Eds.), *Sex-related differences in intellectual functioning: Developmental issues,* Academic Press, New York. pp. 263–302.

Nesher, P., Kilpatrick, J., (Eds.), (1990): *Mathematics and cognition. A research synthesis by the international group for the Psychology of Mathematics Education,* ICMI Study Series, Cambridge University Press.

Newcombe, N., Dubas, J.S., Baenninger, M.A., (1989): 'Associations of timing of puberty, spatial ability, and lateralitzation in adult women.' *Child Development* **60**, pp. 246–254.

Nisbett, R.E., Wilson, T.D., (1977): 'Telling more than we know: verbal reports on mental processes.' *Psychological Review* **84**, pp. 231-279.

Northam, J., (1988): 'Girls and boys in primary maths books' en L. Burton, (Ed.), *Girls into Maths Can Go,* Rinehart and Winston, Londres, pp. 110–116.

Noss, R., (1987): 'Children learning of geometrical concepts through LOGO.' *Journal for Research in Mathematics Education* **18**, pp. 343–362.

Nussbaum, J., Novak, J.D., (1976): 'An Assessment of Children's Concepts of the

Earth Utilizing Structured Interviews.' *Science Education* **60**(4), pp. 535–550.

Osta, I. (1987): 'L'outil informatique el l'enseignement de la geometrie dans l'espace' en J.C. Bergeron, N. Herscovics, C. Kieran, (Eds.), *Proceedings of the Eleventh International Conference for the Psychology of Mathematics Education,* Vol II, University of Montreal, Montreal, Canada, pp 31–38.

Owens, D.T., (1990): 'Spatial abilities.' *Arithmetic Teacher* **37**, pp. 48–51.

Pallascio, R., Allaire, R., Mongeau, P., (1993): 'The development of spatial competencies through alternating analytic and synthetic activities.' *For the Learning of Mathematics* **13**(3), pp. 8–15.

Parzysz, B., (1988): '"Knowing" vs "Seeing". Problems of the Plane Representation of Space Geometry Figures.' *Educational Studies in Mathematics* **19**(1), pp.79–92.

Parzysz, B., (1989a): 'Représentations planes et géométrie de l'espace au lycée.' Contribution à l'étude de la relation voir/savoir. Thèse de doctorat, IREM, Université Paris-7.

Parzysz, B., (1989b): 'From shadow to ligth. An introduction to space geometry at senior school level' en W. Blum, M. Niss i I. Huntley, (Eds.), *Modelling, Applications and Applied Problem Solving. Teaching Mathematics in a Real Context,* Ellis Horwood, Chichester, pp. 98–108.

Parzysz, B., (1991): 'Representation of space and students' conceptions at high school level.' *Educational Studies in Matemathics* **22**, pp. 575–593.

Pattison, P., Grieve, N., (1984): 'Do spatial skills contribute to sex differences in different types of mathematics problems?' *Journal of Educational Psychology* **76**, pp. 678–689.

Pegg, J., (1993): 'Implications of research to teaching geometry in Queensland Schools' en A.R. Baturo, (Ed.), *Proceedings of the Third Annual Recent Workshop of Mathematics Teaching and Learning: New directions in research on geometry and visual thinking,* Centre for Mathematics and Science Education, Kelvin Grove Campus, Australia.

Pegg, J., Faithfull, M., (1993): 'Analysing high order skills in deductive geometry' en A.R. Baturo, (Ed.), *Proceedings of the Third Annual Recent Workshop*

of Mathematics Teaching and Learning: New directions in research on geometry and visual thinking, Centre for Mathematics and Science Education, Kelvin Grove Campus, Australia.

Phelps, E., Damon, W., (1989): 'Problem solving with equals: Peer collaboration as a context for learning mathematics and spatial concepts.' *Journal of Educational Psychology* **81**, pp. 639–646.

Piaget, J., Inhelder, B., (1948): *La représentation de l'espace chez l'enfant,* Presses Universitaires de France, Paris.

Piaget, J., Inhelder, B., (1966): *L'image mentale chez l'enfant,* Presses Universitaires de France, Paris.

Piaget, J., Inhelder, B., (1971): *Mental Imagery in the Child.* Basic Books. New York.

Piaget, J., Inhelder, B., Szeminska, A., (1948): *La géométrie spontanée de l'enfant,* Presses Universitaires de France, Paris.

Piaget, J., Inhelder, B., Szeminska, A., (1966): *La psychologie de l'enfant,* Presses Universitaires de France, Paris.

Pilyshin, Z.W., (1979): 'The rate of "mental rotation" images: A test of a holistic analogue hypothesis.' *Memory and Cognition* **7**(1), pp. 19–28.

Presmeg, N.C., (1985): *The Role of Visually Mediated Processes in High School Mathematics: A Classroom Investigation,* Unpublished PhD Dissertation. University of Cambridge.

