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AUTHOR	McCann, Wendy Sherman, Ed.; Haury, David L., Ed.
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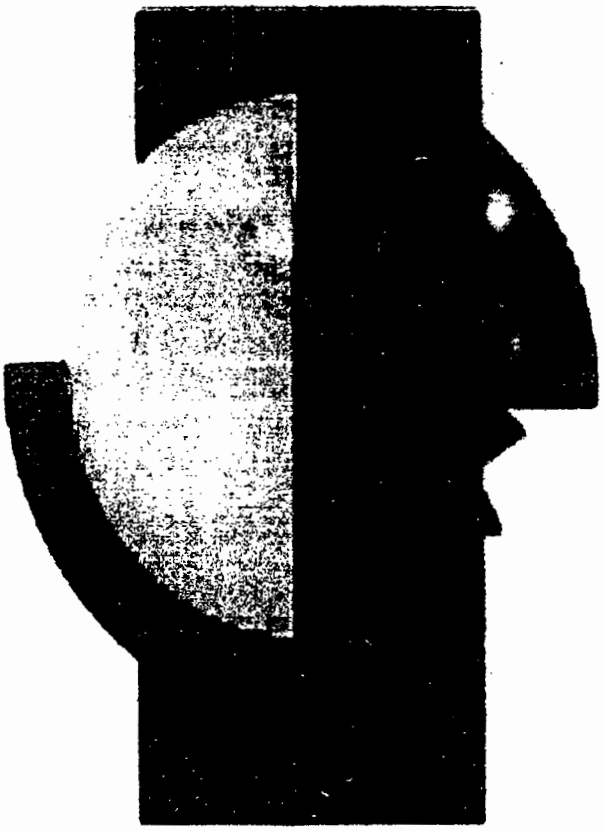
IDENTIFIERS	Conceptual Change

ABSTRACT

This document contains summaries of research in science education for the year 1998 and provides easy access to research findings and a critique of research efforts. Contents include: (1) "Science Education Research Published in Professional Journals" (Judith Sulkes Ridgway and Hyonyong Lee); (2) "Science Education Research Papers, Monographs, and Electronic Documents" (Lynda C. Titterington and Youngsun Kwak); (3) "Science Education Dissertations and Theses" (Suzanne Shaw Drummer, Chris A. Ingersol, and Joyce C. Miller); (4) "Concept Representation and Modeling in Science" (Judith Sulkes Ridgway); (5) "Evolution Education" (Suzanne Shaw Drummer); (6) "Constructivist Perspectives of Teaching and Learning Science" (Youngsun Kwak); (7) "Computer-Based Learning in Science" (Lynda C. Titterington); and (8) "Integrating Science with Other School Subjects" (Hyonyong Lee). (YDS)

Trends in Science Education Research



Wendy Sherman McCann & David L. Haury, Editors

TRENDS IN SCIENCE EDUCATION RESEARCH–1998

Taking the Annual Pulse of the Science Education Research Community

Edited by

Wendy Sherman McCann & David L. Haury

Distributed by
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David L. Haury, *ERIC/CSMEE Executive Editor*
Linda A. Milbourne, *ERIC/CSMEE Copyeditor*

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- A rationale for development of the document, including identification of target audience and the needs served.
- A vita and a writing sample.

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Attn: Database Coordinator
1929 Kenny Road
Columbus, OH 43210-1080

Contents

Preface

For many years, the ERIC Clearinghouse for Science, Mathematics, and Environmental Education published an annual *Summary of Research in Science Education* that appeared as a special issue of *Science Education*. The *Summary* was intended to facilitate access to research findings and provide a critique of research efforts in science education at one-year intervals. Sort of a "progress report." A variety of factors led to the demise of that *Summary*, but many science educators continued to express interest in some sort of annual overview of research in science education. For two years, the Clearinghouse produced an annotated listing of research in science education, but no effort was made to provide a critical analysis of research or research trends; authors simply attempted to identify and accurately describe the science education research reported through doctoral dissertations, journal articles, conference papers, and other documents. The hope was that one-year "snapshots" of research would provide an overview of the field for experienced researchers, doctoral students, and practitioners who use research findings.

The most recent *Annual Summary* (presenting research reported in 1997) provided a broader view of science education research by incorporating electronic documents available on the World Wide Web, and by including articles from journals less familiar to science educators. During the past two years, the *Annual Summary* grew in scope, and the positive feedback from science education students and researchers convinced us to find some mechanism to continue producing the annual summary of research in science education.

This year's *Trends in Science Education Research–1998* (*TiSER*) represents another evolutionary step in presenting an annual summary of research in the field. As in previous years, this document includes annotated listings of research reported during the most recent year for which articles, dissertations, and other reports have been gathered, 1998. A new layout has been developed in response to feedback received, and a new section has been added as a small step toward greater analysis of trends in science education research. This year's summary also marks the beginning of a new production process that we hope will ensure a means of ongoing support for this experimental publication. *TiSER* is now being produced as a special project of doctoral students at The Ohio State University, under the supervision of a faculty member, and is being distributed through the ERIC Clearinghouse for Science, Mathematics, and Environmental Education.

We hope you find TiSER to be a useful resouce. Though this may not be a comprehensive listing of the science education research reported in 1998, we believe it is the most complete listing available and presents the major trends in science education research. We welcome your comments and suggestions for improving this document, so please forward your feedback to us at: Trends in Science Education Research (TiSER), ERIC/CSMEE, 1929 Kenny Road, Columbus, OH, 43210-1080; or send e-mail to the attention of David Haury at ericse@osu.edu.

WSM & DLH

Key to Codes

The following topic codes have been used to indicate the major and minor emphases of each dissertation, journal article, paper, or electronic document in this listing. Each entry has been assigned a minimum of one and a maximum of three major codes and maximum of three minor codes. Within the *Research Directory* immediately following this section, major codes have been used to categorize each publication.

The grade level or educational level of each study is indicated in parentheses after the topic codes. The level codes for teacher education studies may also reflect the grade level(s) at which the interns or teacher participants teach.

Topic Codes

ach	achievement	eqt	equity issues	nas	nature of science
alf	alternative frameworks	esg	earth & space science/ geology	nfd	nonformal & informal education
asm	assessment			ntw	networks/ collaboration/ partnerships
ats	student attitudes	eth	ethnicity		
att	teacher attitudes	evo	evolution		
bfs	belief systems/worldviews	fsd	field studies/ outdoor education	pbs	problem solving/ science reasoning
bio	biology				
bkg	background factors/ context, social factors	gen	gender	ped	pedagogy
		his	history/ historical implications	phe	philosophy/ epistemology
car	science-related study/ career choice	hos	hands-on science	phy	physics
cbi	computer-based instruction	inq	inquiry	ref	reform/ educational change/ standards
ccg	conceptual change	int	integration, interdisciplinary		
che	chemistry	kns	student knowledge		
chs	student characteristics	knt	teacher knowledge	rem	representation/ modeling
cht	teacher characteristics	lab	laboratory		
cid	classroom interactions/ discourse interaction	lit	science literacy	res	research/ review of research/ conference proceedings
		lrg	learning/ comprehension		
cns	constructivism				
cpl	cooperative learning/ group work	lsy	learning style/ cognitive style	sks	student skills
				skt	teacher skills
cul	cross-cultural studies	lth	learning theory	sts	science, technology, & society
cur	curriculum	mat	materials, equipment	tec	technology
edt	educational technology	mce	multicultural education/ bilingual education	tpd	teacher professional development
ene	environmental education				

Level Codes

AD	adult
EC	early childhood, PreK-4
EL	elementary, K-8
MS	middle school
SE	secondary, 5-12
HS	high school, 9-12
PS	post secondary, 13-
K-12	all school levels
ALL	all student levels
TE	teacher education, teachers
GEN	general interest

Further Elaboration of Selected Codes

In some cases, the codes we have used to group items may not correspond to the more precise terminology often used within the science education discourse community. To aid readers in making a match between the codes we have used and some common areas of research, we offer a further elaboration of codes on the next page. The codes we have used are indicated on the left, and the categories they represent include the topics listed on the right.

Elaboration of Codes

ach	achievement, grades, academic success
ats	student attitudes, mental state, interest, motivation, efficacy, perceptions
asm	assessment issues, including program evaluations
bfs	student or teacher belief systems, worldviews
bkg	background, context, including social or economic factors, past experience, family interest or background, environment, rural vs. urban
cbi	instruction by computer programs or simulations, including software design
chs	student characteristics, including creativity, at-risk behaviors, physical disabilities, learning disabilities, giftedness
cid	classroom interaction, discourse interaction (not necessarily classroom)
cul	comparison of cultural factors, not simply a study of another culture, including subculture-main culture comparisons
edt	educational technology, instructional technology other than computers, distance education, multimedia education
eqt	equity issues, power issues
his	includes science education history
int	integration, interdisciplinary issues, including thematic education
kns	student knowledge, cognitive structures, mental constructs, system of constructs
lrg	learning, comprehension
lsy	learning or cognitive styles and orientations, learning strategies
lth	learning theory in a more general sense than *lrg*
mat	print or electronic materials, other media, equipment and supplies
mce	multicultural education, including bilingual education, diversity issues
ntw	networks; collaborations between students, teachers, schools; partnerships; mentoring programs
res	research as a topic of study, review of research, including conference proceedings
sks	student skills, including science process skills
tec	technology as a topic of study, technology education, engineering

Acronyms Used

The following acronyms may appear without definition in abstracts throughout this volume:

AAAS	American Association for the Advancement of Science
CAI	Computer Assisted Instruction
GPA	Grade Point Average
NAEP	National Assessment of Educational Progress
NCTM	National Council of Teachers of Mathematics
NRC	National Research Council
NSF	National Science Foundation
NSTA	National Science Teachers Association
SS&C	Scope, Sequence & Coordination
STEBI	Science Teaching Efficacy Beliefs Instrument
STS	Science, Technology, Society
TIMSS	Third International Mathematics & Science Study

Research Directory

Each research document included in TiSER has been indexed using major and minor codes as described in the *Key to Codes* (see page ix). In this Directory, research contributions have been clustered according to the major codes assigned to each report. For instance, to find all the research having to do with "beliefs," you would find the index term on page 3 and note the dissertations, articles, and other documents grouped under that heading. Each item is referenced according to author name, and authors of dissertations, articles, and other documents are listed separately.

Achievement (ach)

Published Articles

Alspaugh & Harting int, ach, ped
Anderman, E.M. ach, chs, bkg
Boone, W.J. ach, asm, gen
Bunyan, P. ach, asm, sks
Chinn, P.W.U. ref, ats, ach
Halloun & Hestenes ats, chs, ach
Hanson & Kraus gen, ach, bkg
Huppert, Yaakobi, et al. ach, cbi, gen
Johnson & Lawson ach, ped, sks
Lin, H.-S. ped, his, ach
Rennie. & Parker ach, asm, eqt
Sandor, Clark et al. pbs, ped, ach
Schmidt & McKnight. ach, cul, res
Smith. & Hausafus bkg, ach, eth
Wang, J. cul, ach, asm
Yu, F.-Y. cbi, cpl, ach

Papers and Electronic Documents

Howie, & Hughes chs, ach, lit
Johnson & Siegendorf ach
Kahle, J.B. & Rogg, S.R. eqt, ref, ach
Kahle, J.B. eqt, ref, ach
Keiser, Nelson, et al. asm, ach, bkg
Mullis, Martin, et al. ach, cul, lit
Pushkin & Gonzalez. bkg, ach, che
Rasekoala, E. ach, eth, eqt
Shear, L. cbi, cur, ach
Takahira, Gonzales. et al. ach, lit, cul
Young, D.J. ach, bkg

Dissertations and Theses

Brent, B.M. cur, che, ach
Burke, P.A. cbi, ats, ach
Chorny, J.J. inq, ach, phy
Chung-Schickler. cpl, ats, ach
Dardis, D.J.A. ats, ach, ped
Decker, L.M. lsy, ats, ach
Figueroa, D.E. ach, che, che
Gatlin, L.S. cns, ped, ach
Good, J.M. eth, tec, ach
Holschuh, J.L. phe, ach, pbs
Ismail, N.K. ach, kns, knt
Keller, T.E. ach, che
King, M.J. ach, edt, cbi
Kovanis, L.N. cur, ach, ats
Lizarzaburu, V.G. cur, ach, mce
Mackin, J.E. cbi, ach, gen
Riley, W.D. chs, che, ach
Ross, D.L. bkg, ats, ach
Shimizu, K. inq, ach, hos
Tai, R.H. bkg, gen, ach
Turner, D.R. ach, ped, sks
Von Secker, C.E. ach, bkg
Waayers, D.P. cbi, ach
Walker, C.M. ach, asm, cns
Warnick, B.K. int, ach, bio
Wright, K.J. cpl, ach

Alternative Frameworks (alf)

Published Articles

Ahtee, M. & Varjola, I. alf, kns, che
Arikaw & Maruno alf, ccg, hos
Atkinson & Bannister asm, alf
Bar, V. & Zinn, B. phe, his, alf
Boo, H.K. alf, kns, che
Boo, H.-K. & Toh, K.-A. alf, knt, skt
Camacho & Cazares alf, rem, kns
Dekkers & Thijs alf, ped, ccg
Enderstein & Spargo bfs, bkg, alf
Johnson, P. alf, kns, che
Krnel, Watson, & Glazar res, alf, che
Raghavan, Sartoris, et al. rem, lrg, alf
Rowlands, Graham, et al. alf, kns, phy
Sadler, P.M. alf, lrg, esg
Schoon & Boone alf, ats, nas
Seroglou, Koumaras, et al. ccg, his, alf
Sinclair & Pendarvis evo, bfs, alf
Sneider & Ohadi alf, cns, his
Trumper, R. alf, kns, tpd
Venville & Treagust alf, ccg, phe
Vosniadou & Ioannides lth, ccg, alf
Yip, D.-Y. ccg, alf, ped
Yip, D.-Y. knt, alf, bio

Papers and Electronic Documents

Klammer, J. alf, asm, phy
Savelsbergh, et al. cbi, alf, phy

Dissertations and Theses

Beeber, C. alf, kns, asm
Dawson, C.J. alf, lrg, ccg
Marx, J.D. alf, asm, phy
Osmundson, E. alf, cns, lth
Smith, S.H. kns, alf, che
Voska, K.W. alf, che, asm
Wissing, D.R. cbi, alf, asm

Assessment (asm)

Published Articles

Atkinson & Bannister asm, alf
Berglund, Danieis, et al. asm, sks, ref
Boone, W.J. ach, asm, gen
Bowen, C.W. asm, cbi, che
Bunyan, P. ach, asm, sks
Campbell, Wahl, et al. ref, asm, car
Dekkers, P.J.J.M. asm, kns, pbs
Duchovic, R.J. ped, asm, cpl
Grandy, J. ats, eth, asm
Heffernan, B.M. asm, nfd, fsd

Attitudes –Student (ats)

Attitudes–Teacher (att)

Background Factors; Context; Social Factors (bkg)

Beliefs; Worldviews (bfs)

Biology (bio)

Computer-Based Instruction (cbi)

Published Articles

Abell, Bryan, et al. tpd, cbi, skt
Bowen, C.W. asm, cbi, che
Briano, R. & Midoro, V. ene, cbi, cpl
Carter, M.W. ped, fsd, cbi
Collins, M. cbi, ntw, ped
Denning & Smith cbi, pbs, chs
Eidson & Simmons cbi, pbs, sks
Erickson & Lehrer cbi, mat, res
Huppert, Yaakobi, et al. ach, cbi, gen
Karadelis, J.N. cur, cbi, tec
Khoo & Koh cbi, rem, lrg
Nason, Lloyd, & Ginns cbi, cpl, ped
Orfinger, B. cbi, nfd, ped
Robinson, P. cbi, ats, sks
Swaak, et al. cbi, edt, kns
Windschitl, & Andre ccg, cns, cbi,
Yu, F.-Y. cbi, cpl, ach

Papers and Electronic Documents

Howse, M.A. pbs, cbi, rem
Murfin, B. & Go, V. cbi, res, bio
O'Hara, S.P. ats, cbi
Savelsbergh, et al. cbi, alf, phy
Schwarz & White rem, cur, cbi
Shear, L. cbi, cur, ach

Dissertations and Theses

Akpan, J.P. cbi, lrg, lab
Barrett, J.B. cbi, bio, att
Bos. N.D. cbi, int, lrg
Britton, L.A. kns, ped, cbi
Brophy, S.P. cbi, pbs, lab
Burke, P.A. cbi, ats, ach
Carr, K.M. cur, cbi, pbs
Chou, C.-H. cbi, cns, phy
Davis, E.A. ped, lrg, cbi
Ealy, J.B. cns, rem, cbi
Graves, A.P. cbi, rem, che
Hunter, W.J.F. cbi, che, rem
Kim, H.-W. cbi, lrg, ats
King, M.J. ach, edt, cbi
Lee, K.M. inq, cbi, tpd
Luttig, E.P. cbi, che, lrg
Lyon, E.B. cbi, cpl, ats
Mackin, J.E. cbi, ach, gen
Marszalek, C.S. cbi, lab, bio
Mishra, P. cbi, rem, lth
Robertson, W.O. cbi, cur, esg
Sandoval, W.A. inq, evo, cbi
Schwarz, C.V. rem, nas, cbi
Steffy, H.L. ref, ats, cbi
Titus, A.P. pbs, cbi, sks
Waayers, D.P. cbi, ach
Wissing, D.R. cbi, alf, asm

Conceptual Change (ccg)

Published Articles

Arikawa, & Maruno alf, ccg, hos
Beeth, M.E. ccg, bkg, ped
Beeth, M.E. ccg, ped, lrg
Dekkers & Thijs alf, ped, ccg
Duit, Roth, et al. cid, ccg, lth
Scott, P. ccg, cid, cns
Seroglou, Koumaras, et al. ccg, his, alf
Stofflett, R.T. ccg, cns, ped
Taber, K.S. ccg, che, res
Van Driel, De Vos, et al. ccg, che
Venville & Treagust alf, ccg, phe
Vosniadou & Ioannides lth, ccg, alf
Weaver, G.C. ccg, cid, ped
Wilson, J.M. rem, kns, ccg
Windschitl & Andre ccg, cns, cbi,
Yip, D.Y. ccg, alf, ped

Papers and Electronic Documents

Ogunsola-Bandele, M.F. ccg, ats, bio
Tsai, C.-C. rem, ccg, lrg

Dissertations and Theses

Dawson, C.J. alf, lrg, ccg
Feather, R.M.J. ccg, ped
Heide, C.L. ccg, ped, ats
Ollerenshaw, J.A. ccg, ped

Chemistry (che)

Published Articles

Ahtee, M. & Varjola, I. alf, kns, che
Boo, H.K. alf, kns, che
Bowen, C.W. asm, cbi, che
Collard & McKee nfd, che, sts
Johnson, P. alf, kns, che
Krnel, Watson, & Glazar res, alf, che
Lagowski, J.J. cur, his, che
Niaz, M. mat, his, che
Taber, K.S. ccg, che, res
Van Driel, De Vos, et al. ccg, che
Van Driel, De Vos, et al. che, his, ped
Winn, P. ats, che

Papers and Electronic Documents

Kesner, Hofstein, et al. che, att, knt
Pushkin & -Gonzalez bkg, ach, che
Tien, L.T. & Stacy, A.M. inq, lab, che

Dissertations and Theses

Brent, B.M. cur, che, ach
Canestraight, K.K. che, cid, bkg
Figueroa, D.E. ach, che, che
Graves, A.P. cbi, rem, che
Hunt, T.P. lab, asm, che
Hunter, W.J.F. cbi, che, rem
Keller, T.E. ach, che
Luttig, E.P. cbi, che, lrg
Plohocki, B.A. knt, lab, che
Riley, W.D. chs, che, ach
Robinson, J.B. bkg, lrg, che
Saunders, G.L. lsy, phe, che
Smith, S.H. kns, alf, che
Voska, K.W. alf, che, asm
Wood, K.A. cur, che

Constructivism (cns)

Published Articles

Bischoff, & Anderson kns, phe, cns
Dawson, & Taylor cns, ped, tpd
Gough, N. ene, cns, res
Jones, Rua, & Carter knt, tpd, cns
Kuiper & Wilkinson cns, edt, tpd
Matthews, M.R. cns, nas, phe
Ravanis & Bagakis lth, ped, cns
Ritchie, S.M. ped, cns, lrg
Rodriguez, A.J. att, cns, mce
Sahlstroem & Lindblad cid, cns, gen
Scott, P. ccg, cid, cns
Sneider & Ohadi alf, cns, his
Sprod, T. cns, cid, pbs
Staver, J.R. cns, ped, nas
Stofflett, R.T. ccg, cns, ped
Tsai, C.-C. cns,phe, rem
van der Veer, R. cns, his,
Windschitl & Andre ccg, cns, cbi,

Papers and Electronic Documents

Jelinek, D.J. ats, nas, cns
Lin, W.-J. cns, ats, cpl
Norman, Stein, et al. cns, cur, ref
Roberts, & Ostman cur, cns, cid
Shymansky, Lee, et al. cns, asm, ats
Shymansky, Yore, et al. ats, ref, cns

Dissertations and Theses

Carter, C.W.E. lab, kns, cns
Carter, T.L. cns, lrg, ats
Chou, C.-H. cbi, cns, phy
Dharmadasa, I. cns, kns, ped
Ealy, J.B. cns, rem, cbi
Freed, A.B. cns, tpd, gen
Gatlin, L.S. cns, ped, ach

Guarino, L.F. cns, asm, lrg
Lemire, C. edt, ped, cns
Marion, V.F. tpd, cns, inq
Morris, K.A. cns, mat, hos
Osmundson, E. alf, cns, lth
Rea-Ramirez, M.A. lrg, cns, rem
Seatter, C.E.S. cns, lth, phe
Walker, C.M. ach, asm, cns
Wessel, W.E. cns, kns, phy

Cooperative Learning; Group Work (cpl)

Published Articles

Briano, R. & Midoro, V. ene, cbi, cpl
Duchovic, R.J. ped, asm, cpl
Francisco, Nicoll, et al. ped, cpl, lsy
King, Staffieri, et al. inq, cpl, lsy
Mpofu, Das, et al. gen, pbs, cpl
Nason, Lloyd, & Ginns cbi, cpl, ped
Rothenberg, et al. cpl, ped, att
Yu, F.-Y. cbi, cpl, ach

Papers and Electronic Documents

Cooper, J. & Robinson, P. cpl, lth, cid
Jimenez-Aleixandre, et al. cid, pbs, cpl
Lin, W.-J. cns, ats, cpl
Reed, & Costner edt, res, cpl
Vellom, R.P. cid, cpl

Dissertations and Theses

Allen, V.L. cpl, ped, ats
Breen, T. asm, sks, cpl
Chung-Schickler, G.C. cpl, ats, ach
Jones, D.A.P. cid, cpl, lab
Lyon, E.B. cbi, cpl, ats
McCammon, C.L. cpl, chs, lth
McPhail, C.L. mce, cid, cpl
Novemsky, L.F. cpl, cid, phy
Templin, M.A. cid, lrg, cpl
Wright, K.J. cpl, ach

Cross-Cultural Studies (cul)

Published Articles

Allen & Crawley cul, phe, bfs
Botton, C. & Brown, C. att, sts, cul
Kawagley, et al. phe, bfs, cul
Lannes, Flavoni, et al. car, cul, nas
Lloyd, Smith, et al. cul, knt, skt
Schmidt & McKnight ach, cul, res
Supovitz, J.A. asm, cul, gen
Taylor, C. cul, ene
Valverde, & Schmidt cul,cur, ref
Venville, Wallace, et al. cul, cur, tpd
Wang, J. cul, ach, asm

Papers and Electronic Documents

Johnson, J.M. car, cul, sts
Mullis, Martin, et al. ach, cul, lit
She, H.-C. & Fisher, D.L. cid, cul, ats
Takahira, Gonzales, et al. ach, lit, cul
Tuan, Chang, Wang, et al. cul, knt, ats

Dissertations and Theses

McEneaney, E.H. mat, cul, bkg
Sawatzky, V.F. cul, phy, mat

Curriculum (cur)

Published Articles

Alsop, Hanson, & Watts ats, cur, lth
Becu-Robinault, et al. cur, lab, phy
Bybee, R.W. ntw, cur, ref
Cajas, F. cur, sts, tec
Cummings & Winston cur, pbs, ped
Cunningham, C.M. knt, cur, nas
Dickinson & Flick ats, cur, lsy
Donnelly, J.F. cur, lab, att
Dorweiler & Yakhou ene, cur, tec
Eide & Heikkinen mce, mat, cur
Ferry, Hedberg, & Harper knt, cur, skt
Fisher, Harrison, et al. lab, bkg, cur
Galili, I. & Lavrik, V. cur, kns, phe
Gayford, C. att, ene, cur
Gonzalez, A.M. bkg, cur, his
Greenberg, Raphael, et al. cur, ped, edt
Hodson, D. & Bencze, L. ref, cur, tpd
Hong, Shim, & Chang cur, ats, bio
Huntley, M.A. cur, int, ped
Johnson, P. cur, kns, lrg
Karadelis, J.N. cur, cbi, tec
Kumar, D. & Berlin, D. cur, ref, sts
Lagowski, J.J. cur, his, che
Lerner, L.S. evo, ref, cur
Lock, R. bio, cur, att
Lonning, DeFranco, et al. cur, int, ref
Lubben & Ramsden att, inq, cur
Lubben, Campbell, et al. cur, ntw, ref
Luft, Narro, & Slaughter tpd, cur, att
Maguire, R. cur, int, ref
McCulloch, G. his, cur, ref
McKenzie & Glasson lab, cur, inq
Milne, C. phe, his, cur
Osborne, J. & Millar, R. ref, lit, cur
Osborne, Driver, & Simon ats, ref, cur
Parkinson, Hendley, et al. ats, cur, ref
Pirrie, Wilson, , et al. int, ref, cur
Pruneau, Chouinard, et al. cur, ene
Raghavan, Sartoris, et al. cur, rem, lrg
Reiss, M.J. cur, mat
Schmidt, H. cur, int, ped
Soyibo & Figueroa ats, cur, pbs
Spence, M. int, lit, cur
Staer, Goodrum, et al. inq, cur, lab
Stewart, G. & Osborn, J. ats, gen, cur
Tamir, P. & Ziv, S. att, cur, cht
Valverde & Schmidt cul,cur, ref
VanTassel-Baska, et al. cur, sks, int
Venville, Wallace, et al. cul, cur, tpd
White & Frederiksen asm, cur, inq
Wistedt, I. asm, cur
Woodward & Woodward ats, ref, cur

Papers and Electronic Documents

Hammrich, P.L. lit, cur, inq
Huntley, M.A. int, lth, cur
Kennedy, M. lrg, cur, tpd
Norman, Stein, et al. cns, cur, ref
O' Sullivan, Weiss, et al. knt, tpd, cur
Polman, J.L. lit, sts, cur
Rakow, S.J. cur, lit, ref
Ridgway, J. asm, cur, ref
Roberts & Ostman cur, cns, cid
Schwarz & White rem, cur, cbi
Shear, L. cbi, cur, ach
Wang, H.A. cur, res, mat
Whitworth, J.M. edt, ats, cur

Dissertations and Theses

Bell, P.L. cur, nas, cid
Bradford, R.S. ene, bfs, cur
Brent, B.M. cur, che, ach
Buck, G.A. ntw, cur
Cajas, M.F. tec, cur, int
Carr, K.M. cur, cbi, pbs
Coates, J.M. his, ref, cur
Dallas, S.J. int, inq, cur
Dawes, M.E. cur, tec, ats
Hayes, M.T. cur, bkg
Horn, S.J. cur, tec, sts
Hulley, K.L.S. int, sts, cur
Kovanis, L.N. cur, ach, ats
Laba, K.A. nas, att, cur
Lemont, K.J. cur, hos, lrg
Little, K.W. eth, ntw, cur
Lizarzaburu, V.G. cur, ach, mce
Loman, K.L. ats, cur, ene
Merkel, J.B. inq, cur, att
Monhardt, L.C. ats, cur, ref
Nass, J.J. cur, inq, lrg
Ostgaard, M.M. ats, cur, sts
Pollock, K.R. cur, mat, bio
Pulver, E.J. cur, mat, phy
Robertson, W.O. cbi, cur, esg
Salyer, B.A. ref, att, cur
Saul, J.M. cur, pbs, phy
Slaughter, J.M. cur, att, knt
Wittman, M.C. mat, cur, phy

Wood, K.A. cur, che

Educational Technology (edt)

Published Articles

Goldman-Segall, R. gen, edt, ats
Greenberg, et al. cur, ped, edt
Kuiper & Wilkinson cns, edt, tpd
Mayer-Smith, et al. ntw, edt, tpd
Parkinson, J. edt, tpd, skt
Pedretti, Woodrow, et al. edt, ats, mat
Spitulnik & Krajcik edt, lit, tpd
Swaak, et al. cbi, edt, kns
Wiesenmayer & Koul att, edt, ped

Papers and Electronic Documents

Eveland & Dunwoody edt, lrg
Haslam, Turnbull, et al. tpd, ref, edt
Herbert, Bednarz, et al. edt, esg, cid
Jarrett, D. ref, edt, ped
Reed & Costner edt, res, cpl
Whittle, C. lit, nfd, edt
Whitworth, J.M. edt, ats, cur

Dissertations and Theses

Baucum, L.L. edt, ats, lrg
Cavanaugh, T.W. ped, edt
Dean, K.E. A. edt, hos, skt
Dwyer, W.M. edt, skt
King, M.J. ach, edt, cbi
Lemire, C. edt, ped, cns
Madore, K.A. edt, lsy, chs
Shih, C.-C. edt, lsy, ats
Slough, S.W. att, edt
Smith, B.K. edt, inq, lrg
York, K.J. att, edt

Earth & Space Science; Geology (esg)

Published Articles

Ault, C.R., Jr. esg, inq, phe
Sadler, P.M. alf, lrg, esg
Smith & Laws chs, esg, car

Papers and Electronic Documents

Harwell, S.H. esg, knt, tpd
Herbert, Bednarz, et al. edt, esg, cid

Dissertations and Theses

Dudley, J.S. kns, sks, esg
Robertson, W.O. cbi, cur, esg

Environmental Education (ene)

Published Articles

Bailey, S. & Watson, R. ene, int, ped
Bogner, F.X. nfd, fsd, ene
Briano, R. & Midoro, V. ene, cbi, cpl
Dorweiler & Yakhou ene, cur, tec
Ferreira, G. fsd, nfd, ene
Fisher, B.W. kns, lit, ene
Gayford, C. att, ene, cur
Gough, N. ene, cns, res
Hsu, S.-J. & Roth, R.E. ene, lit, knt
Mansaray, Ajiboye, et al. att, knt, ene
Orams & Hill nfd, ene, fsd
Oskamp, Burkhardt, et al. ene,nfd
Payne, P. ene, phe
Pruneau, Chouinard, et al. cur, ene
Robertson, A. ene, phe, tpd
Sanera, M. ene, sts, ped
Taylor, C. cul, ene,
Thirunarayanan, M.O. ene, sts
Wikle, T.A. ene, nfd
Wylie, Sheehy, et al. ene, kns, lth
Yeung, S.P.-M. lit, kns, ene

Papers and Electronic Documents

Henderson, Fisher, et al. ats, cid, ene
Simmons, M.R. ats, ene

Dissertations and Theses

Bradford, R.S. ene, bfs, cur
Chang, B.-L. att, ene, tpd
Cromwell, J.R. ene, nfd, tpd
Dierberger, B.S. car, ene, bkg
Dunkerly-Kolb, S.J. res, ene, sts
Hefty, E.A. att, ene, tpd
Hoikka, K.A. pbs, ene, lrg
Hug, J.W. ene, phe, ped
Levy, J.A. tpd, att, ene
Loman, K.L. ats, cur, ene
Luera, G.R. ats, asm, ene
Saxena, J.L. eth, ene, sts

Equity (eqt)

Published Articles

Altermatt, et al. gen, eqt, cid
Barton, A.C. chs, gen, eqt
Buxton, C.A. chs, ref, eqt
Carnes, G.N. tpd, ped, eqt
Durndell, Uzunova, et al. bkg, eqt, gen
Erwin & Maurutto gen, eqt, car
Johnson, Borleske, et al. cid, asm, eqt
Jovanovic & Dreves gen, eqt, ats
Koch, J. eqt, gen, phe
Kulis, S. bkg, eqt, gen
Maher, F.A. eqt, phe, nas
Mastropieri, et al. chs, eqt, hos
Norman, O. nas, eqt, phe
Norman, Caseau, et al. chs, eqt, tpd
Rennie, L.J. eqt, gen
Rennie & Parker ach, asm, eqt
Richmond, Howes, et al. att, gen, eqt
Scholer, A.-M. eqt, gen, car
Webb, N.L. eqt, ref, res

Papers and Electronic Documents

Jones, L.S. car, eqt, bkg
Kahle, J.B. & Rogg, S.R. eqt, ref, ach
Kahle, J.B. eqt, ref, ach
Kahle, J.B. eqt, ref, asm
Lee, O. ref, eqt, asm
Rasekoala, E. ach, eth, eqt

Dissertations and Theses

Brown, N.M. asm, eth, eqt
Eaglin, P.G. att, eqt, eth
Kostas, N.A. mat, gen, eqt

Ethnicity (eth)

Published Articles

Boone & Kahle tpd, gen, eth
Grandy, J ats, eth, asm
Kumano, Y. eth, bfs, sts
Leslie, McClure, et al. gen, eth, car
Smith & Hausafus bkg, ach, eth

Papers and Electronic Documents

Melear, C.T. & Alcock, M.W. lsy, eth
Rasekoala, E. ach, eth, eqt

Dissertations and Theses

Bailer, J. ats, gen, eth
Brown, N.M. asm, eth, eqt
Eaglin, P.G. att, eqt, eth
Gillette, S.C. ntw, gen, eth
Good, J.M. eth, tec, ach
Hunter, E.M.I. eth, car, bkg
Little, K.W. eth, ntw, cur
Saxena, J.L. eth, ene, sts
Whitfield, F.A. eth, lit, car

Evolution (evo)

Published Articles

Lerner, L.S. evo, ref, cur
Rudolph & Stewart evo, his, lrg
Sinclair & Pendarvis evo, bfs, alf

Dissertations and Theses

Aguillard, D.W. evo, knt, att
Firenze, R.F. evo, att, tpd
Maldonado-Rivera, J.G. evo, bkg, bfs
Sandoval, W.A. inq, evo, cbi

Field Studies; Outdoor Education (fsd)

Published Articles

Bogner, F.X. nfd, fsd, ene
Carter, M.W. ped, fsd, cbi
Ferreira, G. fsd, nfd, ene
Heffernan, B.M. asm, nfd, fsd
Helms, J.V. fsd, sts, lit
Mappin, M.J. ntw, fsd, nfd
Michie, M. fsd, ped, att
Murphy, A.P. fsd, ntw, res
Orams & Hill nfd, ene, fsd
Rohrer, J. & Welsch, S. nfd, gen, fsd

Dissertations and Theses

Kaspar, M.J. fsd, nfd, att
Mullins, J.A. fsd, nfd, ats
Nieland, J.J. nfd, fsd
Rahm, J. nfd, fsd, lrg

Gender (gen)

Published Articles

Adamson, Foster, et al. ats, gen, bkg
Altermatt, et al. gen, eqt, cid
Atwater, M.M. gen, nas, phe
Barton, A.C. chs, gen, eqt
Boone, W. & Kahle, J. tpd, gen, eth
Boone, W.J. ach, asm, gen
Dreves & Jovanovic ats, gen, hos
Durndell, Uzunova, et al. bkg, eqt, gen
Erwin, L. & Maurutto, P. gen, eqt, car
Gaskell, Hepburn, et al. res, gen, phe
Goldman-Segall, R. gen, edt, ats
Hadjikyriacou, R.M. car, nas, gen
Hanson, S. & Kraus, R. gen, ach, bkg
Howes, E.V. gen, ats, sts
Huppert, Yaakobi, et al. ach, cbi, gen
Jovanovic, J. & King, S. ats, hos, gen
Jovanovic, J. & Dreves, gen, eqt, ats
Kenway, J. & Gough, A. gen, res, car
Kleinman, S.S. phe, gen, nas
Koch, J. eqt, gen, phe
Kulis, S. bkg, eqt, gen
Leslie, McClure, et al. gen, eth, car
Mayberry, M. gen, ped, phe
McGinnis & Pearsall, M. att, tpd, gen
Meyer, K. gen, ped, phe
Mpofu, Das, et al. gen, pbs, cpl
Rennie, L.J. eqt, gen
Richmond, Howes, et al. att, gen, eqt
Rohrer, J. & Welsch, S. nfd, gen, fsd
Sahlstrom, & Lindblad cid, cns, gen
Scho[illegible] A.-M. eqt, gen, car
She, H.-C. bfs, gen, nas
Stewart, M. ats, gen, phy
Stewart, G. & Osborn, J. ats, gen, cur
Supovitz, J.A. asm, cul, gen
Tunnicliffe, S.D. ats, bio, gen

Papers and Electronic Documents

Letts, W.J.I.V. gen, nas, phe
Morrell & Andrews gen, car, ats
Provo, Lamar, & Newby sks, gen, bio
Whittle, C. nfd, gen, bkg

Dissertations and Theses

Bailer, J. ats, gen, eth
Bauchspies, W.K. gen, knt, cht
Ely, J.A. car, gen, ats
Freed, A.B. cns, tpd, gen
Gillette, S.C. ntw, gen, eth
Kostas, N.A. mat, gen, eqt
Lee, J.D. car, gen, ats
Mackin, J.E. cbi, ach, gen
Mullinnix, D.L. ats, sts, gen
Orloff, T.L. gen, ats, car
Silcox, P.E. car, gen, ats
Tai, R.H. bkg, gen, ach

Hands on Science (hos)

Published Articles

Arikawa & Maruno alf, ccg, hos
Brooke & Solomon nfd, pbs, hos
Coelho & Sere pbs, ats, hos
Dreves & Jovanovic ats, gen, hos
Jovanovic & King ats, hos, gen
Mastropieri, et al. chs, eqt, hos
Neathery, Glynn, & Long hos, inq, tpd

Papers and Electronic Documents

Kuh, Simmons, et al. mce, nfd, hos
Mayer, N. & Kight, C. hos, int, lrg

Dissertations and Theses

Dean, K.E. A. edt, hos, skt
Lemont, K.J. cur, hos, lrg
Morris, K.A. cns, mat, hos
Petrosino, A.J.J. chs, hos, sks
Shimizu, K. inq, ach, hos

History; Historical Implications (his)

Published Articles

Bar, V. & Zinn, B. phe, his, alf
Calabrese-Barton, A. his, sts, nas
Constantinescu & Bugoi his, phy
Gonzalez, A.M. bkg, cur, his
Kelly, Chen, & Crawford res, his, nas
Lagowski, J.J. cur, his, che
Lin, H.-s. ped, his, ach
McCulloch, G. his, cur, ref
Milne, C. phe, his, cur
Niaz, M. mat, his, che
Roth, W.-M. his, phe, nas
Rowe, M. & Hacker, R. his, ped, bkg
Rudolph & Stewart evo, his, lrg
Sebesta, J. & Zajac, R. phy, his, nas
Seroglou, Koumaras, et al. ccg, his, alf
Sneider, C. & Ohadi, M. alf, cns, his
van der Veer, R. cns, his,
Van Driel, De Vos, et al. che, his, ped

Papers and Electronic Documents

Lin, H.-S. nas, his, knt
Ridgway, J. rem, phe, his
Wang & Marsh att, his, ped

Dissertations and Theses

Chen, S. his, sts
Coates, J.M. his, ref, cur
Ding, D.X. his, lit, nas
King, K.P. lit, tec, his
Robin, R.S. lit, his, sts
Wang, H. mat, his, phy

Inquiry (inq)

Published Articles

Ault, C.R., Jr. esg, inq, phe
Boone & Gabel tpd, tec, inq
Glasson & McKenzie lab, inq, ref
King, Staffieri, et al. inq, cpl, lsy
Krajcik, et al. inq, pbs, ped
Lubben & Ramsden att, inq, cur
McKenzie & Glasson lab, cur, inq
Neathery, Glynn, & Long hos, inq, tpd
Roth, McGinn, et al. pbs, inq, rem
Staer, Goodrum, et al. inq, cur, lab
White & Frederiksen asm, cur, inq

Papers and Electronic Documents

Hammrich, P.L. lit, cur, inq
Luft, J.A. tpd, inq, ped
Priestley, Priestley, et al. inq, cid, res

Rakow, S.J. knt, inq, nas
Shiao Yueh, S. mat, bio, inq
Tien, L.T. & Stacy, A.M. inq, lab, che

Dissertations and Theses
Brockmeyer, M.A. inq, tpd, knt
Chastain, P.L. inq, tpd, phy
Chorny, J.J. inq, ach, phy
Cody, A.M. inq, ped, tpd
Dallas, S.J. int, inq, cur
Gibson, H.L. inq, ats, car
Lee, K.M. inq, cbi, tpd
Marion, V.F. tpd, cns, inq
Merkel, J.B. inq, cur, att
Mueller, A.C. inq, ats, bkg
Nass, J.J. cur, inq, lrg
Sandoval, W.A. inq, evo, cbi
Schepige, A.C. ref, inq, int
Shimizu, K. inq, ach, hos
Smith, B.K. edt, inq, lrg
Sopko, L.D. inq, knt, att
Spitulnik, M.W. inq, rem, lrg
Tien, L.T. lab, inq, rem

Integration; Interdisciplinary (int)

Published Articles
Alspaugh & Harting int, ach, ped
Bailey, S. & Watson, R. ene, int, ped
Carle, D.O. & Krest, M. int, sks, ped
Hepburn & Gaskell int, tec, tpd
Huntley, M.A. cur, int, ped
Lonning, DeFranco, et al. cur, int, ref
Maguire, R. cur, int, ref
Penner, Lehrer, et al. rem, int, kns
Pirrie, Wilson, et al. int, ref, cur
Ross & Hogaboam-Gray int, ref, ped
Schmidt, H. cur, int, ped
Soyibo, K. mat, sks, int
Spence, M. int, lit, cur
Tirosh, Stavy, & Cohen int, pbs
VanTassel-Baska, et al. cur, sks, int

Papers and Electronic Documents
Gance, L.L. ref, int, pbs
Huntley, M.A. int, lth, cur
Mayer, N. & Kight, C. hos, int, lrg
Richardson & Norman chs, int, ats
Soyibo et al. int, mat, lrg

Dissertations and Theses
Bos, N.D. cbi, int, lrg
Cajas, M.F. tec, cur, int
Dallas, S.J. int, inq, cur
Hulley, K.L.S. int, sts, cur
Jadonath, C. ntw, int, tec
Johnson, S.T. int, sks, phy
Schepige, A.C. ref, inq, int
Schleyer, C.J. int, att
Warnick, B.K. int, ach, bio

Knowledge–Student (kns)

Published Articles
Ahtee, M. & Varjola, I. alf, kns, che
Bischoff & Anderson kns, phe, cns
Boo, H.K. alf, kns, che
Camacho & Cazares alf, rem, kns
Chinn & Brewer kns, phe, nas
Coleman & Gotch sks, lrg, kns
Dekkers, P.J.J.M. asm, kns, pbs
Fisher, B.W. kns, lit, ene
Furio, C. & Guisasola, J. kns, phe, phy
Galili, I. & Lavrik, V. cur, kns, phe
Gunter, et al. ats, kns, bio
Gustafson & Rowell tec, kns, pbs
Halloun, I. kns, phy, phe
Hill, Stanisstreet, et al. kns, sts, bio
Johnson, P. alf, kns, che
Johnson, P. cur, kns, lrg
Keys, C.W. kns, lrg, pbs
Kikas, E. lrg, ped, kns
Klein, P.D. lth, res, kns
Liu, X. kns, lth, phy
Markow & Lonning ats, kns, ped
McGinn & Roth kns, asm, pbs
Moss, Abrams, & Kull nas, kns, res
O'Reilly, Symons, et al. lsy, kns
Penner, Lehrer, et al. rem, int, kns
Pushkin, D.B. lth, pbs, kns
Rice, Ryan, & Samson asm, kns, rem
Rowlands, Graham, et al. alf, kns, phy
Rye, J.A. & Rubba, P.A. rem, kns, lrg
Stylianidou & Boohan rem, mat, kns
Swaak, et al. cbi, edt, kns
Trend, R. kns
Trumper, R. alf, kns, tpd
Wilson, J.M. rem, kns, ccg
Wright, Wiggins, et al. kns, lrg, lth
Wylie, Sheehy, et al. ene, kns, lth
Yeung, S.P.-M. lit, kns, ene
Yore, Craig, & Maguire kns, lth, sks

Papers and Electronic Documents
Korpan, Bisanz, et al. res, kns, bkg
Mascazine, et al. lit, sts, kns

Dissertations and Theses
Adams, S.T. kns, car, lit
Beeber, C. alf, kns, asm
Britton, L.A. kns, ped, cbi
Carter, C.W.E. lab, kns, cns
Dharmadasa, I. cns, kns, ped
Dickinson, V.L. skt, cid, kns
Discenna, J.L. kns, rem, phy
Dudley, J.S. kns, sks, esg
Hines, M.E. rem, kns
Ismail, N.K. ach, kns, knt
Iuli, R.J. phe, kns, car
Moss, D.M. nas, kns
Smith, S.H. kns, alf, che
Sohan, D.E. kns, sts, lit
Wessel, W.E. cns, kns, phy
Williams, K.A. lth, phy, kns

