THE RELATIONSHIP OF INQUIRY-BASED INSTRUCTION, STUDENT'S ATTITUDES TOWARD SCIENCE AND TEACHER'S SUPPORT TOWARDS SCIENCE ACHIEVEMENT

VIGNESWARY D/O M. RAMACHANDARAMURTHY

UNIVERSITI UTARA MALAYSIA 2011

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VIGNESWARY D/O M. RAMACHANDARAMURTHY

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UNIVERSITI UTARA MALAYSIA 2011

DECLARATION

I herewith declare that this is an original work except for quotation and citation which has been stated its original source.

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ABSTRAK

Sains dipelajari melalui pelbagai kaedah. Tidak ada kaedah tertentu di mana semua pelajar mampu belajar sains. Tujuan kajian quantitatif ini dijalankan adalah untuk melihat perhubungan di antara pengajaran inkuiri, sikap pelajar terhadap sains dan sokongan guru terhadap pencapaian sains. Ia juga meninjau perbezaan pencapaian jantina dalam sains. Kajian ini dilaksanakan dikalangan 149 pelajar di satu sekolah kebangsaan di satu kawasan luar bandar di Kedah. Soal selidik diberi kepada pelajar untuk maklum balas. Keputusan kajian menunjukkan pelajar perempuan mencapai keputusan lebih baik daripada pelajar lelaki dalam sains. Keputusan ujian regrasi pula menunjukkan ketiga-tiga pembolehubah utama iaitu pengajaran inkuiri, sikap pelajar terhadap sains and sokongan guru mempunyai hubungan signifikan dengan pencapaian sains. Implikasi dan cadangan kajian lanjutan turut dibincangkan.

ABSTRACT

Science is studied in various ways. There is no one way set that all students learn science. The purpose of this quantitative study is to seek the relationship between inquiry-based instruction, student's attitudes toward science and teacher's support towards science achievement. It also looks at the gender differences in science achievement. This study was done among 149 students in a national primary school in a rural area in Kedah. Questionnaires were given to the students for feedback. The results indicated that female students perform better in science than male students. In addition the regression results revealed that all three independent variables namely inquiry-based instruction, student's attitudes toward science and teacher's support significantly influence science achievement among year five students. Implications and future direction of studies were also discussed.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

In Malaysia, the Integrated Curriculum for Primary Schools (ICPS) or Kurikulum Bersepadu Sekolah Rendah (KBSR) was first introduced in 1982 among 302 primary schools. In 1983, it was implemented in all primary schools and fully completed the implementation in one cycle in 1988. The education system encompasses education in five levels: pre-school, primary education, secondary education, post-secondary education and higher education. The government's vision is to make Malaysia a centre of educational excellence. Education is an on-going effort towards developing potentiality among individuals in a holistic and integrated manner in order to develop intellectual, spiritual, emotional and physically balanced and harmonious individual with high moral standards. Some of the integrated concepts in ICPS are elements should be taught across the curriculum including language, the environment, science and technology, patriotism, thinking skills and study skills. It also integrates the past experiences and the newly acquired experiences of students. The motivation for improvements and interventions aligned the curriculum's existence and future needs since 1999.

In 1994, science subject was introduced as a replacement subject for *Alam dan Manusia*. Starting 2003, the science subject was introduced to the year one students.