Presmeg N.C., (1986a): 'Visualisation in high school mathematics.' *For the Learning of Mathematics* **6**(3), pp. 43-44.

Presmeg N.C., (1986b): 'Visualisation and mathematical giftedness.' *Educational Studies in Matemathics* **17**(3), pp. 297–311.

Presmeg N.C., (1989): 'Visualization in Multicultural Mathematics Classrooms.' *Focus on Learning Problems in Mathematics,* Winter Edition 1989, **11**(1), Center for Teaching/Learning Mathematics, pp. 17–24.

Puchalska, E., Gaulin, C., (1985): 'Pour une variété d'approches aux répresenta-

tions graphiques des formes et des relations à trois dimensions.' *Séminaires du CIRADE sur la Représentation,* 8 Nov 1985, Centre Interdisciplinaire de Recherches sur l'Apprentissage et le Developement en Education, Université de Québec à Montreal.

Ranucci, E.R., (1952): *Effect of the study of solid geometry on certain aspects of space perception habilities,* Columbia University.

Reynisch, J.M., Rosenblum, L.A., Sanders, S.A., (Eds.) (1987): *Masculinity/Feminity.* Oxford University Press, Oxford.

Rheingold, H.L, Cook, K.V., (1975): 'The content of boys' and girls' rooms as an index of parents behavior.' *Child Development* **46**, pp. 459–463.

Richardson, A., (1977): 'The meaning and measurement of memory imagery.' *British Journal of Psychology* **68**, pp. 29–43.

Rudisill, E.M., Morrison, L.J., (1989): 'Sex differences in mathematics achievement: An emerging case for physiological factors.' *School Science and Mathematics* **89**, pp. 570–577.

Salthouse, T.A., Babcock, R.L., Skovronek, E., Mitchell. D.R., Palmon. R., (1990): 'Age and experience effects in spatial visualization.' *Developmental psychology* **26**, pp. 128–136.

Samuels, M., Samuels, N., (1980): *Seeing with the mind's eye: the history, techniques and uses of visualization,* Random House, New York, USA.

Sanmartí, N., (1989): *Dificultats en la comprensió de la diferenciació entre els conceptes de mescla i compost,* Tesi Doctoral. Universitat Autònoma de Barcelona.

Sanmartí, N., (1993, en premsa): *Les xarxes sistèmiques: construcció i aplicacions.* Universitat Autònoma de Barcelona.

Schielack, V.P,, (1987): 'Mathemtical applications of geometry' en M.M. Lindquist, A.P. Shulte, (Eds.), *Learning and Teaching Geometry, K–12, Yearbook,* N.C.T.M., Reston, Virginia.

Schoenfeld, A.H., (1982): 'Psychological factors affecting students' performance on geometry problems' en S. Wagner, (Ed.), *Proceedings of the Fourth Annual Meeting of the North American Branch of the International Group for the Psychology of*

Mathematics Education, University of Georgia, Athens, pp. 168–174.

Schoenfeld, A.H., (1986): 'On having and using geometric knowledge' en J. Herbert, (Ed.), *Conceptual and procedural knowledge: The case of mathematics,* Lawrence Erlbaum Associates, Hillsdale, N.J., USA, pp. 225–264.

Sheckels, M.P., Eliot, J., (1983): 'Preference and solution patterns in Mathematics performance.' *Perceptual and Motor Skills* **57**, pp. 811–816.

Shepard, R.N., (1978b): 'The Mental Image.' *American Psychologist* **33**, pp. 125-137.

Shepard, R.N., Metzler, J., (1971): 'Mental rotation of three-dimensional objects.' *Science* **171**, pp. 701–703.

Shuard, H.B. (1982): 'Differences in Mathematical Performance between Boys and Girls' en W.H. Crockroft, (Ed.), *Mathematics counts,* Her Majesty's Stationery Office, Londres.

Shuard, H., (1986): 'The relative attainment of girls and boys in mathematics in the primary years' en L.Burton, (Ed.), *Girls into Maths Can Go,* Rinehart and Winston, Londres, pp. 23–37.

Skemp, R.R., (1987): *The psychology of learning mathematics. (Expandend american edition),* Lawrence Erlbaum Associates, Hillsdale, New Jersey, USA.

Smith, I.M., (1964): *Spatial ability: Its educational and social significance,* University of London Press, Londres.

Smith, I.M., (1982): 'Sex Differences in Spatial test Performance.' *An International Directory of Spatial Tests,* NFER-NELSON, pp. 448–451.

Smith, W.S., Schroeder, C.K., (1981): 'Preadolescents' Learning and Retention of a Spatial Visualization Skill.' *School Science and Mathematics* **81**, pp. 705–709.

Spearman, C.E., (1927): *The Abilities of Man: Their Nature and Measurement,* Macmillan, London.

Steiner, H.G., (1988): 'Two kinds of "Elements" and the dialectic between synthetic-deductive and analytic-genetic approaches in mathematics.' *For the Learning of Mathematics* **8**(3), pp. 7–15.