Knowledge–Teacher (knt)

Published Articles
Boo & Toh alf, knt, skt
Cunningham, C.M. knt, cur, nas
Evrard, Huynen, et al. cid, lrg, knt
Ferry, Hedberg, & Harper knt, cur, skt
Geddis, A.N. & Roberts D.A. lsy, knt
Helms, J.V. att, knt, tpd
Hsu, S.-J. & Roth, R.E. ene, lit, knt
Jones, Rua, & Carter knt, tpd, cns
Keating, J. & Ihara, J. knt, skt, ref
Lloyd, Smith, Fay, et al. cul, knt, skt
Mansaray, Ajiboye, et al. att, knt, ene
Nott & Wellington knt, nas, tpd
Osborne, M.D. knt, phe
Pardhan & Wheeler knt, ped, tpd
Peterson & Treagust knt, pbs, ped
Price, B. tpd, knt
Radford, D.L. tpd, ref, knt
Roth, W.-M. knt, ped, skt
van Driel, Verloop, & de Vos knt, ped
Yip, D.-Y. knt, alf, bio
Yip, Chung, & Mak knt, phy, tpd

Papers and Electronic Documents
Harwell, S.H. esg, knt, tpd
Jita, L. att, knt, ref
Kesner, Hofstein, et al. che, att, knt
Kim, Germann, & Patton nas, knt, ped
Klepper & Barufaldi knt, cht, bkg
Larson, Mayer, et al. tpd, res, knt
Lin, H.S. nas, his, knt
Martins, I.P. sts, knt, lit
O' Sullivan, Weiss, et al. knt, tpd, cur
Rakow, S.J. knt, inq, nas
Rubba & Rye res, tpd, knt
Stetter, D. ref, tpd, knt
Tuan, Chang, et al. cul, knt, ats

Warren & Ogonowski knt, tpd, ats
Zuckerman, J.T. att, knt, tpd

Dissertations and Theses
Aguillard, D.W. evo, knt, att
Almeida, J.M. knt, cht, ats
Bauchspies, W.K. gen, knt, cht
Bodwell, M.B. cid, tpd, knt
Brockmeyer, M.A. inq, tpd, knt
Foster, A.S. cht, knt, att
Guilbert, R.A. att, knt, ped
Ismail, N.K. ach, kns, knt
Kao, H.-L. cht, knt, ped
Kim, Y.-S. nas, knt, tpd
Lowery, M.N.V. knt, lsy, ped
Mann, S.D. knt, att, nas
Plohocki, B.A. knt, lab, che
Rearden, K.T. knt, att, ped
Slaughter, J.M. cur, att, knt
Sopko, L.D. inq, knt, att

Laboratory (lab)

Published Articles
Allie, Buffler, et al. lab, sks, pbs
Becu-Robinault, et al. cur, lab, phy
Donnelly, J.F. cur, lab, att
Fisher, Harrison, et al. lab, bkg, cur
Glasson & McKenzie lab, inq, ref
Henderson & Fisher lab, ats, res
Johnstone, Watt, & Zaman lab, ped
McKenzie & Glasson lab, cur, inq
Robinson, W.R. lab, rem, ped
Sindhu & Sharma asm, lab, sks
Staer, Goodrum, et al. inq, cur, lab

Papers and Electronic Documents
Lebowitz, S.J. lab, ped, lsy
Tien, L.T. & Stacy, A.M. inq, lab, che

Dissertations and Theses
Akpan, J.P. cbi, lrg, lab
Brophy, S.P. cbi, pbs, lab
Carter, C.W.E. lab, kns, cns
Hunt, T.P. lab, asm, che
Jones, D.A.P. cid, cpl, lab
Marszalek, C.S. cbi, lab, bio
Plohocki, B.A. knt, lab, che
Tien, L.T. lab, inq, rem

Learning; Comprehension (lrg)

Published Articles
Beeth, M.E. ccg, ped, lrg
Coleman, S. & Gotch, A. sks, lrg, kns
Coleman, E.B. ped, lrg, cid
Evrard, Huynen, et al. cid, lrg, knt
Johnson, P. cur, kns, lrg
Keys, C.W. kns, lrg, pbs
Khoo, G.-S. & Koh, T.S. cbi, rem, lrg
Kikas, E. lrg, ped, kns
Lehrer, R. & Schauble, L. pbs, lrg, sks
Mellado, V. att, lrg, ped
Raghavan, Sartoris, et al. rem, lrg, alf
Raghavan, Sartoris, et al. cur, rem, lrg
Resnick & Wilensky ped, lrg, rem
Ritchie, S.M. ped, cns, lrg
Rudolph & Stewart evo, his, lrg
Rye, J.A. & Rubba, P.A. rem, kns, lrg
Sadler, P.M. alf, lrg, esg
Souter, N.T. rem, sks, lrg
Wright, Wiggins, et al. kns, lrg, lth
Zohar, Schwartzer, et al. cid, lrg, sks

Papers and Electronic Documents
Eveland & Dunwoody edt, lrg
Kennedy, M. lrg, cur, tpd
Mayer, N. & Kight, C. hos, int, lrg
Soyibo et al. int, mat, lrg
Tsai, C.C. rem, ccg, lrg

Dissertations and Theses
Akpan, J.P. cbi, lrg, lab
Baucum, L.L. edt, ats, lrg
Bos, N.D. cbi, int, lrg
Brown, D.G. ped, sks, lrg
Carter, T.L. cns, lrg, ats
Cavalli-Sforza, V.L.M. rem, lrg, ped
Davis, E.A. ped, lrg, cbi
Dawson, C.J. alf, lrg, ccg
Grant, A.M. lsy, ped, lrg
Guarino, L.F. cns, asm, lrg
Hoikka, K.A. pbs, ene, lrg
Kim, H.-W. cbi, lrg, ats
Lemont, K.J. cur, hos, lrg
Luttig, E.P. cbi, che, lrg
McWhirter, L.J. lth, lrg, phe
Nass, J.J. cur, inq, lrg
Rahm, J. nfd, fsd, lrg
Rea-Ramirez, M.A. lrg, cns, rem
Robinson, J.B. bkg, lrg, che
Smith, B.K. edt, inq, lrg
Spitulnik, M.W. inq, rem, lrg
Taylor, R. ped, lrg
Templin, M.A. cid, lrg, cpl
Wells, F.B. rem, lrg, bio

Learning Styles; Cognitive Style; Learning Orientations; Learning Strategies (lsy)

Published Articles
Dhillon, A.S. pbs, rem, lsy
Dickinson & Flick ats, cur, lsy
Francisco, Nicoll, et al. ped, cpl, lsy
Geddis, & Roberts lsy, knt
King, Staffieri, et al. inq, cpl, lsy
O'Reilly, Symons, et al. lsy, kns

Papers and Electronic Documents
Lebowitz, S.J. lab, ped, lsy
Mascazine, J.R. lsy, car, chs
Melear, C.T. & Alcock, M.W. lsy, eth
Pickens, T.L. lsy, ats

Dissertations and Theses
Decker, L.M. lsy, ats, ach
Grant, A.M. lsy, ped, lrg
Knappenberger, N. nfd, lsy
Lowery, M.N.V. knt, lsy, ped
Madore, K.A. edt, lsy, chs
Nelson, W.R. lsy, tpd, ped
Saunders, G.L. lsy, phe, che
Shih, C.-C. edt, lsy, ats

Learning Theory (lth)

Published Articles
Alsop, Hanson, & Watts ats, cur, lth
Duit, Roth, et al. cid, ccg, lth
Klein, P.D. lth, res, kns
Liu, X. kns, lth, phy
Pushkin, D.B. lth, pbs, kns
Ravanis & Bagakis lth, ped, cns
Roth, W.-M. asm, lth
Tsaparlis, G. lth, pbs, rem
Vosniadou & Ioannides lth, ccg, alf
Wright, Wiggins, et al. kns, lrg, lth
Wylie, Sheehy, et al. ene, kns, lth
Yore, Craig, & Maguire kns, lth, sks

Papers and Electronic Documents
Cooper, J. & Robinson, P. cpl, lth, cid
Huntley, M.A. int, lth, cur
Parsons, S. ntw, lth, phe
Rennie, L res, tpd, lth

Dissertations and Theses
Huang, H.-J. lth, bkg, cid
McCammon, C.L. cpl, chs, lth
McWhirter, L.J. lth, lrg, phe
Mishra, P. cbi, rem, lth

Steussy & Thomas tpd, ref, ntw

Dissertations and Theses

Buck, G.A. ntw, cur
Gillette, S.C. ntw, gen, eth
Hatton, M.E. tpd, ntw
Jadonath, C. ntw, int, tec
Little, K.W. eth, ntw, cur
Luebeck, J.L. ntw, tpd, bkg
Mathew, N.M. att, ntw, tpd
O'Neill, D.K. ntw, sks
Parker, M.J. pbs, ntw, sks
Shaklee, J.M. nas, ntw, phe
Wallace, J.Y. pbs, ntw, bkg

Nonformal and Informal Education (nfd)

Published Articles

Bogner, F.X. nfd, fsd, ene
Brooke & Solomon nfd, pbs, hos
Collard & McKee nfd, che, sts
Ferreira, G. fsd, nfd, ene
Heffernan, B.M. asm, nfd, fsd
Lach, J.-M. lit, nfd, sts
Levidow, L. nfd, ntw, sts
Mappin, M.J. ntw, fsd, nfd
Orams & Hill nfd, ene, fsd
Orfinger, B. cbi, nfd, ped
Oskamp, Burkhardt, et al. ene, nfd
Rohrer, J. & Welsch, S. nfd, gen, fsd
Talisayon, V.M. ats, nfd, res
Wikle, T.A. ene, nfd

Papers and Electronic Documents

Kuh, Simmons, et al. mce, nfd, hos
Whittle, C. nfd, gen, bkg
Whittle, C. lit, nfd, edt

Dissertations and Theses

Cromwell, J.R. ene, nfd, tpd
Kaspar, M.J. fsd, nfd, att
Knappenberger, N. nfd, lsy
Mullins, J.A. fsd, nfd, ats
Nieland, J.J. nfd, fsd
Rahm, J. nfd, fsd, lrg

Pedagogy (ped)

Published Articles

Alspaugh, & Harting int, ach, ped
Bailey, S. & Watson, R. ene, int, ped
Ball & Osborne ref, ped, mce
Beeth, M.E. ccg, bkg, ped
Beeth, M.E. ccg, ped, lrg
Black, et al. ats, att, ped
Carle, D.O. & Krest, M. int, sks, ped
Carnes, G.N. tpd, ped, eqt
Carter, M.W. ped, fsd, cbi
Coleman, E.B. ped, lrg, cid
Collins, M. cbi, ntw, ped
Cummings & Winston cur, pbs, ped
Dawson & Taylor cns, ped, tpd
Dekkers & Thijs alf, ped, ccg
Denyer, G. mat, skt, ped
Duchovic, R.J. ped, asm, cpl
Francisco, Nicoll, et al. ped, cpl, lsy
Ginsberg, & Panasuk ats, pbs, ped
Ginsberg, & Panasuk ats, pbs, ped
Greenberg, Raphael, et al. cur, ped, edt
Hacker, R. & Rowe, M. bkg, ped, ref
Hildebrand, G.M. phe, nas, ped
Huntley, M.A. cur, int, ped
Johnson & Lawson ach, ped, sks
Johnstone, Watt, & Zaman lab, ped
Kaunda, Allie, et al. chs, sks, ped
Kikas, E. lrg, ped, kns
Kipnis, N. nas, rem, ped
Krajcik, et al. inq, pbs, ped
Lather, P. nas, phe, ped
Lin, H.-S. ped, his, ach
Loving, C.C. nas, mce, ped
Markow & Lonning ats, kns, ped
Mayberry, M. gen, ped, phe
Mellado, V. att, lrg, ped
Meyer, K. gen, ped, phe
Michie, M. fsd, ped, att
Nason, Lloyd, & Ginns cbi, cpl, ped
Orfinger, B. cbi, nfd, ped
Pardhan & Wheeler knt, ped, tpd
Peterson & Treagust knt, pbs, ped
Pinkerton, K.D. cid, ped
Ravanis & Bagakis lth, ped, cns
Resnick & Wilensky ped, lrg, rem
Richmond & Neureither bio, ped, ref
Rioseco, Romero, et al. ats, pbs, ped
Ritchie, S.M. ped, cns, lrg
Robinson, W.R. lab, rem, ped
Ross & Hogaboam-Gray int, ref, ped
Roth, W.-M. knt, ped, skt
Rothenberg, et al. cpl, ped, att
Rowe, M. & Hacker, R. his, ped, bkg
Sandor, Clark, et al. pbs, ped, ach
Sanera, M. ene, sts, ped
Schmidt, H. cur, int, ped
Scruggs, et al. chs, ped, mat
Shelton & Smith ats, ped, pbs
Skeff, Stratos et al. ped, tpd, skt
Staver, J.R. cns, ped, nas
Stofflett, R.T. ccg, cns, ped
Van Driel, De Vos, et al. che, his, ped
van Driel, Verloop, et al. knt, ped
Weaver, G.C. ccg, cid, ped
Wiesenmayer & Koul att, edt, ped
Yerrick, R. cid, ref, ped
Yerrick, Pedersen, et al. nas, ped, phe
Yip, D.-Y. ccg, alf, ped

Papers and Electronic Documents

Jarrett, D. ref, edt, ped
Kim, Germann, & Patton nas, knt, ped
Lebowitz, S.J. lab, ped, lsy
Luft, J.A. tpd, inq, ped
McGinnis & Simmons sts, att, ped
Wang & Marsh att, his, ped

Dissertations and Theses

Allen, V.L. cpl, ped, ats
Arburn, T.M. ped, chs, pbs
Britton, L.A. kns, ped, cbi
Brown, D.G. ped, sks, lrg
Cavalli-Sforza, V.L.M. rem, lrg, ped
Cavanaugh, T.W. ped, edt
Cody, A.M. inq, ped, tpd
Dardis, D.J.A. ats, ach, ped
Davis, E.A. ped, lrg, cbi
Dharmadasa, I. cns, kns, ped
Feather, R.M.J. ccg, ped
Gatlin, L.S. cns, ped, ach
Grant, A.M. lsy, ped, lrg
Guilbert, R.A. att, knt, ped
Halsted, S.E.W. pbs, ped, att
Harrell, P.E. att, ped, cht
Heide, C.L. ccg, ped, ats
Hug, J.W. ene, phe, ped
Jolly, A.B. pbs, rem, ped
Kao, H.-L. cht, knt, ped
Karrow, D.D. att, phe, ped
Lemire, C. edt, ped, cns
Lowery, M.N.V. knt, lsy, ped
Nelson, W.R. lsy, tpd, ped
Ollerenshaw, J.A. ccg, ped
Rearden, K.T. knt, att, ped
Taylor, R. ped, lrg
Turner, D.R. ach, ped, sks
Willcox, J.K. att, tpd, ped
Zerbe, M.J. ped, lit, nas

Philosophy; Epistemology (phe)

Published Articles

Allen & Crawley cul, phe, bfs
Atwater, M.M. gen, nas, phe
Ault, C.R., Jr. esg, inq, phe
Bar, V. & Zinn, B. phe, his, alf

Bischoff & Anderson kns, phe, cns
Chinn, C. & Brewer, W. kns, phe, nas
Furio & Guisasola kns, phe, phy
Galili, I. & Lavrik, V. cur, kns, phe
Gaskell, Hepburn, et al. res, gen, phe
Halloun, I. kns, phy, phe
Hildebrand, G.M. phe, nas, ped
Kawagley, et al. phe, bfs, cul
Kleinman, S.S. phe, gen, nas
Koch, J. eqt, gen, phe
Lather, P. nas, phe, ped
Maher, F.A. eqt, phe, nas
Matthews, M.R. cns, nas, phe
Mayberry, M. gen, ped, phe
Meyer, K. gen, ped, phe
Milne, C. phe, his, cur
Mortimer, E.F. csn, cid, phe
Norman, O. nas, eqt, phe
Osborne, M.D. knt, phe
Payne, P. ene, phe
Robertson, A. ene, phe, tpd
Roth, W. his, phe, nas
Roth & McGinn phe, nas, res
Roth, W. & McGinn, M. res, phe, asm
Roth, McRobbie, et al. bfs, phe, nas
Tsai, C.-C. cns,phe, rem
Venville & Treagust alf, ccg, phe
Yerrick, Pedersen, et al. nas, ped, phe

Papers and Electronic Documents
Howse, M.A. nas, att, phe
Letts, W.J.I.V. gen, nas, phe
Parsons, S. ntw, lth, phe
Ridgway, J. rem, phe, his
Snively, & Corsiglia mce, bfs, phe
Zembylas, M. phe, att, cht

Dissertations and Theses
Holschuh, J.L. phe, ach, pbs
Hug, J.W. ene, phe, ped
Iuli, R.J. phe, kns, car
Karrow, D.D. att, phe, ped
Klepper, N.H. cht, phe, tpd
McWhirter, L.J. lth, lrg, phe
Saunders, G.L. lsy, phe, che
Seatter, C.E.S. cns, lth, phe
Shaklee, J.M. nas, ntw, phe
Smithson, J.L. res, phe

Physics (phy)

Published Articles
Becu-Robinault et al. cur, lab, phy
Constantinescu & Bugoi his, phy
Czerniak & Haney att, rem, phy
Furio & Guisasola kns, phe, phy
Halloun, I. kns, phy, phe
Liu, X. kns, lth, phy
Rowlands, Graham, et al. alf, kns, phy
Sebesta, J. & Zajac, R. phy, his, nas
Stewart, M. ats, gen, phy
Yip, Chung, & Mak knt, phy, tpd

Papers and Electronic Documents
Klammer, J. alf, asm, phy
Savelsbergh, et al. cbi, alf, phy

Dissertations and Theses
Chastain, P.L. inq, tpd, phy
Chorny, J.J. inq, ach, phy
Chou, C.-H. cbi, cns, phy
Discenna, J.L. kns, rem, phy
Johnson, S.T. int, sks, phy
Marx, J.D. alf, asm, phy
Novemsky, L.F. cpl, cid, phy
Pulver, E.J. cur, mat, phy
Saul, J.M. cur, pbs, phy
Sawatzky, V.F. cul, phy, mat
Wang, H. mat, his, phy
Wessel, W.E. cns, kns, phy
Williams, K.A. lth, phy, kns
Wittman, M.C. mat, cur, phy

Reform; Educational Change; Standards (ref)

Published Articles
Ball, D. & Osborne, M. ref, ped, mce
Berglund, Daniels, et al. asm, sks, ref
Buxton, C.A. chs, ref, eqt
Bybee, R.W. ntw, cur, ref
Campbell, Wahl, et al. ref, asm, car
Chinn, P.W.U. ref, ats, ach
Druger, M. & Allen, G. ntw, car, ref
Glasson, & McKenzie lab, inq, ref
Hacker, R. & Rowe, M. bkg, ped, ref
Hodson, D. & Bencze, L. ref, cur, tpd
Keating, J. & Ihara, J. knt, skt, ref
Kumar, D. & Berlin, D. cur, ref, sts
Lerner, L.S. evo, ref, cur
Lonning, DeFranco, et al. cur, int, ref
Lubben, Campbell, et al. cur, ntw, ref
Maguire, R. cur, int, ref
McCulloch, G. his, cur, ref
Means, B. ntw, ref, asm
Naidoo, P. & Lewin, K.M. ref, mat
Osborne, J. & Millar, R. ref, lit, cur
Osborne, Driver, & Simon ats, ref, cur
Parkinson, Hendley,et al. ats, cur, ref
Pirrie, Wilson, et al. int, ref, cur
Pullen, S.L. cht, ref
Radford, D.L. tpd, ref, knt
Richmond & Neureither bio, ped, ref
Ross & Hogaboam-Gray int, ref, ped
Saez, M.J. & Carretero, A.J. ref, asm
Valverde & Schmidt cul,cur, ref
Vesilind, E.M. & Jones, M.G. att, ref
Webb, N.L. eqt, ref, res
Woodward & Woodward ats, ref, cur
Yerrick, R. cid, ref, ped
Zeidler, D.L. att, ref

Papers and Electronic Documents
Clune, W. ref
Gance, L.L. ref, int, pbs
Haslam, Turnbull,et al. tpd, ref, edt
Jarrett, D. ref, edt, ped
Jita, L. att, knt, ref
Kahle, J.B. & Rogg, S.R. eqt, ref, ach
Kahle, J.B. eqt, ref, ach
Kahle, J.B. eqt, ref, asm
Lee, O. ref, eqt, asm
Lopez-Ferrao & Warner ref, res
Norman, Stein, et al. cns, cur, ref
Rakow, S.J. cur, lit, ref
Ridgway, J. asm, cur, ref
Shymansky, Yore, et al. ats, ref, cns
Soyibo & Rainford ref, ats, sks
Stetter, D. ref, tpd, knt
Steussy & Thomas tpd, ref, ntw

Dissertations and Theses
Coates, J.M. his, ref, cur
Crane, C.C. att, ref, skt
Eskridge, R.H. asm, nas, ref
Finley, S.J. skt, tpd, ref
Monhardt, L.C. ats, cur, ref
Salyer, B.A. ref, att, cur
Schepige, A.C. ref, inq, int
Steffy, H.L. ref, ats, cbi
Trax, M.F. att, ref, bkg
Wieseman, K.C. att, ref

Representation; Modeling (rem)

Published Articles
Camacho & Cazares alf, rem, kns
Czerniak & Haney att, rem, phy
Dhillon, A.S. pbs, rem, lsy
Khoo & Koh cbi, rem, lrg
Kipnis, N. nas, rem, ped
Penner, Lehrer, et al. rem, int, kns
Raghavan, Sartoris, et al. rem, lrg, alf
Raghavan, Sartoris, et al. cur, rem, lrg
Resnick & Wilensky ped, lrg, rem

Rice, Ryan, & Samson asm, kns, rem
Robinson, W.R. lab, rem, ped
Roth, McGinn, et al. pbs, inq, rem
Rye, J.A. & Rubba, P.A. rem, kns, lrg
Souter, N.T. rem, sks, lrg
Stylianidou & Boohan rem, mat, kns
Tsai, C.-C. cns,phe, rem
Tsaparlis, G. lth, pbs, rem
Wilson, J.M. rem, kns, ccg

Papers and Electronic Documents
Howse, M.A. pbs, cbi, rem
Ridgway, J. rem, phe, his
Schwarz, C. & White, B. rem, cur, cbi
Tsai, C.-C. rem, ccg, lrg

Dissertations and Theses
Cavalli-Sforza, V.L.M. rem, lrg, ped
Discenna, J.L. kns, rem, phy
Ealy, J.B. cns, rem, cbi
Graves, A.P. cbi, rem, che
Hines, M.E. rem, kns
Hunter, W.J.F. cbi, che, rem
Jolly, A.B. pbs, rem, ped
Mishra, P. cbi, rem, lth
Rez-Ramirez, M.A. lrg, cns, rem
Schwarz, C.V. rem, nas, cbi
Spitulnik, M.W. inq, rem, lrg
Tien, L.T. lab, inq, rem
Wells, F.B. rem, lrg, bio

Research; Reviews of Research; Conference Proceedings (res)

Published Articles
Erickson, J. & Lehrer, R. cbi, mat, res
Gaskell, Hepburn, et al. res, gen, phe
Gough, N. ene, cns, res
Henderson & Fisher lab, ats, res
Kelly, Chen, & Crawford res, his, nas
Kenway, J. & Gough, A. gen, res, car
Klein, P.D. lth, res, kns
Krnel, Watson, & Glazar res, alf, che
Ma, X. ats, res, asm
Moss, Abrams, & Kull nas, kns, res
Murphy, A.P. fsd, ntw, res
Plummer & Barrow cht, res, tpd
Roth & McGinn phe, nas, res
Roth & McGinn res, phe, asm
Schmidt & McKnight ach, cul, res
Taber, K.S. ccg, che, res
Talisayon, V.M. ats, nfd, res
van Zee, E.H. res, tpd
Webb, N.L. eqt, ref, res
Welch, Huffman, et al. res, asm

Papers and Electronic Documents
Haury, D.L. res
Haury, D.L. & McCann, W.S. res
Korpan, Bisanz, et al. res, kns, bkg
Larson, Mayer, et al. tpd, res, knt
Lopez-Ferrao & Warner ref, res
McGinnis & Watanabe asm, res, tpd
Murfin, B. & Go, V. cbi, res, bio
Pontius, R. att, res, asm
Priestley, Priestley, et al. inq, cid, res
Rapoport, A.I. res, car, tec
Reed & Costner edt, res, cpl
Rennie, L. res, tpd, lth
Rubba & Rye res, tpd, knt
Wang, H.A. cur, res, mat

Dissertations and Theses
Dunkerly-Kolb, S.J. res, ene, sts
Joseph, J.L. att, res, bkg
Smithson, J.L. res, phe

Skills–Student (sks)

Published Articles
Allie, Buffler, et al. lab, sks, pbs
Berglund, Daniels, et al. asm, sks, ref
Bunyan, P. ach, asm, sks
Carle, D.O. & Krest, M. int, sks, ped
Coleman, S. & Gotch, A. sks, lrg, kns
Eidson & Simmons cbi, pbs, sks
Johnson & Lawson ach, ped, sks
Kaunda, et al. chs, sks, ped
Lehrer, R. & Schauble, L. pbs, lrg, sks
Robinson, P. cbi, ats, sks
Sindhu & Sharma asm, lab, sks
Souter, N.T. rem, sks, lrg
Soyibo, K. mat, sks, int
VanTassel-Baska, et al. cur, sks, int
Vidal-Abarca & Sanjose sks, pbs, mat
Yore, Craig, & Maguire kns, lth, sks
Zohar, Schwartzer, et al. cid, lrg, sks

Papers and Electronic Documents
Provo, Lamar, & Newby ks, gen, bio
Soyibo & Rainford ref, ats, sks

Dissertations and Theses
Agairre-Ortiz, M. asm, sks, chs
Breen, T. asm, sks, cpl
Brown, D.G. ped, sks, lrg
Chien, M.-H. chs, sks, ats
Dudley, J.S. kns, sks, esg
Johnson, S.T. int, sks, phy
O'Neill, D.K. ntw, sks
Parker, M.J. pbs, ntw, sks
Petrosino, A.J.J. chs, hos, sks
Scott, G. pbs, sks
Titus, A.P. pbs, cbi, sks
Turner, D.R. ach, ped, sks

Skills–Teacher (skt)

Published Articles
Abell, Bryan, et al. tpd, cbi, skt
Boo, H.-K. & Toh, K.-A. alf, knt, skt
Denyer, G. mat, skt, ped
Ferry, Hedberg, & Harper knt, cur, skt
Keating, J. & Ihara, J. knt, skt, ref
Lloyd, Smith, et al. cul, knt, skt
Parkinson, J. edt, tpd, skt
Roth, W.-M. knt, ped, skt
Skeff, Stratos, et al. ped, tpd, skt
Summers, Kruger, et al. att, skt, tpd
Volkmann & Anderson att, tpd, skt
Winslow, J. & Smith, D. bkg, tec, skt

Papers and Electronic Documents
Yei, Wang, & Huang cid, skt

Dissertations and Theses
Alshannag, Q.M. tpd, skt, cht
Brooks, C.M. tpd, skt
Crane, C.C. att, ref, skt
Dean, K.E. A edt, hos, skt
Dickinson, V.L. skt, cid, kns
Dwyer, W.M. edt, skt
Finley, S.J. skt, tpd, ref

Science, Technology, Society; Science and Society (sts)

Published Articles
Botton, C. & Brown, C. att, sts, cul
Cajas, F. cur, sts, tec
Calabrese-Barton, A. his, sts, nas
Collard & McKee nfd, che, sts
Hammrich, P.L. att, nas, sts
Helms, J.V. fsd, sts, lit
Hill, Stanisstreet, et al. kns, sts, bio
Howes, E.V. gen, ats, sts
Kumano, Y. eth, bfs, sts
Kumar, D. & Berlin, D. cur, ref, sts
Lach, J.-M. lit, nfd, sts
Levidow, L. nfd, ntw, sts
Lumpe, Haney, et al. att, ats, sts
Sanera, M. ene, sts, ped
Thirunarayanan, M.O. ene, sts
Vlaardingbroek, B. att, sts, bkg

Papers and Electronic Documents

Hollenbeck, J.E. sts, tpd, att
Johnson, & Regets car, sts, tec
Johnson, J.M. car, cul, sts
Martins, I.P. sts, knt, lit
Mascazine, et al. lit, sts, kns
McGinnis & Simmons sts, att, ped
Polman, J.L. lit, sts, cur
Wilkinson, R.K. car, sts, tec

Dissertations and Theses

Chen, S. his, sts
Dunkerly-Kolb, S.J. res, ene, sts
Horn, S.J. cur, tec, sts
Hulley, K.L.S. int, sts, cur
Jasper, W.G. att, sts, bio
Mullinnix, D.L. ats, sts, gen
Ostgaard, M.M. ats, cur, sts
Robin, R.S. lit, his, sts
Saxena, J.L. eth, ene, sts
Sohan, D.E. kns, sts, lit

Teacher Professional Development (tpd)

Published Articles

Abell, Bryan, et al. tpd, cbi, skt
Bodzin, A. & Park, J. ntw, tec, tpd
Boone, W. & Gabel, D. tpd, tec, inq
Boone, W. & Kahle, J. tpd, gen, eth
Carnes, G.N. tpd, ped, eqt
Dawson, V. & Taylor, P. cns, ped, tpd
Helms, J.V. att, knt, tpd
Hepburn, G. & Gaskell, P. int, tec, tpd
Hodson, D. & Bencze, L. ref, cur, tpd
Jones, Rua, & Carter knt, tpd, cns
Kuiper & Wilkinson cns, edt, tpd
Luft, Narro, & Slaughter tpd, cur, att
Mayer-Smith, et al. att, tpd, gen
Neathery, Glynn, & Long hos, inq, tpd
Norman, Caseau, et al. chs, eqt, tpd
Nott, M. & Wellington, J. knt, nas, tpd
Pardhan & Wheeler knt, ped, tpd
Parkinson, J. edt, tpd, skt
Plummer & Barrow cht, res, tpd
Price, B. tpd, knt
Radford, D.L. tpd, ref, knt
Robertson, A. ene, phe, tpd
Rosebery & Puttick att, nas, tpd
Skeff, Stratos, et al. ped, tpd, skt
Spitulnik & Krajcik edt, lit, tpd
Summers, Kruger, et al. att, skt, tpd
Trumper, R. alf, kns, tpd
van Zee, E.H. res, tpd
Venville, Wallace, et al. cul, cur, tpd
Volkmann & Anderson att, tpd, skt
Yip, Chung, & Mak knt, phy, tpd
Zuckerman, J.T. cht, tpd

Papers and Electronic Documents

Harwell, S.H. esg, knt, tpd
Haslam, Turnbull, et al. tpd, ref, edt
Henriques, L. tpd, att
Hollenbeck, J.E. sts, tpd, att
Kennedy, M. lrg, cur, tpd
Larson, Mayer, et al. tpd, res, knt
Luft, J.A. tpd, inq, ped
Mathew, Barufaldi, et al. att, ntw, tpd
McGinnis & Watanabe asm, res, tpd
O' Sullivan, Weiss, et al. knt, tpd, cur
Rennie, L. res, tpd, lth
Risacher, B.F. tpd, car
Rubba & Rye res, tpd, knt
Stetter, D. ref, tpd, knt
Steussy & Thomas tpd, ref, ntw
Warren & Ogonowski knt, tpd, ats
White, P.A. tpd, att
Zuckerman, J.T. att, knt, tpd

Dissertations and Theses

Alshannag, Q.M. tpd, skt, cht
Bodwell, M.B. cid, tpd, knt
Brockmeyer, M.A. inq, tpd, knt
Brooks, C.M. tpd, skt
Chang, B.-L. att, ene, tpd
Chastain, P.L. inq, tpd, phy
Cody, A.M. inq, ped, tpd
Cromwell, J.R. ene, nfd, tpd
Finley, S.J. skt, tpd, ref
Firenze, R.F. evo, att, tpd
Freed, A.B. cns, tpd, gen
Hatton, M.E. tpd, ntw
Hefty, E.A. att, ene, tpd
Kim, Y.-S. nas, knt, tpd
Klepper, N.H. cht, phe, tpd
Klett, M.D. tpd, att
Lee, K.M. inq, cbi, tpd
Levy, J.A. tpd, att, ene
Luebeck, J.L. ntw, tpd, bkg
Marion, V.F. tpd, cns, inq
Mathew, N.M. att, ntw, tpd
McLoughlin, A.S. bkg, tpd, att
Nelson, W.R. lsy, tpd, ped
Toolin, R.E. tpd, bkg, att
Weld, J.D. att, tpd
Willcox, J.K. att, tpd, ped
Wozny, P.D. asm, tpd

Technology (tec)

Published Articles

Bodzin & Park ntw, tec, tpd
Boone & Gabel tpd, tec, inq
Cajas, F. cur, sts, tec
Dorweiler & Yakhou ene, cur, tec
Gustafson & Rowell tec, kns, pbs
Hepburn & Gaskell int, tec, tpd
Karadelis, J.N. cur, cbi, tec
Winslow, J. & Smith, D. bkg, tec, skt

Papers and Electronic Documents

Johnson & Regets car, sts, tec
Rapoport, A.I. res, car, tec
Wilkinson, R.K. car, sts, tec

Dissertations and Theses

Cajas, M.F. tec, cur, int
Dawes, M.E. cur, tec, ats
Good, J.M. eth, tec, ach
Horn, S.J. cur, tec, sts
Jadonath, C. ntw, int, tec
King, K.P. lit, tec, his

Science Education Research Published in Professional Journals

Judith Sulkes Ridgway & Hyonyong Lee
The Ohio State University

Listed here are 349 articles that were published in professional journals during 1998. Each entry is coded (see *Key to Codes*, page *ix*) with one to three major codes (in bold type) and up to three minor codes, as well as the appropriate educational level in parentheses following each citation. As with many science-related areas of study, science education is becoming an interdisciplinary field. Many of the articles listed here are examples of research in science education, but appear in publications outside the traditional science education literature. Wherever possible, we have coded these articles to reflect their specific contributions to science education research methods, techniques, and applications. A brief scan through the list of searched journals will demonstrate the increasing diversity of this literature. All entries are indexed by major codes in the *Research Directory*, and the list of searched journals (containing the number of articles from each) is included at the end of this chapter (see page 63).

Abell, Sandra K.; Bryan, Lynn A.; Anderson, Maria A. (1998). **Investigating preservice elementary science teacher reflective thinking using integrated media case-based instruction in elementary science teacher preparation.** *Science Education, 82*(4), 491-510.

Investigates preservice elementary teachers' theories about science teaching and learning through their reflections on integrated media case-based instruction. Gives implications for reforms in methods course instruction and for the preparation and continuing education of elementary science teachers.

tpd, cbi, skt, tec, lsy, ref (TE, PS)

Adamson, Lauren B.; Foster, Martha A.; Roark, Martha L.; Reed, Donna B. (1998). **Doing a science project: Gender differences during childhood.** *Journal of Research in Science Teaching, 35*(8), 845-857.

Reports on a case study that examines the beginnings of gender differentiation during a naturally occurring academic activity designed to support and guide young children's interest in doing science. Discusses factors that might lead to an early divergence of boys' and girls' interests in science within a context that promotes its exploration.

ats, gen, bkg, eqt , inq (K-12)

Ahtee, Maija; Varjola, Irma. (1998). **Students' understanding of chemical reaction.** *International Journal of Science Education, 20*(3), 305-316.

Presents a study that examines the conceptions of chemical reactions held by middle school students, high school students, and general chemistry students at the university level. Suggests that very few students understand the nature of a chemical reaction.

alf, kns, che, ccg, phe, lrg (ALL)

Allen, Nancy J.; Crawley, Frank E. (1998). **Voices from the bridge: Worldview conflicts of Kickapoo students of science.** *Journal of Research in Science Teaching, 35*(2), 111-132.

Compares the worldview of Native American students of the traditional Kickapoo Band with the worldview encountered in the science classroom. Describes periodic observations made in two classrooms over an 18-month period of time.

phe, bfs, mce, kns (K-12)

Allie, Saalih; Buffler, Andy; Kaunda, Loveness; Campbell, Bob; Lubben, Fred. (1998). **First-year physics students' perceptions of the quality of experimental measurements.** *International Journal of Science Education, 20*(4), 447-459.

Investigates the procedural understanding of first-year university science students in South Africa. Explores ideas related to the reliability of experimental data and discusses the types of reasoning underlying the students' responses.

lab, sks, pbs, lit, phy, alf (PS)

Alsop, Steve; Hanson, Jane; Watts, Mike. (1998). **Pupils' perceptions of radiation and radioactivity: The wary meet the unsavoury.** *School Science Review, 79*(289), 75-79.

Reports on part of a survey into the teaching and learning of radiation and radioactivity that focuses on the relationships between students' feelings about and liking for the topics. Suggests that the nature of the content does affect the learning of some students.

ats, cur, lth, phy, sts (K-12)

Alspaugh, John W.; Harting, Roger D. (1998). **Interdisciplinary team teaching versus departmentalization in middle schools.** *Research in Middle Level Education Quarterly, 21*(4), 31-42.

Investigates the effects of interdisciplinary teaming versus departmentalization on student achievement in middle schools. Suggests that team teaching merits further investigation as a potential strategy for mediating the student achievement loss associated with the transition to middle school.

int, ach, ped, bkg, cpl (MS)

Altermatt, Ellen Rydell; Jovanovic, Jasna; Perry, Michelle. (1998). **Bias or responsivity? Sex and achievement-level effects on teachers' classroom questioning practices.** *Journal of Educational Psychology, 90*(3), 516-527.

Examines rates of both teacher responsiveness and student participation (n=165) in the science classroom question-asking context. Finds no systematic sex or achievement-level differences in the types of questions to which students responded. Argues for the need to focus on the role that both teachers and their students play in creating and maintaining sex differences in the teacher-student interaction.

gen, eqt, cid, ped (MS, TE)

Anderman, Eric M.; Griesinger, Tripp; Westerfield, Gloria. (1998). **Motivation and cheating during early adolescence.** *Journal of Educational Psychology, 90*(1), 84-93.

Explores the relations of motivational variables to self-reported cheating behavior and beliefs in science with 285 middle school students. Finds that the use of deep cognitive strategies was related negatively to cheating.

ats, chs, bfs, lrg (MS)

Anderman, Eric M. (1998). **The middle school experience: Effects on the math and science achievement of adolescents with learning disabilities (LD).** *Journal of Learning Disabilities, 31*(2), 128-38.

Applies hierarchical linear modeling to data from the National Education Longitudinal Study. Finds that there is a strong gap in achievement in math and science between adolescents with and without learning disabilities. Notes that the gap was reduced for learning disabled adolescents who did not make a school transition until at least ninth grade.

ach, chs, bkg, ats (MS)

Arikawa, Makoto; Maruno, Shunichi. (1998). **Analysis of mental models of junior high school students on learning the process of heating using electricity.** *Japanese Journal of Educational Psychology, 46*(1), 58-67.

Explores the types of naive mental models junior high school students use in order to understand electric heating, and also examines the possibility that their models might change from unscientific models to scientific models after scientific experiments are performed by students. Finds eleven types of naive student models.

alf, ccg, hos, phy, lab, lrg (HS)

Atkinson, Hilary; Bannister, Sarah. (1998). **Concept maps and annotated drawings: A comparative study of two assessment tools.** *Primary Science Review; n51 p3-5 Jan-Feb 1998*(51), 3-5.

Argues that the use of concept mapping as an assessment tool allows links to be made between concepts and shows both scientifically correct propositions and misconceptions. Contends that annotated drawings offer an alternative form of expression to children who may hold ideas but find it difficult to express them in words or to recognize links between them.

asm, alf, pbs (EL)

Atwater, Mary M. (1998). **Science literacy through the lens of critical feminist interpretive frameworks.** *Journal of Research in Science Teaching, 35*(4), 375-377.

Focuses on developing knowledge and skills for ascertaining whether scientific evidence justifies a

claim or a conclusion. Suggests that critical feminist interpretive frameworks may be able to alter the ways in which science research is conducted.

gen, nas, phe, pbs, sts (SE)

Ault, Charles R., Jr. (1998). **Criteria of excellence for geological inquiry: The necessity of ambiguity.** *Journal of Research in Science Teaching, 35*(2), 189-212.

Reports on the application of Gowin's epistemology to examples from geological inquiry which yield criteria of excellence responsive to the demands characteristic of geological problems. Supports this approach with a case study about how geologists apply analogies.

esg, inq, phe, cur, res, nas (K-12)

Bailey, Simon; Watson, Rebecca. (1998). **Establishing basic ecological understanding in younger pupils: A pilot evaluation of a strategy based on drama/role play.** *International Journal of Science Education, 20*(2), 139-152.

Presents the results of a pilot study on the possible advantages of utilizing a teaching strategy based on drama and role-playing to develop understanding of basic ecological concepts in students aged 7-11.

ene, int, ped, lrg (EL)

Ball, Deborah Loewenberg; Osborne, Margery D. (1998). **Teaching with difference: A response to Angela Calabrese Barton. Teaching science with homeless children: Pedagogy, representation, and identity.** *Journal of Research in Science Teaching, 35*(4), 395-397.

Suggests that educating all students entails going beyond seeking ways to enable marginalized students to engage in present educational forms. Argues that an education for homeless and minority children involves rethinking foundational assumptions about the nature of the disciplines, the purposes of education, and the role of teachers. Contends that respecting diversity implies that ideas about subject matter will evolve.

ref, ped, mce, cul, sts (EL)

Bar, Varda; Zinn, Barbara. (1998). **Similar frameworks of action-at-a-distance: Early scientists' and pupils' ideas.** *Science and Education, 7*(5), 471-491.

Reports on research designed to discover whether certain conceptual difficulties experienced by present day students in the realm of "action at a distance" are parallel to the experiences of scientists in previous generations.

phe, his, alf, phy, lth (K-12)

Barton, Angela Calabrese. (1998). **Teaching science with homeless children: Pedagogy, representation, and identity.** *Journal of Research in Science Teaching, 35*(4), 379-394.

Explores the question of what it means to create a "science for all" from the vantage point of urban homeless children. Describes the work of critical and feminist scholars on science and education as well as on teaching and research to question how inclusive the science education community is in its efforts to understand the margins of science for all.

chs, gen, eqt, bkg, nfd, sts (ALL)

Baumert, Jurgen; Evans, Robert H.; Geiser, Helmut. (1998). **Technical problem solving among 10-year-old students as related to science achievement, out-of-school experience, domain-specific control beliefs, and attribution patterns.** *Journal of Research in Science Teaching, 35*(9), 987-1013.

Presents a study of ten-year-old students (n=531) from the U.S. and Germany that sought to determine the relationships between everyday experience, domain-specific control beliefs, acquisition of science knowledge, and solving of everyday technical problems. Presents a causal model, developed and tested through structural equation modeling, which shows that domain-specific out-of-school experience, mediated by control beliefs, only indirectly influenced problem-solving performance.

pbs, bkg, bfs, tec, chs (EL)

Becu-Robinault, Karine; Tiberghien, Andree. (1998). **Integrating experiments into the teaching of energy.** *International Journal of Science Education, 20*(1), 99-114.

Analyzes the evolution of the French physics curricula and experiments from the beginning of the century to the present. Shows the strong coherence of the aspects of energy presented through teaching content and experiments.

cur, lab, phy, his, ped (SE)

Beeth, Michael E. (1998). **Teaching science in fifth grade: Instructional goals that support conceptual change.** *Journal of Research in Science Teaching, 35*(10), 1091-1101.

Presents characteristics of a learning environment drawn from a study of a grade 5 teacher. Analyzes the instructional activities presented to the students in order to explore the relationship between learning goals and conceptual change.

ccg, bkg, ped, kns (EL)

Beeth, Michael E. (1998). **Facilitating conceptual change learning: The need for teachers to support metacognition.** *Journal of Science Teacher Education, 9*(1), 49-61.

Argues that teachers need to be aware of the way students understand a conception and the way it is situated in their conceptual ecology in order to facilitate their negotiation of the scientific discourse.

ccg, ped, lrg, alf, tpd, cid (TE)

Berglund, Anders; Daniels, Mats; Hedenborg, Mathias; Tengstrand, Anders. (1998). **Assessment to increase students' creativity: Two case studies.** *European Journal of Engineering Education, 23*(1), 45-54.

Explores the use of assessment to stimulate creativity and communication skills in engineering students. Describes full-scale studies for students in engineering, physics, computer science, and mathematics at two universities in Sweden. Discusses new examination methods, including continuous assessment, seminars, mini-conferences, oral presentations, written reports, and new ways of posing questions on finals.

asm, sks, ref, tec (ALL)

Bischoff, Paul J.; Anderson, O. R. (1998). **A case study analysis of the development of knowledge schema, ideational networks, and higher cognitive operations among high school students who studied ecology.** *School Science and Mathematics, 98*(5), 228-237.