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REFERENCES

- Abd-El-Khalick, F., Boujaoude, S., Duschl, R., Lederman, N.G., Mamlok-Naaman, R., Hofstein, A., Niaz, M., Treagust, D., Tuan, H. (2004). Inquiry in science education: International perspectives. *Science Education*, 88, 397-419.
- Abdullah, S., & Abbas, M. (2006). The Effects of Inquiry- Based Computer Simulation with Cooperative Learning on Scientific Thinking and Conceptual Understanding. *Malaysian Online Journal of Instructional Technology (MOJIT)*, 3(2), 1-16.
- Aknipar, E., Yildiz, E., Tatar, N., & Ergin, O. (2009). Students' attitude toward science and technology: an investigation of gender, grade level and academic achievement. *Procedia Social and Behavioral Sciences*, 1, 2804-2808.
- Alberta Learning. (2004). Focus on inquiry: a teacher's guide to implementing inquiry-based learning: Edmonton: Alberta Learning.
- Alouf, J. L., & Bentley, M. L. (2003). Assessing the impact of inquiry-based science teaching in professional development activities, PK-12. Paper presented at the annual meeting of the Association of Teacher Educators, Jacksonville, FL. (ERIC Document Reproduction Service No. ED475577)
- Andre, T., Whigham, M., Hendrickson, A., & Chambers, S. (1999). Competency beliefs, positive affect and gender stereotypes of elementary students and their parents about science versus other school subjects. *Journal of Research in Science Teaching*, 36(6), 717-747.
- Amaral, O., Garrision, L., & Klentschy, M. (2002). Helping English learners increase achievement through inquiry-based science instruction. *Bilingual Research Journal*, 26(2), 213-239.
- Amrein, A. L., & Berliner, D. C. (2002). *High-stakes testing, uncertainty, and student learning*. (18 Ed. Vol. 10): Education Policy Analysis Archives.
- Ary, D., Jacobs, L. C., & Razaveigh, A. (2002). *Introduction to research in education*. (6 Ed.). Wadsworth/ Thomson Learning.
- Ashton, P. T., & Webb, R. B. (1986). Making a difference: Teacher's sense of efficacy and student achievement.: New York: Longmans.
- Australia Capital Territory Parliamentary Counsel. (2004). from http://www.legislation.act.gov.au/a/2004-17/current/pdf/2004-17.pdf.
- Baker, T.L. (1994), Doing Social Research (2nd Ed.). New York: McGraw-Hill Inc.
- Baker, D. (2002). Where is gender and equity in science education? *Journal for Research in Science Teaching*, 39(8), 659-663.

- Banchi, H., & Bell, R. (2008). The many levels of inquiry. Science and Children. 46(2), 26-29.
- Bandura, A. (1986). Social foundations of thought and action: A social cognitive theory. Englewood Cliffs, NJ: Prentice-Hall.
- Bandura, A. (2001). Social cognitive theory: An agentive perspective. *Annual Review of Psychology*, 52, 1-26.
- Barrow, L. (2006). A brief history of inquiry: From Dewey to standards. *Journal of Science Teacher Education*, 17(3), 265-278.
- Basterra, M. R. (1999). Using standardized tests to make high-stake decisions on English-language learners: Dilemmas and critical issues. *Equity Review, Winter* 1998 Spring 1999.
- Bates, G. C. (Ed.). (1978). The role of the laboratory in secondary school science programs. (Vol. 1). Washington, DC: National Science Teachers Association.
- Behuniak, P. (2000). Consumer-referenced testing. (3 ed. Vol. 83): Phi Delta Kappan.
- Bianchini, J. A., & Colburn, A. (2000). Teaching the nature of science through inquiry to prospective elementary teachers: A tale of two researches. *Journal of Research in Science Teaching*, 37(2), 177-209.
- Bikkar, R. S., Beamer, J. E., & Lundberg, I. (1993). Role of mathematics self efficacy in the structural model of mathematics achievement. *Journal of Educational Psychology*, 85(1), 41-48.
- Birch, S. H., & Ladd, G. W. (1996). Interpersonal relationships in the school environment and children's early school adjustment: The role of teachers and peers. New York: Cambridge University Press.
- Blanchard, P. N., & Thacker, J. W. (1999). Effective training: Systems, strategies, and practices. NJ: Prentice-Hall.
- Bleuer, J., & Walz, G. (2002). Are boys falling behind in academic? Part 1. Washington, DC: U.S. Department of Education, Office of Educational Research and Improvement.
- Bloom, B. S. (1976). *Human characteristics and school learning*. (New York: McGraw-Hill).
- Blosser, P. E. (1984). Attitude research in science education, (Information bulletin No. 1). Columbus, OH: Eric Clearinghouse for Science, Mathematics, and Environmental Education. (ERIC Document Reproduction Service No. ED 259941).
- Bohlander, G., Snell, S., & Sherman, A. (2001). *Managing human resources* (12 Ed.). Australia: South-Western College Publishing.