Sternberg, R.J., (1980): 'Representation and Process in Linear Syllogistic Reasoning.' *Journal of Experimental Psychology: General* **109**(2), pp. 119–159.

Suwarsono, S., (1982): *Visual Imagery in the Mathematical Thinking of Seventh Grade Students,* Unpubl. Ph. D. Dissertation, Monash University, Melbourne.

Swanson, D., Schwartz, R., Ginsburg, H., Kossan, N., (1981): 'The clinical interview: Validity, reliability and diagnosis.' *For the Learning of Mathematics* **2**(2), pp. 31–45.

Tapley, S.M., Bryden, M.P., (1977): 'An investigation of sex differences in spatial ability: Mental rotation of three-dimensional objects.' *Canadian Journal of Psychology* **31**, pp. 122–130.

Tartre, L.A., (1990): 'Spatial orientation skill and mathematical problem solving.' *Journal for Research in Mathematics Education* **21**(3), pp. 216–229.

Thurstone, L.L., (1938): 'Primary Mental Abilities.' *Psychometric Monographs* **1**, pp. 1–121.

Toumasis, C., (1990): 'The epos of eculidean geometry in greek secondary education (1836–1985): Pressure for change and resistance.' *Educational Studies in Matemathics* **21**(4), pp. 491–508.

Usiskin, Z., (1982): 'Van Hiele levels and achievement in secondary school geometry.' (CDASSG Project Report,) University of Chicago, School of Education. Chicago.

Usiskin, Z., (1987): 'Resolving the Continuing Dilemma in School Geometry' en M.M. Lindquist i A.P. Shulte, (Eds.), *Learning and Teaching Geometry, K–12,* N.C.T.M., Reston, Virginia.

Van Leeuwen, M. S., (1978): 'A cross-cultural examination of psychological differentation in males and females.' *International Journal of Psychology* **13**, pp. 87.

Van Sommers, P., (1986): *Drawing and cognition. Descriptive and experimental studies of grapohic production processes,* Cambridge University Press.

Vergnaud, G., (1982): 'Cognitive and Developmental Psychology and Research in Mathematics Education: some theoretical and methodological issues.' *For the*

Learning of Mathematics **3**(2), pp. 31–41.

Vergnaud, G., (1986): 'Conceptualisation de l'espace et mathématiques.' *Technologies, Idéologies, Pratiques,* V/4, VI/1, pp. 91–94.

Vinner, S., (1981): 'The nature of geometrical objects as conceived by teachers and prospective teachers' en C. Comiti i G. Vergnaud, (Eds.), *Proceedings of the Fifth International Conference for the Psychology of Mathematics Education,* Institut IMAG, Grenoble, France, pp. 375–380.

Vinner, S., Hershkowitz, R., (1983): 'On concept formation in geometry.' *Zentralblatt für Didaktik der Mathematik* **83**(1), pp. 20–25.

Warren, E., (1993): 'Children's facility with plane shapes: a multifaceted skill' en A.R. Baturo, (Ed.), *Proceedings of the Third Annual Recent Workshop of Mathematics Teaching and Learning: New directions in research on geometry and visual thinking,* Centre for Mathematics and Science Education, Kelvin Grove Campus, Australia.

Wattanawaha, N., (1977): *Spatial Ability and Sex Differences in Performance on Spatial Tasks,* M. Ed. Thesis, Monash University, Melbourne.

Weinzweig, A.I., (1978): 'Mathemtical foundations for the development of spatial concepts in children' en R. Lesh, D. Mierkiewicz, (Eds.), *Recent research concerning the development of spatial and geometric concepts,* ERIC/SMEAC, Columbus, Ohio, pp. 105–176.

Wheeler, A., Hill, D., (1990): 'Diagram-ease.' *Science Teacher* **57**(5), pp. 59–63.

Wirszup, I., (1976): 'Breakthroughs in the Psychology of Learning and Teaching Geometry' en J.L. Martin, (Ed.), *Space and Geometry: Papers from a Research Workshop,* ERIC, Columbus, Ohio.

Witkin, H.A., Dyk, R.B., Faterson, G.E., Goodenough, D.R., Karp, S. A., (1962): *Psychological Differentiation,* Willey, New York.

Wolfe, L.R., (1970): *The effects of space visualization on spatial ability and arithmetic achievement of junior high school students,* School of Education, Department of Curriculum and Instruction, State University of N.Y. at Albany.

Wolleat, P., Pedro, J.D., Becker, A.D., Fennema, E., (1980): 'Sex differences in

high shool students' causal attributions of performance in mathematics.' *Journal for Research in Mathematics Education* **11**(5), pp. 356–366.

Zimmerman, W., Cunningham, S., (Eds.), (1991): *Visualization in teaching and learning mathematics,* The Mathematical Association of America, California.