Investigates high school students' (n=13) changes in knowledge schema through interview and narrative data. Finds that the current theory influences gains in new knowledge and is closely linked to a capacity to apply higher order cognitive thought processes in constructing abstract knowledge.

kns, phe, cns, lrg, lth, ene (HS)

Black, Thomas R.; Atwaru-Okello, Denis; Kiwanuka, Julie; Serwadda, Debra; Birabi, Olive; Malinga, Florence; Biumigishu, Albert; Rodd, Alastair. (1998). **Science education in Uganda: Progress and possibilities.** *International Journal of Science Education, 20*(2), 239-252.

Reports the results of a questionnaire on teaching and facilities completed by teachers (n=214) and students (n=630) in Uganda. Indicates that teachers hold a view of science as problem solving while students see science as heavy with memorization.

ats, att, ped, bkg, nas, ref (SE)

Bodzin, Alec M. ; Park, John C. (1998). **A study of preservice science teachers' interactions with a web-based forum.** *Electronic Journal of Science Education, 3*(1).

Examines the potential benefits and existing barriers for preservice science teachers (n=22) engaging in an electronic professional community on the World Wide Web. Finds that the predominant barriers that preservice science teachers encounter when using the SciTeach forum appear to be a lack of adequate access to a networked computer and structuring time to engage in the web forum dialogue.

ntw, tec, tpd, bkg, cht (TE, PS)

Bogner, Franz X. (1998). **The influence of short-term outdoor ecology education on long-term variables of environmental perspective.** *Journal of Environmental Education, 29*(4), 17-29.

Evaluates the ultimate goals of environmental and ecological education. Examines two versions of an established outdoor ecology program in a national park. Surveys students' (n=700) use of knowledge statements.

nfd, fsd, ene, cur, kns, asm (K-12)

Boo, Hong Kwen. (1998). **Students' understandings of chemical bonds and the energetics of chemical reactions.** *Journal of Research in Science Teaching, 35*(5), 569-581.

Investigates 12th grade students' understandings of the nature of chemical bonds and the energetics elicited across five familiar chemical reactions following a course of instruction. Describes the many ways in which students can misconstruct concepts and principles.

alf, kns, che, lrg (SE)

Boo, Hong-Kwen; Toh, Kok-Aun. (1998). **An investigation on the scientific thinking ability of fourth year university students.** *Research in Science Education, 28*(4), 491-506.

Describes interviews with secondary science education majors in Singapore that took place after the students viewed five common chemical reactions. Explores reasons and remedies for the students' lack of scientific thinking ability.

alf, knt, skt, che, pbs (TE, PS)

Boone, William J.; Gabel, Dorothy L. (1998). **Effectiveness of a model teacher preparation program for the elementary level.** *Journal of Science Teacher Education, 9*(1), 63-84.

Reports on the Quality University Elementary Science Teaching (QUEST) program. Explores changes in how teachers enable student conceptual understanding of science, how students modify their views of scientific inquiry during instruction, and how teachers value the use of technology in science instruction.

tpd, tec, inq, ped (TE, EL)

Boone, William J.; Kahle, Jane Butler. (1998). **Student perceptions of instruction, peer interest, and adult support for middle school science: Differences by race and gender.** *Journal of Women and Minorities in Science and Engineering, 4*(4), 333-340.

Focuses on monitoring a statewide systemic initiative (SSI) for reform of mathematics and science students through survey. Analyzes responses by race and gender. Finds that different types of teaching and learning activities occurred in classes taught by teachers who had participated in SSI's professional development.

tpd, gen, eth, asm, ref, ped (HS)

Boone, William J. (1998). **Assumptions, cautions, and solutions in the use of omitted test data to evaluate the achievement of underrepresented groups in science--implications for long-term evaluation.** *Journal of Women and Minorities in Science and Engineering, 4*(2-3), 183-194.

Uses science test results to evaluate differences in achievement between males and females. Analyzes data collected in Ohio at the statewide level and suggests that it could be important to consider the rate of item omission before scores are computed.

ach, asm, gen, eqt (K-12)

Botton, Chris; Brown, Chris. (1998). **The reliability of some VOSTS items when used with preservice secondary science teachers in England.** *Journal of Research in Science Teaching, 35*(1), 53-71.

Describes the development and testing of Views on Science-Technology-Society (VOSTS) items for a group of 29 postgraduate trainee science teachers. Discusses findings as compared with those from the Canadian study, and reviews implications for the professional development of science teachers.

att, sts, cul, tec, tpd (PS, TE)

Bowen, Craig W. (1998). **Item design considerations for computer-based testing of student learning in chemistry.** *Journal of Chemical Education, 75*(9), 1172-1175.

Focuses on how computers might help broaden assessment practices by examining the types of test items that might be used in computer environments. Explores ideas from cognitive psychology and research on problem solving.

asm, cbi, che, pbs, kns (ALL)

Briano, Renata; Midoro, Vittorio. (1998). **Teaching environmental science via cooperative production of a hypermedia.** *Journal of Computers in Mathematics and Science Teaching, 17*(2-3), 223-237.

Explores an innovative approach to environmental science education by describing two experimental projects related to flooding in an Italian basin. Finds that cooperative production of the learning environment can be a way of re-evaluating the work performed by teachers.

ene, cbi, cpl, mat, asm (K-12)

Brooke, Helen; Solomon, Joan. (1998). **From playing to investigating: Research in an interactive science centre for primary pupils.** *International Journal of Science Education, 20*(8), 959-971.

Analyzes observations of primary students in a small Interactive Science Centre using a model of play, practice, and problem solving derived from a range of literature. Discusses salient features of the creative phase of the activities.

nfd, pbs, hos, sks, ped (EL)

Bunyan, Phil. (1998). **Comparing pupil performance in Key Stages 2 and 3 science SATs [Student Assessment Tasks].** *School Science Review, 79*(289), 85-87.

Explores whether it is easier to achieve a higher level in the Key Stage 2 Student Assessment Tasks than in those for Key Stage 3. Reports the results of a study in which samples of both were given to two groups of pupils and finds that most obtained the same level in both or one level higher in the Key Stage 3.

ach, asm, sks, ref (K-12)

Buxton, Cory A. (1998). **Improving the science education of English language learners: Capitalizing on educational reform.** *Journal of Women and Minorities in Science and Engineering, 4*(4), 341-369.

Investigates the role of second language issues as a barrier to adequate science education for underrepresented groups in science and engineering. Explores how current educational reform initiatives provide an opportunity for widespread change in how English Language Learners (ELL) learn science. Examines several model projects that attempt to provide innovative science education to linguistically diverse secondary students.

chs, ref, eqt, bkg, ped (SE)

Bybee, Rodger W. (1998). **Improving precollege science education--the involvement of scientists and engineers.** *Journal of College Science Teaching, 27*(5), 324-328.

Compares and contrasts the views of two people with interests in science education. Provides a stark and insightful contrast of the roles of scientists and engineers in precollege science education. Recommends that action be taken in addition to speeches about the issue.

ntw, cur, ref, ped (SE)

Cajas, Fernando. (1998). **Introducing technology in science education: The case of Guatemala.** *Bulletin of Science, Technology and Society, 18*(3), 194-203.

Describes the introduction of technology into the science curriculum and offers a general framework for analyzing technology as artifact, knowledge, and social practice. Provides analytical tools to study the implications of technology in general education.

cur, sts, tec, lit, nas (K-12)

Calabrese-Barton, Angela. (1998). **Examining the social and scientific roles of invention in science education.** *Research in Science Education, 28*(1), 135-151.

Investigates the multiple uses and definitions of invention in science in order to develop a theory of invention and inventive acts around themes related to invention as a social act, invention as a recursive and socially linked process, and invention as an embodied agency.

his, sts, nas, phe (GEN)

Camacho, Fernando Flores; Cazares, Leticia Gallegos. (1998). **Partial possible models: An approach to interpret students' physical representation.** *Science Education, 82*(1), 15-29.

Describes the construction of conceptual models of pressure and flotation using high school students' (n=314) previous ideas on these concepts expressed in an interview and in their answers to a questionnaire. Contends that these models allow the analysis of students' ideas about physical phenomena and recognize the inferential structure used by the students. Addresses the possible use of models in education.

alf, rem, kns, phy (HS)

Campbell, Patricia B.; Wahl, Ellen; Slater, Morton; Iler, Elisabeth; Moeller, Babette; Ba, Harouna; Light, Daniel. (1998). **Paths to success: An evaluation of the gateway to higher education program.** *Journal of Women and Minorities in Science and Engineering, 4*(2-3), 297-308.

Compares participants in a special program with a cohort of non-participants. Finds significant differences in high school graduation rates, completion of academic high school courses in science and mathematics, strong Scholastic Aptitude Test (SAT) performance, and college attendance.

ref, asm, car, ach, ped (SE)

Carle, Daria O.; Krest, Margie. (1998). **Facilitating research between the library and the science writing classroom.** *Journal of College Science Teaching, 27*(5), 339-342.

Describes an approach to the instruction of science writing which includes both a collaboration between the librarian and the scientific writing teacher and the incorporation of ongoing and incremental

library instruction that is integrated with the writing assignments.

int, sks, ped, cur (PS)

Carnes, G. Nathan. (1998). **An assessment of equitable instruction within three urban middle school classrooms.** *Journal of Women and Minorities in Science and Engineering, 4*(2-3), 283-295.

Explores how teacher participation in professional development activities impacts science instruction in middle school classrooms. Employs classroom observations and teacher interviews to examine the use of equitable teaching strategies.

tpd, ped, eqt, ref, gen, eth (MS)

Carter, Marshall W. (1998). **A portable paradox? Laptop computers and outdoor learning.** *Journal of Experiential Education, 21*(1), 14-21.

Uses three case studies to examine philosophical and pedagogical issues surrounding the use of laptop computers in outdoor education. Describes the relationship between nature and technology and the use of computers in education. Calls for greater recognition of the value of field education, especially in science. Presents criteria for using laptops in field programs.

ped, fsd, cbi, ene (SE)

Chinn, Clark A.; Brewer, William F. (1998). **An empirical test of a taxonomy of responses to anomalous data in science.** *Journal of Research in Science Teaching, 35*(6), 623-654.

Investigates a taxonomy of seven proposed responses to anomalous data. Finds that one additional type of data is needed in the taxonomy. Suggests that the taxonomy can be used as a framework to guide classroom discussion.

kns, phe, nas, pbs, sks (SE)

Chinn, Pauline W. U. (1998). **Teacher-student action research: Answering Melissa's question.** *Teaching and Change, 5*(2), 96-115.

Describes research conducted by a high school student in conjunction with her chemistry teacher that examined whether students who took reformed middle school science differed from students in regular science in grades, attitudes and evaluation of science learning. Finds that students from the reformed program rated science significantly higher, felt better prepared for high school, and planned to take more science courses.

ref, ats, ach, che, res (SE, TE)

Coelho, Suzana Maria; Sere, Marie-Genevieve. (1998). **Pupils' reasoning and practice during hands-on activities in the measurement phase.** *Research in Science and Technological Education, 16*(1), 79-96.

Describes tendencies and difficulties experienced by students aged 14 through 17 years during an activity involving measurement in physics. Surveys these tendencies and difficulties through clinical interviews involving data collection, data processing, and data interpretation.

pbs, ats, hos, sks, phy (SE)

Coleman, Elaine B. (1998). **Using explanatory knowledge during collaborative problem solving in science.** *Journal of the Learning Sciences, 7*(3-4), 387-427.

Evaluates the effects of the scaffold explanation-based approach to collaborative discussion on students' understanding of photosynthesis. Finds that the average intervention (AI) students developed a more accurate scientific and functional understanding than the average control (AC) group.

ped, lrg, cid, bio, kns (K-12)

Coleman, Sharon L.; Gotch, Albert J. (1998). **Spatial perception skills of chemistry students.** *Journal of Chemical Education, 75*(2), 206-209.

Examines the cognitive development of students enrolled in three levels of freshman chemistry courses and focuses on changes in spatial ability over time. Finds that performance on general Piagetian-type tasks, including spatial visualization, can be refined through educational intervention. Concludes that students appear less prepared in formal thought than comparable students in the 1980s.

sks, lrg, kns, pbs, ped, che (PS)

Collard, David M.; McKee, Scott. (1998). **Polymer chemistry in science centers and museums: A survey of educational resources.** *Journal of Chemical Education, 75*(11), 1419-1423.

Reports on a survey of 129 science and technology-related centers and museums revealed a shortage of polymer chemistry exhibits. Describes those displays

that do exist and suggests possibilities for future displays and exhibits.

nfd, che, sts, ref, mat (ALL)

Collins, Michael. (1998). **The use of email and electronic bulletin boards in college-level biology.** *Journal of Computers in Mathematics and Science Teaching, 17*(1), 75-94.

Presents a study using an electronic bulletin board as the software platform for students in a large second year college biology course to improve communications among students and between students and the instructor. Finds that the bulletin board was successful in fostering interaction between students as well as improving student-instructor interaction.

cbi, ntw, ped, bio, cid (PS)

Constantinescu, Bogdan; Bugoi, Roxana. (1998). **Romanian university physics teaching and research (1860-1940).** *Science and Education, 7*(3), 307-311.

Traces the evolution of physics teaching and research in Bucharest and Jassy, the two most important Romanian intellectual centers. Reports on three stages of historical development and includes selected biographies of Romanian scientists.

his, phy, phe (GEN)

Cummings, Lynda; Winston, Michael. (1998). **Service-based solutions.** *Science Teacher, 65*(1), 39-41.

Describes the Solutions model used at Shelley High School in Idaho, which gives students the opportunity to gain practical science experience while tackling community problems. Demonstrates how this approach is built on the three fundamentals of an integrated curriculum, a problem-solving focus, and service-based learning.

cur, pbs, ped, int, fsd (SE)

Cunningham, Christine M. (1998). **The effect of teachers' sociological understanding of science (SUS) on curricular innovation.** *Research in Science Education, 28*(2), 243-257.

Reports on a study that investigates the effect of teachers' sociological understanding of science on their design and implementation of curriculum innovations.

knt, cur, nas, phe, tpd, ped (K-12)

Czerniak, Charlene M.; Haney, Jodi J. (1998). **The effect of collaborative concept mapping on elementary preservice teachers' anxiety, efficacy, and achievement in physical science.** *Journal of Science Teacher Education, 9*(4), 303-320.

Examines the effects of using concept maps in a physical science class for elementary science teachers on physical science achievement, self-efficacy, and anxiety toward learning and teaching physical science. Discusses implications for teacher education.

att, rem, phy, ach, tpd, knt (TE)

Dawson, Vaille M.; Taylor, Peter C. (1998). **Establishing open and critical discourses in the science classroom: Reflecting on initial difficulties.** *Research in Science Education, 28*(3), 317-336.

Presents a reflective account of a science teacher's endeavors to use the referent of critical constructivism to transform her pedagogical practices during a Year 10 bioethics unit taught at an independent girls' school.

cns, ped, tpd, lrg, bio (SE, TE)

Dekkers, Peter J. J. M.; Thijs, Gerard D. (1998). **Making productive use of students' initial conceptions in developing the concept of force.** *Science Education, 82*(1), 31-51.

Investigates the effectiveness of activities for students (n=306) in pre-university courses in Botswana and South Africa. Uses a cognitive conflict strategy to design learning activities to develop aspects of the Newtonian concept of force. Finds that the students' prior correct beliefs need to be identified as a basis for development of the scientific concept of force.

alf, ped, ccg, phy (SE)

Dekkers, Peter J. J. M. (1998). **Example of a 'concept practical'--giving meaning to the concept of acceleration.** *Science Education International, 9*(3), 18-26.

Describes the implementation of a concept practical in a physics class. Uses the example of students predicting and testing what will happen to the speed and acceleration of a ball rolling down variously-sloped railings. Finds some evidence of conceptual development evident in pre- and post-test scores. Argues that a well-conducted class discussion is critical to the process.

asm, kns, pbs, phy, sks (SE)

Denning, Rebecca; Smith, Philip J. (1998). **A case study in the development of an interactive learning environment to teach problem-solving skills.** *Journal of Interactive Learning Research, 9*(1), 3-36.

Describes an interactive learning environment and characterizes students' interactions with the system. Discusses a series of 3 formative evaluations, which were crucial in the refinement of the system to make it an effective environment for teaching problem-solving skills to students at risk for academic failure.

cbl, pbs, chs, bio. sks (K-12)

Denyer, Gill. (1998). **Why no fun and games in science?** *Primary Science Review*(51), 17-19.

Presents the results of a survey of British teachers on the use of games in science teaching. Findings indicate that if science games were more widely available, less expensive, and relevant to the National Curriculum, teachers would be more likely to use them as a teaching tool.

mat, skt, ped, cur, ref (K-12)

Dhillon, Amarjit Singh. (1998). **Individual differences within problem-solving strategies used in physics.** *Science Education, 82*(3), 379-405.

Investigates the problem-solving behavior of a university lecturer, doctoral students (n=2), master's students (n=4), and first year undergraduates (n=6) by using think-aloud sessions, pen-and-paper problem solving, observations, and interviews. Finds that an understanding of fundamental aspects of expert problem solving can help inform novice structuring of, representation of, and access to knowledge.

pbs, rem, lsy, phy, ped (PS, TE)

Dickinson, Valarie L.; Flick, Lawrence B. (1998). **Beating the system: Course structure and student strategies in a traditional introductory undergraduate physics course for nonmajors.** *School Science and Mathematics, 98*(5), 238-246.

Describes the relationships between instructor and student goals, course design, and student strategies for learning physics in a traditional introductory undergraduate physics course for nonmajors. Finds that diverse goals and the structure of the course inhibited the understanding of physics and were conducive to students engaging in unexpected behaviors designed to help them successfully pass the course.

ats, cur, lsy, phy (PS)

Donnelly, James F. (1998). **The place of the laboratory in secondary science teaching.** *International Journal of Science Education, 20*(5), 585-596.

Focuses on how teachers understand the place of the laboratory and laboratory work in their practice. Bases findings on interviews conducted with secondary science teachers in England.

cur, lab, att, sks (SE, TE)

Dorweiler, Vernon; Yakhou, Mehenna. (1998). **Environmental education for the nonenvironmental engineering student: An imperative for the next generation of engineers.** *Journal of Environmental Education, 29*(4), 52-58.

Provides educators with a baseline of approaches to environmental education for non-environmental engineering students. Explores the scope of environmental programs offered as special programs. Analyzes survey responses and makes suggestions for program implementation.

ene, cur, tec, bkg, sts (PS)

Dreves, Candice; Jovanovic, Jasna. (1998). **Male dominance in the classroom: Does it explain the gender difference in young adolescents' science ability perceptions?** *Applied Developmental Science, 2*(2), 90-98.

Examines explicitly whether students' level of active participation and perceptions of male dominance in the science classrooms contribute to the gender difference in young adolescents' perceptions of science ability. Finds that there is a trend for girls with higher ability perceptions at the start of the year to actively participate more in the hands-on activities and not to perceive boys as the dominant participants in the classroom.

ats, gen, hos, cid (MS)

Druger, Marvin; Allen, George. (1998). **A study of the role of research scientists in K-12 science education.** *American Biology Teacher, 60*(5), 344-349.

Reports on the involvement of scientists in K-12 science education and their perception of science

education. Argues that findings should prove useful in determining how scientists might best contribute to science education in the future.

ntw, car, ref, cur (K-12)

Duchovic, Ronald J. (1998). **Teaching college general chemistry: Techniques designed to communicate a conceptual framework.** *Journal of Chemical Education, 75*(7), 856-857.

Presents two pedagogical techniques designed to promote the development of a conceptual framework in general chemistry. Describes an exam repechage which aims to turn exams into learning experiences for students, and the grouped laboratory essay approach in which students complete essays outside of class.

ped, asm, cpl, che, cur (PS)

Duit, Reinders; Roth, Wolff-Michael; Komorek, Michael; Wilbers, Jens. (1998). **Conceptual change cum discourse analysis to understand cognition in a unit on chaotic systems: Towards an integrative perspective on learning in science.** *International Journal of Science Education, 20*(9), 1059-1073.

Investigates how even a well-designed curriculum can lead students to construct an unwanted conception. Finds that the conceptual change cum discourse perspective has the potential to integrate the affordances of both methodological approaches and past empirical accomplishments.

cid, ccg, lth, cns, alf (SE)

Durndell, A.; Uzunova, F.; Asenova, D.; Asenov, A.; Thomson, K. (1998). **Gender neutral engineering: An impossible dream?--the case of Eastern Europe.** *International Journal of Science Education, 20*(7), 783-793.

Presents the outcome of a survey of student and qualified engineers (n=189) in Bulgaria . Finds a need for women to work for economic reasons and discusses the role of the communist system in emphasizing engineering and gender equity.

bkg, eqt, gen, tec, car (AD, K-12)

Eide, Kathleen Y.; Heikkinen. Michael W. (1998). The **inclusion of multicultural material in middle school science teachers' resource manuals.** *Science Education, 82*(2), 181-195.

Examines and categorizes multicultural teaching information found in middle school science teacher resource manuals to determine how multicultural information relates to guidelines for teaching in multicultural classrooms.

mce, mat, cur, ref (MS, TE)

Eidson, Sandra; Simmons, Patricia E. (1998). **Microcomputer simulation graphic and alphanumeric modes: Examining students' process skills and conceptual understanding.** *Journal of Computers in Mathematics and Science Teaching, 17*(1), 21-61.

Examines the relationship of microcomputer simulation graphics and alphanumeric modes of data presentation to ninth-grade biology students' science process skills and conceptual understanding of selected science topics (n=64). Finds that the use of microcomputers and appropriate software can result in significant learning and understanding of genetics concepts and can enhance students' abilities to use specific process skills in problem-solving.

cbi, pbs, sks, kns, bio, lrg (SE)

Enderstein, L. G.; Spargo, P. E. (1998). **The effect of context, culture and learning on the selection of alternative options in similar situations by South African pupils.** *International Journal of Science Education, 20*(6), 711-736.

Investigates the intuitive beliefs held by students (n=2326) about a number of well-known physical events. Finds that the context of the question has a clear effect on the frequency with which different options are selected in physically similar situations.

bfs, bkg, alf, phy, lsy (K-12)

Erickson, Julie; Lehrer, Richard. (1998). **The evolution of critical standards as students design hypermedia documents.** *Journal of the Learning Sciences, 7*(3-4), 351-386.

Describes a two-year design experiment in which 6th and 7th grade science students designed hypermedia documents to be used by their classmates. Presents information on how teachers assisted with the longitudinal transitions in students' critical standards for judging research questions and evaluating the quality of hypermedia design.

cbi, mat, res, asm (MS)

Erwin, Lorna; Maurutto, Paula. (1998). **Beyond access: Considering gender deficits in science education.** *Gender and Education, 10*(1), 51-69.

Explores the processes by which female undergraduate students (n=91) make sense of their educational and career options and choices as they move through their education at a large Canadian university. Discusses implications for retaining more female students in the sciences.

gen, eqt, car, cur, ats (PS)

Evrard, Nathalie; Huynen, Anne-Marie; de Bueger-Vander Borght, Cecile. (1998). **Communication of scientific knowledge in class--from verbalization to the concept of chemical equilibrium.** *International Journal of Science Education, 20*(8), 883-900.

Hypothesizes that the structure of a teacher's oral discourse is a factor that influences student learning about the concept of chemical equilibrium. Sets out to establish the conceptual and discursive frameworks of three teachers.

cid, lrg, knt, che, chs (SE, TE)

Ferguson, Peter D.; Fraser, Barry J. (1998). **Student gender, school size and changing perceptions of science learning environments during the transition from primary to secondary school.** *Research in Science Education, 28*(4), 387-397.

Investigates Tasmanian students' (n=1,040) perceptions of the learning environment. Data were collected in the final stages of primary school and again in the initial term in secondary school. Contends that first exposure to specialized science learning environments and teachers changed students' perceptions. Finds that both school size and student gender influenced factors in some learning environment dimension perceptions.

ats, bkg, gen (K-12)

Ferreira, Gherda. (1998). **Environmental education through hiking: A qualitative investigation.** *Environmental Education Research, 4*(2), 177-185.

Ascertains what people notice in the environment during hikes and whether this could influence environmental education. Identifies four themes: (1) the natural and physical environment; (2) trail aspects; (3) each hiker's physical and psychological preparedness and cognitive development; and (4) social aspects.

fsd, nfd, ene, lrg, cur (SE, PS)

Ferry, Brian; Hedberg, John; Harper, Barry. (1998). **How do preservice teachers use concept maps to organize their curriculum content knowledge?** *Journal of Interactive Learning Research, 9*(1), 83-104.

Reports on preservice teachers' (n=69) use of a concept-mapping tool to create and modify concept maps about science-related curriculum content knowledge. Shows how the preservice teachers used the concept-mapping tool to construct their curriculum content knowledge in the form of more powerful integrated patterns. Finds that the process of concept map construction enhanced preservice teacher skills in planning instruction.

knt, cur, skt, tpd (PS, TE)

Fisher, Brian W. (1998). **There's a hole in my greenhouse effect.** *School Science Review, 79*(288), 93-99.

Presents the results of a study that elucidates children's developing powers of explanation as they relate to global warming and ozone depletion. Discusses the results using charts and provides questions from the instrument.

kns, lit, ene, sts (K-12)

Fisher, Darrell; Harrison, Allan; Henderson, David; Hofstein, Avi. (1998). **Laboratory learning environments and practical tasks in senior secondary science classes.** *Research in Science Education, 28*(3), 353-363.

Draws data from student responses to the Science Laboratory Environment Inventory (SLEI) and a curriculum analysis of the implemented laboratory tasks. Involves biology, chemistry, and physics students (n=387) in 20 classes in Tasmania, Australia.

lab, bkg, cur, phy, bio, che (SE)

Francisco, Joseph S.; Nicoll, Gayle; Trautmann, Marcella. (1998). **Integrating multiple teaching methods into a general chemistry classroom.** *Journal of Chemical Education, 75*(2), 210-213.

Compares students' levels of participation during four different methods of teaching--cooperative learning, class discussions, concept maps, and

lectures--in a freshman-level general chemistry course. Finds that multiple modes of learning foster the metacognitive skills necessary for mastering general chemistry.

ped, cpl, lsy, che, ats, lrg (PS)

Furio, C.; Guisasola, J. (1998). **Difficulties in learning the concept of electric field.** *Science Education, 82*(4), 511-526.

Investigates students' main difficulties in learning the concept of the electric field. Finds that most students, even university students, have ontological and epistemological difficulties using the idea of the electric field, thus preferring the use of reasoning based on the Newtonian model of action at a distance to solve problems.

kns, phe, phy, pbs, lrg (HS, PS)

Fysh, Robert; Lucas, Keith B. (1998). **Religious beliefs in science classrooms.** *Research in Science Education, 28*(4), 399-427.

Assesses beliefs about science and religion held by students (n=44), teachers (n=10), and clergy (n=4) in a Lutheran secondary school in Australia via a survey and interview. Finds that participants' views of the relationship between science and religious beliefs were complex. Contends that traditional science programs do not adequately address the range of student and teacher beliefs about science.

bfs, bkg, phe (SE, TE)

Galili, Igal; Lavrik, Valentina. (1998). **Flux concept in learning about light: A critique of the present situation.** *Science Education, 82*(5), 591-613.

Investigates high school students' post-instructional knowledge of natural phenomena related to the concept of light flux as it applies to the seasons and to illumination. Describes didactic, cognitive, and ontological perspectives in relation to specific changes in the science curriculum.

cur, kns, phe, phy, ped, alf (SE)

Gaskell, P. James; Hepburn, Gary; Robeck, Edward. (1998). **Re/presenting a gender equity project: contrasting visions and versions.** *Journal of Research in Science Teaching, 35*(8), 859-876.

Provides three different accounts of a gender equity project in a grade 10 science class. Describes different rhetorical forms for representing research and different assumptions about gender, equity, pedagogy, and the representation of data.

res, gen, phe, eqt, cns, bkg (K-12)

Gayford, Chris. (1998). **The perspectives of science teachers in relation to current thinking about environmental education.** *Research in Science and Technological Education, 16*(2), 101-113.

Emphasizes aspects of current thinking about environmental education within the international community. Discusses an inquiry into practice among secondary science teachers (n=81) in England.

att, ene, cur, sts, ref, knt (TE, SE)

Geddis, Arthur N.; Roberts, Douglas A. (1998). **As science students become science teachers: A perspective on learning orientation.** *Journal of Science Teacher Education, 9*(4), 271-292.

Describes conceptualizations of learning orientations in beginning science teachers and how these orientations interact with the structure of teacher education programs.

lsy, knt, tpd (TE)

George, Rani; Kaplan, David. (1998). **A structural model of parent and teacher influences on science attitudes of eighth graders: Evidence from NELS: 88.** *Science Education, 82*(1), 93-109.

Presents a model of parent and teacher influences on the science attitudes of eighth grade students using data from the base year survey of the National Educational Longitudinal Study of 1988 (NELS: 88). Utilizes structural equation modeling methodology for analysis of categorical data.

bkg, ats, asm (MS)

Ginsberg, Edward S.; Panasuk, Regina M. (1998). **Survey of physics student attitiudes on access to problem solutions.** *Electronic Journal of Science Education, 2*(3).

Examines data on the attitudes of current physics students about their use of solutions to end-of-the-chapter problems in textbooks. Presents and analyzes students' responses about their actual use of the solutions, their reactions to the standard practice of restricted access, and their opinions about providing free access.

ats, pbs, ped, phy, att, cur (PS)

Ginsberg, Edward S.; Panasuk, Regina M. (1998). **Follow-up survey of physics student attitudes on differing modes of access to problem solutions.** *Electronic Journal of Science Education, 2*(4).

Assesses students' (n=128) reactions to altered circumstances for access to physics problem solutions. Finds that student reactions relate to various aspects of college-level education for adult learners, such as learner control, self-direction, participation, and self-confidence.

ats, pbs, ped, phy, cur, chs (PS)

Glasson, George E.; McKenzie, Woodrow L. (1998). **Investigative learning in undergraduate freshman biology laboratories.** *Journal of College Science Teaching, 27*(3), 189-193.

Describes the development and implementation of an investigative laboratory class. Focuses on a new laboratory design that was determined by faculty, teaching assistants, and students. Includes a sample laboratory description.

lab, inq, ref, bio, ped (PS)

Goldman-Segall, Ricki. (1998). **Gender and digital media in the context of a middle school science project.** *Meridian, 1*(1), 1-12.

Reports on a two-year ethnographic study focusing on gender, science education, and the introduction of networked digital media for learning in middle schools. Presents how learners become active participants, exploring gender attitudes, when studying socio-scientific issues related to an endangered rain forest and using video, the Internet, and computer media.

gen, edt, ats, cbi, eqt, sts (MS)

Gonzalez, Antonio Moreno. (1998). **Science in quarantine: Academic physics in Spain (1750-1900).** *Science and Education, 7*(3), 281-300.

Describes historical information on the incorporation of physics as a subject into secondary schools in Spain. Reviews religious and political tensions as early roadblocks to curriculum development.

bkg, cur, his, phy, phe (SE)

Gough, Noel. (1998). **Rethinking the subject: (De)constructing human agency in environmental education research.** *Environmental Education Research, 5*(1), 35-48.

Analyzes some of the ways in which human subjectivity and agency are constructed in the contemporary discourse of environmental education research. Finds that methods of constructivist science education research are not applicable to either subjects or subject matters of environmental education, and poststructuralist methodologies may provide useful frameworks for rethinking the ways in which human subjectivity and agency are deployed.

ene, cns, res, cur, phe (ALL)

Grandy, Jerilee. (1998). **Response bias in a survey of Asian-American and white science and engineering students.** *Journal of Women and Minorities in Science and Engineering, 4*(1), 1-13.

Describes a project consisting of reanalyzing survey data showing Asian-American science and engineering majors to be less content with their undergraduate experiences and their field of study than other students. Questions whether Asian-Americans were really less content or whether their style of responding instead reflects a questionnaire item-type bias.

ats, eth, asm, tec (PS)

Greenberg, Richard; Raphael, Jacqueline; Keller, Jill L.; Tobias, Sheila. (1998). **Teaching high school science using image processing: A case study of implementation of computer technology.** *Journal of Research in Science Teaching, 35*(3), 297-327.

Describes an in-depth case study of teachers' use of image processing in biology, earth science, and physics classes in one high school science department. Explores issues surrounding technology implementation.

cur, ped, edt, cbi, inq (SE)

Gunter, Barrie; Kinderlerer, Julian; Beyleveld, Deryck. (1998). **Research report. Teenagers and biotechnology: A survey of understanding and opinion in Britain.** *Studies in Science Education, 32*, 81-112.

Describes British teenagers' (n=138) knowledge, perceptions, and attitudes toward biotechnology with particular reference to food production. Finds

that more than half the teenagers were familiar with the term "biotechnology," but most lacked detailed knowledge of the subject. Finds also that teenagers rated formal schooling in science as an important source of their current science knowledge and claimed to mistrust print media resources.

ats, kns, bio, sts, mat, tec (SE)

Gustafson, Brenda J.; Rowell, Patricia M. (1998). **Elementary children's technological problem solving: Selecting an initial course of action.** *Research in Science and Technological Education, 16*(2), 151-163.

Analyzes the responses of elementary school children (n=336) to an Awareness of Technology Survey question intended to explore how they would begin the technological problem solving process.

tec, kns, pbs, lth (EL)

Hacker, Roger; Rowe, Michael. (1998). **Class size and teaching quality.** *School Science Review, 79*(288), 47-50.

Reports on the replication of a study of teaching styles from the 1970s. Explores possible relationships between class size and the quality of teaching in 60 classrooms. Suggests some reasons for teachers choosing teaching strategies that are ineffective.

bkg, ped, ref, tpd, ach (K-12)

Hadjikyriacou, Ritsa Maria. (1998). **Cyprus children's images of scientists.** *Science Education International,* 9(3), 29-34.

Explores an attempt to determine if there were gender or age differences in the images that 11- to 1-year-old students have of scientists. Finds that as female students get older they adopt and project a more stereotypic image of scientists, whereas male students seem to harbor a less stereotypic image of scientists as they age.

car, nas, gen, ats (K-12)

Halloun, Ibrahim. (1998). **Schematic concepts for schematic models of the real world: The Newtonian concept of force.** *Science Education, 82*(2), 239-263.

Presents the epistemology of scientific concepts from a schematic modeling perspective. Discusses students' initial cognitive states based on the level of commensurability between students' own concepts and their scientific counterparts.

kns, phy, phe, lth (HS, PS)

Halloun, Ibrahim; Hestenes, David. (1998). **Interpreting VASS dimensions and profiles for physics students.** *Science and Education, 7*, 553-577.

Explores student views about knowing and learning physics along six conceptual dimensions via the Views About Sciences Survey (VASS). Finds that student profiles correlate significantly with physics achievement.

ats, chs, ach, lrg, phy (ALL)

Hammrich, Penny L. (1998). **Two cultures of teacher preparation: Effects on teacher candidates' world view.** *Journal of Elementary Science Education, 10*(1), 18-38.

Investigates observations that teacher candidates majoring in elementary education exhibit a world view very different from teacher candidates majoring in a science discipline while obtaining teacher certification in elementary education.

bfs, cht, bkg, tpd (TE, EL)

Hammrich, Penny L. (1998). **Cooperative controversy challenges elementary teacher candidates' conceptions of the "nature of science".** *Journal of Elementary Science Education, 10*(2), 50-65.

Reports on a study in which upper-level elementary education majors (n=37) at an urban university participated in a cooperative controversy lesson. Finds that before the cooperative controversy lesson, 73% of the students felt that the nature of science was fact-based; however, after participating in the cooperative controversy exercise, 60% of the students felt that the nature of science was a combination of factual information and belief.

att, nas, sts, tpd, knt (TE, EL)

Hanson, Sandra L.; Kraus, Rebecca S. (1998). **Women, sports, and science: Do female athletes have an advantage?** *Sociology of Education, 71*(2), 93-110.

Analyzes data from a longitudinal study of high school youth to assess that involvement in sports often has a strong and positive association with young women's success in high school science. Describes both the functionalist and conflict theories regarding the purpose of sports.

gen, ach, bkg, chs (HS)

Hawkey, Roy; Clay, John. (1998). **Expectations of secondary science: Realisation and retrospect.** *School Science Review, 79*(289), 81-83.

Describes a series of interviews with students at the end of their first year of studying science in secondary schools. Compares and contrasts students' perceptions of reality with their expectations.

ats, bkg, phy, cur (SE)

Heffernan, Bernadette M. (1998). **Evaluation techniques for the Sandy Point Discovery Center, Great Bay National Estuarine Research Reserve.** *Journal of Environmental Education, 30*(1), 25-33.

Describes work done to provide staff of the Sandy Point Discovery Center with methods for evaluating exhibits and interpretive programming. Focuses on quantitative and qualitative evaluation measures designed to assess the program's objective of estuary education. Uses pretest-posttest questionnaires and interviews to measure subjects' knowledge and attitudes before and after a site visit.

asm, nfd, fsd, ene, ats, kns (EL)

Helms, Jenifer V. (1998). **Science and/in the community: Context and goals in practical work.** *International Journal of Science Education, 20*(6), 643-653.

Argues that community, field-based, service-oriented projects can be a powerful way to address concerns of scientific literacy. Recommends that an ethic of care and responsible action be an exemplar for schools and teachers, based on a case study of two ninth grade students.

fsd, sts, lit, cur, ats, ped (HS)

Helms, Jenifer V. (1998). **Science--and me: Subject matter and identity in secondary school science teachers.** *Journal of Research in Science Teaching, 35*(7), 811-834.

Investigates the relationship between subject matter and secondary science teacher identity, or sense of self. Develops a multidimensional model of identity and discusses the role of subject matter in the teachers' descriptions of who they are. Provides implications of this relationship for science education reform and teacher education.

att, knt, tpd, ref, chs (TE, SE)

Henderson, David; Fisher, Darrell. (1998). **Assessing learning environments in senior science laboratories.** *Australian Science Teachers' Journal, 44*(4), 57-62.

Describes the use of the Science Laboratory Environment Inventory (SLEI) which was designed for assessing senior science students' perceptions of aspects of their laboratory learning environment. Explains ways in which SLEI has been used in research studies and outlines ways educators could use the instrument for evaluating aspects of their own science laboratory experiments.

lab, ats, res, asm, bkg, ped (PS)

Hepburn, Gary; Gaskell, P. James. (1998). **Teaching a new science and technology course: A sociocultural perspective.** *Journal of Research in Science Teaching, 35*(7), 777-789.

Explores the influence of subject communities on the practice of secondary school teachers as they teach a new science and technology course that crosses traditional subject and department boundaries.

int, tec, tpd, knt, att, ped (TE, SE)

Herrenkohl, Leslie Rupert; Guerra, Marion R. (1998). **Participant structures, scientific discourse, and student engagement in fourth grade.** *Cognition & Instruction, 16*(4), 431-473.

Examines the interrelations among student engagement, scientific thinking practices, and student role taking and social interaction in the context of 4th grade science lessons. Discusses findings in terms of the importance of combining guidance in the social as well as the intellectual norms associated with scientific thinking and discourse.

nas, ats, cid, ped, bkg (EL)

Hildebrand, Gaell M. (1998). **Disrupting hegemonic writing practices in school science: Contesting the right way to write.** *Journal of Research in Science Teaching, 35*(4), 345-362.

Challenges ways in which a positivist view of science has led to hegemonic discourse on writing to learn science and highlights contradictions in this discourse. Argues for pedagogy that draws on critical, feminist, and hegemonic pedagogies and incorporates affective, creative, critical, cognitive, and diverse language practices set within sociocultural contexts.

phe, nas, ped, gen, lsy (SE)

Hill, Ruaraidh; Stanisstreet, Martin; Boyes, Edward; O'Sullivan, Helen. (1998). **Reactions to a new technology: Students' ideas about genetically engineered foodstuffs.** *Research in Science and Technological Education, 16*(2), 203-216.

Investigates the prevalence of various ideas among 16-19 year old students regarding the application of the rapidly expanding technology of genetic engineering to food production. Finds that more females were cautious about these foodstuffs than males.

kns, sts, bio, ats, gen, tec (SE)

Hodson, Derek; Bencze, Larry. (1998). **Becoming critical about practical work: Changing views and changing practice through action research.** *International Journal of Science Education, 20*(6), 683-694.

Describes how a group of teachers sought to overcome the difficulties of major innovation by working with a change agent to critique their current practice, devise a more authentic school science, and implement their ideas.

ref, cur, tpd, hos, res, skt (SE)

Hong, Jung-Lim; Shim, Kew-Cheol; Chang, Nam-Kee. (1998). **A study of Korean middle school students' interests in biology and their implications for biology education.** *International Journal of Science Education, 20*(8), 989-999.

Analyzes middle school students' interests in biology to provide information on instructional strategies and curriculum development in Korea. Finds that the highest interest domains are genetics and microscope observations.

cur, ats, bio, ped (MS)

Howes, Elaine Virginia. (1998). **Connecting girls and science: A feminist teacher research study of a high school prenatal testing unit.** *Journal of Research in Science Teaching, 35*(8), 877-896.

Explores how high school girls (n=12) express their relationship to and understanding of prenatal testing. Discusses the students' recognition of its possible place in their lives and the lives of others in the context of a short unit on prenatal testing in a semester-long genetics course.

gen, ats, sts, bio, cur, kns (SE, TE)

Hsu, Shih-Jang; Roth, Robert E. (1998). **An assessment of environmental literacy and analysis of predictors of responsible environmental behaviour held by secondary teachers in the Hualien area of Taiwan.** *Environmental Education Research, 4*(3), 229-249.

Assesses the environmental literacy of secondary teachers via survey and analyzes predictors of teachers' responsible environmental behavior. Discusses implications for program development and instructional practice and makes recommendations for further research.

ene, lit, knt, cht, ped, cur (SE, TE)

Huntley, Mary Ann. (1998). **Design and implementation of a framework for defining integrated mathematics and science education.** *School Science and Mathematics, 98*(6), 320-327.

Examines middle school integrated mathematics and science education from the perspectives of theory and practice. Includes a conceptual framework in the form of a mathematics/science continuum to lend clarity and precision to the phrase 'integrated mathematics and science'. Discusses barriers to integrating mathematics and science.

cur, int, ped, ref (MS)

Huppert, Jehuda; Yaakobi, Judith; Lazarowitz, Reuven. (1998). **Learning microbiology with computer simulations: Students' academic achievement by method and gender.** *Research in Science & Technological Education, 16*(2), 231-245.

Investigates the achievement of 10th grade biology students (n=82) who used computer assisted learning (CAL). Findings indicate that no significant gender differences in academic achievement were found within each group. Concludes that these computer simulations can be successfully integrated as short episodes in the existing biology curricula.

ach, cbi, gen, bio, cur, ped (HS)

Johnson, Ellen; Borleske, Barbara; Gleason, Susan; Bailey, Bambi; Scantlebury, Kathryn. (1998). **Structured observation.** *Science Teacher, 65*(3), 46-49.

Describes a tool that quantifies the number and kinds of interactions between students and teachers, based on the premise that structured observation of classroom events indicates whether a teacher is interacting equitably with each student in the

classroom. Finds that both inservice and student teachers employed changes in teaching practice in response to the data.

cid, asm, eqt, bkg, skt, tpd (SE, TE)

Johnson, Margaret A.; Lawson, Anton E. (1998). **What are the relative 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.

Determines factors to predict success in college biology (i.e., prior knowledge of biology or reasoning ability) depending on the instructional method employed (i.e., expository or inquiry). Finds that reasoning ability accounts for a significant amount of variance in final examination scores, regardless of instructional method.

ach, ped, sks, bio, kns (PS)

Johnson, Philip. (1998). **Children's understanding of changes of state involving the gas state, Part 2: Evaporation and condensation below boiling point.** *International Journal of Science Education, 20*(6), 695-709.

Reports on the findings of a three-year study that explored the development of children's concepts of evaporation at room temperature and condensation of atmospheric water vapor.

alf, kns, che, lrg (K-12)

Johnson, Philip. (1998). **Children's understanding of changes of state involving the gas state, Part 1: Boiling water and the particle theory.** *International Journal of Science Education, 20*(5), 567-583.

Investigates the development of children's conceptions of a substance and reports the findings in relation to children's understanding of boiling water and particle ideas. Argues that boiling water should have a broad significance in the curriculum.

cur, kns, lrg, che, alf (K-12)

Johnstone, A. H.; Watt, A.; Zaman, T. U. (1998). **The students' attitude and cognition change to a physics laboratory.** *Physics Education, 33*(1), 22-29.

Reports the results of an experiment in teaching strategies with undergraduates in a physics laboratory. Finds that preparation before a lab session improves student performance in the lab. Contends that follow-up work can lead to meaningful learning.

lab, ped, phy, lsy (PS)

Jones, M. Gail; Rua, Melissa J.; Carter, Glenda. (1998). **Science teachers' conceptual growth within Vygotsky's Zone of Proximal Development.** *Journal of Research in Science Teaching, 35*(9), 967-985.