- Booth, G. (2001). Is inquiry the answer? The Science Teacher, 68(7), 57-59.
- Borgatta, E. F., & Montgomery, R. J. V. (2000). *Encyclopedia of Sociology* (2 Ed., Vol. 2). New York: Macmillan Reference, USA.
- Breaugh, J. A. (1992). Recruitment: Science and practice. Boston: PWS-Kent.
- Bredderman, T. (1983). Effects of activity-based elementary science on student outcomes: A quantitative synthesis. *Review of Educational Research*, 53, 499-518.
- Brophy, J., & Good, T. L. (1986). Teacher behavior and student achievement. Handbook of research on teaching (3 Ed.), New York: Macmillan.
- Brophy, J. (1987). Socializing students' motivation to learn. Advances in motivation and achievement. *Enhancing motivation*, 15, 181-210.
- Brophy, J. (2004). Motivating students to learn. Mahwah, NJ: Lawrence Erlbaum.
- Brown, P. L., Abell, S. K., Demir, A., & Schmidt, F. J. (2006). College science teachers' views of classroom inquiry. *Science Education*, 90, 784-802.
- Brunkhorst, B. J. (1992). A study of student outcomes and teacher characteristics in exemplary middle and junior high science programs. *Journal of Research in Science Teaching*, 29, 571-583.
- Bybee, R. W. (1997). Achieving scientific literacy. N.H. Heinemann: Portsmounth.
- Bybee, R. W. (2000). *Teaching science as inquiry*. Washington, DC: American Association for the Advancement of Science.
- Bybee, R. W. (2006). The science curriculum: Trends and issues. In Rhoton, J. and Shane, P. (Eds.). Washington, DC: NSTA Press.
- Campbell, J. R., Hombo, C. M., & Mazzeo, J. (2000). NAEP 1999 trends in academic progress: Three decades of student performance (NCES 2000-469). Washington, DC: U.S. Department of Education, National Center for Education Statistics.
- Carter, A. (2004). Autonomy, inquiry and mathematics reform. *The Constructivist*, 15(1), 1-15.
- Cashin, W. E. (1979). "Motivating Students" Idea Paper, no. 1., Manhattan: Center for Faculty Evaluation and Development in Higher Education, Kansas State University.
- Caskey, M. M., & Friend, J. (2006). Research on same-gender grouping in eighth grade science classrooms. *Online Research in Middle Level Education*, 30(4), 1-15.

- Caskey, M. M., Kohlhaas, K., Lin, H. H., & Chu, K. L. (2010). Disaggregated outcomes of gender, ethnicity and poverty on fifth grade science performance. *Online Research in Middle Level Education*, 33(7), 1-12.
- Castillo, Joan Joseph (2009). Research Population. Retrieved [Date of Retrieval] from Experiment Resources: http://www.experiment-resources.com/research-population.html
- Christophel, D. M. (1990). The relationships among teacher immediacy behaviors, student motivation, and learning. (Vol. 39): Communication Education.
- Christophel, D. M., & Gorham, J. (1995). A test-retest analysis of student motivation, teacher immediacy, and perceived sources of motivation and demotivation in college classes. (Vol. 44): Communication Education.
- Clark, C. M., & Peterson, P. (1986). Teachers' thought processes. Handbook of Research on Teaching. (3 Ed.). New York: Macmillan.
- Clark, C. M., & Yinger, R. J. (1979). Teachers' thinking. Berkeley CA: McCutchan.
- Colburn, A. (2000). An inquiry primer. Science Scope, 42-44.
- Coleman, G. (2001). Issues in education: View from the other side of the room. Westport, CT: Bergin & Garvey.
- Crawford, B. A. (2007). Learning to teach science as inquiry in the rough and tumble of practice. *Journal for Research in Science Teaching*, 44(4), 613-642.
- Davis, D. L. (2000). Business research for decision making (5 Ed.). Pacific Grove, CA: Duxbury Thomson Learning.
- DeBoer, G. E. (1991). A history of ideas in science education: Implications for practice. New York: Teachers College Press.
- De Vaus, D.A. (1993), Surveys in Social Research (3rd Ed.). London: UCL Press.
- Dewey, J. (1910). How We Think. Lexington, MA: D.C. Health and Co.
- Dewey, J. (1933). How We Think. Lexington, MA.
- Dewey, J. (1938). Logic: The Theory of Inquiry. New York: Holt, Rinehart and Winston.
- Ebenezer, V. J., & Zoller, U. (1993). Grade 10 students' perceptions of attitudes toward science teaching and school sciences. *Journal of Research In Science Teaching*, 30(2), 175-186.
- Eick, C. J., & Reed, C. J. (2002). What makes an inquiry-oriented science teacher? The influence of learning histories on student teacher role identity and practice. *Science Education*, 86(3), 401-416.

- Elmore, R. (2000). Building a new structure for school leadership. The Albert Shanker Institute.
- Fisher, D. L., Fraser, B. J., & Wubbles, T. (1993). *Interpersonal teacher behavior and school environment*. London: Falmer Press.
- Fisher, D. L., & Rickards, T. (1996). Associations between teacher-student interpersonal behavior and student attitude in mathematics classes. Paper presented at the Proceedings Western Australian Institute for Educational Research Forum 1996.
- Forster, P. A. (1999). How do I actually learn? A questionnaire for (co)participatory learning in the presence of technology. Paper presented at the Proceedings Western Australia Institute for Education Research Forum 1999.
- Fraser, B. J. (1998a). Classroom environment instruments: Development, validity and application. *Learning Environments Research: An International Journal*, 1, 7-33.
- Fraser, B. J. (1998b). Science learning environments: Assessment, effects and determinants. Dordrecht, the Netherlands: Kluwer Academic Publishers.
- Fraser, B. J. (1998c). Research on classroom and school climate. New York: Macmillan.
- Fraser, B. J. (1998d). Students' perceptions of their classroom environments. New York: The Falmer Press.
- Fraser, B. J., & Wubbles, T. (1995). Classroom learning environments. Chicago: University of Chicago Press.
- Geier, R., Blumenfeld, P. C., Marx, R. W., Krajcik, J. S., Fishman, B., Soloway, E. (2008). Standardized test outcomes for students engaged in inquiry-based science curricula in the context of urban reform. *Journal of Research in Science Teaching*, 45(8), 922-939.
- Gentile, M. A. (1997). The relationship between middle school teachers' perceptions of school climate and reading and mathematics achievement.: Widener University, Chester, PA.
- George, R. (2006). A cross-domain analysis of change in students' attitudes towards science and attitudes about the utility of science. *International Journal of Science Education*, 28(6), 571-589.
- Gerber, B. L., Marek, E. A., & Cavallo, A. M. L. (1997). Relationships among informal learning environments, teaching procedures and scientific reasoning ability. Paper presented at the National Association for Research in Science Teaching, Oak Brook.

- Germann, P. J. (1988). Development of the attitude toward science in school assessment and its use to investigate the relationship between science achievement and attitude toward science in school. *Journal of Research in Science Teaching*, 25, 689-703.
- Girod, M. (2001). Teaching 5th grade science for aesthetic understanding. Michigan State University, East Langsing.
- Girod, M., & Twyman, T. (2009). Comparing the added values of blended Science and Literacy Curricula to inquiry-based science curricula in two-2nd. grade classrooms. *Journal of Elementary Science Education*, 21(3), 13-32.
- Greenfield, T. A. (1996). Gender, ethnicity, science achievement and attitudes. *Journal of Research in Science Teaching*, 33(8), 901-933.
- Griggs, W. S., Lauko, M. A., & Brockway, D. M. (2006). *The nation's report card:* Science 2005. Washington, DC: U.S. Government Printing Office.
- Grolnick, W. S., & Ryan, R. M. (1987). Autonomy support in education: Creating the facilitating environment. *New directions in educational psychology*, 2, 213-232.
- Haefner, L. A. (2004). Learning by doing? Prospective elementary teachers' developing understandings of scientific inquiry and science teaching and learning. *International Journal of Science Education*, 26(13), 1653-1674.
- Hair, J. F., Anderson, R. E., Tatham, R. L., & Black, W. C. (1998). *Multivariate data analysis* (5 Ed.). Upper Saddle, NJ: Prentice-Hall.
- Haladyna, T., & Shaughnessy, J. (1982). Attitude toward science: A quantitative synthesis. Science Education, 66, 547-563.
- Hancock, D. R., Bray, M., & Nason, S. A. (1995). Influencing university students' achievement and motivation in a technology course. *Journal of Educational Research*, 95(6).
- Hargreaves, D. H., Hester, S. K., & Mellor, F. J. (1975). *Deviance in classrooms*. London: Routledge & Kegan Paul.
- Haury, D. L. (1993/2002). Teaching science through inquiry: ERIC, Clearinghouse for Sciences, Mathematics and Environmental Education.
- Haury, D. L., & Rillero, P. (1994). *Perspectives of hands-on science teaching*: ERIC, Clearinghouse for Science, Mathematics and Environmental Education.
- Haydel, A. M., & Roeser, R. W. (2002). On the links between students' motivational patterns and their perceptions of beliefs about, and performances on different types of science assessment: A multidimensional approach to achievement validation. Los Angeles: Stanford University, National Center for Research Evaluations, Standards and Student Testing.