Investigates how science teachers' (n=14) knowledge of science and science pedagogy changed after participation in a constructivist-based methods course. Finds that within the zone of proximal development, peers, teachers' students, instructors, readings, and tools mediated knowledge development.

knt, tpd, cns, phy, cpl, ped (TE, SE)

Jovanovic, Jasna; King, Sally Steinbach. (1998). **Boys and girls in the performance-based science classroom: Who's doing the performing?** *American Educational Research Journal, 35*(3), 477-496.

Describes a study of middle-level, performance-based science classrooms whose teachers were identified as being both exemplary hands-on science teachers and sensitive to increasing girls' participation in science. Finds that boys and girls did not participate equally in the classrooms, and that girls (but not boys) reported a decrease in science ability perception over the school year. Suggests that boys and girls experience the classrooms differently.

ats, hos, gen, eqt, cur, ref (MS)

Jovanovic, Jasna; Dreves, Candice. (1998). **Students' science attitudes in the performance-based classroom: Did we close the gender gap?** *Journal of Women and Minorities in Science and Engineering, 4*(2-3), 235-248.

Examines the assumption that girls will benefit from performance-based or hands-on science classrooms by examining changes in students' attitudes toward science over the school year.

gen, eqt, ats, hos, cur, ref (K-12)

Karadelis, J. N. (1998). **A stimulating approach to teaching, learning and assessing finite element methods: A case study.** *European Journal of Engineering Education, 23*(1), 91-103.

Investigates the benefits of introducing finite element methods into the curriculum of undergraduate courses. Analyzes the structure of the computer-assisted-design module and the extent to which it fulfills its main objectives. Discusses the efficiency of modern teaching and learning techniques used to develop skills for solving engineering problems and monitors the developing abilities of students tackling engineering problems.

cur, cbi, tec, ref, pbs, sks (PS)

Kaunda, L.; Allie, S.; Buffler, A.; Campbell, B.; Lubben, F. (1998). **An investigation of students' ability to communicate science investigations.** *South African Journal of Higher Education, 12*(1), 122-29.

Investigates the ability of educationally disadvantaged and limited-English-proficient South African students to write about science research projects. Finds a relationship between task presentation methods, specific task-completion guidelines, and quality of writing. Contends that poor understanding of procedure resulted in lack of detail and inappropriate sequencing.

chs, sks, ped, res, kns (PS)

Kawagley, Angayuqaq Oscar; Norris-Tull, Delena; Norris-Tull, Roger A. (1998). **The indigenous worldview of Yupiaq culture: Its scientific nature and relevance to the practice and teaching of science.** *Journal of Research in Science Teaching, 35*(2), 133-144.

Presents evidence from the Yupiaq culture that demonstrates a body of scientific thought and epistemology which differs from that of Western science. Argues that this information can provide a more culturally relevant framework for science learning for some students.

phe, bfs, cul, kns, lrg, his (K-12)

Keating, Joseph; Ihara, Jeffrey. (1998). **An integrated content/process approach to teaching science to elementary teachers.** *Journal of College Science Teaching, 27*(3), 183-88.

Describes a teaching model called Content-Process-Application-Evaluation (CPAE). Discusses this approach as a means of bridging the gap between teacher training programs and the sciences.

knt, skt, ref, (TE, EL)

Kelly, Gregory J.; Chen, Catherine; Crawford, Teresa. (1998). **Methodological considerations for studying science-in-the-making in educational settings.** *Research in Science Education, 28*(1), 23-49.

Explores the methodological implications of sociocultural approaches to the study of scientific knowledge and practices. Reviews the history of the nature of science research to trace the methodological influence of science and technology studies upon science education.

res, his, nas, tec (ALL)

Kenway, Jane; Gough, Annette. (1998). **Gender and science education in schools: A review 'with attitude'.** *Studies in Science Education, 31*, 1-30.

Reviews literature related to gender, science discourse, and the discourse designed to enhance girls' post-school options through exploration of nontraditional choices.

gen, res, car, eqt (ALL)

Keys, Carolyn W. (1998). **A study of grade six students generating questions and plans for open-ended science investigations.** *Research in Science Education, 28*(3), 301-316.

Explores the reasoning strategies of urban Year 6 students involved in creating their own questions and plans for scientific investigations. Emphasizes how students generate ideas for their own investigations.

kns, lrg, pbs, res, inq (EL)

Khoo, Guan-Seng; Koh, Thiam-Seng. (1998). **Using visualization and simulation tools in tertiary science education.** *Journal of Computers in Mathematics and Science Teaching, 17*(1), 5-20.

Describes a study conducted in undergraduate science classes in Singapore using computer modeling and simulation. Reports that the use of computer models and simulations proved to be valuable in explaining many aspects of science. Finds that students felt that three-dimensional images helped them in their understanding.

cbi, rem, lrg, kns (PS)

Kikas, Eve. (1998). **The impact of teaching on students' definitions and explanations of astronomical phenomena.** *Learning & Instruction, 8*(5), 439-454.

Discusses whether knowledge learned in school has been integrated into students' everyday knowledge or just memorized. Examines the way the topics were covered in the textbook and taught in the classroom. Presents the results of student interviews soon after having been taught the topics as well as years later, to establish the impact of the teaching on their ability to define and explain concepts correctly.

lrg, ped, kns, esg (EL)

King, Alison; Staffieri, Anne; Adelgais, Anne. (1998). **Mutual peer tutoring: Effects of structuring tutorial interaction to scaffold peer learning.** *Journal of Educational Psychology, 90*(1), 134-152.

Demonstrates that tutorial interaction can be structured so that peers can support each other's thinking and learning in science. Compares students who were assigned to one of three mutual peer-tutoring conditions.

inq, cpl, lsy, ped, cid (SE)

Kipnis, Nahum. (1998). **Theories as models in teaching physics.** *Science and Education, 7*(3), 245-60.

Argues that discussing theories, including their origin, development and replacement by other theories, can help students understand both the objective and subjective aspects of the scientific process.

nas, rem, ped, his, kns, phe (PS)

Klein, Perry D. (1998). **The role of children's theory of mind in science experimentation.** *Journal of Experimental Education, 66*(2), 101-124.

Discusses the theory that children's development of experimentation strategies results from developments in their theory of mind. Finds that as students participated in tasks and physics experiments, their ability to predict, explain, and affect the reasoning of an change was a predictor of their performance in planning experiments and in justifying their causal and non-causal inferences.

lth, res, kns, sks (EL)

Kleinman, Sharon Sue. (1998). **Overview of feminist perspectives on the ideology of science.** *Journal of Research in Science Teaching, 35*(8), 837-44.

Uses historical and contemporary examples to show that many feminist analyses fit together into a perspective on the ideology of science. Discusses how this affects persons who pursue careers in science.

phe, gen, nas, his, car (ALL)

Koch, Janice. (1998). **Response to Karen Meyer: Reflections on being female in school science.** *Journal of Research in Science Teaching, 35*(4), 473-74.

Dissects the artificial separation between that which is scientific and the personal to help provide meaningful context for the science classroom. Argues that discourse about girls and science has focused on how we can fix girls so that they can fit into the science classroom. Suggests that the goals of science education must be reconstructed to be inclusive.

eqt, gen, phe, bkg, ref (SE)

Krajcik, Joseph; Blumenfeld, Phyllis C.; Marx, Ronald W.; Bass, Kristin M.; Fredericks, Jennifer; Soloway, Elliot. (1998). **Inquiry in project-based science classrooms: Initial attempts by middle school students.** *Journal of the Learning Sciences, 7*(3-4), 313-350.

Investigates when students have difficulties in their first encounters with inquiry learning. Describes how students performed inquiry tasks. Finds that students were thoughtful in designing investigations and in planning procedures but failed to focus on the merit of generated questions, systematic experimentation, and discussion of the conclusions. Contends that teachers were central to the success of the inquiry.

inq, pbs, ped, skt (MS)

Krnel, D.; Watson, R.; Glazar, S. A. (1998). **Survey of research related to the development of the concept of 'matter'.** *International Journal of Science Education, 20*(3), 257-89.

Presents a survey and analysis of research related to the development of concepts of matter. Proposes that the clarity with which students understand the distinction between matter and objects influences their explanations.

res, alf, che, lth, ccg (K-12)

Kuchma, V. R.; Bobrishcheva-Pushkina, N. D.; Shlenskii, A. A.; Purgaeva, V. K.; Sukhinina, S. P. (1998). **The health status of pupils studying information technology at schools of physics and mathematics.** *Gigiena i Sanitariya*(2), 27-29.

Presents a study of the sanitary conditions of information technology classes and the capacities and health status of students studying information technology. Finds that students performed poorly in poor working conditions. Finds also that student health deteriorated and the number of students with myopia, poor posture, and scoliosis increased in number.

bkg, mat, chs, tec (HS)

Kuiper, J.; Wilkinson, W. (1998). **Teachers' professional development through technology education.** *South African Journal of Higher Education, 12*(1), 207-19.

Presents the argument that a social constructivist perspective can affect the design of teacher professional development programs. Provides an example of a South African training program in technology use for science teachers. Reports on teachers' related comments.

cns, edt, tpd, att, skt (TE)

Kulis, Stephen. (1998). **Organizational variations in women scientists' representation in academia.** *Journal of Women and Minorities in Science and Engineering, 4*(1), 43-67.

Investigates links between organizational conditions and women's representation on college faculties. Finds that selective organizational contexts play a substantial role in representation, along with the female doctoral labor supply and political constraints.

bkg, eqt, gen, car (PS)

Kumano, Yoshisuke. (1998). **The science world view among Japanese people: Their conceptions of the nature of science, technology and society.** *Science Education International, 9*(2), 28-32.

Explores the views of Japanese students concerning the nature of STS via a questionnaire. Discusses the results within the context of Japanese culture.

eth, bfs, sts, ats, nas (SE)

Kumar, David; Berlin, Donna. (1998). **A study of STS themes in state science curriculum frameworks in the United States.** *Journal of Science Education and Technology, 7*(2), 191-97.

Presents the results of a study of themes in state science curriculum frameworks. Analyzes 25 state frameworks and finds that 88% of these emphasize the standard science and technology in society. Recommends an examination of educational policy links to state science frameworks.

cur, ref, sts, tec (K-12)

Lach, Jean-Marie. (1998). **Science education and the WI.** *Education in Science*(177), 22-23.

Describes ways in which the Women's Institute, the largest and most influential women's organization in the United Kingdom, attempts to fulfill its goal of creating an atmosphere in which its members can become more aware of the scientific and technological contexts of their lives.

lit, nfd, sts, gen (PS)

Lagowski, J. J. (1998). **Chemical education: Past, present, and future.** *Journal of Chemical Education, 75*(4), 425-36.

Reviews the history of the acquisition and refinement of the chemical arts in the context of the use of metals by humans, the academic-industry connection in chemical education, curriculum history in chemistry, and the state of the chemistry teaching and learning environment.

cur, his, che, ntw, ped, ref (SE, PS)

Lannes, D.; Flavoni, L.; De Meis, L. (1998). **The concept of science among children of different ages and cultures.** *Biochemical Education, 26*(3), 199-204.

Investigates school children's images of a scientist in Brazil, the United States, France, Italy, Chile, Mexico, India, and Nigeria by having them make drawings. Discusses the relationship between image and career choice.

car, cul, nas, ats (K-12)

Larochelle, Marie; Desautels, Jacques. (1998). **On the sovereignty of school rhetoric: Representations of science among scientists and guidance counselors.** *Research in Science Education, 28*(1), 91-106.

Sheds light on views held by those who enjoy a certain degree of institutional legitimacy for talking about science either as practitioners in the field of science or as guidance counselors working with students interested in having science-related careers.

car, nas, att, bkg (K-12)

Lather, Patti. (1998). **Reaction to "Disrupting hegemonic writing practices in school science".** *Journal of Research in Science Teaching, 35*(4), 363-64.

Responds to an article which advises risky practices that trouble traditional distinctions between science and non-science, and in particular argues to politicize science as a way to organize teaching. Raises questions about science as a regime of truth in a place where such questions carry much weight: the teaching of science to children.

nas, phe, ped, gen (SE)

Lehrer, Richard; Schauble, Leona. (1998). **Reasoning about structure and function: Children's conceptions of gears.** *Journal of Research in Science Teaching, 35*(1), 3-25.

Presents interviews of elementary school children who were questioned about how gears move on a gearboard and about work in commonplace machines. Finds that children's reasoning became more general, formal, and mathematical as problem complexity increased, suggesting that mathematical forms of reasoning may develop when they provide a clear advantage over simple causal generalizations.

pbs, lrg, sks, kns (EL)

Lerner, Lawrence S. (1998). **K-12 science standards, state by state.** *Reports of the National Center for Science Education, 18*(1), 25-26.

Summarizes a study evaluating state standards in science. Discusses the treatment of evolution, which varies tremendously in quality from state to state, at length. Highlights local political battles. Describes exemplary evolution curricula in Connecticut, Indiana, and other states.

evo, ref, cur, bio (K-12)

Leslie, Larry L.; McClure, Gregory T.; Oaxaca, Ronald L. (1998). **Women and minorities in science ande engineering. A life sequence analysis.** *Journal of Higher Education, 69*(3), 239-76.

Reviews literature and discusses results of two national surveys that sought to identify factors influencing the participation of women and minorities in science and engineering. Contends that notions of self-concept/self-efficacy, peer influence, and goal commitment, which can be traced to early socialization experiences, may account for most participation disparities by race and gender. Finds that evidence is more limited for minorities than for women.

gen, eth, car, bkg, eqt, ats (HS, PS)

Levidow, Les. (1998). **Domesticating biotechnology: How London's Science Museum has framed the controversy.** *Ecologist, 28*(3), 143-45.

Critiques exhibits in London's Science Museum in light of the problem of balance in presenting controversial issues in museum exhibits. Contends that while science museums claim to portray controversial issues in a neutral manner, neutrality is impossible. Asks how science museums can involve visitors in the controversy and how the museum's role can be reconciled with commercial sponsorship.

nfd, ntw, sts, bio (ALL)

Lin, Huann-shyang. (1998). **The effectiveness of teaching chemistry through the history of science.** *Journal of Chemical Education, 75*(10), 1326-30.

Reports on a study designed to determine whether the historical approach to chemistry teaching will promote the conceptual problem-solving ability of eighth-grade students and to identify whether high or low achievers profit more from this teaching approach.

ped, his, ach, pbs, cur, che (MS)

Liu, Xiufeng. (1998). **Structural characteristics of students' conceptions of natural phenomena.** *Research in Science & Technological Education, 16*(2), 177-202.

Applies digraphing methodology to a synthesis of research investigating the structural characteristics of students' conceptions of natural phenomena. Finds that, based on phenomenography, students' conceptions of natural phenomena (gravity, light, heat) were structured by the internal horizon, external horizon, and the interaction between these 2 horizons.

kns, lth, phy, lrg (ALL)

Lloyd, Jane K.; Smith, Robin G.; Fay, Chin Long; Khang, Goh Ngoh; Wah, Lucille Lee Kam; Sai, Chia Lian. (1998). **Subject knowledge for science teaching at primary level: A comparison of pre-service teachers in England and Singapore.** *International Journal of Science Education, 20*(5), 521-32.

Reports on a comparative study of aspects of the science knowledge of primary student teachers in Singapore and Great Britain. Finds that there is no connection between content knowledge and the ability to teach that knowledge.

cul, knt, skt, lit (TE, EL)

Lock, Roger. (1998). **Advanced-level biology--Is there a problem?** *School Science Review, 80*(290), 25-28.

Explores whether there are problems with A-level biology that are broadly shared by teachers. Addresses five major areas of concerns: (1) teaching and learning; (2) practical work; (3) subject content; (4) assessment; and (5) initial teacher training.

bio, cur, att, asm, ped, tpd (SE, TE)

Lonning, Robert A.; DeFranco, Thomas C.; Weinland, Thomas P. (1998). **Development of theme-based, interdisciplinary, integrated curriculum: A theoretical model.** *School Science and Mathematics, 98*(6), 312-19.

Presents a model for developing theme-based, interdisciplinary, integrated curricula, which includes a theme creation phase and an activity refinement phase.

cur, int, ref, (K-12)

Loving, Cathleen C. (1998). **Cortes' multicultural empowerment model and generative teaching and learning in science.** *Science and Education, 7*(6), 533-52.

Adapts Cortes' Multicultural Empowerment Model to science teaching and to Wittrock's Model of Generative Learning and Teaching in Science. Argues that all children should be encouraged to learn science and learn about science.

nas, mce, ped, lth, lrg (K-12)

Lubben, Fred; Ramsden, Judith Bennett. (1998). **Assessing pre-university students through extended individual investigations: Teachers' and examiners' views.** *International Journal of Science Education, 20*(7), 833-48.

Reports on a study of the views of teachers and staff on the introduction of individual investigative work into the pre-college, advanced-level chemistry courses in Great Britain.

att, inq, cur, res, hos, che (HS,PS)

Lubben, Fred; Campbell, Bob; Maphalala, Tizie; Putsoa, Bongi. (1998). **Science curriculum material development through a teacher-industrialist partnership: Industrialists' perceptions of their role.** *Research in Science and Technological Education, 16*(2), 217-30.

Focuses on a curriculum development project involving a team of teachers and industrial technologists in the creation of lesson materials for secondary school science classes in Swaziland.

cur, ntw, ref, mat (SE)

Luft, Julie A. ; Narro, Martha L. ; Slaughter, Jeanne M. (1998). **Science teachers and the master's programs they select: A preliminary study.** *Electronic Journal of Science Education, 2*(3).

Examines in-service teachers' perceptions about two types of master's programs, a subject-specific master's program and an education-based master's program. Identifies the themes focusing on the benefits and detriments that in-service science teachers experienced within their respective programs. Describes the type of student that participates in each program, and suggests how master's programs could be better structured to meet the needs of science teachers.

tpd, cur, att, skt, cht (TE)

Lumpe, Andrew T.; Haney, Jodi J.; Czerniak, Charlene M. (1998). **Science teacher beliefs and intentions to implement science-technology-society (STS) in the classroom.** *Journal of Science Teacher Education, 9*(1), 1-24.

Reviews research and practice related to science-technology-society (STS) instruction. Focuses on STS-related instruments that reveal teacher and student beliefs about STS issues and teacher actions that result from those beliefs.

att, ats, sts, cur, ped (K-12)

Ma, Xin. (1998). **Analyzing neutral responses on environmental issues: The case of the 1991 British Columbia Assessment of Science.** *Journal of Environmental Education, 29*(4), 39-44.

Argues that neglecting the high percentages of neutral survey responses on some environmental issues may distort the picture of respondents' attitudes toward the environment and compromise valuable information on these issues.

ats, res, asm, ene, sts (K-12)

Maguire, Robert. (1998). **From GCSE sciences to a Level--a Northern Ireland perspective.** *PSSI Forum (Past Sixteen Science Issues)*(25), 4-7.

Describes the progress made in Northern Ireland toward the introduction of GCSE science curricula in post-primary schools. Documents the move from separate courses in chemistry, physics, and biology to integrated science courses.

cur, int, ref, (SE)

Maher, Frances A. (1998). **Response from the feminist classroom: A response to Maralee Mayberry.** *Journal of Research in Science Teaching, 35*(4), 461-62.

Demonstrates ways in which science and science education can be arenas for liberatory pedagogical practices for a nonscience feminist educator, when socioeconomic power relations can be challenged. Argues that the evolution and practice of scientific knowledge itself operates to exploit and oppress people everywhere in the name of a dominant class.

eqt, phe, nas, gen, eth, ped (SE)

Mansaray, A.; Ajiboye, J. O.; Audu, U. F. (1988). **Environmental knowledge and attitudes of some Nigerian secondary school teachers.** *Environmental Education Research, 4*(3), 329-39.

Explores the environmental knowledge and attitudes of secondary teachers. Reveals that negative environmental attitudes are prevalent and that most of the teachers in the study have never attended any workshop or seminar on the teaching of the subject.

att, knt, ene, lit (SE)

Mappin, Michael J. (1998). **Choosing an environmental monitoring program.** *Green Teacher,* (55), 12-15.

Reviews types of environmental monitoring as well as the general aims of the organizations which sponsor volunteer monitoring programs for school and community groups. Describes how these programs address educators' interest in involving students in authentic science experiences and provide interdisciplinary activities that link schools and communities.

ntw, fsd, nfd, sts, ene (HS, AD)

Markow, Peter G.; Lonning, Robert A. (1998). **Usefulness of concept maps in college chemistry laboratories: Students' perceptions and effects on achievement.** *Journal of Research in Science Teaching, 35*(9), 1015-29.

Describes a study of concept map construction as a means of increasing the conceptual learning of first-year, non-major college chemistry students. Finds no significant differences between the control (essay-writing) and treatment (concept map-constructing) groups on post-lab multiple-choice achievement tests. Finds also that students indicated positive attitudes toward concept mapping.

ats, kns, ped, che, lrg (PS)

Mastropieri, Margo A.; Scruggs, Thomas E.; Mantzicopoulos, Panayota; Sturgeon, Amy; Goodwin, Laura; Chung, SuHsiang. (1998). **"A place where living things affect and depend on each other": Qualitative and quantitative outcomes associated with inclusive science teaching.** *Science Education, 82*(2), 163-179.

Describes the school factors associated with inclusive science instruction, and evaluates the classroom achievement of students with disabilities as compared to nondisabled students in the same class. Makes achievement and attitude comparisons between the classrooms. Finds that students in the activities/inclusion classroom demonstrated superior performance on content recall, higher level thinking, verbal elaboration, and affective measures.

chs, eqt, hos, sks, ach, ped (EL)

Matthews, Michael R. (1998). **In defense of modest goals when teaching about the nature of science.** *Journal of Research in Science Teaching, 35*(2), 161-74.

Draws attention to some contemporary educational issues that hinge upon interpretations of the nature of science, especially constructivist proposals. Discusses the range of philosophical debate on the merits of constructivism.

cns, nas, phe, ped, his (K-12)

Matyas, Marsha Lakes; Frank, Martin. (1998). **The employment of recent doctoral graduates in physiology.** *Physiologist, 41*(4), 153, 156-60.

Presents subset findings of a survey monitoring the flow of students from graduate studies through

postdoctoral positions and into permanent professional positions. Finds that the traditional career path continues to describe the first professional position for most, but not all, physiology Ph.D. recipients

car, ats (PS)

Mayberry, Maralee. (1998). **Reproductive and resistant pedagogies: The comparative roles of collaborative learning and feminist pedagogy in science education.** *Journal of Research in Science Teaching, 35*(4), 443-59.

Describes how feminist pedagogy is concerned with transforming both how students learn science and the science curriculum that students are expected to learn. Argues that collaborative approaches (the dominant approach to reforming science education) serve to reproduce the dominant discourse of existing science systems. Contends that feminist pedagogy invites students to critically analyze existing scientific systems.

gen, ped, phe, ref, cur (SE)

Mayer-Smith, Jolie; Pedretti, Erminia; Woodrow, Janice. (1998). **An examination of how science teachers' experiences in a culture of collaboration inform technology implementation.** *Journal of Science Education and Technology, 7*(2), 127-34.

Illustrates how a culture of collaboration may contribute to significant technological reform and foster conceptual change leading to distinctive pedagogy and praxis. Presents a case study exploring a collaborative effort between a teacher and a researcher.

ntw, edt, tpd, att, ccg, ped (ALL)

McCulloch, Gary. (1998). **Historical studies in science education.** *Studies in Science Education, 31*, 31-54.

Reviews and evaluates the contribution of historical studies in science education with particular reference to the case of England and Wales, where a series of challenges threaten to undermine the enterprise as a whole.

his, cur, ref, lit (K-12)

McGinn, Michelle K.; Roth, Wolff-Michael. (1998). **Assessing students' understanding about levers: Better test instruments are not enough.** *International Journal of Science Education, 20*(7), 813-32.

Investigates variations in students' responses to lever problems across multiple assessment contexts and formats. Discusses various data sources, including students' semantic maps, written responses to questions, and modeled solutions to practical problems.

kns, asm, pbs, lth, phy, alf (K-12)

McGinnis, J. Randy; Pearsall, Marjorie. (1998). **Teaching elementary science methods to women: A male professor's experiences from two perspectives.** *Journal of Research in Science Teaching, 35*(8), 919-49.

Reports on an action research study of one male science education professor's experience teaching elementary science methods to females. Presents the perspectives of co-researchers and examines what each learned about the professor's practice.

att, tpd, gen, bkg, eqt, ped (TE)

McKenzie, Woodrow L.; Glasson, George E. (1998). **Investigative learning in undergraduate freshman biology laboratories.** *Journal of College Science Teaching, 27*(3), 189-93.

Describes the development and implementation of an investigative laboratory class. Reports that the new laboratory design was determined to be a success by faculty, teaching assistants, and students. Includes a sample laboratory description.

lab, cur, inq, bio, ref, ped (PS)

Means, Barbara. (1998). **Melding authentic science, technology, and inquiry-based teaching: Experiences of the GLOBE program.** *Journal of Science Education and Technology, 7*(1), 97-105.

Reports findings from the evaluation of the Global Learning and Observations to Benefit the Environment (GLOBE) Program. Examines issues concerning student-scientist partnerships such as benefits of the program to students and scientists, enhancement of authentic science in schools through technology, and the relationship between this program and other reform efforts.

ntw, ref, asm, hos, inq (K-12)

Mellado, Vicente. (1998). **The classroom practice of preservice teachers and their conceptions of teaching and learning science.** *Science Education, 82*(2), 197-214.

Describes research carried out with 4 student teachers of primary and secondary science

education. Analyzes and compares the preservice teachers' conceptions of the learning and teaching of science with their classroom practice when teaching science lessons.

att, lrg, ped, knt, tpd (TE)

Meyer, Karen. (1998). **Reflections on being female in school science: Toward a praxis of teaching science.** *Journal of Research in Science Teaching, 35*(4), 463-71.

Questions the phenomenon and the implications of being female in school science. Discusses several directions within teaching that interpret bell hooks' engaged pedagogy, which emphasizes a commitment to self-actualization and well being for both teacher and student.

gen, ped, phe, eqt; bkg (HS, PS)

Michie, Michael. (1998). **Factors influencing secondary science teachers to organise and conduct field trips.** *Australian Science Teachers' Journal, 44*(4), 43-50.

Explores the factors that influence teachers to organize field trips. Describes a series of interviews conducted with secondary science educators. Finds that reasons for avoiding trips include discouragement from school administration, student behavior, and preparation of teaching materials.

fsd, ped, att, mat (SE)

Milne, Catherine. (1998). **Philosophically correct science stories? Examining the implications of heroic science stories for school science.** *Journal of Research in Science Teaching, 35*(2), 175-87.

Identifies four different types of science stories: (1) heroic; (2) discovery; (3) declarative; and (4) politically correct. Examines the philosophical assumptions that underpin heroic science stories. Considers the implications of these stories in the science classroom.

phe, his, cur, mat, ped (ALL)

Mortimer, Eduardo Fleury. (1998). **Multivoicedness and univocality in classroom discourse: An example from theory of matter.** *International Journal of Science Education, 20*(1), 67-82.

Analyzes talk amongst students on videotaped recordings from a teaching sequence on the particle model of matter. Emphasizes the role of two types of discourse and the epistemological and ontological obstacles in the construction of scientific meanings in the classroom.

csn, cid, phe, lrg, kns (SE)

Moss, David M.; Abrams, Eleanor D.; Kull, Judith A. (1998). **Can we be scientists too? Secondary students' perceptions of scientific research from a project-based classroom.** *Journal of Science Education and Technology, 7*(2), 149-61.

Examines the conceptual development of high school students' understanding of scientific research over a school year. Finds that students have uninformed notions of scientific questioning and have little experience with data analysis or communication of results.

nas, kns, res, sks, alf (SE)

Mpofu, D. J. S.; Das, M.; Stewart, T.; Dunn, E.; Schmidt, H. (1998). **Perceptions of group dynamics in problem-based learning sessions: A time to reflect on group issues.** *Medical Teacher, 20*(5), 421-27.

Reports on student and faculty perceptions of group dynamics in problem-based learning situations. Finds that gender differences were demonstrated in interpretation of over half of the questionnaire items.

gen, pbs, cpl, cid (HE)

Murphy, Anthony P. (1998). **Students and scientists take a "lichen" to air quality assessment in Ireland.** *Journal of Science Education and Technology, 7*(1), 107-13.

Describes a cooperative project in which students in a number of areas in Ireland collect environmental data for use by scientists working to solve real problems. Reports on the follow-up survey to the study.

fsd, ntw, res, hos, ene, nas (EL,SE)

Naidoo, Prem; Lewin, Keith M. (1998). **Policy and planning of physical science education in South Africa: Myths and realities.** *Journal of Research in Science Teaching, 35*(7), 729-44.

Concludes that serious questions should be asked about the science education policy initiatives in South Africa. Cites the efficient and effective use of resources as the most important issue in the reform efforts.

ref, mat, cur (K-12)

Nason, Rod; Lloyd, Peter; Ginns, Ian. (1998). **Knowledge construction in elementary school science projects.** *Journal of Computers in Mathematics and Science Teaching, 17*(4), 355-80.

Reports on a study in which a teacher used the collaborative development of a format-free computer database to facilitate knowledge construction in a group of three Year 6 students during a science project.

cbi, cpl, ped, kns (EL)

Neathery, M. Faye; Glynn, Justine; Long, Katherine. (1998). **Professional development for elementary teachers: A collaborative effort involving a university, a forest learning center, industry, and state agencies.** *Electronic Journal of Science Education, 3*(1).

Describes elementary school teachers' participation in a series of daylong workshops that involved hands-on, inquiry-based approaches to learning in formal and informal settings. Determines attitudinal change and teaching confidence levels through post-project questionnaires which were administered immediately and one year after the workshops.

hos, inq, tpd, nfd, att, ntw (TE, EL)

Neil, Peter S.; O'Rawe, Des. (1998). **Northern Ireland teachers' and pupils' views on science across Europe.** *School Science Review, 79*(289), 89-94.

Reports the establishment of links between Northern Ireland school science departments and other European schools through a special project. Finds that the benefits to teachers and students extend beyond the science curriculum.

ntw, ats, att, cur (SE)

Newton, Lynn D.; Newton, Douglas P. (1998). **Primary children's conceptions of science and the scientist: Is the impact of a national curriculum breaking down the stereotype?** *International Journal of Science Education, 20*(9), 1137-49.

Explores stereotypes of scientists and the effectiveness of a national curriculum at altering these ideas among primary children. Confirms the prevalence of a gender-biased stereotype and an unrealistic view of students' work.

nas, car, ats, gen (EL)

Niaz, Mansoor. (1998). **From cathode rays to alpha particles to quantum of action: A rational reconstruction of structure of the atom and its implications for chemistry textbooks.** *Science Education; v82 n5 p527-52 Sep 1998, 82*(4), 527-52.

Reports on a study that involves the analysis of twenty-three chemistry textbooks at the college freshman level to determine the degree to which they address developments in the history and philosophy of science.

mat, his, che, nas, asm (HE)

Norman, Katherine; Caseau, Dana; Stefanich, Greg P. (1998). **Teaching students with disabilities in inclusive science classrooms: Survey results.** *Science Education, 82*(2), 127-46.

Reports on a survey of elementary, middle, high school, and university science teachers. Finds that teacher education programs reflect little commitment to preparing or in-servicing science teachers to work effectively with students who have disabilities.

chs, eqt, tpd, cur, ped (TE)

Norman, Obed. (1998). **Marginalized discourses and scientific literacy.** *Journal of Research in Science Teaching, 35*(4), 365-7[illegible].

Focuses on the marginalized discourses that have arisen to oppose the racism, sexism, and classism espoused and advocated by mainstream science since its institutionalization up until the first half of the 20th century.

nas, eqt, phe, his (SE)

Nott, Mick; Wellington, Jerry. (1998). **Eliciting, interpreting and developing teachers' understandings of the nature of science.** *Science and Education, 7*(6), 579-94.

Describes ways of eliciting teachers' views on the nature of science, interpreting and understanding these views, and developing these views in the context of initial or in-service teacher education.

knt, nas, tpd, att, lrg (TE, K-12)

O'Reilly, Tenaha; Symons, Sonya; MacLatchy-Gaudet, Heather. (1998). **A comparison of self-explanation and elaborative interrogation.** *Contemporary Educational Psychology, 23*(4), 434-445.

Examines the effectiveness of two learning strategies, self-explanation and elaborative interrogation, for

the retention of scientific facts. Discusses the practicality and flexibility of each approach for university students.

lsy, kns, lrg (PS)

Orams, Mark B.; Hill, Greg J. E. (1998). **Controlling the ecotourist in a wild dolphin feeding program: Is education the answer?** *Journal of Environmental Education, 29*(3), 33-38.

Evaluates the effectiveness of an education program for tourists who hand-feed wild dolphins at Tangalooma, Moreton Island in eastern Australia. Finds that after the education program, inappropriate behaviors toward the dolphins were significantly reduced.

nfd, ene, fsd, sts (ALL)

Orfinger, Becky. (1998). **Virtual science museums as learning environments: Interaction for education.** *Informal Learning Review*(33), 1,8,-13.

Explores the use of web virtual science museums in the classroom. Discusses the educational advantages of using virtual museums for both students and teachers. Contends that virtual museum visits can have comparable educational value to actual science museum field trips. Lists and examines sites which support classroom instruction.

cbi, nfd, ped, lrg (K-12)

Osborne, Jonathan; Millar, Robin. (1998). **Science education for the future: Which way now?** *Primary Science Review*(52), 21-23.

Explores conclusions from a series of seminars and open meetings held to review the future of science education. Addresses the successes and failures of science education, the science-education needs of students for lifelong learning in the next century, the possible form and structure of a suitable model for a science curriculum, and the problems with implementing such a curriculum.

ref, lit, cur, his (EL)

Osborne, Jonathan; Driver, Rosalind; Simon, Shirley. (1998). **Attitudes to science: Issues and concerns.** *School Science Review, 79*(288), 27-33.

Reviews some of the main features of the research evidence and the latest data on student attitudes toward science. Argues that the recent introduction of an extension of compulsory science education in England, Wales, and Northern Ireland has not succeeded in changing the level of interest in science.

ats, ref, cur, ach (K-12)

Osborne, Margery D. (1998). **Teacher as knower and learner: Reflections on situated knowledge in science teaching.** *Journal of Research in Science Teaching, 35*(4), 427-39.

Argues that a teacher's practice reflects changing experiences, knowledge, values, and identities, and as such can be productively thought of as a site for learning and for expounding upon what is known. Suggests a vision for what constitutes effective practice different from that commonly held in science.

knt, phe, tpd, ref (SE)

Oskamp, Stuart; Burkhardt, Rachel L.; Schultz, P. Wesley; Hurin, Sharrilyn; Zelezny, Lynnette. (1998). **Predicting three dimensions of residential curbside recycling: An observational study.** *Journal of Environmental Education, 29*(2), 37-42.

Reports on a study of three dependent variables of household recycling behavior in a suburban community over 8 weeks, with 10 independent variables serving as predictors. Finds that many of the independent variables that predicted recycling behavior in past research have weaker relationships in current, more convenient curbside programs.

ene, nfd, sts (AD)

Pardhan, Harcharan; Wheeler, Alan E. (1998). **Enhancing science teachers' learning through pedagogical content knowledge.** *Science Education International, 9*(4), 21-25.

Describes a project undertaken to increase the pedagogical content knowledge of Pakistani science and math teachers. Presents specific features of the Subject Specialist Teacher Programme in relation to both the contextual quality and relevance of the initiative. Addresses the challenges and possibilities associated with the model as a change agent.

knt, ped, tpd, ref (SE, TE)

Parkinson, John. (1998). **The difficulties in developing information technology competencies with student science teachers.** *Research in Science and Technological Education, 16*(1), 67-78.

Describes the information technology (IT) capabilities of a group of science student teachers. Argues that using IT in the classroom is an essential component of a teacher training course and that progress is hampered by the infrequent use of computers by school mentors.

edt, tpd, skt, ref, ped (TE)

Parkinson, John; Hendley, Dave; Tanner, Howard; Stables, Andrew. (1998). **Pupils' attitudes to science in Key Stage 3 of the National Curriculum: A study of pupils in South Wales.** *Research in Science & Technological Education, 16*(2), 165-176.

Investigates whether the introduction of the National Curriculum has had any significant effect on whether students enjoy science lessons, their perceptions of the importance of science, their attitudes toward practical and non-practical activities in lessons, and their views on how difficult science is to learn. Finds that the involvement of practical applications is the most significant factor in promoting positive attitudes.

ats, cur, ref, ped (SE)

Payne, Phillip. (1998). **Postmodern challenges and modern horizons: Education for being for the environment.** *Environmental Education Research, 5*(1), 5-34.

Argues that a humanly-constructive critical theory of environmental education called 'a critical ecological ontology for educational inquiry' provides a necessary complement to the socially-critical perspective by focusing on our individual and collective being in the world. Explains that a critical ecological ontology highlights the personal politic required for socio-ecological praxis. Discusses three practical applications of a critical ecological ontology that emerge.

ene, phe, sts (HE)

Pedretti, Erminia; Woodrow, Janice; Mayer-Smith, Jolie. (1998). **Technology, text, and talk: Students' perspectives on teaching and learning in a technology-enhanced secondary science classroom.** *Science Education, 82*(5), 569-89.

Reports on a case study, situated within the context of the Technology Enhanced Secondary Science Instruction (TESSI) project, that examines the teaching and learning impact of technology from the perspective of students participating in a long-term study of technology implementation.

edt, ats, mat, ref, ped (SE)

Penner, David E.; Lehrer, Richard; Schauble, Leona. (1998). **From physical models to biomechanics: A design-based modeling approach.** *Journal of the Learning Sciences, 7*(3-4), 429-449.

Examines children's developing understanding of the natural world via the designing, building, testing, and evaluation of models. Finds that students became engaged in investigating the relation between force and the location of the attachment point of the biceps. Contends that students' understanding of the relations between mathematics and science were developed through the construction and interpretation of data tables and graphs.

rem, int, kns, bio, phy, ped (EL)

Peterson, Raymond F.; Treagust, David F. (1998). **Learning to teach primary science through problem-based learning.** *Science Education, 82*(2), 213-237.

Describes the development of a problem-based learning (PBL) framework. Focuses on the development of preservice teachers' knowledge base for teaching and pedagogical reasoning ability.

knt, pbs, ped, cur, tpd (TE)

Pinkerton, K. David. (1998). **Enhancing conceptual learning by understanding levels of language-rich teaching.** *Electronic Journal of Science Education, 3*(1).

Describes a year-long study conducted in 3 high school physics classes to provide empirical support for the existence of levels of language-rich teaching. Presents three levels (low, medium, and high) of language-rich teaching.

cid, ped, phy (HS)

Pirrie, Anne; Wilson, Valerie; Harden, R. M.; Elsegood, John. (1998). **AMEE Guide No. 12. Multiprofessional education: Part 2--Promoting cohesive practice in health care.** *Medical Teacher, 20*(5), 409-16.

Draws data from an interview study of the perceptions of multidisciplinary education in health care. Suggests that multidisciplinary education is neither an easy nor a cheap option and that it requires careful planning.

int, ref, cur, ped, car (PS)

Plummer, Donna M.; Barrow, Lloyd H. (1998). **Ways to support beginning science teachers.** *Journal of Science Teacher Education, 9*(4), 293-301.

Provides a review of the literature as well as methods related to the special needs of beginning science teachers.

cht, res, tpd, (TE)

Price, Besty. (1998). **The importance for preservice teachers to have practice experiences to apply theory to reality.** *Electronic Journal of Science Education, 2*(3).

Reports on case studies of two undergraduates who showed how their level of skills, thinking, and teaching styles improved and expanded with the opportunity to practice what they acquired from their methods courses. Suggests that preservice teachers do better after they have had an opportunity to practice educational theory.

tpd, knt, bio, cbi (TE)

Pruneau, Diane; Chouinard, Omer; Arsenault, Charline. (1998). **The Cap Pele Model.** *Alternatives Journal, 24*(3), 28-31.

Reports on a model of environmental education that aims to encourage greater attachment to the bioregion of Arcadia. Explains how the model results from cooperation within a village community and addresses the environmental education of people of all ages.

cur, ene, sts (ALL)

Pullen, Sharon L. (1998). **Economic and policy determinants of science teacher supply.** *Journal of Research in Science Teaching, 35*(7), 745-55.

Finds significant positive correlations between teacher supply in one or more science subjects and the existence of a broad field science endorsement, the number of hours of science required for a broad field science endorsement, and the number of subjects covered by a broad field science endorse-ment.

cht, ref, (TE, K-12)

Pushkin, David B. (1998). **Introductory students, conceptual understanding, and algorithmic success.** *Journal of Chemical Education, 75*(7), 809-10.

Addresses the distinction between conceptual and algorithmic learning and clarifies what is meant by a "second-tier" student. Explores why novice learners in chemistry and physics are able to apply algorithms without signifi-cant conceptual understanding.

lth, pbs, kns, che, phy (SE, HE)

Radford, David L. (1998). **Transferring theory into practice: A model for professional development for science education reform.** *Journal of Research in Science Teaching, 35*(1), 73-88.

Describes Project LIFE, a state systemic initiatives professional development program for middle-grade life science teachers. Finds the project has been successful in improving the science content knowledge, process skills, and attitudes toward teaching science of the teachers participating in the project. Gives the essential characteristics of this project as a guide for individuals planning or delivering reform-based science education professional development.

tpd, ref, knt, skt, att (ALL)

Raghavan, Kalyani; Sartoris, Mary L.; Glaser, Robert. (1998). **Why does it go up? The impact of the MARS Curriculum as revealed through changes in student explanations of a helium balloon.** *Journal of Research in Science Teaching, 35*(5), 547-567.

Reviews research on children's ideas about floating and sinking. Describes the Model-Assisted Reasoning in Science (MARS) project curriculum and student responses to a question about helium balloons.

rem, lrg, alf, cur, kns (MS)

Raghavan, Kalyani; Sartoris, Mary L.; Glaser, Robert. (1998). **Impact of the MARS curriculum: The mass unit.** *Science Education, 82*(1), 53-91.

Examines the impact of the MARS curriculum mass unit. Describes classroom observations, examination of students' written work, and analysis of protocol data from interviews conducted at the end of each of the three main sections of the curriculum.

cur, rem, lrg, kns, ped (MS)

Ramsden, Phil. (1998). **Science teaching resources: 11-16 year olds. The survey findings.** *Education in Science*(180), 19-21.

Presents answers to a survey on the state of science education for 11-16 year-olds in the United Kingdom. Describes findings on various topics including class size, per pupil expenditure, extent of laboratory technician support, textbook provision, condition of laboratory facilities, reprographics costs, and technology use.

bkg, mat, (SE)

Rannikmae, Miia. (1998). **STL teaching--Theoretical background and practical findings.** *Science Education International, 9*(4), 7-14.

Analyzes Estonian teacher interviews and student responses to open-ended questions about lessons created to promote scientific and technological literacy (STL) on process, attitudinal, and instructional domains.

ats, att, lit, ped, cur, sts (SE)

Ravanis, Konstantinos; Bagakis, George. (1998). **Science education in kindergarten: Sociocognitive perspective.** *International Journal of Early Years Education, 6*(3), 315-27.

Examines didactic strategies used for introducing preschoolers to the natural sciences. Describes general characteristics of activities based on empiricist or Piagetian theory of cognitive development. Discusses a new sociocognitive approach for developing natural-science kindergarten activities within the framework of Neo-Piagetian, socioconstructive, and Vygotskian theories.

lth, ped, cns, bkg , hos (EL)

Reiss, Michael J. (1998). **The representation of human sexuality in some science textbooks for 14-16 year olds.** *Research in Science and Technological Education, 16*(2), 137-49.

Analyzes the ways in which some school science textbooks used with 14-16 year olds in Great Britain portray the topic of human sexuality. Finds that the 15 books examined vary greatly in their approach to the topic.

cur, mat, bio, sts (K-12)

Rennie, Leonie J. (1998). **Gender equity: Toward clarification and a research direction for science teacher education.** *Journal of Research in Science Teaching, 35*(8), 951-961.

Discusses a 1997 symposium, during which speakers raised three issues about gender equity and research: (1) the distinction between the meanings of the terms 'gender' and 'sex;' (2) assuring that science methods classes are gender inclusive; and (3) determining the reasons for changing practice.

eqt, gen, res, tpd, ped (ALL)

Rennie, Leonie J.; Parker, Lesley H. (1998). **Equitable measurement of achievement in physics: High school students' responses to assessment tasks in different formats and contexts.** *Journal of Women and Minorities in Science and Engineering, 4*(2-3), 113-27.

Reports on research that aimed to establish whether patterns of students' reactions to and achievement on physics assessment tasks were associated with the format of the task and the absence or presence of real world contexts in the tasks.

ach, asm, eqt, phy (ALL)

Resnick, Mitchel; Wilensky, Uri. (1998). **Diving into complexity: Developing probabilistic decentralized thinking through role-playing activities.** *Journal of the Learning Sciences, 7*(2), 153-172.

Argues that role-playing activities can be a powerful technique in mathematics and science education, particularly in the study of the new sciences of complexity. Detailed descriptions and analyses of two role-playing activities are presented.

ped, lrg, rem, (ALL)

Rice, Diana C.; Ryan, Joseph M.; Samson, Sara M. (1998). **Using concept maps to assess student learning in the science classroom: Must different methods compete?** *Journal of Research in Science Teaching, 35*(10), 1103-27.

Reports on a year-long study implemented in grade 7 life science classes with the students' regular teacher serving as a teacher researcher. Suggests that concept mapping may be useful in assessing declarative and procedural knowledge.

asm, kns, rem, bio (SE)

Richmond, Gail; Howes, Elaine; Kurth, Lori; Hazelwood, Constanza. (1998). **Connections and critique: Feminist pedagogy and science teacher education.** *Journal of Research in Science Teaching, 35*(8), 897-918.

Shares assignments developed and used by feminist science and teacher educators in undergraduate and graduate teacher education classes. Focuses on students' reactions to these assignments.

att, gen, eqt, tpd, ped (TE)

Richmond, Gail; Neureither, Barbara. (1998). **Making a case for cases.** *American Biology Teacher, 60*(5), 335-42.

Summarizes the process of a reform effort in biology instruction. Describes the use of a case study about cholera epidemics and explains how it enables critical objectives in the science curriculum to be addressed.

bio, ped, ref, cur (K-12)

Richmond, Gail. (1998). **Scientific apprenticeship and the role of public schools: General education of a better kind.** *Journal of Research in Science Teaching, 35*(6), 583-87.

Speculates about the experiences that contribute to the overall development and preparation of a scientist and whether educators can recreate this process to support the development of all students.

ntw, car, nas, bkg (SE, PS)

Rioseco, Marilu; Romero, Ricardo; Pedersen, Jon E. (1998). **Warming up to physics.** *Science Teacher, 65*(1), 24-28.

Examines the interest level of Chilean students in physics and technology in light of unacceptable performance levels in these areas. Finds that relevant thermodynamics problems applicable to students' daily lives generated more interest. Discusses the importance of presentation to student acceptance of the curriculum.

ats, pbs, ped, phy (K-12)

Ritchie, Stephen M. (1998). **The teacher's role in the transformation of students' understanding.** *Research in Science Education, 28*(2), 169-85.

Studies a teacher's role and actions in a science learning community. Interprets two teaching episodes that illustrate how the teacher helps a group of students transform their understanding of electrical circuits.

ped, cns, lrg, phy, cid (K-12)

Robertson, Alistair. (1998). **Engaging students' ecophilosophies in research and teaching.** *Canadian Journal of Environmental Education, 3*, 171-88.

Interprets student teachers' responses to open-ended interview probes concerning the relationship of humans to the nonhuman natural world. Supports the argument for incorporating students' ecophilosophies into instruction in environmental education.

ene, phe, tpd, knt, att (SE, PS)

Robinson, Paulette. (1998). **A necessary evil: A phenomenological study of student experiences of computer conferencing.** *Bulletin of Science, Technology and Society, 18*(1), 38-46.

Presents a phenomenological study of student experience in a computer conference learning environment. Suggests that issues for students in conferences revolved around spatial disorientation. Finds that students grappled with getting into a computer space, familiarity of use, getting stuck, and the class as a necessary evil within spatial issues.

cbi, ats, sks, sts (PS)

Robinson, William R. (1998). **A view of the science education research literature: Visual aids in laboratory manuals improve comprehension.** *Journal of Chemical Education, 75*(3), 282-83.

Argues that visual images can act as conceptual pegs for concepts or complicated procedures and help students perform better in the cognitive, affective, and manipulative domains of the laboratory. Bases conclusions on a study of chemistry laboratory students.

lab, rem, ped, lrg, res, che (HS,PS)

Rodriguez, Alberto J. (1998). **Strategies for counterresistance: Toward sociotransformative constructivism and learning to teach science for diversity and for understanding.** *Journal of Research in Science Teaching, 35*(6), 589-622.

Reports on two types of resistance by preservice science teachers, resistance to ideological change and resistance to pedagogical change. Suggests a sociotransformative constructivist orientation as a vehicle to link multicultural and socioconstructivist theoretical frameworks.

att, cns, mce, eqt, ped, tpd (TE)

Rohrer Jane; Welsch, Sue. (1998). **The Lake Tahoe Watershed Project: A summer program for female middle school students in math and science.** *Roeper Review, 20*(4), 288-90.

Describes a math and science summer program for high-achieving middle school girls. Covers the organization, curriculum, instruction, and outcomes of the program and describes elements that students rated favorably and those which needed to be changed for the second summer.

nfd, gen, fsd, ats, cur (MS)

Rosebery, Ann S.; Puttick, Gillian M. (1998). **Teacher professional development as situated sense-making: A case study in science education.** *Science Education, 82*(6), 649-677.

Presents a case study that explores the ways in which a beginning elementary classroom teacher started to gain proficiency in teaching science. Examines the teacher's experiences learning science in an educational research project and her work in the classroom to bring her students' ideas into contact with accepted scientific ideas and practices. Explores an approach to professional development that engages teachers in learning and viewing science as a socially and historically constituted sense-making practice.

att, nas, tpd, ped, skt, phe (EL, TE)

Ross, John A.; Hogaboam-Gray, Anne. (1998). **Integrating mathematics, science, and technology: Effects on students.** *International Journal of Science Education, 20*(9), 1119 -35.

Compares a school that integrated mathematics, science, and technology in grade 9 to a school in the same district that taught the same courses separately. Discusses the benefits of an integrated learning setting for the students.

int, ref, ped, tec, cur, lrg (SE)

Roth, Wolff-Michael; McGinn, Michelle K.; Bowen, G. Michael. (1998). **How prepared are preservice teachers to teach scientific inquiry? Levels of performance in scientific representation practices.** *Journal of Science Teacher Education, 9*(1), 25-48.

Asks whether teachers are prepared to teach inquiry with the associated transformation and analysis of data. Investigates the extent to which future secondary teachers employ inscriptions in the analysis of a problem in ecology and the nature of the written arguments they provide in support of their answers.

pbs, inq, rem, tpd, ped, ene (TE, SE)

Roth, Wolff-Michael. (1998). **Science and technology studies and science education: A natural match?** *Research in Science Education, 28*(1), 1-7.

Provides a framework for and a guide to the multiple links between the ten articles in this special journal issue that address science and technology and science education. Argues for creating a more accurate image of science.

his, phe, nas, res, sts (ALL)

Roth, Wolff-Michael; McGinn, Michelle K. (1998). **Knowing, researching, and reporting science education: Lessons from science and technology studies.** *Journal of Research in Science Teaching, 35*(2), 213-35.

Discusses how scientific knowledge emerges from the social, natural, political, cultural, historical, and economic contingencies of scientific work. Illustrates the advantages of familiarity with research in science and technology.

phe, nas, res, his, ped (ALL)

Roth, Wolff-Michael. (1998). **Situated cognition and assessment of competence in science.** *Evaluation & Program Planning, 21*(2), 155-169.

Analyzes assessment data gathered in a study of knowing and learning in a mixed classroom, in which a unit on simple machines was taught according to a conception of learning by participation in open-ended design activities. Proposes a framework for understanding variations in cognitive performance across situations.

asm, lth, ped, phy (MS)

Roth, Wolff-Michael. (1998). **Science teaching as knowledgability: A case study of knowing and learning during coteaching.** *Science Education, 82*(3), 357-377.

Investigates what two teachers learned from each other as they engaged in co-teaching an engineering curriculum. Argues that co-teaching afforded experiences that have been shown to arise from co-participation in other domains. Finds that science content and content pedagogical knowledge fully

unfolded only when embedded in and supported by appropriate practical pedagogical knowledge.

knt, ped, skt, tpd (EL)

Roth, Wolff-Michael; McGinn, Michelle K. (1998). **>unDELETE science education:/lives/work/voices.** *Journal of Research in Science Teaching, 35*(4), 399-421.

Develops an analytical framework in which inscription (i.e., grades) and actor networks are the central points. Gives an example of this framework in a case study of grades and grading practices. Shows how the framework can be used to provide constructive poststructuralist analyses and how the efforts of critical and liberation pedagogies are undercut by the stability of existing networks.

res, phe, asm, eqt, ntw (ALL)

Roth, Wolff-Michael; McRobbie, Campbell J.; Lucas, Keith B. (1998). **Four dialogues and metalogues about the nature of science.** *Research in Science Education, 28*(1), 107-18.

Analyzes and explores questions about the dialogic nature of beliefs and students' belief talk about the nature of science and scientific knowledge. Argues that students' discourse is better understood as a textual bricolage sensitive to conversational context.

bfs, phe, nas, cid, rem (K-12)

Rothenberg, Julia Johnson; McDermott, Peter; Martin, Glen. (1998). **Changes in pedagogy: A qualitative result of teaching heterogeneous classes.** *Teaching & Teacher Education, 14*(6), 633-642.

Examines teaching and learning factors in an urban school where studies were taught in heterogeneous classes using cooperative learning methods. Finds that changes in pedagogy and attitude among the teachers that included: more student-centered, interactive classes; greater higher order questioning and critical thinking on the part of both teachers and students; and more enjoyment of the teaching and learning processes.

cpl, ped, att, cur, pbs, tpd (HS)

Rowe, Michael; Hacker, Roger. (1998). **Class size and teaching quality.** *School Science Review, 79*(288), 47-50.

Reports on the replication of a study of teaching styles from the 1970s. Explores possible relationships between class size and the quality of teaching in 60 classrooms. Suggests some reasons why teachers choose teaching strategies that are ineffective.

his, ped, bkg, ref (ALL)

Rowlands, Stuart; Graham, Ted; Berry, John. (1998). **Identifying stumbling blocks in the development of student understanding of moments of forces.** *International Journal of Mathematical Education in Science and Technology, 29*(4), 511-31.

Reports on a small-scale investigation of student understanding of moments of forces to provide some indication as to the nature of intuitive ideas in this area. Finds three stumbling blocks in the conceptual understanding of moment of forces.

alf, kns, phy, lrg (SE)

Rudolph, John L.; Stewart, Jim. (1998). **Evolution and the nature of science: On the historical discord and its implications for education.** *Journal of Research in Science Teaching, 35*(10), 1069-89.

Examines how the theory of evolution was received by the scientific community at the time of its inception in order to provide insight into some of the difficulties that students have in learning important biological concepts.

evo, his, lrg, kns, bio (K-12)

Rye, James A.; Rubba, Peter A. (1998). **An exploration of the concept map as an interview tool to facilitate the externalization of students' understandings about global atmospheric change.** *Journal of Research in Science Teaching, 35*(5), 521-46.

Investigates the effectiveness of two different types of interviews: one that embeds a concept map, and one that does not embed a concept map in order to elicit post-instructional understandings. Focuses on students' understandings of chlorofluorocarbons and their role in global atmospheric change.

rem, kns, lrg, che, sts (SE)

Sadler, Philip M. (1998). **Psychometric models of student conceptions in science: Reconciling qualitative studies and distractor-driven assessment instruments.** *Journal of Research in Science Teaching, 35*(3), 265-96.

Reports on a study that uses psychometric modeling to rank the appeal of a variety of children's

astronomical ideas on a single uniform scale. Supports the view that alternative conceptions may be markers of progress toward understanding.

alf, lrg, esg, asm, rem (K-12)

Saez, Maria Jose; Carretero, Antonia J. (1998). **Evaluating innovation: The case study approach.** *Studies in Educational Evaluation, 24*(1), 25-43.

Characterizes the methodology of case studies, using examples from science education, with regard to their potential for the analysis of innovation and formulation of emerging trends. Argues that the theoretical and empirical support for evaluation will generate a call for negotiation as the formula that regulates the assessment of a program's efficiency and usefulness.

ref, asm, ref (K-12)

Sahlstroem, Fritjof; Lindblad, Sverker. (1998). **Subtexts in the science classroom--an exploration of the social construction of science lessons and school careers.** *Learning & Instruction, 8*(3), 195-214.

Examines female students' work constructed in the science classroom and how their science lessons relate to the construction(s) of their school careers. Uses a sociocultural approach to learning to focus on the students' activities, their interactions with peers and the teacher, and artifacts of science. Finds that differences in the students' grades and classroom social networks seem to be closely mirrored in the classroom interaction. Suggests that an understanding of science learning in education benefits from considering the different situations and strategies of different students.

cid, cns, gen, chs, lrg (SE)

Sandor, M. Kay; Clark, Michele; Campbell, Doris; Rains, Anna P.; Cascio, Rita. (1998). **Evaluating critical thinking skills in a scenario-based community health course.** *Journal of Community Health Nursing, 15*(1), 21-29.

Discusses the influence of a scenario-based community health course on the ability of senior nursing students to address complex problems seen in the community health setting. Finds that improvements were made on the Interpretation and Evaluation subscales and on the total critical thinking score from pretest to posttest for students who completed the course. Finds also that students who completed nursing prerequisites in midsized, 4-yr universities had higher pretest mean score than did other students.

pbs, ped, ach, sks (PS)

Sanera, Michael. (1998). **Environmental education: Promise and performance.** *Canadian Journal of Environmental Education, 3*, 9-26.

Discusses ideas for narrowing the gap between intent and performance when students are taught about environmental issues. Alleges that environmental bias is common in the teaching of environmental issues.

ene, sts, ped, cur, tpd (ALL)

Santiago, Anna M.; Einarson, Marne K. (1998). **Background characteristics as predictors of academic self-confidence and academic self-efficacy among graduate science and engineering students.** *Research in Higher Education, 39*(2), 163-98.

Finds that that at time of entry, women and U.S. minority graduate students in science and engineering have academic credentials and expectations similar to those of their Anglo male peers. Discusses student perceptions of academic preparedness, status-related disadvantages, and expectations about student-faculty interactions as significant predictors for academic self-efficacy and career-related outcomes expectations.

bkg, ats, car, gen, eth, ach (PS)

Schmidt, Hilary. (1998). **Integrating the teaching of basic sciences, clinical sciences, and biopsychosocial issues.** *Academic Medicine, 73*(9).

Discusses the approaches taken to integrating teaching of basic sciences, clinical sciences, and biopsychosocial issues by eight medical schools participating in a large-scale curriculum development project. Addresses the problems encountered, resources needed to support interdisciplinary courses, benefits of integration, and lessons learned.

cur, int, ped, bio, car (PS)

Schmidt, William H.; McKnight, Curtis C. (1998). **What can we really learn from TIMSS?** *Science, 282*(5395), 1830-31.

Discusses some results of the TIMSS and responds to criticisms of that study.

ach, cul, res, ref (ALL)

Scholer, Anne-Marie. (1998). **Issues of gender and personal life for women in academic biology.** *Journal of Women and Minorities in Science and Engineering, 4*(1), 69-89.

Explores issues of gender and personal life that arose during discussions with women scientists about factors contributing to their success in completing training and pursuing an academic career. Describes such issues as gender discrimination, perception of reverse discrimination, efforts toward assisting junior women in science, and the possibility that women practice science in a different manner than male colleagues.

eqt, gen, car, ntw, nas (PS)

Schoon, Kenneth J.; Boone, William J. (1998). **Self-efficacy and alternative conceptions of science of preservice elementary teachers.** *Science Education, 82*(5), 553-568.

Discusses a survey of preservice elementary teachers meant to determine the extent to which they held certain alternative conceptions of science and to determine the relationship between science teaching efficacy and the holding of specific alternative conceptions. Finds that certain alternative conceptions were related to self efficacy.

alf, ats, nas, knt (TE, EL)

Scott, Philip. (1998). **Teacher talk and meaning making in science classrooms: A Vygotskian analysis and review.** *Studies in Science Education, 32,* 45-80.

Uses a theoretical framework derived from Vygotsky's writings to review studies of science classroom discourse interactions between teachers and students. Suggests that shifting the research focus from isolated instructional activities to promote conceptual change toward viewing such activities in the critically influential context of an ongoing flow of discourse could greatly inform teaching practices.

ccg, cid, cns, ped, lth (K-12)

Scruggs, Thomas E.; Mastropieri, Margo A.; Boon, Richard. (1998). **Science education for students with disabilities: A review of recent research.** *Studies in Science Education, 32,* 21-44.

Summarizes recent findings of empirical research in science education concerning students with disabilities. Discusses learning characteristics of disabled students, effective instructional strategies including text-based interventions and inquiry-oriented interventions, and inclusion practices.

chs, ped, mat, hos, inq, res (K-12)

Sebesta, Juraj; Zajac, Rudolf. (1998). **Science and education in a totalitarian regime: The case of Slovakia.** *Science and Education, 7*(3), 225-99.

Reflects on how physics and physics education in Slovakia has been influenced by totalitarian social organization. Focuses on two historical periods, 1939-1945 and 1948-1949.

phy, his, nas, phe, sts (GEN)

Seroglou, Fanny; Koumaras, Panagiotis; Tselfes, Vassilis. (1998). **History of science and instructional design: The case of electromagnetism.** *Science and Education, 7*(3), 261-80.

Addresses two research questions pertaining to the search for students' potential alternate conceptions within the history of science and the possibility of helping students overcome these misconceptions through historical experiments.

ccg, his, alf, ped, phy (HS)

She, Hsiao-Ching. (1998). **Gender and grade level differences in Taiwan students' stereotypes of science and scientists.** *Research in Science & Technological Education, 16*(2), 125-135.

Explores the reasons behind student-held images of science and scientists. Finds that male students were more strongly influenced by public stereotypes of science and scientists at a younger age compared with female students. Demonstrates that parents, peers, and teachers have an impact on students' science-related career choices.

bfs, gen, nas, ats (EL)

Shelton, J. B.; Smith, R. F. (1998). **Problem-based learning in analytical science undergraduate teaching.** *Research in Science & Technological Education, 16*(1), 19-29.

Presents a study of freshman biomedical science students exposed to a problem-based learning curriculum. Describes student attitudes and performance following instruction as compared to previous years under traditional instruction.

ats, ped, pbs, cur, hos (PS)

Sinclair, Anne; Pendarvis, Murray Patton. (1998). **Evolution vs. conservative religious beliefs.** *Journal of College Science Teaching, 27*(3), 167-70.

Describes a study designed to assess students' understanding and acceptance of the credibility of the scientific evidence supporting evolution. Discusses results and implications and offers advice to professors on how to ameliorate the divisiveness resulting from this controversy.

evo, bfs, alf, bio, nas, tpd (PS)

Sindhu, R. S.; Sharma, Reeta. (1998). **Practicable taxonomy of basic skills of science practicals at secondary level for their assessment.** *Science Education International, 9*(2), 34-37.

Explains a taxonomy of basic skills of science practicals that is used in the assessment of secondary science students. Details the assessment scheme, which involves the evaluation of students through laboratory practical examinations, observational assessment, and written records of academic sessions.

asm, lab, sks, pbs (SE)

Skeff, Kelley M.; Stratos, Georgette A.; Bergen, Merlynn R.; Regula, Donald P., Jr. (1998). **A pilot study of faculty development for basic science teachers.** *Academic Medicine, 73*(6), 701-04.

Investigates the effectiveness of the Stanford Faculty Development program of nine small-group seminars designed to provide teachers with a framework for analyzing teaching and identifying areas for improvement and to provide training in specific teaching skills. Finds that the program has significant potential for enhancing teaching effectiveness of basic science instructors.

ped, tpd, skt, ref, car (PS, TE)

Smith, Frances M.; Hausafus, Cheryl O. (1998). **Relationship of family support and ethnic minority students' achievement in science and mathematics.** *Science Education, 82*(1), 111-25.

Identifies those aspects of family support that have the most influence on students' learning in mathematics and science. Examines the relationship of the mother's support and participation to the eighth-grade minority child's score on standardized tests.

bkg, ach, eth, (MS)

Smith, Michael Steven; Laws, Richard Anthony. (1998). **Tracking the modern geoscience undergraduate--a University of North Carolina case study.** *Journal of College Science Teaching, 27*(5), 312-16.

Challenges the accepted American view that the modern undergraduate student takes longer to graduate than the traditional four years. Evaluates a 10-year record of geoscience students who graduated from three programs.

chs, esg, car, (PS)

Sneider, Cary I.; Ohadi, Mark M. (1998). **Unraveling students' misconceptions about the Earth's shape and gravity.** *Science Education, 82*(2), 265-284.

Analyzes the effectiveness of a constructivist-historical teaching strategy in changing students' misconceptions about the earth's shape and gravity. Describes the impact of the treatment on students' understanding of the earth's shape and gravity concepts.

alf, cns, his, esg, kns, ped (EL, MS)

Souter, N. T. (1998). **A balanced way of teaching semi-circular canals?** *School Science Review, 79*(289), 61-64.

Summarizes research into how children perceive three-dimensional objects. Focuses on the difficulty that students have in appreciating how the orientation of the semicircular canals affects balance and space perception.

rem, sks, lrg, bio, res (SE, PS)

Soyibo, Kola. (1998). **An assessment of Caribbean integrated science textbooks' practical tasks.** *Research in Science & Technological Education, 16*(1), 31-41.

Analyzes the structure and skill level of the tasks in the practical activities prescribed in process-oriented integrated science textbooks for Caribbean pupils. Finds that most of the tasks are structured and deductive in approach with an emphasis on low-level inquiry skills. Suggests that it is doubtful that the tasks increase students' ability to carry out open-ended scientific investigations.

mat, sks, int, inq (SE)

Soyibo, Kola; Figueroa, Marceline. (1998). **ROSE and nonROSE students' perceptions of five psychosocial dimensions of their science practical activities.** *Research in Science Education, 28*(3), 377-85.

Compares Reform of Secondary Education (ROSE) students' and non-ROSE students' perceptions of five psychosocial dimensions of their science practical tasks, including student cohesiveness, open-endedness, integration, rule clarity, and material environment.

ats, cur, pbs, bkg, sks (SE)

Spence, Mary. (1998). **Measurement in primary science and maths.** *Primary Science Review*(53), 6-9.

Reports on a study of children aged 10-11 years exploring forces. Reveals a gap between the ways that measurement is used in mathematics and the ways it is used in science. Reviews the focus of the National Numeracy Project.

int, lit, cur, lrg (EL, PS)

Spitulnik, Michele Wisnudel; Krajcik, Joseph. (1998). **Technological tools to support inquiry in a science methods course.** *Journal of Computers in Mathematics and Science Teaching, 17*(1), 63-74.

Discusses how to promote scientific and technological literacy within a science methods course. Describes the rationale for the design of the course, the structure of the course, prospective students, the types of technological tools, the integration of those tools into the course with examples of student-constructed artifacts, and challenges experienced throughout the course.

edt, lit, tpd, inq, skt (TE)

Sprod, Tim. (1998). **"I can change your opinion on that": Social constructivist whole class discussions and their effect on scientific reasoning.** *Research in Science Education, 28*(4), 463-80.

Describes how constructivist-based discussions in the science classroom were elicited through the application of an intervention model for effective whole-class discussion based on the "Philosophy for Children" program. Finds that the experimental class experienced significantly greater gains in scientific reasoning than the control group. Contends that the discussion transcripts support theoretical accounts of how scientific reasoning improvement occurs.

cns, cid, pbs, ped (MS)

Staer, Helen; Goodrum, Denis; Hackling, Mark. (1998). **High school laboratory work in Western Australia: Openness to inquiry.** *Research in Science Education, 28*(2), 219-28.

Uses data from a survey of Perth lower secondary science teachers to determine the nature of the laboratory work undertaken by their students. Finds low levels of inquiry learning.

inq, cur, lab, att, ref (SE)

Staver, John R. (1998). **Constructivism: Sound theory for explicating the practice of science and science teaching.** *Journal of Research in Science Teaching, 35*(5), 501-20.

Responds to critics of constructivism and asserts that constructivism is a sound theory that explains the practice of science and science pedagogy. Offers a constructivist account of some long-standing epistemological issues.

cns, ped, nas, phe (K-12)

Stewart, Gay; Osborn, Jon. (1998). **Closing the gender gap in student confidence: Results from a University of Arkansas physics class.** *Journal of Women and Minorities in Science and Engineering, 4*(1), 27-42.

Compares male and female perceptions of and confidence in an experimental physics class at the University of Arkansas. Finds that women made statistically significant gains in confidence and attitude toward science in the experimental course compared with students in a traditional course.

ats, gen, cur, phy, ped (PS)

Stewart, Mary. (1998). **Gender issues in physics education.** *Educational Research, 40*(3), 283-293.

Considers differences in ability and attitude toward physics still remaining between males and females who had made a positive decision to study the subject beyond the compulsory minimum level. Finds that gender differences were still apparent.

ats, gen, phy, car (SE)

Stofflett, Rene' T. (1998). **Putting constructivist teaching into practice in undergraduate introductory science.** *Electronic Journal of Science Education, 3*(2).

Examines the process that one instructor of undergraduate introductory science underwent when she attempted to execute constructivist teaching into practice. Explains how the instructor met the four criteria for conceptual change. Gives recommendations for facilitating pedagogical conceptual change into constructivist college science teaching practices.

ccg, cns, ped, lrg, ref (PS, TE)

Stylianidou, Fani; Boohan, Richard. (1998). **Understanding why things happen: Case-studies of pupils using an abstract picture language to represent the nature of changes.** *Research in Science Education, 28*(4), 447-62.

Describes a study of six 12-year-old students who were followed during an eight-month course using "Energy and Change" curricular materials, which introduce ideas related to the Second Law of Thermodynamics through an abstract picture language. Concludes that students had higher levels of generalization in their explanations of physical, chemical and biological change. Proposes that teachers should be instructed in the use of these project materials.

rem, mat, kns, lrg, cur (MS)

Suarez, Mercedes; Pias, Rosa; Membiela, Pedro; Dapia, Dolores. (1998). **Classroom environment in the implementation of an innovative curriculum project in science education.** *Journal of Research in Science Teaching, 35*(6), 655-671.

Analyzes the perceptions of students, teachers, and external observers in order to study the influence of classroom environment on the implementation of an innovative project in science education.

ats, att, bkg, cur, ref (HS)

Summers, Mike; Kruger, Colin; Mant, Jenny; Childs, Ann. (1998). **Developing primary school teachers' understanding of energy efficiency.** *Educational Research, 40*(3), 311-328.

Reports about the preconceptions of efficiency displayed by six primary school teachers, and the ways in which these became more scientific following in-service training. Suggests that ideas about energy efficiency (a scientific concept) need to be taught explicitly and distinguished from energy conservation.

att, skt, tpd, (EL)

Supovitz, Jonathan A. (1998). **Gender and racial/ethnic differences on alternative science assessments.** *Journal of Women and Minorities in Science and Engineering, 4*(2-3), 129-40.

Explores gender and racial differences on two science alternative assessments, an open-ended paper-and-pencil assessment and a hands-on performance assessment. Notes significant differences in achievement.

asm, cul, gen, (EL,SE)

Swaak, Janine; van Joolingen, Wouter R.; de Jong, Ton. (1998). **Supporting simulation-based learning: The effects of model progression and assignments on definitional and intuitive knowledge.** *Learning & Instruction, 8*(3), 235-252.

Reports on a comparison of intuitive knowledge and definitional knowledge for students using computer simulations with model progression and assignments of small exercises. Finds a small gain in definitional knowledge for three tested conditions. Finds also that the gain in intuitive knowledge was considerable and differed across the experimental groups in favor of the conditions in which assignments and/or model progression were present.

cbi, edt, kns, phy (HS)

Taber, Keith S. (1998). **An alternative conceptual framework from chemistry education.** *International Journal of Science Education, 20*(5), 597-608.

Argues that many students of chemistry demonstrate alternative conceptions about some fundamental aspects of chemistry. Suggests that research evidence provides strong support for this view.

ccg, che, res, (PS)

Talisayon, Vivien M. (1998). **Evaluation of clientele impact of scienceexhibits.** *Science Education International, 9*(1), 31-36.

Explores the use of an impact evaluation model across time and clientele groups that is used to evaluate exhibits from two science centers in Manila. Finds that students prefer exhibits that produce sound, light, and motion.

ats, nfd, res, (EL,SE)

Tamir, Pinchas; Ziv, Sari. (1998). **Self-reported views of Israeli junior high school teachers on science teaching and learning.** *Research in Science & Technological Education, 16*(2), 115-124.

Investigates how Israeli junior high school science teachers perceived and implemented the science curriculum in 1994-95. Reports on teachers' job characteristics, perceived constraints, professional

activities, perceptions of preparedness and readiness to deliver the curriculum, instructional strategies, views on science learning, educational goals, and assessment strategies.

att, cur, cht, (EL)

Taylor, Christopher. (1998). **Environmental education in primary education: Status and trends in Southern and Eastern Africa.** *Environmental Education Research, 4*(2), 201-15.

Presents the results of an international comparative study into the status of environmental education. Concludes that the current provisions for environmental education for primary children in Nigeria are insufficient for the development of national programs.

cul, ene,, cur (EL)

Thirunarayanan, M. O. (1998). **An exploratory study of the relationships among science, technology, and society (STS) issues as conceived by fifth grade students.** *Journal of Elementary Science Education, 10*(1), 60-75.

Explores students' conceptions of the relationships among 31 environmental issues using multidimensional scaling analysis. Suggests that both male and female Grade 5 subjects develop meaningful conceptions of relationships among issues which have personal relevance to them.

ene, sts, rem (EL)

Tirosh, Dina; Stavy, Ruth; Cohen, Shmuel. (1998). **Cognitive conflict and intuitive rules.** *International Journal of Science Education, 20*(10), 1257-69.

Studies the role of intuitive rules in science and mathematics education. Describes the effect of two intuitive rules on students in grades 7-12 as they perform tasks related to mathematical and physical objects.

int, pbs, lsy (SE)

Trend, Roger. (1998). **An investigation into understanding of geological time among 10- and 11-year-old children.** *International Journal of Science Education, 20*(8), 973-88.

Focuses on British children's understanding of geologic time as they participated in related activities. Indicates that 10- and 11-year-old children lack a clear chronology of geologic events.

kns, (EL,SE)

Trumper, Ricardo. (1998). **A longitudinal study of physics students' conceptions of energy in pre-service training for high school teachers.** *Journal of Science Education and Technology, 7*(4), 311-18.

Discusses the results of a four-year study of the conceptions of energy held by science teachers in training. Concludes that the group held a number of different alternative conceptual frameworks.

bfs, tpd, (SE, PS)

Tsai, Chin-Chung. (1998). **An analysis of scientific epistemological beliefs and learning orientations of Taiwanese eighth graders.** *Science Education, 82*(4), 473-89.

Explores the interaction between scientific epistemological beliefs and learning orientations in a group of Taiwanese eighth grade students. Suggests the importance of employing a constructivist philosophy in the classroom.

cns,phe, rem, ats (MS)

Tsaparlis, Georgios. (1998). **Dimensional analysis and predictive models in problem solving.** *International Journal of Science Education, 20*(3), 335-50.

Proposes a simple predictive model for multistep problems and compares the model's predictions with actual data. Examines mechanisms that may block the solution or lead to violation of the model.

lth, pbs, rem, lrg (SE)

Tunnicliffe, Sue Dale. (1998). **Boy talk/girl talk: Is it the same at animal exhibits?** *International Journal of Science Education, 20*(7), 795-811.

Explores the responses of primary school groups to animal exhibits. Suggests more similarities than differences by gender.

ats, bio, gen, chs (EL)

Valverde, Gilbert A.; Schmidt, William H. (1998). **Refocusing U.S. math and science education.** *Issues in Science and Technology, 14*(2), 60-66.

Concludes that differences in performance on the TIMSS at different grade levels are due to unfocused curriculum, a static conception of basics, dispersed control, and splintered versus integrated reform.

cul,cur, ref, (EL)

van der Veer, Rene. (1998). **From concept attainment to knowledge formation.** *Mind, Culture, & Activity, 5*(2), 89-94.

Outlines Vygotsky's distinction between everyday and scientific concepts in education, and traces what happens to everyday concepts once a child enters school. Argues that Vygotsky's distinction was plausible and fruitful, but that it was problematic in its details and its application in actual schooling. Claims that Vygotsky's legacy can be criticized on both theoretical and empirical grounds, and urges Vygotskians to continue this process.

cns, his,, alf (GEN)

Van Driel, Jan H.; De Vos, Wobbe; Verloop, Nico; Dekkers, Hetty. (1998). **Developing secondary students' conceptions of chemical reactions: The introduction of chemical equilibrium.** *International Journal of Science Education, 20*(4), 379-92.

Describes an empirical study concerning the introduction of the concept of chemical equilibrium in chemistry classrooms in a way which challenges students' initial conceptions of chemical reactions.

ccg, che, ped (SE)

Van Driel, Jan H.; De Vos, Wobbe; Verloop, Nico. (1998). **Relating students' reasoning to the history of science: The case of chemical equilibrium.** *Research in Science Education, 28*(2), 187-98.

Relates the reasoning of students introduced to the concept of chemical equilibrium to the historical development of the concept. Concludes that the study of authentic historical sources may inspire the design of effective teaching activities.

che, his, ped, (SE)

van Driel, Jan H.; Verloop, Nico; de Vos, Wobbe. (1998). **Developing science teachers' pedagogical content knowledge.** *Journal of Research in Science Teaching, 35*(6), 673-95.

Discusses the concept of pedago ıl content knowledge within the context of scie. :e teaching. Defines the concept and identifies teaching experience as the major source of pedagogical content knowledge.

knt, ped, rem (TE)

VanTassel-Baska, Joyce; Bass, George; Ries, Roger; Poland, Donna; Avery, Linda D. (1998). **A national study of science curriculum effectiveness with high ability students.** *Gifted Child Quarterly, 42*(4), 200-211.

Assesses the growth of students' integrated science process skills after students were taught a science unit based on the Integrated Curriculum Model developed specifically for gifted learners. Describes the Integrated Curriculum Model, which stresses advanced content, high-level process and product skills, and a concept dimension.

cur, sks, int, chs (EL)

van Zee, Emily H. (1998). **Preparing teachers as researchers in courses on methods of teaching science.** *Journal of Research in Science Teaching, 35*(7), 791-809.

Discusses meanings of the term 'teacher research,' a rationale for preparing teachers to do research as they learn to teach, and ways to educate prospective teachers as researchers.

res, tpd, (EL, TE)

Vaughan, Melina N.; Sumrall, Joe; Rose, Lucinda H. (1998). **Preservice teachers use the newspaper to teach science and social studies literacy.** *Journal of Elementary Science Education, 10*(2), 1-19.

Investigates the effectiveness of using the newspaper to teach science and social studies in grades K-6. Uses semantic mapping and attitudinal measures from preservice teachers, inservice teachers, and elementary students to measure the effectiveness of this technique. Finds positive attitudes and a substantial increase in conceptual awareness.

lit, ats, att, ped, sts (EL)

Venville, Grady J.; Treagust, David F. (1998). **Exploring conceptual change in genetics using a multidimensional interpretive framework.** *Journal of Research in Science Teaching, 35*(9), 1031-1055.

Describes a study of changes in students' conceptions of genes during genetics instruction. Finds that, ontologically, most students moved from passive to active models of genes. Argues that, affectively, students were interested in genetics but unmotivated by microscopic mechanistic explanations; however, teaching approaches were simplistic. Contends that, epistemologically, most students held intelligible or plausible--but not fruitful--conceptions.

alf, ccg, phe, bio, lrg (HS)

Venville, Grady; Wallace, John; Louden, William. (1998). **A state-wide change initiative: The primary science teacher-leader project.** *Research in Science Education, 28*(2), 199-217.

Suggests that the results of TIMSS rank Western Australia as first in the world in science. Examines a statewide curriculum reform initiative that focuses on primary level science teacher leaders.

cul, cur, tpd, ref (EL)

Vesilind, Elizabeth M.; Jones, M. Gail. (1998). **Gardens or graveyards: Science education reform and school culture.** *Journal of Research in Science Teaching, 35*(7), 757-75.

Describes what happens when two lead teachers in a statewide reform project try to change science teaching in their schools. Illustrates the importance of patience in reform implementation and the need for sensitive study of early change within school contexts.

att, ref, bkg (K-12, TE)

Vidal-Abarca, Eduardo; Sanjose, Vicente. (1998). **Levels of comprehension of scientific prose: The role of text variables.** *Learning & Instruction, 8*(3), 215-234.

Investigates the role played by two types of textual changes -- those aimed at improving the relationships within text ideas, and those aimed at producing better links between text ideas and the reader's knowledge -- on shallow and deep levels of comprehension. Finds that: main idea performance was affected by improving the relationships within text ideas, both textual changes contributed separately to recall, and problem solving increased only when the two changes were presented together.

sks, pbs, mat, lrg (HS)

Vlaardingbroek, Barend. (1998). **Challenges to reform: Botswana junior secondary school science teachers' perceptions of the development functions of science education.** *International Journal of Educational Reform, 7*(3), 264-70.

Finds that Botswana junior-level science teachers reported mediocre performance for socioeconomic developmental functions over the past decade when surveyed concerning their views on science education's development functions. Argues that the system seems to work well at combatting the HIV/AIDS virus, preparing students for further study, and instilling some environmental awareness, but less well at preparing young people for self-employment.

att, sts, bkg, car (SE)

Volkmann, Mark J.; Anderson, Maria A. (1998). **Creating professional identity: Dilemmas and metaphors of a first-year chemistry teacher.** *Science Education, 82*(3), 293-310.

Uses a hermeneutic phenomenological research perspective to analyze the teaching journal of a first year chemistry teacher: Describes the process of creating a professional identity for the science teacher through examination of three dilemmas the teacher experienced, the metaphors she created, and the identity she constructed.

att, tpd, skt, che (TE)

Vosniadou, Stella; Ioannides, Christos. (1998). **From conceptual development to science education: A psychological point of view.** *International Journal of Science Education, 20*(10), 1213-20.

Describes a theoretical framework for science education based on cognitive/developmental research. Argues that science learning is a gradual process during which initial conceptual structures based on children's everyday experiences are continually restructured.

lth, ccg, alf, kns (K-12)

Wang, Jianjun. (1998). **Comparative study of student science achievement between United States and China.** *Journal of Research in Science Teaching, 35*(3), 329-36.

Compares the achievement in science for ninth grade students in China and the United States. Reveals a small difference between the two groups and presents a rationale for the comparison.

cul, ach, asm, cur, lit (HS)

Weaver, Gabriela C. (1998). **Strategies in K-12 science instruction to promote conceptual change.** *Science Education, 82*(4), 455-472.

Describes a study of three suburban schools that sought to understand the science classroom environment and to propose changes in methodology.

ccg, cid, ped, hos (ALL)

Webb, Norman L. (1998). **Conditional equity metrics as tools for evaluating equity in schools and education systems.** *Journal of Women and Minorities in Science and Engineering; v4 n2-3 p141-60 1998, 4*(2-3), 141-160.

Comments on the fact that conditional equity metrics report differences in performance among groups of students given one or more conditions under which that performance may have been influenced. Discusses their use as a tool for evaluating equity.

eqt, ref, res, asm (ALL)

Welch, Wayne W.; Huffman, Douglas; Lawrenz, Frances. (1998). **The precision of data obtained in large-scale science assessments: An investigation of bootstrapping and half-sample replication methods.** *Journal of Research in Science Teaching, 35*(6), 697-704.

Argues that science educators often face the problem of non-normal distributions when conducting large-scale assessments or evaluating national curriculum projects that require complex sampling plans. Examines the precision of science test scores.

res, asm, ach, cur (K-12)

White, Barbara Y.; Frederiksen, John R. (1998). **Inquiry, modeling, and metacognition: Making science accessible to all students.** *Cognition & Instruction, 16*(1), 3-118.

Reports on the instructional trials of the ThinkerTools Inquiry curriculum by teachers in urban classrooms. Describes the curriculum, which centers around a metacognitive model of research called the Inquiry Cycle, and a metacognitive process of student reflection called Reflective Assessment.

asm, cur, inq, sks, res, lrg (SE)

Wiesenmayer, Randall L.; Koul, Ravinder. (1998). **Integrating Internet resources into the science classroom: Teachers' perspectives.** *Journal of Science Education and Technology, 7*(3), 271-77.

Presents teacher perspectives of the impact of Internet usage on their teaching practices. Uses semi-structured interviews and two online surveys to provide data from teacher participants in the West Virginia K-12 RuralNet Project.

att, edt, ped, (ALL)

Wikle, Thomas A. (1998). **A comparison of geographic membership patterns in three national environmental organizations.** *Journal of Environmental Education; v29 n3 p39-48 Spr 1998, 29*(3), 39-48.

Compares geographic membership patterns for three national environmental organizations to determine if similar membership patterns exist for different types of environmental organizations. Finds strong similarities in the spatial patterns of membership among the groups. Concludes that all three organizations had higher membership ratios in northeastern, western, and Rocky Mountain states and lower ratios in the Midwest and South.

ene, nfd, (AD)

Wilson, Janice M. (1998). **Differences in knowledge networks about acids and bases of year-12, undergraduate and postgraduate chemistry students.** *Research in Science Education, 28*(4), 429-46.

Analyzes differences in the status of ontological categories on the concept maps of secondary-, undergraduate- and graduate-level chemistry students with the "Pathfinder" scaling algorithm and multidimensional scaling. Finds differences among groups in the structural significance of abstract process-related nodes and matter-related nodes on the topic of acid-base equilibria. Discusses implications for theories of conceptual change.

rem, kns, ccg, che, lth (SE, PS)

Windschitl, Mark; Andre, Thomas. (1998). **Using computer simulations to enhance conceptual change: The roles of constructivist instruction and student epistemological beliefs.** *Journal of Research in Science Teaching, 35*(2), 145-60.

Investigates the effects of a constructivist versus objectivist learning environment on college students' conceptual change using a computer simulation of the human cardiovascular system as an instructional tool.

ccg, cns, cbi,, phe, kns (PS)

Winn, Pauline. (1998). **Crossing the bridge from GCSE to A-level chemistry: What do the students think?** *PSSI Forum (Past Sixteen Science Issues)*(25), 8-9.

Reports on a study that explores student perspectives on the transfer to A-level chemistry from GCSE

chemistry. Explores the attitudes of groups of new A-level chemistry students at a sixth-form college.

ats, che, cur, ref (PS)

Winslow, Joseph; Smith, Doug. (1998). **Virtual interns in the field: Pre-service educators as online mentors to at-risk middle school science students.** *Electronic Journal of Science Education, 3*(2).

Describes an exploratory study in which undergraduate education majors mentored at-risk middle school science students using real-time (synchronous) chat technology. Describes the program, in which mentors and mentees met in web-based chat rooms three times a week for six weeks to discuss concepts relevant to the science curricula.

bkg, tec, skt, tpd, ntw (MS, TE)

Wistedt, Inger. (1998). **Assessing student learning in gender inclusive tertiary mathematics and physics education.** *Evaluation & Program Planning, 21*(2), 143-153.

Presents a study of the merits and the limitations of an assessment method based on an intentional perspective and implemented in an inclusive educational program at the tertiary level of university education. Describes how an interdisciplinary assessment procedure can promote critical reflection on the ways in which a subject matter is perceived in different disciplines and academic genres.

asm, cur, gen, res (PS)

Woodward, Catherine; Woodward, Nicholas. (1998). **Welsh primary school leavers' perceptions of science.** *Research in Science & Technological Education, 16*(1), 43-52.

Examines whether children had adopted negative perceptions of science at the time that they left primary school, and whether the introduction of the National Curriculum in England and Wales in 1989 influenced students' attitudes.

ats, ref, cur. (EL)

Wright, Lynne; Wiggins, Di; Sinclair, Catherine. (1998). **Jane's story.** *Primary Science Review; n52 p25-27 Mar-Apr 1998*(52), 25-27.

Presents an update on the Association for Science Education (ASE) Primary Science Committee's five-year study of children's scientific development. Uses a questionnaire and asks the same questions each year in order to see how and when children change their ideas. Focuses on one student who is five years old.

kns, lrg, lth, lit (EL)

Wylie, Judith; Sheehy, Noel; McGuinness, Carol; Orchard, Gerry. (1998). **Children's thinking about air pollution: A systems theory analysis.** *Environmental Education Research, 4*(2), 117-37.

Uses a methodology for probing systems-thinking, developed and used to investigate the way children think about the natural environment. Finds that eight-year-old children are capable of this type of systems-thinking.

ene, kns, lth, lrg, pbs (EL)

Yerrick, Randy. (1998). **Reconstructing classroom facts: Transforming lower track science classrooms.** *Journal of Science Teacher Education, 9*(4), 241-70.

Identifies and clarifies an interpretation of scientific discourse that can be used as a lens for viewing problems of teaching science. Discusses why reform visions for science education are reasonable, desirable, and yet problematic in lower track classrooms.

cid, ref, ped, bkg, chs (SE)

Yerrick, Randy K.; Pedersen, Jon E.; Arnason, Johanes. (1998). **"We're just spectators:" A case study of science teaching, epistemology, and classroom management.** *Science Education, 82*(6), 619-648.

Examines the interaction of two contrasting epistemological treatments of science in a high school physics class and the subsequent classroom management techniques influenced by these beliefs. Identifies a range of epistemological commitments found during surveys, interviews, and observations of a physics teacher and his students.

nas, ped, phe, cid (HS)

Yeung, Stephen Pui-Ming. (1998). **Environmental consciousness among students in senior secondary schools: The case of Hong Kong.** *Environmental Education Research, 4*(3), 251-68.

Examines the level of environmental consciousness of students in an educational system where curriculum objectives are shaped by public examinations. Finds that respondents have only

a limited understanding of environmental issues, especially in regard to objectives like synthesis and evaluation.

lit, kns, ene, sts (SE)

Yip, Din Yan. (1998). **Children's misconceptions on reproduction and implications for teaching.** *Journal of Biological Education, 33*(1), 21-26.