- Hesse-Biber, S., & Carger, G. L. (2000). Working women in America: Split dreams. Oxford University Press.
- Hmelo-Silver, C., Duncan, R., & Chinn, C. (2007). Scaffolding and achievement in problem-based and inquiry learning: A response to Kirschner, Sweller and Clark (2006). *Educational Psychologist*, 42(2), 99-107.
- Ho, M. L., Marzuki, H. B., & Lim, V. (2005). Probing Primary School Science Teachers' Conceptions of the Experiment in an In-Service Course: Maktab Perguruan Sarawak, Malaysia.
- House, J. D. (1996). Student expectancies and academic self-concept as predictors of student achievement. *Journal of Psychology*, 130, 679-681.
- Jaeger, R. M. (1988). Survey research methods in education. In R.M. Jaeger. (Ed). Methods for research in education. (2nd Ed.). Washington, DC: American Education Research Association.
- Johnson, M. A., & Lawson, A. E. (1998). What are the relativ effects of reasoning ability and prior knowledge on biology achievement in expository and inquiry classes? *Journal of Research in Science Teaching*, 35(1), 89-103.
- Jorgenson, O., & Vanosdall, R. (2002). The death of science? What we risk in our rush toward standardized testing and the three R's. *Phi Delta Kappan*, 83(8), 601-605.
- Kahle, J. B. (Ed.). (1996). Opportunities and obstacles: Science education in the schools. San Francisco, CA: Jossey-Bass.
- Kahle, J. B., & Meece, J. L. (1994). Research on gender issues in the classroom. In D. Gabel. Washington, DC: National Science Teachers Association.
- Kanai, K., & Norman, J. (1997). Systematic reform evaluation: Gender differences in student attitudes toward science and mathematics. Paper presented at the Annual International Conference of the Association for the Education Teachers in Science, Cincinnati, OH.
- Kasl, E., & Yorks, L. (2002). Collaborative inquiry for adult learning. *New Directions for Adult and Continuing Education*, 94, 39-43.
- Kazempour, M. (2009). Impact of inquiry-based professional development on core conceptions and teaching practices: A case study. *Science Educator*, 18(2), 56-68.
- Ketpichainarong, W., Panijpan, B., & Ruenwongsa, P. (2010). Enhanced learning of biotechnology students by an inquiry-based cellulase laboratory. *International Journal of Environmental & Science Education*, 5(2), 169-187.
- Kirschner, P. A., Sweller, J., & Clark, R. E. (2006). Why minimal guidance during instruction does not work: an analysis of the failure of constructivist, discovery,

- problem-based, experiential and inquiry-based teaching. *Educational Psychology*, 41, 75-86.
- Kleiman, G. M. (2005). Does technology combined with inquiry-based lessons increase student's learning?

 Retrieved from http://cosn.org/resources/edc/vol_1.pdf
- Koballa, R. T., & Crawley, E. F. (1985). The influence of attitude on science teaching and learning. School Science and Mathematics, 85(83), 222-232.
- Koballa, R. T. (1995). Children's attitudes toward learning science. In S. Glynn and R. Duit. Learning science in the schools: Research reforming practice. (Mahwah, NJ: Erlbaum), 59-84.
- Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. Educational and psychological measurement, 30, 607-610.
- Krockover, G., & Shepardson, D. (1995). The missing links in gender equity research. Journal for Research in Science Teaching, 32(3), 223-224.
- Kurvink, K. (1993). Contracting as a motivational teaching tool. *Journal of College Science Teaching*, 22(5), 310.
- Lambert, J. (2007). Using model-centered instruction to introduce GIS in teacher preparation programs. *Journal of Geosciences Education*. 55(5), 387-395.
- Lambert, J., & Ariza, E. N. W. (2008). Improving achievement for linguistically & culturally diverse learners through an inquiry-based earth systems curriculum. Journal of Elementary Science Education, 20(4), 61-79.
- Lee, O., & Anderson, C. W. (1993). Task engagement and conceptual change in middle school science classrooms. *American Educational Research Journal*, 30(3), 585-610.
- Lee, O., & Brophy, J. (1996). Motivational patterns observed in six-grade science classroom. *Journal of Research Science Teaching*, 33(3), 303-318.
- Lee, V. E., & Burkam, D. T. (1996). Gender differences in middle grade science achievement: Subject domain, ability and course emphasis. *Science Education*, 80, 613-650.
- Leonard, J., Boakes, N., & Moore, C. M. (2009). Conducting science inquiry in primary classrooms: Case studies of two pre-service teachers' inquiry-based practices. *Journal of Elementary Science Education*, 21(1), 27-50.
- Li, Q., Dyjur, P., Nicolson, N., & Moorman, L. (2009). Using Videoconferencing to Provide Mentorship in Inquiry-Based Urban and Rural Secondary Classrooms. Canadian Journal of Learning and Technology, 35(3), 1-22.

- Likert, R. (1932). A technique for the measurement of attitudes. (Vol. 140). New York: Johnson Associates.
- Lynch, S. (2000). Equity and science education reform. Mahwah, NJ: Lawrence Erlbaum.
- Maeher, M. L. (1984). Meaning and motivation: Toward a theory of personal investment. New York: Academic Press.
- Maeher, M. L., & Steinkamp, M. (1983). A synthesis of findings on sex differences in science education research. Washington, DC: National Science Foundation.
- Mahony, M., Wozniak, H., Everingham, F., Reid, B., & Poulos, A. (2003). *Inquiry-based teaching and learning: What's in a name?* Paper presented at the HERDSA.
- Marchant, G. (2004). What is at stake with high stakes testing? A discussion of issues and research. *The Ohio Journal of Science*, 104(2), 2-7.
- Marshall, H. H. (1987). Motivational Strategies of Three Fifth-Grade Teachers. *The Elementary School Journal*, 88(2), 135-150.
- Mathis, R. L., & Jackson, J. H. (2003). *Human resource management* (Vol. 10). Clifton Park, NY: Thompson-Southwestern.
- Mattern, N., & Schau, C. (2002). Gender differences in science attitude-achievement relationships over time among white middle-school students. *Journal of Research in Science Teaching*, 39(4), 324-340.
- Meerah, T. S. M., Halima, L., Rahmana, S., Abdullaha, R. T., Haruna, H., Hassana, A., (2010). Teaching marginalized children: primary science teachers' professional development through collaborative action research. *Cypriot Journal of Educational Sciences*, 5, 26-38.
- Ministry of Education (2006). *Integrated Curriculum for Primary Schools, Science Year 5*. Kuala Lumpur: Dewan Bahasa dan Pustaka.
- Moore, A., Masterson J.T., Christophel, D. M., & Shea, K. A. (1996). College teacher immediacy and student ratings of instruction. (Vol. 45): Communication Education.
- Moreno, N. P., & Tharp, B. Z. (2006). How do students learn science? In Rhoton, J. & Shane, P. Washington, D.C.: NSTA Press.
- Mullis, I. V. S., Dossey, J. A., Owen, E. H., & Phillips, G. W. (1993). *NAEP 1992 math report card for the nation and the states*. Washington, DC: Government Printing Office.
- Murphy, K. R., & Davidshofer, C. O. (1994). *Psychological testing: Principles and applications.* (Vol. 3): Englewood Cliffs, NJ: Prentice Hall.

- National Research Council. (1996). National science education standards. Washington, D.C.: National Academy Press.
- National Research Council. (2000). *Inquiry and the national science education standards: A guide for teaching and learning.* (2000). Washington, DC: National Academy Press.
- National Center for Education Statistics. (1992). The 1990 science report card: NAEP's assessment of fourth, eight and twelfth grades (NCES Report No. 92-064. Washington DC: U.S. Department of Education, Office of Educational Research and Improvement, National Center for Education Statistics.
- Newman, R. S. (2000). Social Influences on the Development of Children's Adaptive help Seeking: The Role of Parents, Teachers and Peers. *Developmental review*, 20, 350-404.
- Newman, F., Bryk, A., & Nagaoka, J. (2001). Authentic intellectual work and standardized test: Conflict or coexistence? Chicago: Consortium on Chicago School Research.
- Nicholls, J. G. (1984). Achievement motivation: Concepts of ability, subjective experience, task choice and performance. *Psychological Review*, 91(3), 328-346.
- Norris, S. P., & Phillips, L. M. (1994). Interpreting pragmatic meaning when reading popular reports of science. Journal of Research in Science Teaching, 31(9), 947-967.
- Nuangchalerm, P. (2010). Engaging students to perceive nature of science through socioscientific issues-based instruction. *Journal of Social Sciences*, 13, 34-37.
- Nuangchalerm, P., & Thammasena, B. (2009). Cognitive development, analytical thinking and learning satisfaction of second grade students learned through inquiry-based learning. *Asian Social Science*, 5, 82-87.
- Office of the National Education Commission [ONEC] (1999). National Education Act 1999. Bangkok: ONEC.
- Osborne, J., Simon, S., & Collins, S. (2003). Attitudes towards science: A review of the literature and its implications. *International Journal of Science Education*, 25(9), 1049-1079.
- Otchet, A. (2008). A View Inside Primary Schools. Institute for Statistics. UNESCO.
- Owenes, T. M. (2009). Improving science achievement through changes in education policy. FALL, 18(2), 49-55.
- Panasan, M., & Nuangchalerm, P. (2010). Learning outcomes of project-based and inquiry-based learning activities. *Journal of Social Sciences*, 6(2), 252-255.