Probes certificate-level students' understanding of the menstrual cycle by analyzing their performance on a multiple-choice item in a public examination. Finds that many students showed problems in relating the time of conception to the condition of the uterine lining. Suggests that conceptual development can be promoted by classroom instruction that avoids excessive factual detail, establishes meaningful connections between new and existing concepts, and takes into account students' prior knowledge.

ccg, alf, ped, bio (PS)

Yip, Din-yan. (1998). **Identification of misconceptions in novice biology teachers and remedial strategies for improving biology learning.** *International Journal of Science Education, 20*(4), 461-77.

Uses an instrument designed to identify misconceptions in biology to reveal that novice biology teachers hold a number of conceptual errors which are also prevalent among secondary science students.

knt, alf, bio, kns (SE, PS)

Yip, D. Y.; Chung, C. M.; Mak, S. Y. (1998). **The subject matter knowledge in physics related topics of Hong Kong junior secondary science teachers.** *Journal of Science Education and Technology, 7*(4), 319-28.

Assesses the subject matter competence in physics of inservice junior secondary science teachers in Hong Kong. Concludes that teachers lack subject area knowledge. Discusses general implications for educational improvement.

knt, phy, tpd, ref (SE, TE)

Yore, Larry D.; Craig, Madge T.; Maguire, Tom O. (1998). **Index of science reading awareness: An interactive-constructive model, test verification, and grades 4-8 results.** *Journal of Research in Science Teaching, 35*(1), 27-51.

Seeks to develop and verify the Index of Science Reading Awareness (ISRA) based on a model of an efficient, successful interactive-constructive science reader and three independent metacognitive awareness domains. Finds no support for the assumption about the three independent metacognitive awareness domains and also finds that students have surface knowledge about science reading, science text, and science reading strategies.

kns, lth, sks, lrg (EL)

Yu, Fu-Yun. (1998). **The effects of cooperation with inter-group competition on performance and attitudes in a computer-assisted science instruction.** *Journal of Computers in Mathematics and Science Teaching, 17*(4), 381-95.

Explores the relative effects of cooperation with and without inter-group competition on Taiwanese students' academic achievement in science and their attitudes toward science in a computer-assisted instruction environment.

cbi, cpl, ach, ats (K-12)

Zeidler, Dana L. (1998). **Visions: Teachers' perceptions of reform goals in science education.** *Science Educator, 7*(1), 38-46.

Discerns high school teachers' perceptions of and commitment to the contemporary goals of science education. Suggests that a minority of teachers hold past goal orientations and that secondary science teachers are moving to embrace current goals.

att, ref, (K-12)

Zohar, Anat; Schwartzer, Noa; Tamir, Pinchas. (1998). **Assessing the cognitive demands required of students in class discourse, homework assignments, and tests.** *International Journal of Science Education, 20*(7), 769-82.

Investigates the scope and nature of tasks demanding students' application of higher order thinking skills while studying biology in junior and senior high schools in Israel.

cid, lrg, sks, bio, ped (SE)

Zuckerman, June Trop. (1998). **Science supervisors' stories: A way to communicate pedagogical values.** *Science Educator; v7 n1 p20-24 Spr 1998, 7*(1), 20-24.

Relates stories told by science supervisors about a novice science teacher each had supervised. Analyzes the metaphorical statements the

supervisors made about teachers and teaching. Concludes that autobiographical stories can be used to communicate values about teaching.

cht, tpd, res (TE)

Journals Searched

The number of science education research articles indexed from each journal is indicated in parentheses.

Academic Medicine (2)
Alternatives Journal (1)
American Biology Teacher (2)
American Educational Research Journal (1)
Applied Developmental Science (1)
Australian Science Teachers' Journal (2)
Biochemical Education (1)
Bulletin of Science, Technology and Society (2)
Canadian Journal of Environmental Education (2)
Cognition & Instruction (2)
Contemporary Educational Psychology (1)
Ecologist (1)
Education in Science (2)
Educational Research (2)
Electronic Journal of Science Education (9)
Environmental Education Research (8)
European Journal of Engineering Education (2)
Evaluation & Program Planning (2)
Gender and Education (1)
Gifted Child Quarterly (1)
Gigiena i Sanitariya (1)
Green Teacher (1)
Informal Learning Review (1)
International Journal of Early Years Education (1)
International Journal of Educational Reform (1)
International Journal of Mathematical Education in Science and Technology (1)
International Journal of Science Education (32)
Issues in Science and Technology (1)
Japanese Journal of Educational Psychology (1)
Journal of Biological Education (1)
Journal of Chemical Education (9)
Journal of College Science Teaching (7)
Journal of Community Health Nursing (1)
Journal of Computers in Mathematics and Science Teaching (7)
Journal of Educational Psychology (3)
Journal of Elementary Science Education (4)
Journal of Environmental Education (7)
Journal of Experiential Education (1)
Journal of Experimental Education (1)
Journal of Higher Education (1)
Journal of Interactive Learning Research (2)
Journal of Learning Disabilities (1)
Journal of the Learning Sciences (5)
Journal of Research in Science Teaching (57)
Journal of Science Education and Technology (8)
Journal of Science Teacher Education (8)
Journal of Women and Minorities in Science and Engineering (13)
Learning & Instruction (4)
Medical Teacher (2)
Meridian (1)
Mind, Culture, & Activity (1)
Physics Education (1)
Physiologist (1)
Primary Science Review (5)
PSSI Forum (Past Sixteen Science Issues) (2)
Reports of the National Center for Science Education (1)
Research in Higher Education (1)
Research in Middle Level Education Quarterly (1)
Research in Science Education (20)
Research in Science and Technological Education (15)
Roeper Review (1)
School Science and Mathematics (4)
School Science Review (10)
Science (1)
Science and Education (9)
Science Education (25)
Science Education International (7)
Science Educator (2)
Science Teacher (3)
Sociology of Education (1)
South African Journal of Higher Education (2)
Studies in Educational Evaluation (1)
Studies in Science Education (5)
Teaching and Change (1)
Teaching & Teacher Education (1)

Science Education Research Papers, Monographs, and Electronic Documents

Lynda C. Titterington & Youngsun Kwak
The Ohio State University

Listed here are 114 papers, monographs, and electronic documents in science education research. The papers and monographs were produced in 1998 and abstracted in the ERIC database by the end of July, 1999. The electronic documents are listed as they appeared on the Internet in September or October, 1999. Some URLs are given as search or index screens when actual document URLs are unwieldy. Each entry is coded (see *Key to Codes*, page *ix*) with one to three major codes (in bold type) and up to three minor codes, as well as the educational level (in parentheses). All entries are indexed by major codes in the *Research Directory* (see page 1).

Clune, William. (1998). *Toward a theory of systemic reform: The case of nine NSF statewide systemic initiatives. A NISE Research Monograph.* Madison, WI: National Institute for Science Education. [Available online.] Retrieved October 19, 1999 from the World Wide Web. [http://www.wcer.wisc.edu/nise/Publications/Research_Monographs/RM16-Toward_a_Theory_of_SR.html]

This paper tests the central thesis of systemic reform and derives lessons about strengths and weaknesses of actual reform strategies that are used in policy and practice. The case studies collect similar kinds of data for all nine systemic reform efforts operating during 1992-1996, thus permitting a methodologically controlled "snapshot" of parallel reforms.

ref (K-12)

Committee on Dimensions, Causes, and Implications of Recent Trends in Careers of Life Scientists. (1998). *Trends in the early careers of life scientists.* Washington, DC: National Research Council. [Available online.] Retrieved October 18, 1999 from the World Wide Web. [http://books.nap.edu/html/trends/]

This report examines the changes that have occurred over the last 30 years in graduate and postgraduate training of life scientists and the nature of their employment on completion of training. It suggests reasons for the decrease in the number of young scientists applying for NIH grants and the growing "crisis in expectation" that grips young life scientists who face difficulty in achieving their career objectives.

car, bio (PS)

Cooper, James; Robinson, Pamela. (1998). *Small-group instruction: An annotated bibliography of science, mathematics, engineering, and technology resources in higher education. A NISE Occasional Paper.* Madison, WI: National Institute for Science Education. [Available online.] Retrieved October 19, 1999 from the World Wide Web. [http://www.wcer.wisc.edu/nise/Publications/Occasional_Papers/OP6-Small-group.html]

Provides answers to questions about small-group instruction concerning the differences between cooperative learning and other forms of small-group instruction; research and theory in cooperative learning in higher education; and sources for using cooperative learning in SMET disciplines. For each question, the authors identify resources that provide additional information, and then identify 99 additional resources that may be of value to SMET researchers and practitioners.

cpl, lth, cid, res (PS)

Eveland, William P. Jr.; Dunwoody, Sharon. (1998). *Surfing the Web for science: Early data on the users and uses of The Why Files. A NISE Brief, Vol. 1 No. 2.* Madison, WI: National Institute for Science Education. [Available online.] Retrieved October 18, 1999 from the World Wide Web. [http://www.wcer.wisc.edu/nise/Publications/Briefs/Vol_2_No2/index.html]

This Brief offers an initial look at one science Web site, The Why Files, to understand how the Web can be used to enhance science-related learning. The Brief offers a preliminary look at the expertise and finances required to develop and maintain a site

like The Why Files, patterns of site usage, and user characteristics.

edt, lrg (ALL)

Gance, Laura Lee. (1998). *Understanding interdisciplinary teamwork: Challenges for research and practice.* Madison, WI: National Institute for Science Education. [Available online.] Retrieved October 18, 1999 from the World Wide Web. [http://www.wcer.wisc.edu/nise/Publications/Workshop_Reports_n_Proceedings/WR5-Understanding_Interdisciplinary_Teamwork.html]

This report provides a synopsis of the issues and ideas that emerged during a 1997 conference in which the National Institute for Science Education (NISE) brought together faculty members of NISE and other individuals with special expertise or experience pertaining to interdisciplinary collaboration and problem solving.

ref, int, pbs (ALL)

Hammrich, Penny L. (1998). *A head start on science: Improving the capacity of families and teachers to promote and enhance the lives of children.* Philadelphia, PA: Mid-Atlantic Regional Educational Laboratory. [SE061755]

This digest provides an overview of the Head Start on Science (HSS) program, which is designed to encourage science literacy of preschool children in Head Start programs and to improve the capacity of Head Start teachers, assistants, and parents. The goals of HSS are to broaden participants' science knowledge and conceptions, to enhance participants' ability to use scientific inquiry, and to integrate HSS with the core curriculum.

lit, cur, inq, ref, tpd (EC)

Harwell, Sharon H. (1998). *Space orientation for professional educators: Program evaluation and effectiveness.* Paper presented at the Southern Area Annual Meeting of the National Science Teachers Association (Birmingham, AL, November 20, 1998). [SE062359]

This evaluation of mini-conferences conducted for Alabama teachers who completed training in the 1996 Summer Space Orientation for Professional Educators (SOPE) examines the effectiveness of follow-up sessions for teachers and provides baseline data regarding teachers' knowledge of and attitudes toward teaching science.

esg, knt, tpd, att (K-12)

Haslam, M. Bruce; Turnbull, Brenda J.; Humphrey, Daniel C. (1998). *Eisenhower mathematics and science education Regional Consortia program: Final evaluation report.* Columbus, OH: Eisenhower National Clearinghouse. [SE061365]

This report analyzes the contributions that the 10 Eisenhower Regional Mathematics and Science Education Consortia have made to the nation's effort to reform mathematics and science education. The data presented in this report were collected largely in the spring of 1996 through surveys, interviews, site visits, and review of a variety of documents. Survey procedures, instruments, and program indicators are included in appendices.

tpd, ref, edt (K-12)

Haury, David L. (Ed.) (1998). *RISE 96: An annotated listing of research in science education published during 1996.* Columbus, OH: ERIC Clearinghouse for Science, Mathematics and Environmental Education. [SE061226]

This publication presents an annotated listing of the research in science education that was reported in 1996. The listing includes doctoral dissertations, journal articles, conference papers, and other documents. This one-year snapshot provides an overview of the field for experienced researchers, doctoral students, and practitioners who use research findings.

res (ALL)

Haury, David L.; McCann, Wendy Sherman (Eds.) (1998). *Annual summary of research in science education '97.* Columbus, OH: ERIC Clearinghouse for Science, Mathematics and Environmental Education. [SE061977]

This document is an annotated listing of research in science education reported during 1997. The listing includes doctoral dissertations and master's theses; journal articles and conference papers; electronic documents; and other items. The 1997 listing represents the first time an attempt has been made to incorporate electronic documents available on the World Wide Web and to include articles from

journals less familiar to science educators. Each entry is assigned major and minor codes representing the topic(s) of the research. An index at the end of the volume characterizes the entries by major codes.

res (ALL)

Henderson, David G.; Fisher, Darrell L.; Fraser, Barry J. (1998). *Learning environment, student attitudes and effects of students' sex and other science study in environmental science classes.* Paper presented at the Annual Meeting of the American Educational Research Association (San Diego, CA, April 13-17, 1998). [SE061522]

This study uses the Environmental Science Learning Environment Inventory (ESLEI) to measures high school students' perceptions of the learning environment students their environmental science classes. The study also investigates associations between attitudes and students' perceptions of the learning environment and differences in student perceptions based on their gender and participation in another science course. Results indicate student cohesion, involvement, and task orientation are most strongly associated with positive attitudes.

ats, cid, ene, gen, bkg (SE)

Henriques, Laura. (1998). *Maximizing the impact of your inservice: Designing the inservice and selecting participants.* Paper presented at the Annual Meeting of the Association for the Education of Teachers of Science (Minneapolis, MN, January 8-11, 1998). [SE061075]

This paper summarizes the research base for effective inservice and describes the features of Science PALs (Science: Parents, Activities and Literature), a four-year systemic reform effort. Data collected related to teachers' beliefs and perceptions of teaching were compared to their actual teaching as well as demographics, survey responses, and interviews. The results indicated that newer teachers were more likely to implement the Science PALs model. Teachers reported much higher levels of implementation than their teaching performance indicated.

tpd, att, knt, skt (TE)

Herbert, Bruce; Bednarz, Sarah; Boyd, Tom; Blake, Sally; Harder, Vicki; Sutter, Marilyn. (1998). *Effective integration of the World Wide Web in earth science education.* [SE061176]

This paper characterizes the student body enrolled in GEOL 101 and also assesses the effectiveness of the associated class Web sites in terms of their ability to foster student learning, the capacity for complex problem solving, lifelong learning, and effective interpersonal interaction.

edt, esg, cid, sks, pbs, sts (PS)

Hollenbeck, James Edward. (1998). *Science, Technology and Society: An American approach to environmental education in practice in Iowa schools.* Paper presented at the Annual Meeting of the Foundation for Environmental Education in Europe (Kranj, Slovenia, September 24, 1998). [SE061908]

The author makes a case for considering science one of the humanities by describing the use of a Chautauqua Model in the state of Iowa to affect teacher attitude and behavior. Included in the model are a two-week experience with science, technology, and society teaching and learning (STS); a two and a half day short course; planning and using a 20-day STS module; identification of local resources; and a follow-up short course. A discussion of the positive effects of STS instruction is included.

sts, tpd, att, knt, skt (TE)

Howie, Sarah; Hughes, Colleen A. (1998). *Mathematics and science literacy of final-year school students in South Africa.* Pretoria, South Africa: Human Sciences Research Council. [SE061710]

This report provides detailed information about TIMSS and highlights the results related to mathematics and science literacy of final year school students in South Africa. It also discusses the results of students who took the TIMSS in their final year of schooling in detail and South African students' background.

chs, ach, lit (SE)

Howse, Melissa A. (1998). *Student ecosystems problem solving using computer simulation.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (San Diego, CA, April 19-22, 1998). [SE061389]

This study examines the performance of biology majors who have taken one ecology course at the university 300-level as they used an ecosystems modeling tool (Environmental Decision Making, EDM) that allows users to pose their own problems

and seek satisfying solutions.

pbs, cbi, rem, ene, bio, lrg (PS)

Howse, Melissa A. (1998). *Biology and physics students' beliefs about science and science learning in non-traditional classrooms.* Paper presented at the Annual Meeting of the American Educational Research Association (San Diego, CA, April, 1998). [SE061390]

This study focuses on preservice elementary education students' understanding of science and science learning as a meaning-making activity. Student reflection books were used to describe these beliefs during a 15-week, nontraditional, inquiry-based biology or physics course. A coding scheme was developed to describe and compare beliefs about science with beliefs about learning. Student beliefs of science making were different from their beliefs about science learning, possibly owing to their firmer beliefs about science teaching.

nas, att, phe, att, knt (TE)

Huntley, Mary Ann. (1998). *Theoretical and empirical investigations of integrated mathematics and science education in the middle grades.* Paper presented at the Annual Meeting of the American Educational Research Association (San Diego, CA, April 16, 1998). [SE061564]

This study examines middle school integrated mathematics and science education from theory and in practice. The theoretical component of this research addresses the ill-defined nature of integrated mathematics and science education, and presents the Math/Science Continuum as a conceptual framework to lend clarity and precision. The theoretical framework guided the design and implementation of a qualitative investigation of two case studies of middle school integrated mathematics and science education.

int, lth, cur (MS)

Jarrett, Denise. (1998). *Integrating technology into middle school mathematics: It's just good teaching.* Portland, OR: Northwest Regional Educational Laboratory. [SE062248]

The aim of this publication is to help teachers incorporate technology into learning activities. Chapters emphasize issues concerning mathematics and science education standards, teaching and learning with technology, ensuring equity, common instructional technology, succeeding with minimal resources, and changing classroom roles.

ref, edt, ped, eqt, cur, skt (MS)

Jelinek, David John. (1998). *Student perceptions of the nature of science and attitude towards science education in an experiential science program.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (April 19-22, 1998). [SE061354]

This case study addresses attitudes and perceptions within an experiential context. Middle school student perceptions of science education were investigated by looking at attitudes toward instructional variables and perceptions of the nature of science, and then experiential education was considered as an approach to enhance attitudes and perceptions while improving students' understanding of science. The results distinguish between pre- and post-perceptions and attitudes, discuss themes of enhanced images of science and scientists, and propose a model to improve student perceptions of the nature of science.

ats, nas, cns, ped (MS)

Jimenez-Aleixandre, Maria Pilar; Diaz de Bustamente, Joaquin ; Duschl, Richard A. (1998). *Scientific culture and school culture: Epistemic and procedural components.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (71st, San Diego, CA, April 19-22, 1998). [SE061309]

This paper discusses the elaboration and application of "scientific culture" categories to analyze student discourse while solving problems in inquiry contexts. The data are drawn from case studies, in the context of a project about students' reasoning and argumentation in high school and university. Results from observation, videotaping, and audiotaping of students while working in groups solving problems about biology and physics showed that students use epistemic and procedural operations in a way related to scientific culture.

cid, pbs, cpl, phe (HS, PS)

Jita, Loyiso. (1998). *Resources for transforming science education: The context and practice of high school science teaching.* EPU Working Paper No. 15.

Durban, South Africa: University of Natal Education Policy Unit. [SE061579]

This paper presents an analysis of the educational resources needed for transformation in schools. The paper presents both the context of science education and the teaching practices of science teachers as potential resources that can be marshaled to facilitate the transformation of science education in schools. The results suggest that huge potential for school change exists in teachers' knowledge, time available, human and textual resources, and various teaching practices that feature a transformative engagement.

att, knt, ref, cur, ped (SE)

Johnson, Eugene G.; Siegendorf, Adriane. (1998). *Linking the National Assessment of Educational Progress (NAEP) and the Third International Mathematics and Science Study (TIMSS): Eighth-grade results.* Washington, DC: National Center for Education Statistics. [SE061691]

This is one of two reports about the linking of NAEP results to TIMSS results for grade 8 mathematics and science. It describes the types of linking approaches considered, the method used to develop the linking functions, the sources of variability that affect the variance of the linking functions, and the validation and results obtained for grade 8 mathematics and science.

ach, asm, res (MS)

Johnson, Jean M.; Regets, Mark C. (1998). *International mobility of scientists and engineers to the United States--Brain drain or brain circulation?* Arlington, VA: National Science Foundation. [SE061680]

This issue brief discusses student flows into the Unites States higher education system, the stay rates of foreign doctoral recipients, and their short and long term employment in United States industry, universities, and government.

car, sts, tec, cul (PS)

Johnson, Jean M. (1998). *Statistical profiles of foreign doctoral recipients in science and engineering: Plans to stay in the United States.* An SRS Special Report. Arlington, VA: National Science Foundation. [SE062017]

This issue brief discusses student flows into the United States higher education system; the stay rates of foreign doctoral recipients; and their short and long term employment in United States industry, universities, and government.

car, cul, sts (PS)

Jones, Leslie S. (1998). *The myth of meritocracy and delusions of equity: Cultural impediments to diversity in natural science programs.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (71st, San Diego, CA, April 19-22, 1998). [SE061297]

This study examines social aspects of the sciences and its role in the scarcity of women and of men of color in science. Interviews with science faculty examined gender and racial/ethnic issues in the professional domain for clues as to how the culture of science might influence demographic participation in science programs. Although scientists believe their training in the scientific method removes subjectivity from their treatment of people, the interviews indicate that people in the sciences are not treated equitably.

car, eqt, bkg, phe, gen, eth (PS)

Kahle, Jane Butler; Rogg, Steven R. (1998). *Bridging the gap: Equity in systemic reform. A pocket panorama of the landscape study, 1997.* Oxford, OH: Ohio Systemic Initiative--Discovery. [SE061405]

The Pocket Panorama presents the findings of a study to examine the landscape of Ohio's Statewide Systemic Initiative (Discovery) to reform science and mathematics education. The funding includes identifying barriers (community and school resources, teaching practices, student attitudes) that may result in achievement differences among groups of students, as well as state funding to improve the college education of all teachers of science and mathematics.

eqt, ref, ach, tpd (TE, K-12)

Kahle, Jane Butler. (1998). *Measuring progress toward equity in science and mathematics education.* Madison, WI: National Institute for Science Education. [SE061850]

This NISE Brief makes a case for reform that addresses multiple parts of an educational system, and increases the access, retention, and achievement of students from all subgroups in science and

mathematics education programs. It is recommended that program evaluators develop guideposts that include an equity metric as a way to measure progress toward equity. A chart of research validated indicators of equity and an initial equity plan for a central city school corporation are presented.

eqt, ref, ach (ALL)

Kahle, Jane Butler. (1998). *Reaching equity in systemic reform: How do we assess progress and problems? A NISE Research Monograph.* Madison, WI: National Institute for Science Education. [Available online.] Retrieved October 18, 1999 from the World Wide Web. [http://www.wcer.wisc.edu/nise/Publications/Research_Monographs/RM9Reachingequityinsystemic.html]

This paper analyzes educational equity in science and mathematics and proposes a practical way to assess equity in systemic reform. Based on an analysis of NELS:88, High School and Beyond, and TIMSS, indicators of equity are proposed. The efficacy of those indicators is analyzed by a review of the pertinent literature, and an equity metric is developed.

eqt, ref, asm, res (SE)

Keiser, Kellie K.; Nelson, Jennifer E.; Norris, Norma A.; Szyszkiewicz, Stephen. (1998). *NAEP 1996 Science Cross-State Data Compendium for the Grade 8 Assessment. Findings from the National Assessment of Educational Progress for the State Science Assessment.* Washington, DC: Office of Educational Research and Improvement. [SE061472]

This document, intended as a companion to the Science Report Card and the Science State Report, presents results of the NAEP 1996 state assessment for grade 8 along with national and regional results from the NAEP 1996 National Assessment. Chapter 1 presents the results for the nation, the four regions, and the participating jurisdictions in the context of the overall average science scale scores and scale scores for the fields of science and the type of school. Chapter 2 presents scores for selected population subgroups. Chapters 3 through 7 relates the results to student, teacher, and school characteristics.

asm, ach, bkg, ref (K-12)

Kennedy, Mary. (1998). *Form and substance in inservice teacher education. A NISE Research Monograph.* Madison, WI: National Institute for Science Education. [Available online.] Retrieved October 18, 1999 from the World Wide Web. [http://www.wcer.wisc.edu/nise/Publications/Research_Monographs/RM13-Form_and_Substance.html]

This paper reviews studies of inservice programs that aim to enhance mathematics and science teaching. It focuses exclusively on studies that examine effects of programs on student learning. The review suggests that the differences among programs that mattered most were differences in the content that was actually provided to teachers, not difference in program forms or structures.

lrg, cur, tpd (TE)

Kesner, Miri; Hofstein, Avi; Ben-Zvi, Ruth. (1998). *Reflections on teachers' in-service training while introducing a new teaching unit on industrial chemistry to the chemistry curriculum in Israeli high schools.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (71st, San Diego, CA, April 19, 1998). [SE061355]

This report presents part of a five-year study on the incorporation of industrial chemistry in the Israeli high school curriculum. The goals of the study were to gain information on teachers' formal education and their attitudes about teaching this subject, as well as the contribution of inservice training to their needs. Findings from questionnaires and interviews suggested that inservice training of chemistry teachers hardly touches on industrial chemistry and few teachers experienced industrial chemistry prior to inservice training.

che, att, knt, tpd, sts (SE, TE)

Kim, Yung-Soo; Germann, Paul J.; Patton, Martha. (1998). *Study of concept maps regarding the nature of science by preservice secondary science teachers.* Paper presented at the Annual Meeting of the National Science Teachers Association (Las Vegas, NV, April 16-19). [SE061386]

This goals of this study include determining the views of preservice teachers about the nature of science, documenting their use of concept mapping and electronic journaling in exploring concepts

related to the nature of science, and examining the evidence they use to support their arguments in the electronic journaling. The results suggest that students rely on figuring out a point for themselves rather than turning to research, theory, or authority. Students generally provide low levels of support for their ideas while carrying on their electronic journaling discussions.

nas, knt, ped, phe, att (TE, SE)

Klammer, Joel. (1998). *An overview of techniques for indentifying, acknowledging and overcoming alternate conceptions in physics education.* 1997-98 Klingenstein Project paper. [SE061720]

This paper surveys the techniques and ideas of a large number of researchers who are seeking solutions to problems related to the nature of physics students' knowledge, the identification of alternative conceptions, and methods to overcome misconceptions. Background for a discussion of effective teaching methodology is provided by examining the nature of knowledge within the classroom and the shortfalls of educational models. The authors propose three techniques for overcoming alternative conceptions.

alf, asm, phy, ccg, kns, ped (SE, PS)

Klepper, Nancy H. ; Barufaldi, James P. (1998). *The induction years: Pathways and barriers to effective practice for the middle school science teacher.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (April 19-22, 1998). [SE061346]

This qualitative study explored philosophies, life experiences, educational preparation, classroom techniques, and limitations that affect teaching efficacy for six middle school science teachers with one to four years of experience. The data identified personal characteristics and experiences typical of effective novices, barriers that discourage teachers from remaining in the profession, techniques that contribute to a successful learning environment, and suggestions to help new teachers cope with the stress associated with the induction years.

knt, cht, bkg (MS)

Korpan, Connie A.; Bisanz, Gay L.; Bisanz, Jeffrey; Lynch, Mervyn A. (1998). *CHARTS: A tool for surveying young children's opportunities to learn about science outside of school.* [SE061258]

This report reviews the development of a structured interview protocol to identify the nature and scope of children's science-related activities outside of school. The protocol, Community and Home Activities Related to Technology and Science (CHARTS), comprises a version for preschool (CHARTS/PS) and school age (CHARTS/SA) children. The PS version was revised to include questions about a wider range of activities. This report includes a discussion of the original protocol and its modifications as well as suggestions for modifying the protocol for other research purposes.

res, kns, bkg (EC, EL)

Kuh, William; Simmons, Jerry; Sorge, Carmen; Whittle, Christopher. (1998). *Group study on adult learning at the Explora Science Center, Albuquerque, New Mexico, USA.* [SE061195]

This research presents a qualitative and quantitative study on adult learning in an informal, hands on setting with the goals of observing and determining the learner characteristics that are crucial to the learning experience, and determining the multicultural use factors in a culturally diverse community. Included are statistical information about who visits which exhibits for what period of time. The findings indicate that there age, gender, and ethnicity affects adult visitors' interactions with the exhibits.

mce, nfd, hos, mat, lsy (ALL)

Larson, Jane O.; Mayer, Naomi; Kight, Cynthia; Golson, Catherine. (1998). *Narrowing gaps and formulating conclusions: Inquiry in a science teacher action research program.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (71st, San Diego, CA, April 19-22, 1998). [SE061308]

This paper describes a professional development program in which teachers conducted research projects to inform their understanding of student learning and achievement, and to increase their awareness of the value of disciplined inquiry to answer questions about teaching and learning. The data included group discussions, electronic mail correspondences, personal journals, written reports, videotaped presentations, and surveys of the practitioners' research experiences. Findings suggest that action research helps refine practice and is an effective means of increasing student achievement.

tpd, res, knt, lrg, ach (TE)

Lebowitz, Stacy J. (1998). *Use of Vee maps in a college science laboratory.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (71st, San Diego, CA, April 19-22, 1998). [SE061421]

This study describes how students in an introductory course in hydrology used a Vee map to guide their laboratory investigation. At the end of the investigation, students complete a survey evaluating their perceptions about using the Vee map approach over the traditional, direct laboratory approach. The results of this study suggest that Vee maps have the potential to stimulate more thinking and learning than is commonly experienced in the traditional laboratory format.

lab, ped, lsy, esg, ats (PS)

Lee, Okhee. (1998). *Current conceptions of science achievement in major reform documents and implications for equity and assessment. A NISE Research Monograph.* Madison, WI: National Institute for Science Education. [Available online.] Retrieved October 18, 1999 from the World Wide Web. [http://www.wcer.wisc.edu/nise/Publications/Research_Monographs/RM12-Current_Conceptions_of_Science.html]

This paper reviews documents on science content standards (NSES and Project 2061), performance standards (New Standards), and large-scale assessment frameworks (1996 NAEP and TIMSS). The results indicate that there is an overall agreement on the conceptions of science achievement. Although equity is emphasized, science achievement is defined in the tradition of Western science. Alternative perspectives from multiculturalism, feminism, critical theory, and postmodernism are considered to develop a broader conception to include students from diverse backgrounds.

ref, eqt, asm, mce, phe (K-12)

Letts, William J. I. V. (1998). *Boys will be boys (if they pay attention in science class).* Paper presented at the Annual Meeting of the American Educational Research Association (Chicago, IL, April 17, 1998). [SE061788]

This paper interrogates what masculine construction and practice of science means to boys (and by extension, to girls as well) in the science classroom. Using data gathered during primary school science lessons, it examines how school science recapitulates a hegemonic version of masculinity that is middle class. The author discusses implications for the discipline of science and for the science classrooms, in terms of the structure of the curriculum and the pedagogies used to convey that curriculum.

gen, nas, phe, cur, eqt (EL)

Lin, Huann-Shyang. (1998). *Promoting pre-service science teachers' understanding about the nature of science through history.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (April 19-22, 1998). [SE061334]

This study used a quasi-experimental design to identify the benefit of teaching chemistry through history to students in the last two years of a teacher preparation program. One group learned how to develop and teach chemistry through the history of science and the control group used standard practices. Analysis of covariance revealed that the experimental group outperformed the control regarding their understanding of the nature of science and scientific observations, and the function of theories and creativity.

nas, his, knt, che, tpd (TE)

Lin, Wan-Ju. (1998). *The efforts of restructuring biology teaching by a constructivist teaching approach: An action research.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (April 19-22, 1998). [SE061351]

This study reports the improvement of a teacher researcher's practice by adopting a constructivist approach for teaching. The nervous system, human circulatory system, evolution, and vertebrate classification were selected as topics of study to illustrate a model of biology teaching. Data from student responses to open-ended discussion questions, attitude surveys, interviews, and document analysis indicated that students show positive attitudes towards cooperative learning and increased understanding of the nature of science.

cns, ats, cpl, nas, cur, bio (SE)

Lopez-Ferrao, Julio E.; Warner, Linda Sue. (1998). *1998 Program Effectiveness Reviews (PER) Report*

Statewide Systemic Initiatives (SSI) Program December 17, 1997. Arlington, VA: National Science Foundation. [SE061280]

This report addresses the following indicators of progress and achievement: student impact, teacher impact, policy changes, resource changes, management change, data utilization, learning infrastructure change, student performance, and partnerships. The review was designed to gain a full understanding of the appropriately documented, effectively measured, significant, and reliable indicators by which progress is assessed as per the Statewide Systemic Initiative Program objectives.

ref, res, tpd, asm, cur (K-12, TE)

Luft, Julie A. (1998). *Inquiry-based demonstration classrooms: An in-service model for science teachers.* Paper presented at the Annual Meeting of the American Educational Research Association (San Diego, CA, April 13-17, 1998). [SE061529]

This study explores how an Inquiry Based Demonstration Classroom (IBDC) professional development program affects the extended inquiry instruction of secondary science teachers, and how teachers view their extended inquiry practice while involved in the IBDC professional development program. Participants were observed while enacting extended inquiry lessons, and data was recorded on the Extended Inquiry Observational Rubric and analyzed for changes in eight categories using a dependent t test.

tpd, inq, ped (SE)

Martins, Isabel P. (1998). *Teachers' conceptions about their understanding of societal science issues.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (71st, San Diego, CA, April 19-22, 1998). [SE061302]

This study investigated how Portuguese teachers judge their own knowledge about science-related social issues. The survey involved 464 teachers from primary school to university level, teaching science and nonscience courses. The issues, selected on the basis of their social relevance, included radioactivity, consumer education, environmental problems, and food. The results indicated that over fifty percent of the teachers thought that they knew very little or just a little about the majority of the themes. The authors argue that this situation could put the scientific literacy of their students at risk.

sts, knt, lit, att (K-12, TE)

Mascazine, John R. (1998). *The learning styles of monozygotic twins studying science.* Paper presented at the Annual Meeting of the Consultation of the International Consortium for Research in Science and Mathematics Education (7th, Trinidad, West Indies, February 26-28, 1998). [SE061229]

This study explores the learning styles of monozygotic twins with the aim of discovering patterns and emergent themes of benefit to educators, parents, and twins. Fifty pairs of twins participated in the study, and the data was collected from in-depth interviewing, grounded surveys, document analysis, and the use of a learning styles instrument. The results indicate that twins exhibit great similarity in motivation for studying science and unique communication patterns.

lsy, car, chs (ALL)

Mascazine, John R.; Titterington, Lynda; Khalaf, Ali K. (1998). *Cloning: What are their attitudes? A report on the general attitudes of a sample of midwestern citizens.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (71st, San Diego, CA, April 19-22, 1998). [SE061292]

This study explored the knowledge of the general population regarding cloning and sought to determine where people gather information on cloning. Findings indicated that participants realize their knowledge about cloning is limited and inadequate for making informed decisions; few were able to relate cloning to all its applications or uses; most were unsure if they used products developed or made from cloning technology. The most frequently reported source of information was television news and magazines; however, respondents cited libraries and the Internet as resources for the most factual information.

lit, sts, kns, bio, nfd (AD)

Mathew, Nishi M.; Barufaldi, James P.; Bethel, Lowell J. (1998). *The effect of electronic networking on preservice elementary teachers' science teaching self-efficacy.* Paper presented at the Annual Meeting of the National Assocation for Research in Science

Teaching (San Diego, CA, April 19-22, 1998). [SE061828]

In this study, electronic networking was introduced as a means to provide a social context in which preservice elementary teachers could learn collaboratively, share and reflect upon science teaching experiences and practices, conduct teleresearch, and meet the demands of student teaching through peer support. Networking included electronic mail, newsgroups, listserv, world wide web access, and electronic mentoring. Findings from quasi-experimental pretest posttest control group design suggest that electronic networking is beneficial.

att, ntw, tpd, knt (EL, TE)

Mayer, Naomi; Kight, Cindy. (1998). *Umm...I think: Student formulated conclusions to science activities.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (71st, San Diego, CA, April 19-22, 1998). [SE061307]

This paper reports a collaborative research project conducted by two first grade teachers that focuses on the use of hands-on science activities in an integrated science curriculum. Data from student interviews, a student survey, and student science journals compare oral language ability versus written language ability, show the effect of an inadequate scientific vocabulary on science learning, and the various paths taken to get a correct answer. The relationship between a teacher and her mentor is also discussed.

hos, int, lrg, ped, cur, tpd (EL, TE)

McGinnis, J. Randy; Watanabe, Tad; Kramer, Steve. (1998). *A longitudinal assessment of teacher candidates' attitudes and beliefs in a reform-based mathematics and science teacher preparation program.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (71st, San Diego, CA, April 19-22, 1998). For related document, see SE 061 547. [SE061545]

This paper reports a longitudinal study to measure teacher candidates' attitudes and beliefs about the nature of and the teaching of mathematics and science using the Attitudes and Beliefs about the Nature of and the Teaching of Mathematics and Science instrument. The authors report how candidates' attitudes and beliefs evolved over a two-year period. The results indicate that candidates' attitudes and beliefs moved in the desired direction on all five subscales of the instrument.

att, bfs, nas (TE)

McGinnis, J. Randy; Watanabe, Tad. (1998). *The use of research to inform the evaluation of the Maryland Collaborative for Teacher Preparation.* Paper presented at the Annual Meeting of the American Educational Research Association (San Diego, CA, April 13-17, 1998). [SE061546]

This paper reflects on how the research program conducted in the Maryland Collaborative for Teacher Preparation (MCTP) informs the evaluation of the project. The paper presents an overview of the MCTP and the MCTP research program, a literature review on evaluation and research, and the use of MCTP research to inform evaluation.

asm, res, tpd (TE)

McGinnis, J. Randy; Simmons, Patricia. (1998). *Teachers' perspectives of teaching science-technology-society in local cultures: A socio-cultural analysis.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (San Diego, CA, April 19-22, 1998). [SE061615]

This study describes and interprets five teachers' classroom practices of infusing STS into the science curriculum after they completed an inservice educational experience. The results indicate that the teachers perceived themselves as outsiders to the perceived school culture and decreased their teaching of controversial issues. The findings suggest that teacher education experiences must include opportunities for practitioners to consider how their beliefs about the local school cultures may affect teaching practices.

sts, att, ped, cur, tpd, knt (TE)

Melear, Claudia T.; Alcock, Martha W. (1998). *Learning styles and personality types of African American children: Implications for science education.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (April 19-22, 1998). [SE061353]

This study correlates the learning styles of African American children as described in the literature are related to the temperaments defined by the

Myers Briggs Type Indicator (MBTI). Analysis of the data show learning style differences among African American youth and a population of white male students, and that the learning styles of African Americans have more heterogeneity than previously reported.

lsy, eth, chs, lrg (K-12)

Millar, Susan B. (1998). *Indicators of success in postsecondary SMET education: Shapes of the future. Synthesis and proceedings of the Third Annual NISE Forum.* Madison, WI: National Institute for Science Education. [Available online.] Retrieved October 18, 1999 from the World Wide Web. [http://www.wcer.wisc.edu/nise/Publications/Workshop_Reports_n_Proceedings/WR6-Indicators_of_Success.html]

This document presents the written records of the Third Annual National Institute for Science Education (NISE) Forum on indicators of success in postsecondary science, mathematics, engineering and technology (SMET) education. These Proceedings comprise the opening keynote, a digest of the three panel discussions, the remarks of panel discussants, a synthesis of participants' observations written after each panel discussion (think pieces), the closing reflections, an analysis of the participants' theories of change, and the presenters' papers.

ref, res (SE)

Morrell, Patricia D.; Andrews, Gail Glick. (1998). *Factors affecting undergraduate women's consideration of graduate study in science.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (April 19-22, 1998). [SE061331]

This study attempts to identify the critical attitudes and concerns of female undergraduate students considering graduate study in the sciences. It considers the factors the women feel contribute to their interest and success in the sciences to that point and the barriers they perceive they needed to overcome in continuing their studies. The findings may provide insights to science educators and career counselors for developing and implementing interventions to increase the participation of women in science careers.

gen, car, ats, eqt (PS)

Mueller, Jennifer C.; Zeidler, Dana L. (1998). *A case study of teacher beliefs in contemporary science education goals and classroom practices.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (71st, San Diego, CA, April 19-22, 1998). [SE061300]

This qualitative study examines to what extent high school teachers' beliefs in contemporary science education goals are embedded in routine classroom practice. Data gathered from a learning community-based high school sensitive to reform issues included video, observer field-notes, interviews, reflexive journals, and responses to a contemporary goals survey. Examples from transcripts of connections between teacher beliefs and classroom practices and implications for further research are included.

bfs, cid, ped, att (HS)

Mullis, Ina V. S.; Martin, Michael O.; Beaton, Albert E.; Gonzalez, Eugenio J.; Kelly, Dana L.; Smith, Teresa A. (1998). *Mathematics and science achievement in the final year of secondary school. IEA's Third International Mathematics and Science Study.* Chestnut Hill, MA: TIMSS International Study Center. [SE061227]

This report, part of TIMSS, presents the results of a 24 nation study of math and science achievement for students in their final year of secondary school. The data is organized into broad categories related to mathematics and science literacy, contexts for achievement in mathematics and science, and advanced mathematics and physics achievement. The appendices provide information related to the development of the TIMSS tests, sample sizes and population rates, compliance with sampling guidelines, and the test-curriculum matching analysis.

ach, cul, lit, sks, pbs (HS)

Murfin, Brian ; Go, Vanessa. (1998). *A model for the development of Web-based, student-centered science education resources.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (71st, San Diego, CA, April 19-22, 1998). [SE061349]

This study presents a two-year experiment in web-based genetics education. A university team worked with a high school biology class and a middle school

science class to develop a World Wide Web site to teach molecular genetics in fun and engaging ways. Pairs of high school and middle school students worked on genetics research projects by gathering survey data in their schools and data from the Web. Interactive Web pages and a webboard guided students during their research. Data sources included genetics and technology literacy surveys, webboard postings, and interviews with teachers and students. The study identified factors related to Web design and implementation and used them to develop a model of student-centered web-based science instruction.

cbi, res, bio, lit, sts, kns (SE, PS)

Norman, John; Stein, Mary; Moussiaux, Sandra; Clay-Chambers, Juanita. (1998). *The effect of the Detroit Urban Systemic Initiative on perceived instructional practice and curriculum adequacy.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (71st, San Diego, CA, April 19-22, 1998). [SE061314]

This study examined the influence of the Detroit Urban Systemic Initiative on the use of constructivist-oriented, standards-based instructional practice as well as the perceived the adequacy of the curriculum for standards-based instruction. In results from teacher and student questionnaires and school case studies, teachers reported that they frequently use inquiry learning, ongoing assessment, and learning communities, and that they are involved in curriculum planning and decision making. Student surveys agreed with teacher reports. Findings indicate that standards-based teaching practice increased from 1996-97.

cns, cur, ref, ped, att (K-12, TE)

O'Hara, Susan P. (1998). *A case study of attitudinal effects of Internet use in a middle school integrated science curriculum.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (71st, San Diego, CA, April 19-22, 1998). [SE061312]

This study, part of an effort to implement a technology-enhanced, integrated curriculum in rural schools, examined grade 5 students' interactions with and attitudes toward using the Internet as a learning tool. Student pairs completed worksheets pertaining to each web site they experienced on a guided tour. Observational analysis indicated that student engagement increased as they progressed through the exercise. Results from an attitude survey indicated that the students were not intimidated by the Internet and were empowered to use it further.

ats, cbi, ped, cpl (MS)

O' Sullivan, Christine Y.; Weiss, Andrew R.; Askew, Janice M. (1998). *Students learning science: A report on policies and practices in U.S. schools.* [Available online.] Retrieved October 23, 1999 from the World Wide Web. [http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=98493] [SE061905]

This report about teachers' academic preparation and professional development, the amount of emphasis science instruction receives in schools, student course taking, and the availability of school resources that support science learning is intended primarily for policy makers, school administrators, and educators concerned with state or school level policies. The data is drawn from the 1996 National Assessment of Educational Progress (NAEP).

knt, tpd, cur, ref (K-12)

Ogunsola-Bandele, Mercy F. (1998). *The effect of a conceptual change teaching strategy (model) on students' attitudes towards the learning of some biology concepts.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (San Diego, CA, April 19-22, 1998). [SE061384]

This study examined the effect of a conceptual change teaching strategy over the traditional method on high school students' attitudes towards learning biology. The study employed a two-group experimental control design with the experimental group taught using a conceptual change teaching strategy. Analysis of a 21-item instrument showed a significant difference in the attitude of students in the two classes after the treatment. The U-test value of the groups was also significant.

ccg, ats, bio, ped, pbs (HS)

Olson, Kristen. (1998). *Total science and engineering graduate enrollment falls for fourth consecutive year.* Arlington, VA: National Science Foundation. [SE062048]

The Division of Science Resources Studies of the National Science Foundation reports statistical data related to total science and engineering graduate enrollment. Included in the overview of the report are data related to: graduate enrollment in science and engineering by enrollment status, 1975-97; graduate students in science and engineering by sex, citizenship, and race/ethnicity, 1990-97; and graduate students in science and engineering by field, 1990-97.

car, chs, eth, gen (PS)

Parsons, Sharon. (1998). *A science education learning community story.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (April 19-22, 1998). [SE061347]

This paper examines the establishment of a collaborative science education learning community over a five-year period. By assuming a pluralistic theoretical perspective which is influenced by post-critical theory, postmodernism, poststructuralism, and feminism, the paper focuses on the challenges experienced in developing a learning community among student teachers, classroom teachers, and university faculty.

ntw, lth, phe, tpd (TE)

Pickens, Teresa Lynn. (1998). *The effectiveness of teaching mnemonics in the study of the solar system.* Master's Thesis, Salem-Teikyo University. [SE061816]

This master's thesis examines the effects of using mnemonics to teach the solar system to a heterogenous group of regular and special educations students in grade 9. The control group received facts about the solar system through lecture and transparencies, and students recorded the information into an outline format. The experimental group received the same facts in lecture and recorded the notes into a mnemonic format. The findings indicate that the students enjoyed the mnemonic and would use it in the future.

lsy, ats, esg, ped (SE)

Polman, Joseph L. (1998). *Why train "little scientists:" The purposes and practices of science education in today's democracy.* Paper presented at the Annual Meeting of the American Educational Research Association (San Diego, CA, April, 1998). [SE061793]

This paper argues in support of training little scientists based on the requirements of participation in a media-laden, democratic society fraught with scientific claims and counterclaims. The leads to a framework for evaluating the effectiveness of various approaches to science education including how they play out in practice. The promise of this framework is also demonstrated by examining some results of case study and survey research in project based science classes at the high school level.

lit, sts, cur, ref (K-12)

Pontius, Richard. (1998). *Correlation analysis and comparison of two self-efficacy instruments.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (71st, San Diego, CA, April 19-22, 1998). [SE061319]

This study developed and tested of two versions of a teacher efficacy scale: a teacher efficacy scale and a science teaching efficacy belief instrument. The instruments were given to students in an elementary science methods class. The results indicated a negative correlation between the analogous scales of the two instruments. Preservice teachers with high personal efficacy tended to have lower science teaching efficacy, and those with high science teaching efficacy tended to have lower general teaching efficacy.

att, res, asm (TE)

Priestley, Holly; Priestley, William J.; Sutman, Frank X.; Schmuckler, Joseph S.; Hilosky, Alexandra; White, Michael. (1998). *Evaluating the use of the inquiry matrix.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (71st, San Diego, CA, April 19-22, 1998). [SE061408]

This paper set reports the development of the Inquiry Matrix instrument and its use to describe and analyze instruction in science classrooms. The papers present Modified-Revised Science Teacher's Behavior Inventory (M-STBI) data from earlier studies and re-examine videotapes from those studies using the Inquiry Matrix. Results indicate the Inquiry Matrix effectively defined and described inquiry in terms both modeled science instruction and classroom instruction.

inq, cid, res (K-12)

Provo, Judy A.; Lamar, Carlton H.; Newby, Timothy J. (1998). *Spatial ability, gender, and the ability to visualize anatomy in three dimensions.* Paper presented at the Annual Meeting of the American Educational Research Association (San Diego, CA, April 13-17, 1998). [SE061530]

This research, to devise an intervention to enhance three dimensional (3-D) anatomical understanding in first year veterinary students, compared the study of cross section anatomical diagrams to dissection of the canine head to see which students developed a better understanding of the 3-D locations and relationships of structures. The study also compared the two methods on the extent to which spatial ability transferred to other areas of the body, and compared the spatial abilities between genders. Analysis of covariance revealed no statistically significant gender or group differences.

sks, gen, bio, cur (PS)

Pushkin, David B.; Colon-Gonzalez, Maria H. (1998). *Access to knowledge and critical thinking in general chemistry via social constructivism: Pedagogical and curricular opportunities for minority science majors.* Paper presented at the Annual Meeting of the American Educational Research Association (Sand Diego, CA, April 13-17, 1998). [SE061261]

This study examines the nature of socio-cognitive influences on general chemistry students' learning in terms of critical thinking skills and academic grades. Learning and success, considered functions of enculturation and empowerment, are measured through both quantitative and qualitative means. A discussion of epistemological racism, institutionalized racism, and the context of gender is also included.

bkg, ach, che, eqt, gen, eth (PS)

Rakow, Steven J. (1998). *Art as a probe of scientific inquiry.* Paper presented at the Annual Meeting of the Consultation of the International Consortium for Research in Science and Mathematics Education (7th, Trinidad, West Indies, February 26-28, 1998). [SE061236]

This study investigates preservice teachers' development of an understanding of scientific inquiry as a result of their participation in a five-week elementary science methods class. Data collected from the final examination suggest that students developed an understanding of scientific inquiry. Students' written responses to a particular work of art demonstrated that a short-term exposure to elementary methods is capable of producing behavioral changes in preservice teachers at the linguistic level.

knt, inq, nas, tpd (TE, EL)

Rakow, Steven J. (Ed.) (1998). *NSTA pathways to the science standards: Guidelines for moving the vision into practice. Middle school edition.* Arlington, VA: National Science Teachers Association. [SE061727]

This guide demonstrates how to apply the National Science Education Standards to the real world of the middle school classroom. The sections outline standards for science teaching, professional development, assessment, content as well as on the program and system level. Following the unifying concepts and processes outlined in the Standards, the book provides classroom vignettes that illustrate how teachers are implementing the standards in their classroom.

cur, lit, ref, tpd, ped, asm (MS)

Ramey, Linda. (1998). *Investigating the importance of prior science experiences for majors and nonmajors.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (71st, San Diego, CA, April 19-22, 1998). [SE061305]

The study presents the results of an open-ended questionnaire on positive and negative science experiences and the preliminary findings for development of a survey instrument based on those results. The objective of the study was to determine if there are detectable differences in prior science experiences science majors and nonmajors. The results indicate that teachers, the learning environment, and perceived success in learning contribute to the positive or negative nature of prior science experiences.

bkg, car, ats, chs (PS)

Rapoport, Alan I. (1998). *How has the field mix of academic R&D changed?* Arlington, VA: National Science Foundation. [SE062028]

This paper examines changes in research and development emphasis in the academic sector by analyzing shifts in the science and engineering

field shares during the 1970s, 1980s and 1990s. It discusses the shifting distribution of overall funds among science and engineering fields and their impact on individual fields. The data is examined to determine whether major differences exist in the shifts in field shares for federal and nonfederal funds for academic research and development.

res, car, tec (PS)

Rasekoala, Elizabeth. (1998). *The black hole in science ranks.* Paper presented at the Annual Meeting of the American Educational Research Association (San Diego, CA, April 13-17, 1998). [SE061510]

This paper reviews four decades of research on race and education in Great Britain and discusses the deficit theories of under achievement that structure most of the studies. The study focuses on black youth of Caribbean origin and includes a summary of interviews with parents, students, and teachers. It also discusses constructive frameworks from gender and political dimension research, parental involvement, role models and cultural identity, career guidance, and multicultural education techniques.

ach, eth, eqt, mce, bfs, phe (K-12)

Reed, Michelle K.; Costner, Kelly M. (Eds.) (1998). *Proceedings of the Second Annual Spring Conference of the Mathematics, Science, and Technology Educators and Researchers of The Ohio State University. May 16, 1998. Columbus, OH.* [SE061588]

This document presents proceedings of the Second Annual Spring Conference, a newly formed organization for graduate students in mathematics, science, and technology education. A copy of the conference program and presentation abstracts are included.

edt, res, cpl, pbs, ref, cid (ALL)

Rennie, Leonie. (Ed.) (1998). *Proceedings of the 23rd Annual Conference of the Western Australian Science Education Association (Perth, Western Australia, November 13, 1998).* Perth, Australia: Western Australian Science Education Association. [SE062598]

These proceedings comprise 11 reviewed and edited papers from the 23rd annual meeting of the Western Australian Science Education Association. Topics include teacher behaviors, approaches for teaching large science classes, assessment, and Web-based instruction, as well as learning theory and teaching methods.

res, tpd, lth, cbi, cid, asm (ALL)

Richardson, Rita Coombs; Norman, Katherine. (1998). *Teaching science in content areas to students with special needs.* Paper presented at the International Consortium for Research in Science and Math Education (Port of Spain, Trinidad, February 25-28, 1998). [SE061237]

This paper focuses on students with learning disabilities who may behave inappropriately due to frustration about their academic deficits. This perception may be the result of text-driven, teacher-centered instruction conveyed through visual and auditory channels. The paper discusses meeting the needs of students with disabilities through an integrated curriculum, and presents a sample thematic unit on butterflies and insect developed for three ability levels that integrates scientific, language arts, and research skills.

chs, int, ats, ref, ped (K-12)

Ridgway, James. (1998). *From barrier to lever: Revising roles for assessment in mathematics education.* Madison, WI: National Institute for Science Education. [SE061204]

This newsletter promotes the reform of assessment systems as an essential component of systemic reform. Topics include sharing conceptual understanding among all stakeholders in the educational system, evaluating the impact of systemic reforms in terms of student attainment of relevant goals, and ideas on how assessment can play a major role in guiding systemic reform. The ideas are applicable to science education.

asm, cur, ref (K-12)

Ridgway, James. (1998). *The modeling of systems and macro-systemic change: Lessons for evaluation from epidemiology and ecology. A NISE Research Monograph.* Madison, WI: National Institute for Science Education. [Available online.] Retrieved October 18, 1999 from the World Wide Web. [http://www.wcer.wisc.edu/nise/Publications/Research_Monographs/RM8Modeling_of_systems.html]

The paper describes three styles of modeling in science: analytic, exemplified by eighteenth century

physics; systemic, exemplified by biology; and macro-systemic, exemplified by studies of ecologies undergoing change. This monograph considers the approaches taken to evaluation and inquiry in some of these disciplines, notably epidemiology and ecology, and the central roles that evaluation plays in planning and monitoring change.

rem, phe, his, inq, asm, ref (PS)

Risacher, Billie F. (Ed.) (1998). *Scientists and mathematicians become school teachers.* Columbus, OH: ERIC Clearinghouse for Science, Mathematics and Environmental Education. [SE061159]

This monograph presents a nontraditional teacher preparation program for mid-career and second-career teachers. Through analysis of this single program and its outcomes, the authors illustrate how the traditional familiar route to teacher certification can be expanded and enhanced by facilitating the entry of scientists and mathematicians into teaching as a second career.

tpd, car, ref (TE)

Roberts, Douglas A.; Ostman, Leif. (Eds.) (1998). *Problems of meaning in science curriculum.* Part of the Ways of Knowing in Science series; foreword by F. James Rutherford. New York: Teachers College Press. [SE061803]

In this book about curriculum and meaning, the authors argue that the socialization of students is not only a matter of their deportment, attitudes, and conduct, but is also very significantly associated with the meanings provided by their educational experiences. The chapters, organized under the headings Back to the Drawing Board, Into the Classroom, and Behind the Scenes, include such authors as: D.A. Roberts, T. Englund, B. Kilbourn, R. Saljo, L. Ostman, J. Willinsky, G. S. Aikenhead, H. Munby, A. Geddis, G. Orpwood, R. W. Bybee, J. Solomon, and P.J. Fensham.

cur, cns, cid, lrg, ats (K-12)

Rubba, Peter A.; Rye, James A. (Eds.) (1998). *Proceedings of the 1998 Annual International Conference of the Association for the Education of Teachers in Science.* [SE061648]

The 40 papers from this conference explore topics related to science teacher education such as gender issues, instructional materials, integrated curricula, constructivist assessment practices, mentoring, conceptions held about astronomy, science standards, literacy through the learning cycle, skills for secondary science teachers and students' perceptions of science teaching.

res, tpd, knt, att, lit (TE)

Savelsbergh, Elwin R.; Ferguson-Hessler, Monica G. M.; de Jong, Ton. (1998). *Physics learning with a computer algebra system.* Enschede, The Netherlands: University of Twente. [SE061542]

An approach to teaching problem solving based on using the computer software, Mathematica, is applied to the study of electrostatics and is compared with the normal approach to the module. The experimental course addresses student misconceptions, and the students found the visualization tools to be more instructive than the problem solving tools. Included are a discussion of how the course can be improved, and how the course can be a valuable supplement to the usual teaching approach.

cbi, alf, phy, lrg, ccg, pbs (HS, PS)

Schwarz, Christina; White, Barbara. (1998). *Fostering middle school students' understanding of scientific modeling.* Paper presented at the Annual Meeting of the American Educational Research Associaton (San Diego, CA, April, 1998). [SE061794]

This paper focuses on the evaluation of an 11-week curriculum created to foster grade 7 students' understanding of scientific modeling. Students created non-Newtonian computer microworlds to embody their conceptual models, evaluated their models with criteria, and reflected on the nature of models. The analysis suggests that students gain a significantly better understanding of the process of creating and evaluating models. These results indicate that while modeling knowledge is difficult to obtain even from extended practice, progress can be furthered by refining model-oriented curricula and assessments.

rem, cur, cbi (MS)

She, Hsiao-Ching; Fisher, Darrell L. (1998). *Combining quantitative and qualitative approaches in studying student perceptions of teacher behavior in Taiwan and Australia.* Paper presented at the Annual Meeting of the National Association for Research in

Science Teaching (71st, San Diego, CA, April 19-22, 1998). [SE061503]

This paper describes part of cross national study of learning environments in Taiwan and Australia pertaining to the development and validation of an instrument, The Teacher Student Interaction (TSI), to assess student perceptions of their teacher's behaviors. Data from student surveys was quantitatively analyzed, the questionnaire validated and quantitative descriptions of teacher behavior were obtained. Interviews and classroom observations were used to further validate the questionnaire and understand the teacher interactions according to the perceptions of students.

cid, cul, ats, cht (SE)

Shear, Linda. (1998). *Debating life on Mars: The Knowledge Integration Environment (KIE) in varied school settings.* Paper presented at the Annual Meeting of the American Educational Research Association (San Diego, CA, April 13-18, 1998). [SE061795]

This paper describes the implementation of a curriculum framework and Internet-based software toolset called the Knowledge Integration Environment (KIE) in two urban schools, and uses the framework of Scaffolded Knowledge Integration (SKI) to assess the interplay between teaching and using new learning tools. Results indicate that improvements in cognitive engagement and learning were achieved by students who had been labeled "failures" in traditional classrooms, and that advanced students integrated their knowledge in new ways. The paper offers suggestions for evaluating the contextual issues that shape the implementation of new learning environments, and presents SKI as a framework to support teacher professional development as they adopt new tools and techniques.

cbi, cur, ach, sks, kns, tpd (HS, TE)

Shiao Yueh, Suey. (1998). *Biological concept development in elementary science textbooks in Taiwan.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (71st, San Diego, CA, April 19-22, 1998). [SE061318]

This study identifies the most common biological concepts presented in elementary science textbooks in Taiwan. Results of the study indicate that the commonly addressed attributes are: habitat, movement, growth, energy source, and structure. Concepts are organized from high level to low level and links among the concepts within a unit or across units are not adequately made. The application of concepts is neglected and inquiry based experiments are lacking.

mat, bio, inq (EL)

Shymansky, James A.; Lee, E. Desmond; Yore, Larry D.; Henriques, Laura; Dunkhase, John A.; Bancroft, Jean. (1998). *Students' perceptions and supervisors' rating as assessments of interactive-constructivist science teaching in elementary school.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (April 19-22, 1998). [SE061357]

This study is part of a local systemic reform effort to implement interactive-constructivist teaching and learning that includes hands-on activities to challenge students' ideas and to promote deep processing and conceptual change. The study verified the use of students' perceptions and attitudes and supervisor's ratings as measures of teachers' implementation of interactive-constructivist teaching in the classroom. Students' perceptions and attitudes and expert ratings of constructivist science teaching had marginal external validity.

cns, asm, ats, hos, ccg, ref (EL)

Shymansky, James A.; Yore, Larry D.; Dunkhase, John A.; Hand, Brian M. (1998). *Do students really notice? A study of the impact of a local systemic reform.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (April 19-22, 1998). [SE061358]

This paper describes an elementary science curriculum, called the Science: Parents, Activities, and Literature (Science PALs) Project. The project emphasized interactive-constructivist teaching and learning, with hands-on activities to challenge students' ideas and to promote deep processing and conceptual change. The study explored students' perceptions of and attitudes in classrooms of teachers who were or were not participating in the project. Perceptions and attitudes were higher in classrooms of teachers with 2 or more years of Science PALs experience than in classrooms of teachers with less experience.

ats, ref, cns, ccg, ped, hos (EL)

Simmons, M. Ruth. (1998). *A study of high school students' attitudes toward the environment and completion of an environmental science course.* [SE061701]

This study examined the effects of an elective environmental education course on student attitudes. A questionnaire was used to survey four components of student attitudes: beliefs and values; behavior intentions; behavior; and affective responses. Students in both groups had positive attitudes toward the environment. The environmental science group had more positive attitudes toward the environment than the school at large, overall and within each attitude component. Attitudes toward the environment did not change significantly over the school year, and there was no evidence to indicate that completion of the course was related to attitude change.

ats, ene (SE)

Snively, Gloria ; Corsiglia, John. (1998). *Discovering indigenous science: Implications for science education.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (71st, San Diego, CA, April 19-22, 1998). [SE061478]

This article explores aspects of multicultural science and pedagogy and describes a branch of indigenous science known to biologists and ecologists as traditional ecological knowledge (TEK). Indigenous science relates to both the science knowledge of long-resident, usually oral culture peoples, as well as the science knowledge of all peoples who are affected by the world view and relativist interests of their home communities. A discussion of TEK literature provides numerous examples of effective indigenous science.

mce, bfs, phe, kns, bio, cur (ALL)

Soyibo, Kola; Rainford, Marcia. (1998). *An evaluation of seventh graders' performance on a Jamaican science project.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (71st, San Diego, CA, April 19-22, 1998). [SE061293]

This study examines the improvement in science content knowledge, process skills, and attitudes of grade seven students after the implementation of a reform effort. Relationships among gender, school location, and performance are also investigated. Data from a science process skills test, a standardized multiple choice content test, and an adapted attitudes to science test indicate that the students display positive attitudes to science on the pre and posttests; there are no gender differences in performance on the three tests; and there are positive correlations among school location and test performance.

ref, ats, sks, gen, kns (MS)

Soyibo, Kola; McKenzie-Briscoe, B. O. (1998). *Relationships among students' grade level, gender, location and school type and abilities to comprehend four integrated science textbooks.* Paper presented at the Annual Meeting of the American Educational Research Association (San Diego, CA, April 13-17, 1998). [SE061526]

This study examines Jamaican high school students' comprehension of four integrated science textbooks and the relationships among their grade level, gender, school location and type. Results from Cloze comprehension and vocabulary tests indicate that most of the subjects could not comprehend the texts. Urban and traditional students significantly outscored their rural and nontraditional counterparts on all the tests, and girls significantly outscored boys on two of the comprehension tests.

int, mat, lrg (SE)

Stetter, Dennis. (1998). *A science curriculum foundations course for elementary education majors.* Paper presented at the Annual Meeting of the Florida Association of Science Teachers (October 16, 1998). [SE061867]

This report describes a methods course for elementary education majors that is based on the structure of the Florida Sunshine State Standards for science. The content of the course includes pedagogical knowledge beyond the type of information obtained in science content courses taken by students during the first two years of undergraduate study. A student assessment of the course and instructor comments are also provided.

ref, tpd, knt, ped (EL, TE)

Steussy, Carol L.; Thomas, Julie A. (1998). *Elementary teachers do science: Guidelines for teacher preparation programs.* Columbus, OH: ERIC Clear-

inghouse for Science, Mathematics and Environmental Education. [SE061205]

This document presents guidelines for strengthening the preparation of elementary science teachers. Focusing on collaboration between teachers of all grade levels, the guidelines prescribe a learning environment that includes collaboratively designed and implemented program support, hands-on problem solving, and student-centered instruction. Other suggestions include placing scientific inquiry at the core of all levels of science teaching and learning and regarding professional growth in science teaching as a continuous and collaborative process.

tpd, ref, ntw, hos, inq, pbs (EL, TE)

Takahira, Sayuri; Gonzales, Patrick; Frase, Mary; Salganik, Laura Hersh. (1998). *Pursuing excellence: A study of U.S. twelfth-grade mathematics and science achievement in international context.* [Available online]. Retrieved October 18, 1999 from the World Wide Web. [http://nces.ed.gov/timss/] [SE061849]

This report from TIMSS compares the general mathematics and science knowledge of U.S. students in grade 12 with that of 35 other countries. The document presents background information about TIMSS, and describes how all U.S. students performed in mathematics and science, as well as examining the achievement of advanced students. It also analyzes the context of learning in included countries. More detailed statistical data are presented in the appendices.

ach, lit, cul, asm, ref (HS)

Tien, L. T.; Stacy, A. M. (1998). *Promoting scientific inquiry through the MORE laboratory.* Paper presented at the Annual Meeting of the American Educational Research Association (San Diego, CA, April 13-19, 1998). [SE061560]

This study investigated the effects of the MORE (Model, Observe, Reflect, Explain) curriculum on undergraduate chemistry students' inquiry skills. MORE emphasizes thinking through the inquiry process, rather than the mechanics of laboratory procedures and algorithmic calculations. The study examined classroom interactions in traditional laboratories and MORE lab sections taught within the same lecture course. Analysis of videotapes from each lab environment indicated that the MORE approach improved student ability to design experiments and make connections between actions and models.

inq, lab, che, cur, sks (PS)

Tsai, Chin-Chung. (1998). *Overcoming eighth graders' misconceptions about microscopic views of phase change: A study of an analogy activity.* Paper presented at the Annual Meeting of the American Educational Research Association (San Diego, CA, April 13-17, 1998). [SE061523]

This study examines the effects of an analogy activity designed to overcome eighth grade students' misconceptions about the microscopic views of phase change. The students were assigned to either a control group (traditional teaching), or an experimental group that participated in an activity in which students, acting as particles, worked together to model phase changes. Results from an immediate posttest indicated that the experimental group did not perform significantly better than the control. The delayed test indicated that the analogy activity increased students' understanding.

rem, ceg, lrg, cpl, alf, ped (MS)

Tuan, Hsiao-Lin; Chang, Huey-Por; Wang, Kuo-Hua; Treagust, David F. (1998). *Combining qualitative and quantitative approaches in a cross-national study of learning environment in Taiwan and Australia.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (April 19-22, 1998). [SE061336]

This paper compares the responses of Australian and Taiwanese tenth grade students to the Teacher Knowledge Questionnaire. The study compares the mean scores of each item in the two countries and uses qualitative research methods (classroom observations and interviews) to probe students' reasons for their responses to the questionnaire. The findings indicate that, compared to Australian teachers, Taiwanese teachers use more verbal illustrations to teach science concepts, concentrate on scientific theories and principles, and reinforce students' memorization and calculating ability. Australian teachers are more likely to help students extend their science learning to daily life.

cul, knt, ats, cht, ped (SE)

Vellom, R. Paul. (1998). *Student decisionmaking and teacher privileging in a student-centered science classroom.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (April 19-22, 1998). [SE061333]

This paper examines privileging and other mechanisms at play over a period of six classroom days. How the claims and ideas of a number of students fare in the larger classroom community discourse is described and supported by brief case studies of student pairs and groups, including transcripts of interactions. The author also reviews the characteristics of student-centered classrooms.

cid, cpl, sks (MS)

Wang, HsingChi A.; Marsh, David D. (1998). *Science teachers' perceptions and practices in teaching the history of science.* Paper presented at the Annual Meeting of the American Educational Research Association (San Diego, CA, April 13-17, 1998). [SE061541]

This study investigates teachers' perceptions of the instructional role of the history of science, and their actual practices of teaching science from an historical point of view. The paper describes the design of an instrument, the History of Science Instructional Survey, and presents the findings and implications from using it to survey teachers.

att, his, ped, nas, knt (TE)

Wang, HsingChi A. (1998). *Science textbook studies reanalysis: Teachers' "friendly" content analysis methods?* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (San Diego, CA, April, 1998). [SE061787]

This study explores the trends for conducting textbook content analysis method in the science educational research, and how these trends address daily instructional needs. The paper reviews the literature on the role of instructional materials, especially textbooks in science education research; past content analysis methods for science textbooks; and research of instructional needs and recommendations. It also proposes a content analysis method for teacher education that is based upon a preliminary survey of teacher needs.

cur, res, mat, ped, ref, att (TE, K-12)

Warren, Beth; Ogonowski, Mark. (1998). *From knowledge to knowing: An inquiry into teacher learning in science.* Newton, MA: Education Development Center. [SE062323]

This paper examines pedagogical content knowledge through a case study of a fifth-grade teacher as she investigates aquatic ecology over a period of several months, in the context of a four-year project in which teachers examined science, science learning, and teaching through their own and their students' experience as learners. The results address how the teacher came to see her own learning and that of her students as she worked to understand aspects of the ecology of a local pond; and how her experience figured in her identity as a learner and her practice as a teacher.

knt, tpd, ats, bio, lth (TE, EL)

White, Paula A. (1998). *NISE fellowship programs: Feedback from past fellows. NISE Occasional Papers.* Madison, WI: National Institute for Science Education. [Available online.] Retrieved October 18, 1999 from the World Wide Web. [http://www.wcer.wisc.edu/nise/Publications/Occasional_Papers/OP7-NISE_Fellows.html]

This Occasional Paper is a summary of the responses to five questions distributed to NISE Fellows for the purpose of gathering information on their experiences. The questions asked respondents how they learned about the NISE Fellow opportunity, their reasons for pursing a NISE Fellowship; and how the NISE experiences affected their professional growth as well as their assessment of the NISE experience and suggestions for improving the Fellowship.

tpd, att, res (TE)

Whittle, Christopher. (1998). *On the ethology of female Homo sapiens sapiens at the New Mexico Museum of Natural History and Science.* [SE061196]

This study seeks to discern the effects of the cultural problems identified by other researchers in a science educational setting. Field observations at the New Mexico Museum of Natural History and Science focused on: gender differences exhibited by visitors in interacting with the exhibits, age differences in patterns of interaction, and what sociological theory of education best fits with the observations. The

results have implications for how we teach science to girls.

nfd, gen, bkg, nas, lth (ALL)

Whittle, Christopher. (1998). *Teaching science by television: The audience, education, history, and the future.* [SE061197]

This study explores the educational effects of television. The findings suggest that science and educational programming are not reaching vast numbers of the population, that people learn from television, and viewers do not relate well to scientists as they are portrayed in the media. Recommendations for increasing the effectiveness of television as a learning tool in science include: incorporating realistic science content into popular television programming, and involving the public in discussions about what science is important.

lit, nfd, edt, nas, sts (GEN)

Whitworth, Joan M. (1998). *Looking at distance learning through both ends of the camera.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (71st, San Diego, CA, April 19-22, 1998). [SE061317]

This report chronicled the experiences of an elementary education instructor and her students during their first distance learning course. Positive student responses included accessibility of courses previously unavailable; learning new technologies and learning from students at different locations; and being more involved in their own learning. Problems included technology problems and less teacher contact, but concerns about the amount of teacher-student contact declined as the semester progressed. Students who used e-mail to correspond with the instructor indicated that they felt they had more interaction and feedback than in traditional classes.

edt, ats, cur (TE, EL)

Wilkinson, R. Keith. (1998). *Employment of scientists and engineers reaches 3.2 million in 1995.* Arlington, VA: National Science Foundation. [Available online.] Retrieved October 18, 1999 from the World Wide Web. [http://www.nsf.gov/sbe/srs/databrf/sdb98325.htm] [SE061839]

This data brief presents statistics related to employment of scientists and engineers in 1995. Organized by broad occupation and degree received, the data is divided into four charts that provide information related to: number of employed scientists and engineers; percentage distribution; unemployment rates; and median annual salaries.

car, sts, tec (GEN)

Yei, Chen-Jen; Wang, Kuo-Hua; Huang, Shih-Chieh. (1998). *A comparative study on the use of questioning strategies between beginning teacher and experience teacher.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (April 19-22, 1998). [SE061340]

This study investigates the questioning strategies adopted by junior high school biology teachers during classroom instruction, and compares them with those of experienced teachers. From classroom observation, document analysis, and interviews of one beginning teacher and two experienced teachers, the findings suggest that the generative learning model can be a useful framework to help science teachers forming various types of questions and in improving a teacher's questioning strategy.

cid, skt, tpd, bio (TE, SE)

Young, Deidra J. (1998). *Characteristics of effective rural schools: A longitudinal study of Western Australian rural high school students.* Paper presented at the Annual Meeting of the American Educational Research Association (San Diego, CA, April 13-17, 1998). [SE061538]

This paper reports the findings from the first two years of the Western Australian School Effectiveness Study, a longitudinal study undertaken in 21 urban and rural schools to identify the characteristics of effective rural high schools in science and mathematics achievement. The results suggest that most variability in student achievement is at the classroom and student level, with negligible amounts at the school level, and that effective schools are characterized by high morale and self-esteem for staff and students.

ach, bkg, chs, cht (SE)

Zembylas, Michalinos. (1998). *Epistemological and affective dimensions of elementary science teachers' work.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (San Diego, CA, April 19-22, 1998). [SE061385]

This study explores the nature and meaning of epistemological and affective issues that shape elementary teachers' work such as ways of knowing, beliefs about the nature of science, and teachers' images of themselves as knowers. Through analyses of two teachers' narratives, classroom observations, and instructional materials, this research reveals how emotions and values are significant dimensions of teaching science and can explicitly or implicitly be part of their personal and professional development.

phe, att, cht, tpd, nas, cid (TE, EL)

Zuckerman, June Trop. (1998). *Inservice science supervisors' stories: A source of practical knowledge for student science teachers.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (San Diego, CA, April 19-22, 1998). [SE061396]

This paper reports on the rules of practice, practical principles, and images of teaching that student science teachers (n=32) constructed from listening to and discussing the stories inservice science supervisors told about a novice science teacher. The results delineate the rules of practice gleaned from each story and practical knowledge themes evident in the students' discussions. Excerpts from the transcripts are provided.

att, knt, tpd, cur (TE)

Science Education Dissertations and Theses

Suzanne Shaw Drummer, Chris A. Ingersol, & Joyce C. Miller
The Ohio State University

Listed here are 234 dissertations and master's theses in science education that were completed in 1998 and abstracted in *Dissertation Abstracts International* during 1998 through October 1999. Each entry is coded (see Key to Codes) with one to three major codes (in bold type), a maximum of three minor codes, and an indication of educational level (in parentheses). All entries are indexed by major codes in the *Research Directory* (see page 1). An index of dissertations and theses by institution is included at the end of this section (see page 123).

Adams, Stephen Thomas. (1998). *What is 'good reasoning' about global warming? A comparison of high school students and specialists* (University of California Berkeley). DAI-A 59/08, p. 2911, Feb 1999. [AAT 9901967]

This study compares the knowledge and reasoning about global warming of 10 twelfth grade students and 6 specialists, including scientists and policy analysts. The study uses global warming as a context for addressing the broad objective of formulating goals for scientific literacy.

kns, car. lit, ene, sks (HS)

Agairre-Ortiz, Maria. (1998). *Open-ended questions: An alternative mode to assess the students' performance in concept development and use of scientific vocabulary* (State University of New York At Buffalo). DAI-A 59/05, p. 1513, Nov 1998. [AAT 9833575]

This study examines the effect of two modes of assessment on students' (n=104) performance. Fifth grade LEP students were asked to answer the same open-ended question by writing paragraphs or making drawings. Results show that students in the drawing mode performed better in in-depth concept development than those in the writing mode.

asm, sks, chs, kns (EL)

Aguillard, Donald Wayne. (1998). *An analysis of factors influencing the teaching of biological evolution in Louisiana public secondary schools* (The Louisiana State University and Agricultural and Mechanical College). DAI-A 60/03, p. 693, Sep 1999. [AAT 9922044]

This study reports on a survey of biology teachers that considered their attitudes toward evolution. Although teachers consider evolution important, instructional time allocated to it is insufficient. Teachers' knowledge base was the most significant factor in the degree of classroom emphasis on evolution. Many teachers avoid discussion of human evolution and hold extreme views on creationism as a component of the curriculum.

evo, knt, att, cht, bio, tpd (SE, TE)

Akpan, Joseph Paul. (1998). *The effects of computer simulation models on middle school students' understanding of the anatomy and morphology of the frog* (Iowa State University). DAI-A 59/07, p. 2429, Jan 1999. [AAT 9841033]

Science class periods were randomly assigned to three conditions. Results indicate that students in the simulation before dissection condition performed significantly better than the dissection before simulation and dissection-only conditions on both the actual dissection and on knowledge of the anatomy and morphology.

cbi, lrg, lab, ped, gen, ats (MS)

Allen, Virginia Lynn. (1998). *A comparison of student behavior in the cooperative learning versus lecture classroom* (Texas Woman's University). MAI 37/03, p. 745, Jun 1999. [AAT 1392958]

The subjects of this study were four, fifth-grade public school math and science teachers and

approximately 300 fifth-grade students. Student misbehavior during 50-minute science lessons was examined over one academic year. The findings indicate that the majority of misbehavior occurred in the lecture classrooms.

cpl, ped, ats, cid (EL)

Almeida, Jose Manuel. (1998). *The relationship between the teacher's experience, the teacher's college major, and the teacher's level of education in predicting classroom attitudes in high school science students* (Florida International University). DAI-A 59/02, p. 405, Aug 1998. [AAT 9824395]

The instrument used in the study was the Classroom Environment Scale (CES), Real Form. There were 40 secondary science teachers and 1200 students sampled in the study which sought to determine the relationship between teachers' educational background and students' perception of the classroom environment.

knt, cht, ats, bkg, tpd (TE, HS)

Alshannag, Qasim Mohammad. (1998). *Knowledge, beliefs, and performance of new high school chemistry teachers: A study of teachers' characteristics and teacher preparation program influences* (Michigan State University). DAI-A 59/10, p. 3777, Apr 1999. [AAT 9909253]

This research focuses on four new high school chemistry teachers who graduated from two different teacher preparation programs at major research universities. The key findings involve major differences between education and science content courses experienced by the teachers and the lack of student-centered teaching.

tpd, skt, cht, bkg, knt, che (HS)

Arburn, Theresa Morkovsky. (1998). *Assisting at-risk community college students' acquisition of critical thinking learning strategies in human anatomy and physiology* (The University of Texas At Austin). DAI-A 59/06, p. 1969, Dec 1998. [AAT 9837897]

This study (n=68) investigates whether learning thinking strategies presented within the course context resulted in increased academic performance and critical thinking skills. The experimental group used a student-generated questioning technique along with lecture presentations. All students were pre- and posttested using the LASSI and the CCTST. No significant differences were demonstrated.

ped, chs, pbs, sks, kns (PS)

Bailer, Jill. (1998). *The effects of 'Women Are Scientists, Too' program on middle school students' perceptions of scientists and their attitudes toward women in science* (University of Houston). DAI-A 59/03, p. 775, Sep 1998. [AAT 9828307]

The quasi-experimental study used a pretest-posttest control group design involving ten language arts teachers and their students (N = 500). Student perceptions of scientists were measured before and after the program by the Draw-A-Scientist Test and attitudes were measured with the Women in Science Scale. The study showed that participation in the WAST program and a student's gender and ethnicity made a significant difference in student's perceptions.

ats, gen, eth, car, cur (MS)

Ballard, Sherri Patrice. (1998). *The role of science self-efficacy, science career efficacy, science career interest, and intentions to enroll in nonrequired science courses in the future selection of science-related careers for high school students* (University of Kentucky). DAI-A 60/03, p. 717, Sep 1999. [AAT 9922587]

A survey was completed by 368 high school students in rural settings. Gender, race, tracking, and socioeconomic differences in career selection variables and future aspirations of pursuing a science-related career were explored. Results indicate differences based on race and gender. Science career interest was predictive of future career selection for this sample.

car, chs, bkg, gen, eth (HS)

Barrett, Joan Beverly. (1998). *An investigative study into the effectiveness of using computer-aided instruction (CAI) as a laboratory component of college-level biology: A case study* (Oregon State University). DAI-A 59/02, p. 402, Aug 1998. [AAT 9824727]

This study sought to understand the practice of CAI and its effectiveness, especially in helping the under-prepared student. Results show that the faculty was primarily self-motivated and self-

taught in their use of CAI, was confident that expectations of helping students have been met and that CAI is becoming the most valuable of learning tools.

cbi, bio, att, lab, ped (PS)

Bauchspies, Wenda K. (1998). *Togolese female science educators: Innovators, bridges or instruments?* (Rensselaer Polytechnic Institute). DAI-A 60/02, p. 380, Aug 1999. [AAT 9918372]

The study was based on the premises that science is a specific way of knowing created by the dominant culture, that education is a social process, that schools are sites of cultural production and that teachers are public intellectuals. Questionnaires, in-depth interviews, participant observation and archival research were used to gather data on science education in Togo.

gen, knt, cht, att, bkg, phe (TE)

Baucum, Loree Lynn. (1998). *A qualitative study of the effects of the use of interactive television in an elementary science class* (Texas Woman's University). MAI 36/05, p. 1230, Oct 1998. [AAT 1389733]

This study determined the effect of Interactive Television on the attitudes and feelings of fourth-grade students and their parents regarding elementary science education. Results support the hypothesis that attitudes of students and parents would be positive regarding the use of Interactive Television. Learning was also documented.

edt, ats, lrg, kns, bkg (EL)

Beeber, Carla. (1998). *An analysis of students' difficulties in learning science as revealed through their understanding of gas exchange in plants* (Rutgers the State University of New Jersey - New Brunswick). DAI-A 59/05, p. 1513, Nov 1998. [AAT 9834112]

This study investigated the extent to which misconceptions held by the students prior to entering introductory courses are part of their knowledge. Essays and interviews were used to gather data. A pattern of dissimilarity between the assessments in the two types of data suggest a need for change in the current methods of assessing students' conceptual understanding.

alf, kns, asm, res, bio, ccg (PS)

Bell, Philip Laverne. (1998). *Designing for students' science learning using argumentation and classroom debate* (University of California Berkeley). DAI-A 60/03, p. 644, Sep 1999. [AAT 9922741]

This research investigated how to design and introduce an educational innovation into a classroom setting to support learning. The research yields cognitive design principles for instruction involving scientific argumentation and debate. Results from the research were synthesized in design principles geared towards helping future designers.

cur, nas, cid, ped, lrg (MS)

Bodwell, Mary Buchinger. (1998). *Discourse-intensive science learning and science education reform: A case study of teacher professional development* (Boston University). DAI-A 59/02, p. 457, Aug 1998. [AAT 9824562]

Tools of discourse analysis were used to examine teachers' conversations in a seminar as they learned about the concept of buoyancy, and as they came to reanalyze students' learning of the same topic. This analysis suggests that extended conversations grounded in science texts, classroom videotape and transcript data can deepen teachers' conceptual and pedagogical understanding.

cid, tpd, knt, phy, lth (TE)

Bos, Nathan Daniel. (1998). *Affordances of students' using the World Wide Web as a publishing medium in project based learning environments* (The University of Michigan). DAI-A 59/10, p. 3794, Apr 1999. [AAT 9909855]

Two models of student publishing on the World Wide Web were investigated over the course of two project-based science curriculums. Findings for the two models were different and include a consideration of the ability of the web to motivate student learning and thinking and the ability of students to evaluate web sites for content.

cbi, int, lrg, pbs, sks, ats (HS)

Bradford, Robert Sanders. (1998). *Environmental concepts in rural Honduras: A case study of their range and application within environmental education design* (Walden University). DAI-A 60/05, p. 1504, Nov 1999. [AAT 9931728]

This qualitative study examined the environmental concepts of 75 rural Hondurans. Conceptual analysis was used to construct a tentative interpretation of the rural Honduran worldview. Results recommend an educational approach that fosters the integration of compatible environmental concepts into the rural Honduran worldview through the application of design strategies for a prospective environmental education process.

ene, bfs, cur, ped, bkg (AD)

Breen, Timothy. (1998). *Alternative assessment in project-based science classrooms: A study of the content and process demands of an innovative classroom assessment* (The University of Michigan). DAI-A 59/10, p. 3796, Apr 1999. [AAT 9909858]

Student performance on products was compared with several characteristics of the students and of the groups within which they worked. Success was dependent upon developing mastery goal orientations, holistic views, and positive group interaction skills. These results suggest that alternative assessments may be used to evaluate and support the goals of science education reform efforts.

asm, sks, cpl, kns, ref, ped (SE)

Brent, Bill M. (1998). *The achievements of Chemistry in the Community students compared to traditional chemistry students in an introductory university chemistry course* (University of Missouri - Columbia). DAI-A 59/08, p. 2832, Feb 1999. [AAT 9901220]

Forty-three students with ChemCom as their high school chemistry background and forty-three students with a traditional chemistry background were sampled. The ChemCom and non-ChemCom students with similar high school backgrounds were comparable in achievement in a university chemistry course and in attitude toward technological and societal issues.

cur, che, ach, bkg, kns, ats (HS, PS)

Brigden, Susan Rae. (1998). *Reporting, grading, and the meaning of letter grades in Science 9: Perspectives of teachers, students, and parents* (The University of British Columbia). DAI-A 59/12, p. 4347, Jun 1999. [AAT NQ34533]

Quantitative data was collected from five Science 9 teachers, 43 students, and 21 parents who volunteered for the study. Results show that while most participants were satisfied with the reporting of student progress, individual teachers consider different kinds of assessment information when they assign letter grades, are not always clear and consistent about what they intend letter grades to mean, and students' and parents' beliefs about the grading components and meanings of letter grades vary widely.

asm, ats, att, bkg (SE)

Britton, Lynda A. (1998). *An exploratory study of the impact of hypermedia-based approach and science-in-fiction approach for instruction on the polymerase chain reaction* (The Louisiana State University and Agricultural and Mechanical College). DAI-A 60/03, p. 693, Sep 1999. [AAT 9922056]

Participants attained a mean understanding of 79% of the concepts identified as necessary after experiencing two approaches to teaching the polymerase chain reaction. The science-in-fiction group scored slightly better than those who experienced the PCR hypermedia program first. Significant conceptual change about the nature of science was not detected, even though most students demonstrated deep and/or elaborative learning styles.

kns, ped, cbi, ccg, lsy, nas (PS)

Brockmeyer, Mark Alan. (1998). *The impact of an extended inquiry-based inservice program on the beliefs and practices of beginning secondary science teachers* (The University of Iowa). DAI-A 60/02, p. 380, Aug 1999. [AAT 9917531]

Six teachers who were in their first, second, or third year of teaching participated in this qualitative study. Findings include changes in the beliefs and pedagogical style of the participants. Follow-up workshops during the academic year were shown as creating opportunities to refine interpretations of extended inquiry from a base of practical classroom experience.

inq, tpd, knt, att, ped (TE)

Brooks, Clare M. (1998). *Enhancing science teaching in an elementary school: A case study of a school-initiated teacher professional development program*

(The University of British Columbia). DAI-A 59/12, p. 4348, Jun 1999. [AAT NQ34534]

This study documents a year long Teacher Professional Development Program (TPDP). The objective of the TPDP was to make science instruction more frequent, active, and student-centered in the school. The results show that teachers, administrators, and parents were satisfied that the objective was met, and that the TPDP contributed significantly to this outcome.

tpd, skt, hos (TE, EL)

Brophy, Sean Patrick. (1998). *Learning scientific principles through problem solving in computer supported and laboratory environments* (Vanderbilt University). DAI-A 59/03, p. 710, Sep 1998. [AAT 9827572]

Analysis indicates that both groups scored low on the initial mastery test, but do significantly better after completing both treatments. The discussion of each treatment highlights the strengths of each treatment approach and recommends starting instruction with problem-oriented activities to frame a need to know more through inquiry activities.

cbi, pbs, lab, ped, lrg (MS)

Brown, Dwight George. (1998). *Human genetic concept attainment in secondary biology students through the use of specifically constructed bioethical case studies and a student decision-making model* (Ball State University). DAI-A 59/10, p. 3778, Apr 1999. [AAT 9911688]

This study considered results for 54 teachers and 2,330 biology students. The teachers in the study attended Project 'Genethics' workshops. Case studies and the Decision-Making Model allowed students to perform essentially the same on the student post-test as those students who did not use them and also gave them the benefit of practicing skills in bioethical decision-making.

ped, sks, lrg, bio, sts, tpd (SE, TE)

Brown, Norman Merrill. (1998). *Performance-based alternative assessments as a means of eliminating gender achievement differences on science tests* (The University of Texas At Austin). DAI-A 59/06, p. 1969, Dec 1998. [AAT 9837913]

The independent variables were test, gender, ethnicity, and grade level. A stratified random sample (N = 2400) was selected from a national pool of norming data. The factors yielding significant results were ethnicity, grade, and ethnicity by grade. No significant differences were found between female and male achievement on the performance-based assessments.

asm, eth, eqt, gen, ach (ALL)

Buck, Gayle A. (1998). *Collaboration between science teacher educators and science faculty from arts and sciences for the purpose of developing a middle childhood science teacher education program: A case study* (Kent State University). DAI-A 59/07, p. 2450, Jan 1999. [AAT 9842486]

The participants in the collaborative program under study came together for many different reasons and had different ideas about how a relationship should be conducted. This created issues that affected the development of curriculum and instruction. Issues involved the lack of mutual respect for the work of the partners, understanding about roles and responsibilities, a clear and understandable goal, and time to collaborate.

ntw, cur, ref, phe (TE, MS)