- Pajares, F. (2002). Self-efficacy belies in academic settings. *Review of Educational Research*, 66, 543-578.
- Pajares, F., & Schunk, D. H. (2001). Self-beliefs and school success: Self-efficacy, self-concept, and school achievement. In R. Riding & S. Rayner. Self-perception (pp. 239-266). London: Ablex Publishing.
- Peat, J., Mellis, C., Williams, K. and Xuan W. (2002), *Health Science Research: A Handbook of Quantitative Methods*, London: Sage.
- Philips, A. H. The effects of student-centered, technology-based instruction on the intrinsic motivation of secondary students.
- Pianta, R. C. (1992). Beyond the parent: The role of other adults in children's lives. New Directions for Child Development (Vol. 57). San Francisco: Jossey-Bass.
- Pintrich, P. (2002). Motivation as an enabler for academic success. *School Psychology Review*, 31(3).
- Pintrich, P. R., & Degroot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology*, 82(33-40).
- Polit, D.F., Beck, C.T. and Hungler, B.P. (2001), Essentials of Nursing Research: Methods, Appraisal and Utilization. 5th Ed., Philadelphia: Lippincott Williams & Wilkins.
- Popham, W. J. (2001). Uses and misuses of standardized tests. *NASSP Bulletin*, 85, 24-31.
- Raffini, J. (1993). Winners without Losers: Structures and strategies for increasing student motivation to learn. Boston: Allyn and Bacon.
- Rennie, L. J., & Punch, K. F. (1991). The relationship between affect and achievement in science. *Journal of Research in Science Teaching*, 28, 193-209.
- Reeve.J. (1996). Motivating others. Needham Heights, MA: Allyn & Bacon.
- Reeve.J., & Hyungshim.J. (2006). What Teachers Say and Do to Support Students' Autonomy During a Learning Activity. *Journal of Educational Psychology*, 98, 209.
- Rettig, M. D., & Canady, R. L. (1996). All around the block: The benefits and challenges of a non-traditional school schedule. *The School Administrator*, 53(8).
- Richardson, G. M., & Liang, L. L. (2008). The use of inquiry in the development of preservice teacher efficacy in Mathematics and Science. *Journal of Elementary Science Education*, 20(1), 1-16.

- Rodriguez, A. J. (1998). Busting open the meritocracy myth: Rethinking equity and student achievement in science education. *Journal of Women and Minorities in Science and Engineering*, 4(2,3), 195-216.
- Roscoe, J. T. (1975). Fundamental research statistics for the behavioral sciences (2nd Ed.). New York: Holt, Rinehart, and Winston.
- Rosenshine, B., & Stevens, R. (1986). Teaching functions. Handbook of research on teaching. (3 Ed.). New York: McMillan.
- Roth, K. J. (1992). Science education: It's not enough to "Do" or "Relate". In M.K. Pearsall (Ed.), Scope, sequence and coordination of secondary school science. (Vol. 2). Washington, DC: National Science Teachers Association.
- Rowell, P. M., & Ebbers, M. (2004). Shaping school science: competing discourses in an inquiry-based elementary program. *International Journal of Science Education*, 26(8), 915-934.
- Saat, R. M., & Ismail, N. A. (2003). Instructional Strategies And Science Achievement of Form 2 Students in Malaysia: Findings from the trends in International Mathematics and Science Study (TIMSS) 2003. *Journal of Science and Mathematics Education in S.E. Asia*, 29(1), 62-78.
- Scantlebury, K. (1994). Emphasizing gender issues in the undergraduate preparation of science teachers: Practicing what we preach. *Journal of Women and Minorities in Science and Engineering*, 1, 153-164.
- Scantlebury, K., & Baker, D. P. (2007). Gender issues in science education research: Remembering where the difference lies. In S.K. Abell & N. G. Lederman (Eds.). Mahwah, NJ: Lawrence Erlbaum.
- Schibeci, R. A. (1984). Attitudes to science: An update. Studies in Science Education, 11, 26-59.
- Schunk, D. H. (1987). Peer models and children's behavioral change. Review of Educational Research, 57, 149-174.
- Sekaran, U. (2003). Research methods for business: A skill building approach (4 ed.). NY: John Wiley & Sons, Inc.
- Shymansky, J. A., Hedges, L. V., & Woodworth, G. (1990). A reassessment of the effects of inquiry-based science curricula of the 60's on student performance. Journal of Research on Science Teaching, 27(127-144).
- Shymansky, J. A., Kyle, W. C., & Alport, J. M. (1983). The effects of new science curricula on student performance. *Journal of Science Teaching*, 20, 387-404.
- Simpson, R. D., Koballa, T. R., Jr., Oliver, J. S., & Crawley, F. E. (1994). Research on the affective dimensions of science learning. In D. Gabel (Ed.), *Handbook of research on science teaching and learning*. (New York: Macmillan), 211-234.

- Simpson, D. R., & Oliver, S. J. (1990). A summary of major influences on attitude toward and achievement in science among adolescent students. *Science Education*, 74(1), 1-18.
- Skinner, E. A., & Belmont, M. J. (1993). Motivation in the Classroom: Reciprocal Effects of Teacher behavior and Student Engagement across the School Year. Journal of Educational Psychology, 85(4), 571-581.
- Stevens, F. I. (1993). Opportunity to learn: Issues of equity for poor and minority students. Washington, DC: U.S. Department of Education, National Center for education Statistics.
- Stevenson, D. L., & Baker, D. P. (1987). The Family-School Relation and the Child's School Performance. *Child Development*, 58, 1348-1357.
- Stipek, D. J. (1996). Motivation and instruction. Handbook of Educational Psychology. New York: Macmillan.
- Stone-Romero, E. F., & Anderson, L. E. (1994). Relative power of moderated multiple regression and the comparison of subgroup correlations coefficients for detecting moderating effects. *Journal of Applied Psychology*, 79, 354-359.
- Tamir, P. (1989). Training teachers to teach effectively in the laboratory. Science Teacher Education, 73(1), 59-69.
- Tan, Y. S. (2007). Attitudes and achievement orientations of students towards learning of science and mathematics in English. *Kajian Malaysia*, XXV (1), 15-39.
- Tavani, C., & Losh, S. (2003). Motivation, self-confidence, and expectations as predictors of the academic performances among our high school students. *Child Study Journal*, 33(3).
- Teddlie, C., & Reynolds, D. (2000). The International Handbook of School Effectiveness Research. New York: Falmer Press.
- Tsai, C. C., Tuan, H. L., Chin, C. C., & Chang, J. C. (2007). Investigating the influence of "Nested Inquiry-based Instruction Model" on 8th. Graders Motivation in Learning Physical Science. Paper presented at the Proceeding of the 2nd. NICE Symposium, Taipei, Taiwan.
- Von Secker, C. E. (2002). Effects of inquiry-based teacher practices on science excellence and equity. *The Journal of Educational Research*, 95(3), 151-160.
- Von Secker, C. E., & Lissitz, R. W. (1999). Estimating the impact of instructional pratices on student achievement in science. *Journal of Research in Science Teaching*, 36(10), 1110-1126.
- Weaver-Hightower, M. (2003). The 'boy turn' in research on gender and education. Review of Educational Research, 73(4), 471-498.

- Webster's new collegiate dictionary: A Merriam-Webster. (1977). Springfield, MA: G&C. Meriam Company.
- Weinburg, M. H. (2000). Gender, ethnicity, and grade level as predictors of middle school students' attitudes toward science. *ERIC*, *ED442662*.
- Wentzel, K. R., Battle, A., Russell, S. L., & Looney, L. B. (2010). Social supports from teachers and peers as predictors of academic and social motivation. *Contemporary Educational Psychology*, 35, 193-202.
- Wentzel, K. R. (1997). Student motivation in middle school: The role of perceived pedagogical caring. *Journal of Educational Psychology*, 89, 411-419.
- Wentzel, K. R. (2002). Are Effective Teachers Like Good Parents? Teaching Styles and Student Adjustment in Early Adolescence. *Child Development*, 73(1), 287-301.
- Wentzel, K. R., & Asher, S. R. (1995). Academic lives of neglected, rejected, popular, and controversial children. *Child Development*, 66, 754-763.
- Wilson, S., & Berne, J. (1999). Teacher learning and the acquisition of professional knowledge: An examination of research in contemporary professional development. *Review of Research in Education*, 24, 173–209.
- Wilson, L., & Corpus, D. (2005). The effects of reward systems on academic performance. *Middle School Journal Research Articles*.
- Windschitl, M. (2003). Inquiry projects in science teacher education: What can investigative experiences reveal about teacher thinking and eventual classroom practice? *Science Education*, 87(1), 112-143.
- Wubbles, T. (1993). Teacher-student relationships in science and mathematics classes. What research says to the science and mathematics teacher. (Vol. 11). Perth, Western Australia: Curtin University of Technology.
- Wubbles, T., & Levy, J. (1991). A comparison of interpersonal behavior of Dutch and American teachers. *International Journal of Intercultural Relations*, 15, 1-18.
- Zikmund, W. G. (2003). Business research methods (7 Ed.). Mason, OH: Thompson South-Western.