Burke, Patricia Anne. (1998). *Structural overview and learner control in hypermedia instructional programs* (Arizona State University). DAI-A 59/06, p. 1900, Dec 1998. [AAT 9837674]

Two structural overview conditions were crossed with two control conditions. No significant differences in scores for either variable or for their interaction was found. Learner-control subjects receiving the structural overview deviated from the linear path significantly more often than subjects who did not have the structural overview, but deviation from the linear path was not associated with higher posttest scores.

cbi, ats, ach, ped (MS)

Burns, Robert Thomas. (1998). *Gender differences associated with enrollment in the Texas Academy of Mathematics and Science* (University of North Texas). DAI-A 59/04, p. 1086, Oct 1998. [AAT 9830823]

Analysis of the data indicates no difference between females and males concerning factors

that influenced them to enroll in TAMS. Both females and males in TAMS ranked extrinsic interest including job opportunity, salary, and promotion, as the most important factor. The least important factor for both females and males was family encouragement.

car, bkg, chs, gen (HS)

Cajas, Mario Fernando. (1998). *Teaching science for understanding and applications: The role of technology* (Michigan State University). DAI-A 60/03, p. 634, Sep 1999. [AAT 9922296]

This dissertation examines the role of technology as curricular content in school science. It contends that the introduction of applications of science in students' everyday lives requires a different kind of subject matter knowledge than traditional scientific knowledge. It is argued that school science knowledge has been the product of views of science which have overemphasized abstract over practical knowledge, erasing most traces of technology from the curriculum.

tec, cur, int, ped, sts (K-12)

Canestraight, Karen Kay. (1998). *Involving parents in a chemistry curriculum* (Michigan State University). MAI 37/02, p. 424, Apr 1999. [AAT 1392185]

A program to increase parental involvement was designed and implemented in five college prep chemistry courses. The time that parents and students spent conversing with each other about chemistry increased somewhat. Parents thought involvement was beneficial and made suggestions for improvement. Students resisted having to work independently but thought it was a unique, beneficial experience.

che, cid, bkg, ped, cpl (HS)

Carr, Kevin Michael. (1998). *Reflective judgment and cognitive interaction in an electronically distributed learning environment* (University of Idaho). DAI-A 59/03, p. 790, Sep 1998. [AAT 9827878]

This study evaluates implementation of the Idaho Virtual Classroom (IVC) Electronically Distributed Learning Environment (EDLE) in meeting the goals of flexibility, critical thinking, and cognitive interaction. Findings indicate that flexibility in time and space were provided by the IVC EDLE and critical thinking and cognitive interaction were successfully facilitated.

cur, cbi, pbs, ped (HS)

Carter, Catherine Wilburn Evelyn. (1998). *A case study of meaningful learning in a collaborative concept mapping strategy as a preparation for a college biology laboratory* (Georgia State University). DAI-A 59/10, p. 3778, Apr 1999. [AAT 9910355]

Students used an instructional strategy in which they independently constructed propositions from laboratory concepts and used them to form concept maps. Emphasis on proposition formation prior to concept map construction was shown to aid knowledge construction especially in relatively balanced student pairs.

lab, kns, cns, rem, cpl, bio (PS)

Carter, Timothy Lewis. (1998). *Enhancing students' science text learning and motivation through analogies* (University of Georgia). DAI-A 59/09, p. 3345, Mar 1999. [AAT 9908586]

This study hypothesized that the use of constructivist learning methods which involve analogies would improve text learning and motivation to learn. The results indicate that the sixth graders in the analogy condition had significantly higher recall than the sixth graders in the control condition.

cns, lrg, ats, ped, kns (MS)

Cavalli-Sforza, Violetta Laura Maria. (1998). *Constructed vs. received graphical representations for learning about scientific controversy: Implications for learning and coaching* (University of Pittsburgh). DAI-A 59/06, p. 1969, Dec 1998. [AAT 9837583]

This dissertation explores the usefulness of graphical representations in teaching students about scientific arguments. The development of a representation, by forcing a deeper analysis, can potentially yield a greater understanding of the domain under study. Results varied depending on the graphical representations used.

rem, lrg, ped, cbi, nas (PS)

Cavanaugh, Terence William. (1998). *Effect of using repurposed science-rich feature films with varying levels of student activity in middle grades science instruction* (University of South Florida). DAI-A 59/07, p. 2456, Jan 1999. [AAT 9842141]

This study investigated the use of repurposed content-rich entertainment videos (versus traditional educational videos) presented in either an active or passive educational setting. The results of the study indicate that the use of content-rich entertainment video may provide an effective alternative for science education.

ped, edt (MS)

Chang, Bao-Lian. (1998). *The relationship between locus of control, attitude toward, and perception of environmental education among preservice teachers in a Taiwan teachers college* (The Ohio State University). DAI-A 59/10, p. 3778, Apr 1999. [AAT 9911170]

The primary reason for doing the study was to access potential for increasing EE in elementary school by means of preservice teacher training. The findings of this study indicate that preservice teachers moderately agreed that their actions to offer EE could bring desirable outcomes in EE; they possess positive attitudes and perceptions regarding EE.

att, ene, tpd (TE)

Chastain, Patricia Louise. (1998). *Implementing inquiry: Effects of the summer institute in physics on curriculum and instruction* (University of Washington). DAI-A 59/09, p. 3407, Mar 1999. [AAT 9907887]

The teachers (n=6) participating in this study used worksheets for instruction in the topic they had studied in the institute, and all had adopted the practice of oral 'check-outs' modeled during the institute. Teachers varied in implementation of other inquiry teaching techniques, with the high school teachers following the model from the institute more closely than the middle school teachers.

inq, tpd, phy, ped, cur (SE, TE)

Chen, Shiwei. (1998). *Government and academy in Republican China: History of Academia Sinica, 1927-1949* (Harvard University). DAI-A 59/10, p. 3927, Apr 1999. [AAT 9910142]

This dissertation investigates the history and legacy of modern China's leading institution of advanced research, the Academia Sinica. The history of Academia Sinica is not simply a narrative of an institution, but the story of an important group of Chinese intellectuals and their interaction with the government at a critical juncture in twentieth-century Chinese history.

his, sts, nas (GEN)

Chien, Min-Huei. (1998). *Moving toward a lifelong learning society: The relationship of readiness to self-directed learning and resource support* (University of South Dakota). DAI-A 59/03, p. 775, Sep 1998. [AAT 9828282]

The hypotheses for this investigation involved the relationship between regular university students and university extension students at Shih Chien University and its educational extension institute in Taiwan. The results of the study showed no significant relationship between SDLRS and resource support in the two groups.

chs, sks, ats (PS)

Chorny, Jeffery John. (1998). *Comparison of high school physics students' achievement in a traditional classroom to students in a discovery-based classroom* (Michigan State University). MAI 37/04, p. 1075, Aug 1999. [AAT 1393504]

The purpose of this study was to compare student achievement in a high school physics unit on pressure using two different teaching methods. This study did not reveal extreme differences between the groups, but some key points can be noted. The test group showed more thorough understanding of the concepts and were able to apply these concepts in new situations.

inq, ach, phy, ped, kns (HS)

Chou, Chiu-Hsiang. (1998). *The effectiveness of using multimedia computer simulations coupled with social constructivist pedagogy in a college introductory physics classroom* (Columbia University Teachers College). DAI-A 59/07, p. 2429, Jan 1999. [AAT 9839055]

This study examined computer simulations within a conceptual change learning environment and compared it to more lecture-centered, traditional ways of teaching. Results indicated that the treatment group significantly outperformed the control group on the achievement test, and

had a higher rate of improvement on two subscales: Isolation of Variables and Abstract Transformation.

cbi, cns, phy, ccg, ped, ach (PS)

Chung-Schickler, Genevieve C. (1998). *The effect of cooperative learning on the attitudes toward science and the achievement of students in a non-science majors' general biology laboratory course at an urban community college* (Florida International University). DAI-A 59/09, p. 3328, Mar 1999. [AAT 9908038]

Results indicate no significant differences in the Test of Science-Related Attitudes scale or biology knowledge between the cooperative learning group and the control group. Analysis of the research data did not show any significant correlation between attitudes toward science and biology knowledge.

cpl, ats, ach, lab, bio (PS)

Coates, Judith Mary. (1998). *The art of creating a school: The Illinois Mathematics and Science Academy, 1979-1986* (Loyola University of Chicago). DAI-A 58/12, p. 4590, Jun 1998. [AAT 9819599]

Using the Academy's process of development as a model for creating other schools, conclusions are drawn and recommendations are proposed regarding seven key phases of development in the creation of a school. Issues are identified which could prove to be useful to educators involved in or considering the development of a new alternative school.

his, ref, cur (SE)

Cody, Anthony Martin. (1998). *Student questions: Foundations for inquiry* (San Jose State University). MAI 37/01, p. 47, Feb 1999. [AAT 1391515]

This qualitative study explores how science instruction can develop student questions into centerpieces of ongoing classroom inquiry. Active collegial dialogue, teacher research methodology and a reflective journal provide multiple perspectives for this exploration and establish the foundation for defining further questions.

inq, ped, tpd, skt (TE, HS)

Crane, Christine Corby. (1998). *Rural elementary teachers' perceptions of science education reform* (The Pennsylvania State University). DAI-A 60/01, p. 55, Jul 1999. [AAT 9915819]

The purpose of this study was to gain insight into elementary teachers' perceptions about current science reform goals and their thinking about factors that might facilitate and constrain them in this rural setting. The results suggest that these teachers felt uncomfortable teaching science, believing they lacked the ability to be quality science teachers.

att, ref, skt, tpd (EL)

Cromwell, John Randolph. (1998). *Training of a Wildlife Habitat Evaluation Program (W.H.E.P.) Team: A case study* (Auburn University). DAI-A 59/08, p. 2911, Feb 1999. [AAT 9904742]

The data indicate that the participants had experiences with nature prior to their W.H.E.P. participation and the greater the participants' experiences with nature the less competitive they were in the Alabama State W.H.E.P. contest. There was also shown to be a symbiotic relationship between the Tbilisi objectives.

ene, nfd, tpd, cht (TE)

Dallas, Sara Jane. (1998). *Broadening the scope: Incorporating biochemical concepts into the high school chemistry curriculum* (Michigan State University). MAI 37/02, p. 424, Apr 1999. [AAT 1392194]

Student success was evaluated by their performance on laboratory activities, a hands-on assessment, and an objective unit test. Results of these assessments indicate the students made connections to other scientific disciplines and were successful in applying learned concepts to new problems. Also, results suggest that students function and learn better in inquiry activities that provide some structure.

int, inq, cur, bio, che (HS)

Dardis, Deborah J. Athas. (1998). *A comparative study of the effect of student and instructor cognitive mapping on student achievement and attitudes in introductory college biology for nonmajors* (The University of Mississippi). DAI-A 59/07, p. 2340, Jan 1999. [AAT 9842370]

Results revealed no significant differences in the achievement of students in the control and experimental groups. Analysis revealed that

students who experienced no mapping consistently rated the instructor higher than did students who experienced instructor mapping. Students who cooperatively constructed cognitive maps reported the lowest scores on the opinion polls.

ats, ach, ped, cns. cpl, gen (PS)

Davis, Elizabeth Anna. (1998). *Scaffolding students' reflection for science learning* (University of California Berkeley). DAI-A 59/08. p. 2911, Feb 1999. [AAT 9902048]

This research sought to determine whether reflection prompts promote knowledge integration and what level of prompt specificity best supports students in that endeavor. Instructional designers should concentrate on building learning environments that provide opportunities for students to reflect, and allow students to take responsibility for directing their own reflection autonomously.

ped, lrg, cbi, phy (MS)

Dawes, Mary Ellen. (1998). *Experimental evaluation of self-efficacy treatment on techn.. l/scientific career outcomes* (Arizona State University). DAI-A 59/05, p. 1543, Nov 1998. [AAT 9833156]

Seventh and eighth grade students (n=169) were randomly assigned either to a published technology education program or to control curricula. Pre- and post-test instruments assessed technical/scientific self-efficacy and career interest. No treatment effects were found. A demand measure showed significantly greater valuing of the technology program over the control curricula.

cur, tec, ats, car (MS)

Dawson. Carol Johnson. (1998). *The impact of alternative conceptions on students' abilities to learn nonrenewable energy concepts pertaining to petroleum and coal* (The University of Alabama). DAI-A 60/03. p. 635, Sep 1999. [AAT 9920846]

The purpose of the study was to investigate sixth-grade students' (n=16) alternative conceptions regarding fossil fuels and issues relating to their use. The findings indicated that students' own interpretations of concepts interacted with ideas presented during classroom instruction. Students' interpretations of these fossil fuels resulted in a diverse set of unintended learning outcomes.

alf, lrg, ccg, esg, ene, kns (MS)

Dean, Kay Esther Axtell. (1998). *Study of hands-on activities in mathematics and science methods courses via interactive instructional television* (Northern Arizona University). DAI-A 59/08, p. 2832, Feb 1999. [AAT 9902500]

The study examined whether student teachers who took methods courses via interactive instructional television received instruction about hands-on activities, and whether they used the activities when they did their student teaching. The study finds that if the instructor models hands-on activities in the televisions broadcast, then student teachers are more likely to use them in the classroom.

edt, hos, skt, ped, tpd, knt (TE)

Decker, Luann Marie. (1998). *Stoichiometry unit project* (Michigan State University). MAI 37/02, p. 424, Apr 1999. [AAT 1392195]

The stoichiometry unit project is a chemistry unit that has been reconstructed to incorporate different teaching strategies embracing all of the different learning styles of the students. Test scores and unit scores were compared to those of a previous year. The difference was not statistically different but overall grades did improve. Students' attitude towards learning also improved.

lsy, ats, ach, cur, che (HS)

Dharmadasa, Indranie. (1998). *Children's conceptualization of force: Experimenting and problem-solving* (Auburn University). DAI-A 59/05, p. 1463, Nov 1998. [AAT 9835326]

This study examined the effects of constructivist instruction on 67 third grade children's conceptualization of force as compared to the instruction based on text and demonstrations by the teacher. Results showed that more than half of the children in the experimental group moved to a higher level in the posttest than did the control group.

cns, kns, ped, ccg, phy (EL)

Dickinson, Valarie L. (1998). *The influence of primary children's ideas in science on teaching practice*

(Oregon State University). DAI-A 59/02, p. 449, Aug 1998. [AAT 9824733]

The study examined how teachers identify and react to student ideas and how their responses impact students' learning. Implications are that children's ideas do play a role in teaching by influencing planning of lessons, encouraging teachers to seek ways of responding to student ideas, forming a basis for dialogue and discussion about science, and informing teachers of areas for improving their own content knowledge.

skt, cid, kns, ped, tpd (EL)

Dierberger, Betsy S. (1998). *Determination of informed choice and pathways leading to selection of the environmental studies (ES) major* (The University of Nebraska - Lincoln). DAI-A 59/11, p. 4099, May 1999. [AAT 9912685]

Interest in environmental issues, the challenge of solving problems and a desire to make a difference were factors identified as influencing selection of this major. Environmental career attributes which influenced choice were variety of tasks and use of science skills. Faculty advisors recommended the ES major to students who demonstrated a clear interest in natural resources.

car, ene, bkg, ats, chs (PS)

Ding, Dan Xiong. (1998). *Historical and social contexts for scientific writing and use of passive voice: Toward an undergraduate science literacy course* (Illinois State University). DAI-A 59/05, p. 1514, Nov 1998. [AAT 9835902]

When science was moving gradually toward a public enterprise from the early seventeenth century, the passive voice gradually replaced the active voice in science writing as a dominant stylistic feature. The passive voice is thus historically and socially conditioned. This work argues that undegraduate science teachers need to emphasize writing practice to have students use passives rhetorically to present experimental processes, materials and methods.

his, lit, nas, sks (PS)

Discenna, Jennifer Lynne. (1998). *A study of the knowledge structure of expert, intermediate, and novice subjects in the domain of physics* (Western Michigan University). DAI-A 59/06, p. 1970, Dec 1998. [AAT 9835499]

The results support a representation of physics knowledge based on both theories and models. The novices' hierarchy of models is a sub-set of the experts' and intermediates' hierarchies indicating that these models exist for experts and intermediates within the scope of the theory. The final representation is a hierarchy of models from general to specific connected and encompassed by a particular theory that can be used to create the models.

kns, rem, phy (ALL)

Dudley, Jutta Siefert. (1998). *The relation between drawing three-dimensional forms and understanding earth motions diagrams* (State University of New York At Buffalo). DAI-A 59/05, p. 1514, Nov 1998. [AAT 9833593]

Results indicate that abilities to imagine relative motion and to visualize from different points of view within a three-dimensional field are important to the understanding of concepts related to earth motions. Some of the same abilities appear to be utilized in the rendering of perspective drawings. Teachers are encouraged to include the drawing of three-dimensional fields in science class.

kns, sks, esg, lsy (SE)

Dunkerly-Kolb, Susan Jessamyn. (1998). *The construction and validation of an instrument to measure 'Community Understanding': Interdependence among community members, awareness of sustainability issues, and experience of connection with the environment* (Georgia State University). DAI-A 59/10, p. 3778, Apr 1999. [: AAT 9910357]

The purpose of this research was to develop an instrument to examine the construct of Community Understanding (CU) and to use the instrument to look at correlations between CU and environmental attitudes and action. Results indicate that research into CU from the standpoint of environmental attitude and action could contribute to knowledge needed to advance the cause of environmentalism in the educational process.

res, ene, sts, nfd (ALL)

Dwyer, William Michael. (1998). *Conceptual changes arising from the use of a search interface developed for an elementary science curriculum database* (University of Florida). DAI-A 60/02, p. 380, Aug 1999. [AAT 9919555]

The treatment included a training session in the use of Science Helper, followed by finding appropriate lessons to form a science mini-unit. The results did not find significant differences between pretest and posttest scores for the treatment group. The results of this study suggest caution in expecting too much from the affordances of a resource alone.

edt, skt, tpd (TE, EL)

Eaglin, Phillip G. (1998). *'Cor 'recting the under-achievement and underrepresentation of African-Americans in science: A case study* (The Florida State University). DAI-A 59/03, p. 776, Sep 1998. [AAT 9827667]

This research focuses on the influence of inequitable science teachers' beliefs and actions on the learning of African-American students. Teachers' beliefs and action produce uneven distribution of opportunities to learn science that are contributing to inequitable outcomes. This study seeks to further the understanding of teacher change towards equitable teaching.

att, eqt, eth, tpd (TE, HS)

Ealy, Julie Bowen. (1998). *Evaluation of a constructivist use of molecular modeling in first year college chemistry* (Columbia University). DAI-A 59/07, p. 2430, Jan 1999. [AAT 9838914]

The treatment group used a molecular modeling program and the control group did not. The use of modeling enhanced the conceptual understanding of the treatment group at the molecular level through their ability to manipulate images in three dimensions. Students reported advantages for both computer-generated and physical models.

cns, rem, cbi, che, lrg (PS)

Ely, Jane Alice. (1998). *Interest in mathematics and science among students having high mathematics aptitude* (State University of New York At Stony Brook). DAI-A 60/02, p. 553, Aug 1999. [AAT 9920401]

This study of men and women college students who all had high mathematics ability showed that there were no gender differences in course selection, attitudes towards mathematics, and career choice. This suggests that women with high ability in mathematics are just as likely as men to pursue interests in mathematics and related courses in college and in selecting careers.

car, gen, ats, bkg (PS)

Eskridge, Rosemary Horn. (1998). *Middle school assessment and the nature of science as related to the National Science Education Standards (NSES)* (Oklahoma State University). DAI-A 59/10, p. 3779, Apr 1999. [AAT 9910319]

Teachers continue to teach science in the way they experienced it or were trained. Few have used the concept of alternative assessments or lab activities. Teachers who had science endorsement reported using fewer process skills and those who have entered teaching from private industry demonstrated great background knowledge yet little participation in inquiry oriented activities. Those teachers who had been exposed to the NSES did describe assessment practices from the standards.

asm, nas, ref, cur, lab, inq (TE, MS)

Essary, Danny Ray. (1998). *Critical incidents influencing students' selection of elective science* (Texas A&M University-Commerce). DAI-A 60/04, p. 1068, Oct 1999. [AAT 9927573]

Nonselectors and selectors of elective science were influenced by various external factors. Nonselectors chose to select the minimum number of science classes necessary for graduation. Selectors were influenced by curriculum requirements, future concerns and mentors. Special programs that required extra science classes were influential in students' decisions. Gender differences were not influential.

ats, bkg, car, cur (PS)

Feather, Ralph Merle Jr. (1998). *The use of guided free and formal journal writing in the development of conceptual change in ninth-grade earth science students as measured using concept maps and achievement tests* (University of Pittsburgh). DAI-A 59/06, p. 1970, Dec 1998. [AAT 9837495]

Students within the experimental group spent five minutes at the end of each class for freewriting about concepts presented that day. Students in both groups began each unit of study by creating a concept map and taking a pre-achievement test. results show a significant interaction whereby journal writing did affect a positive increase in conceptual change when compared to students not using journal writing.

ccg, ped, cns, ach (HS)

Figueroa, Daphne Elizabeth. (1998). *Predicting student success in general chemistry* (The Claremont Graduate University and San Diego State University). DAI-A 59/04, p. 1112, Oct 1998. [AAT 9830211]

The study provides a reference to better judge the prerequisite skills, knowledge and attitudes that students should attain before enrolling in chemistry. Twelve factors (6 demographic, 3 cognitive and 3 affective) emerged as significant predictors of success. There were differences in which factors emerged based on the type of institution and on how student success was defined.

ach, che, che, ats, bkg (PS)

Finley, Sandra Jean. (1998). *Collaboration between a researcher and science teachers as research and professional development: A two-way learning street* (The University of Texas At Austin). DAI-A 59/06, p. 1970, Dec 1998. [AAT 9837957]

Given the present context of classrooms coupled with the radical changes in science teaching that are called for today, it has become critical to understand how teachers see their practice, how they talk about it, how they make sense of the dilemmas they encounter, and how they use their knowledge of teaching to improve their practice in the face of these challenges.

skt, tpd, ref, att (TE)

Firenze, Richard F. (1998). *The identification, assessment, and amelioration of perceived and actual barriers to teachers' incorporation of evolutionary theory as a central theme in life science classes through a two-week institute and follow-up studies* (State University of New York At Binghamton). DAI-A 58/12, p. 4605, Jun 1998. [AAT 9817376]

Participants reported a reduction in their perception of barriers to the incorporation of evolutionary theory, both on post-institute surveys and post-delay (final) surveys at the end of the academic year. Six of ten 'perceived barrier categories' showed a significant decrease. 'Lack of time,' 'personal inertia,' and the 'controversial nature of the topic' were identified as the most persistent barriers.

evo. att, tpd, bkg, ped (TE)

Foster, Andrea Susan. (1998). *Seeing things through science eyes: A case study of an exemplary elementary teacher* (Texas A&M University). DAI-A 59/08, p. 2859, Feb 1999. [AAT 9903113]

Conclusions indicate that an in-depth knowledge and passion for science, students, and teaching drives science-eyed teachers. She organizes curriculum and instruction with scientific principles and skills of inquiry in mind and improvises lessons to meet students' needs and interests in science. She seeks out other science-eyed teachers. She is unique, inventive, and self-aware.

cht, knt, att, skt (EL, TE)

Freed, Andrea Beth. (1998). *Constructing constructivism: The voyage of elementary science teachers* (University of Washington). DAI-A 59/09, p. 3394, Mar 1999. [AAT 9907900]

This study examined how participation in an institute which provided a constructivist learning environment affected the interactions between teachers and students in elementary science. Results indicated that the women interacted approximately twice as often as the men. An experience that provides a constructivist learning environment for participants may be effective in helping teachers to transfer the experience to their classrooms or in reinforcing and validating teachers' current practices.

cns, tpd, gen, att, knt (EL, TE)

Gatlin, Linda Sue. (1998). *The effect of pedagogy informed by constructivism: A comparison of student achievement across constructivist and traditional classroom environments* (University of New Orleans). DAI-A 59/08, p. 2916, Feb 1999. [AAT 9900967]

Students receiving traditional pedagogy scored higher than students taught by constructivist pedagogy on the science achievement posttest. Scores of constructivist students showed a slight increase on the delayed posttest, while traditional students' scores decreased. Those receiving constructivist pedagogy had higher retention, approaching significance of the biology concepts tested over time.

cns, ped, ach, bio, lrg (SE)

Gibson, Helen Lussier. (1998). *A study of the long term impact of an inquiry-based science program on student's attitudes towards science and interest in science careers* (University of Massachusetts). DAI-A 59/02, p. 449, Aug 1998. [AAT 9823739]

Conclusions drawn from the data indicate that Summer Science Exploration Program helped participants maintain a high level of interest in science. In contrast, students who applied but were not accepted showed a decrease in their attitude towards science and their interest in science careers over time, compared to the participants.

inq, ats, car, nfd (MS)

Gillette, Shana Cecile. (1998). *Quality resource networks for young women in science: The role of Internet-facilitated ties* (University of Washington). DAI-A 59/03, p. 647, Sep 1998. [AAT 9828488]

The study of the structure and composition of networks among individuals and school groups provided insight into how media are implicated in the development of resource networks, in particular for a subset of students who have been underrepresented in science--young ethnic minority women.

ntw, gen, eth, tec (HS)

Good, Jennifer Marie. (1998). *Retaining minorities in engineering: Assessment of a program prototype* (Auburn University). DAI-A 59/08, p. 2868, Feb 1999. [AAT 9904749]

This study found that students involved in the Minority Engineering Program had first quarter grade point averages exceeding those of their peers in earlier years prior to the program's existence.

eth, tec, ach, car (PS)

Grant, Andrew Morton. (1998). *Verbal and visual learning of science terminology by high school biology students* (Kent State University). DAI-A 59/06, p. 1888, Dec 1998. [AAT 9835593]

An experiment-1 group of 30 high school students was taught pictorially and a control group (n = 30) was taught verbally. This study found that the experimental group showed more science vocabulary learning than the control group. There were also significant gender differences.

lsy, ped, lrg, gen, bio (HS)

Graves, A. Palmer. (1999). *An investigation comparing traditional recitation instruction to computer tutorials which combine three-dimensional animation with varying levels of visual complexity, including digital video, in teaching various chemistry topics* (The University of Oklahoma). DAI-A 59/11, p. 4099, May 1999. [AAT 9911861]

The simultaneous presentation of digital video, showing the solid to liquid phase change of water, with a molecular animation, had a significant effect on college chemistry student particulate understanding when compared to traditional recitation.

cbi, rem, che, ped, lrg (PS)

Guarino, Lucia Falsetti. (1998). *Development and validation of a method for measuring depth of understanding in constructivist learning* (State University of New York At Buffalo). DAI-A 59/01, p. 143, Jul 1998. [AAT 9822145]

This study included a validation of an instrument, Depth of Understanding Assessment, by examining 230 eighth grade science students. There was a significant difference in depth of understanding which favored both the constructivist group and females. Students in the constructivist group perceived their learning environment to be more constructivist than students did in the objectivist group.

cns, asm, lrg, bkg, gen, cid (MS)

Guilbert, R. Ann. (1998). *Creating a vision of teaching: Two cases of beginning teachers' beliefs and practices* (The University of Iowa). DAI-A 60/02, p. 381, Aug 1999. [AAT 9917555]

Results indicate that beginning teachers enter the classroom with images of their role in the

classroom that are influenced by preservice programs. Those images, however, are not always clear and clarity was an influential factor in th participants' ability to implement the knowledge and skills they had examined in their preservice program. The results further indicate that beginning teachers who come from the same preservice programs enter their first year with a variety of images of teaching.

att, knt, ped, tpd, cht (TE)

Halsted, Sarah E. Washington. (1998). *Facilitating creative and critical thinking in middle school science* (Pacific Lutheran University). MAI 37/01, p. 47, Feb 1999. [AAT 1391339]

The results of this study indicate that educators must first change their pedagogical and theoretical frameworks for teaching science to establish a classroom environment where thinking in all its forms is cultivated. Second, the results support modeling, discourse, cooperative learning, and lab and hands-on activities as useful methods for facilitating creative and critical thinking.

pbs, ped, att, cpl, cid, hos (MS)

Harrell, Pamela Esprivalo. (1998). *How three biology teachers describe their teaching practice through metaphor* (University of Houston). DAI-A 59/03, p. 712, Sep 1998. [AAT 9828319]

Three exemplary high school biology teachers used metaphors (nurturer, provider, inspirer) to describe their teaching practice. These metaphors were stable over time and impacted several aspects of their practice.

att, ped, cht, tpd (TE)

Hatton, Mary E. (1998). *The impact of telecommunications on science teacher professional development* (Boston University). DAI-A 59/07, p. 2323, Jan 1999. [AAT 9900003]

This case study demonstrated that professional growth can occur when teachers interact collaboratively using telecommunications. Teachers from different summer institutes, who had never met, interacted as a community. Findings suggest that telecommunications is an effective option for sustaining collegial interactions and providing support.

tpd, ntw, edt (TE)

Hauge, James Brian. (1998). *Assessment of an outreach program for eighth-grade science students: Measurement of affective and cognitive gains* (Auburn University). DAI-A 59/05, p. 1514, Nov 1998. [AAT 9835336]

The College of Sciences and Mathematics Science Outreach Initiative was a summer program designed to attract students with the interest and ability to succeed in science and to keep them interested until they entered college. Analysis of Summer Science Camp Survey data (n=48) with paired samples (n=43) revealed that interest and self-efficacy significantly increased after Summer Science Camp.

ats, chs, car (SE)

Hayes, Michael Thomas. (1998). *Disciplined knowledge: Differentiating and binding the elementary science curriculum* (The University of Utah). DAI-A 59/04, p. 1117, Oct 1998. [AAT 9831675]

Science curricula at two schools with widely divergent demographics were different. These differences included social discipline, knowledge segmentation and reconfiguration, time and pacing, control of bodies, and testing, and the formality and intensity with which the curriculum was conducted.

cur, bkg, ped (EL)

Hefty, Eunice Ann. (1998). *Examining motivations, efficacy and interest in graduate study among teacher participants of a summer institute* (The University of Texas At Austin). DAI-A 59/09, p. 3356, Mar 1999. [AAT 9905751]

This study examined changes in self and general science teaching efficacy of teachers attending an environmental sciences summer institute in which they earned three hours of graduate credit. Teacher participants' apparent motivation(s) to attend in the absence of state and district mandates were also examined. The data revealed an increase in science teaching efficacy on posttests.

att, ene, tpd (TE)

Heide, Clifford Lee. (1998) *Attitudes of eighth-grade honors students toward the conceptual change methods of teaching science* (Northern Arizona University). DAI-A 60/02, p. 381, Aug 1999. [AAT 9918741]

This study found that students' attitudes toward science are positively influenced through the conceptual change teaching method by enabling students to: (1) choose problems and find solutions to those problems (student directed); (2) work together in large and small groups; (3) learn through student oral presentations; (4) perform hands-on laboratory experiences; (5) learn through conceptual understanding, not memorization; and (6) implement higher order learning skills to make connections from the lab to the real world.

ccg, ped, ats, pbs, cpl, hos (MS)

Hines, Mary Ellen. (1998). *Analysis of processes used by middle-school students to interpret functions embedded in dynamic physical models and represented in tables, equations and graphs* (Northern Illinois University). DAI-A 59/09, p. 3384, Mar 1999. [AAT 9906425]

Student thinking can be challenged and students can connect their knowledge of functions generated in one representation to another. Use of the dynamic physical models enabled students to interpret functions as repeated actions with several students constructing generalized interpretation of the process. Instruction incorporating the use of dynamic physical models is indicated and recommended.

rem, kns, lrg, pbs (MS)

Hoikka, Kari A. (1998). *The effectiveness of using problem solving in teaching ecology* (Michigan State University). MAI 37/02, p. 424, Apr 1999. [AAT 1392211]

This study examined the degree of student learning in ecology when using problem-solving techniques. Students were given an active role as they were presented with questions, then discussed the ideas being presented, decided what notes should be taken, and designed their own procedures to solve the problems. Upon comparing the pretest and the posttest results, a substantial increase in objective scores was noted, and the data were supported by statistical analysis using a t-test.

pbs, ene, lrg (SE)

Holschuh, Jodi Lynn. (1998). *Epistemological beliefs in introductory biology: Addressing measurement concerns and exploring the relationship with strategy use* (University of Georgia). DAI-A 59/10, p. 3779, Apr 1999. [AAT 9908606]

Participants (n = 518) were recruited from two sections of an introductory biology course. A factor analysis demonstrated four factors underlying epistemological beliefs (certain knowledge, innate ability, quick learning, and simple knowledge). A correlational analysis indicated a significant relationship between epistemological beliefs and strategy use. Epistemological beliefs and strategy use contributed a statistically significant amount of unique variance in SAT Verbal score, college GPA, and course grade.

phe, ach, pbs, kns, bio (PS)

Horn, Stanley James. (1998). *Oklahoma administrators' perceptions of applied science* (Oklahoma State University). DAI-A 60/05, p. 1505, Nov 1999. [AAT 9930175]

This study assessed the perceptions that Oklahoma Public School Superintendents have of Applied Biology/Chemistry and Applied Physics (Principles of Technology) compared to the traditional format of science courses.

cur, tec, sts, att (SE)

Huang, Hui-Ju. (1998). *Holistic aspects of children's ways of understanding in making sense of genetics* (University of Illinois At Urbana-Champaign). DAI-A 59/11, p. 4099, May 1999. [AAT 9912274]

The study examined the nature of how children make sense of phenomena in the area of genetics and inheritance in terms of five aspects (cognitive, affective, social, playfulness, and mode of awareness). In addition, the importance of considering language aspects of science learning was an emerging issue. Students' talking about genetics was embedded in the larger framework of social relationships and social institutions.

lth, bkg, cid, bio, sts (SE)

Hug, J. William. (1998). *Learning and teaching for an ecological sense of place: Toward environmental/*

science education praxis (The Pennsylvania State University). DAI-A 59/06, p. 1889, Dec 1998. [AAT 9836693]

This research presents a teaching model designed to enable learners to construct a highly developed ecological perspective and sense of place. The resulting model synthesizes and incorporates key educational philosophies and practices. Autobiographical and literature-based stories anchor the representations of ecological perspective and sense of place. Second, the dissertation text visually differentiates between story narrative, researcher narrative, and meta-narrative.

ene, phe, ped, cur (K-12)

Hulley, Kathy Louise Sullivan. (1998). *An instructional package integrating science and social studies instruction at the fifth-grade level* (The University of Mississippi). DAI-A 59/07, p. 2352, Jan 1999. [AAT 9842381]

This study focused on the integration of science and social studies at the fifth grade level using the Mississippi State Department of Education Curriculum Guidelines and Objectives and the National Science Education Standards. An instructional package was devised that enables teachers to create their own plans for an integrated curriculum of science and social studies.

int, sts, cur (EL)

Hunt, Thomas Paul. (1998). *Laboratory assessment in the chemistry classroom* (Michigan State University). MAI 37/02, p. 424, Apr 1999. [AAT 1392215]

The thesis proposes a comprehensive strategy for Laboratory Assessment in the Chemistry Classroom that effectively evaluated and validated the learning that occurs during laboratory activities. The rationale and methods are provided to implement a cohesive evaluation procedure incorporating ten different forms of laboratory assessment.

lab, asm, che (HS, PS)

Hunter, Evelyn M. Irving. (1998). *An examination of predictive variables toward graduation of minority students in science at a selected urban university* (Texas Southern University). DAI-A 60/02, p. 358, Aug 1999. [AAT 9917513]

This study examined the graduation rates of minority college students (N=101) majoring in the sciences. Socioeconomic status and GPA were found to contribute significantly to the graduation rates of minority students majoring in all sciences when combined with chemistry. Gender, high school GPA, SAT Total Scores, class rank, and socioeconomic status did not contribute significantly to the graduation rates of minority students in biology and pharmacy.

eth, car, bkg, ach, gen (PS)

Hunter, William John Forbes. (1998). *Student participation in World Wide Web-based curriculum development of general chemistry* (Purdue University). DAI-A 59/12, p. 4395, Jun 1999. [AAT 9914496]

This thesis describes an action research investigation of improvements to instruction in General Chemistry at Purdue University. This study was conducted to guide continuous reform of materials delivered via the World Wide Web by involving students, instructors, and curriculum designers. Students were able to learn chemical concepts that utilized 3-dimensional visualizations, but not textual and graphical information delivered via the Web.

cbi, che, rem, lrg (PS)

Ismail, Nageeb Kassem. (1998). *Science achievement of students in the Republic of Yemen and implications for improvement of science instruction* (Wayne State University). DAI-A 59/12, p. 4350, Jun 1999. [AAT 9915668]

Mean scores of the Second International Science Study test for 1,984 Yemeni students were 11.93 out of 35 items for science track students, 9.21 for three-year teacher training institution students, and 8.49 for five-year teacher training institution students. Fifth and ninth grade students' scores ranked at the bottom of scores of students from 15 and 17 other nations respectively.

ach, kns, knt (ALL)

Iuli, Richard John. (1998). *The use of metacognitive tools in a multidimensional research program* (Cornell University). DAI-A 59/04, p. 1113, Oct 1998. [AAT 9831077]

This naturalistic study investigated the Rhizobotany Project of the United States

Department of Agriculture, Agricultural Research Service. The prevalence of conceptual isolation and epistemological confusion among members of the Rhizobotany Project demonstrated the instability and inconsistency of science students' and researchers' epistemological commitments and beliefs.

phe, kns, car, res (PS)

Jadonath, Capildeo. (1998). *A case study of intersections between a physics classroom and industry* (University of Central Florida). DAI-A 59/07, p. 2431, Jan 1999. [AAT 9841677]

The purpose of this study was to describe a journey for one teacher and his students. This journey involved bridging the gap between his classroom and high-tech workplaces, while engaging students in an integrated physics curriculum called Advanced Technology Education.

ntw, int, tec, phy, car (HS)

Jasper, William Gordon. (1998). *Detecting biology teachers' images of teaching about science, technology and society* (University of Calgary). MAI 37/03, p. 745, Jun 1999. [AAT MQ34964]

This study investigated a mandated science curriculum change that incorporated Science-Technology-Society material in a high school biology program for the Canadian province of Alberta.

att, sts, bio, int, knt (HS)

Johnson, Sidney Thomas. (1998). *Writing to learn physics: The effectiveness of personal analytic and formal analytic essays as methods of writing to learn in high school physics classes* (North Carolina State University). DAI-A 59/03, p. 713, Sep 1998. [AAT 9826002]

The effects of writing to learn were investigated with 24 high school physics students. Results indicated no significant difference between groups writing personal analytic and formal analytic essays and no significant effect of writing apprehension on essay quantity. Significant differences appeared on application and concept questions when group performances were analyzed in terms of essay word quantities.

int, sks, phy, lrg (HS)

Jolly, Anju B. (1998). *The effectiveness of learning with concept mapping on the science problem-solving of sixth-grade children* (Indiana University of Pennsylvania). DAI-A 59/09, p. 3356, Mar 1999. [AAT 9908097]

This study analyzed the relationship of concept mapping to science problem solving in sixth grade elementary school children. Results from the analysis of covariance showed that the group receiving instruction in the concept mapping format performed significantly better than the group receiving instruction in traditional format.

pbs, rem, ped, sks, kns (EL)

Jones, Dorothy Ann Paul. (1998). *Cell division dialogues: Qualitative case studies of collaborative learning in an undergraduate biology teaching laboratory* (Purdue University). DAI-A 60/07, p. 2402, Jan 2000. [AAT 9939373]

This qualitative multiple case-study described and explained the nature of the laboratory learning process among small groups of undergraduates at work in introductory biology teaching laboratories through categorical and interpretive analysis of small group discourse, staff interviews and student lab work products. Instances of learning in the epistemological, social/affective, and ontological dimension were documented as question/answer loops.

cid, cpl, lab, bio, lrg (PS)

Joseph, Jann Luciana. (1998). *Faculty commitment to teaching in a research environment: A case study* (The University of Wisconsin - Madison). DAI-A 59/07, p. 2385, Jan 1999. [AAT 9826386]

The purpose of this research was to describe the environment in which research science faculty commit to teaching. The department's history and faculty's perceptions of teaching play an important role in faculty commitment to teaching. Collaboration with their peers and informal relationships, support staff contributions, interactions with graduate students, and administrative actions through tenure and merit increases influence faculty commitment to teaching. The role of Chair is pivotal.

att, res, bkg (PS)

Kao, Huey-Lien. (1998). *Case study of science teaching in an elementary school: Characteristics of an exemplary science teacher* (Indiana University). DAI-A 59/05, p. 1514, Nov 1998. [AAT 9834570]

An identified exemplary science teacher who teaches in an elementary school in Taiwan, Sam-Yu, was the subject of this study. Sam-Yu had a blend of views on the nature of science and a varied knowledge about science pedagogy. Personal preferences, past experiences, and the national science curriculum all played important roles in the refinement of Sam-Yu's beliefs about science and pedagogy.

cht, knt, ped, nas, bkg (EL)

Karrow, Douglas David. (1998). *Science teachers' views of creativity* (The University of Western Ontario). MAI 37/02, p. 424, Apr 1999. [AAT MQ32487]

Three science teachers were interviewed to explore their views of creativity and science pedagogy. Results indicate that science teachers' limited views of creativity can affect their pedagogy. The science teachers shared the commonly held belief that science and creativity are mutually exclusive phenomena.

att, phe, ped (TE)

Kaspar, Michael Joseph. (1998). *Factors affecting elementary principals' and teachers' decisions to support outdoor field trips* (The University of Texas At Austin). DAI-A 59/06, p. 1914, Dec 1998. [AAT 9838013]

To determine what would increase students' attendance at a nature preserve, factors that may affect elementary private and public school principals' and teachers' decisions to support field trips were identified and compared.

fsd, nfd, att, ene (EL)

Keller, Thomas Earl. (1998). *High school chemistry as a predictor of college chemistry performance* (University of Massachusetts). DAI-A 59/02, p. 449, Aug 1998. [AAT 9823746]

Data on completion of high school chemistry courses were disaggregated, analyzed, and compared with grade performance in first-year college chemistry. Completion of any level of high school chemistry failed to correlate with academic performance in college chemistry. Positive correlations were found between test scores and course grades with the mathematics section of the MEA and with both portions of the SAT.

ach, che, chs (HS, PS)

Kim, Hye-Won. (1998). *Effects of animated graphics of plate tectonics on students' performance and attitudes in multimedia computer instruction* (The University of Texas At Austin). DAI-A 59/09, p. 3395, Mar 1999. [AAT 9905768]

The purpose of this study was to examine the instructional effects of different computer models (i.e., text with static models and text with animated models) of plate tectonics on undergraduate students' (n=90) learning of geology concepts and attitudes towards Computer-Assisted Instruction. Students using animated visuals did significantly better than students using static visuals with respect to knowledge of plate tectonics, but they did not make a significant difference on subjects' attitudes in this study.

cbi, lrg, ats, esg (PS)

Kim, Young-Soo. (1998). *A study of concept maps regarding the nature of science by preservice secondary science teachers* (University of Missouri - Columbia). DAI-A 59/08, p. 2912, Feb 1999. [AAT 9901250]

This study investigated changes in preservice secondary science teachers' conceptions of the nature of science during a college level secondary science methods course as assessed through concept mapping. Preservice teachers' concept maps showed a statistically significant gain in acceptable concepts, vertical links, levels of hierarchy and total scores of acceptable components.

nas, knt, tpd (SE, TE)

King, Kenneth Paul. (1998). *'One Hundred Percent Efficiency': Technology and the pursuit of scientific literacy* (Northern Illinois University). DAI-A 60/03, p. 693, Sep 1999. [AAT 9918711]

This dissertation examined the historical role of technology (movies, television, and the computer) in science education. The convergence of the

various technologies into a single entity represents one likely scenario for the use of technology within science teaching. Further developments with telecommunications may provide simple and direct delivery systems for national and/or state curricula.

lit, tec, his, edt (ALL)

King, Michael John. (1998). *The effects of frequency of technology use on high school students' mathematics and science achievement* (University of Houston). DAI-A 59/03, p. 778, Sep 1998. [AAT 9828323]

This study examined the frequency of calculator and computer use among a nationally representative random sample (n=11,000) of U.S. high schools. Frequency of calculator use impacted mathematics and science exam scores, but mathematics students using computers 1-2 times per month scored significantly higher scores than students using computers almost every day.

ach, edt, cbi, ped, lrg (HS)

Klepper, Nancy Haifley. (1998). *The induction years: Pathways and barriers to effective practice for middle school science teachers* (The University of Texas At Austin). DAI-A 59/06, p. 1982, Dec 1998. [AAT 9838020]

This study explored philosophies, life experiences, educational preparation, classroom techniques, and perceived limitations of successful teaching practice for six middle school science teachers. Six themes emerged: Personal and Philosophical Characteristics of the Participants, Teacher Preparation and Life Experiences, Philosophies of Science Teaching, Successful Techniques for Learning, Barriers to Effective Classroom Practice, and Pathways to Success.

cht, phe, tpd, ped, att (TE, MS)

Klett, Mitchell Dean. (1998). *The effect of alternative clinical teaching experience on preservice science teachers' self-efficacy* (University of Idaho). DAI-A 59/02, p. 460, Aug 1998. [AAT 9825538]

This study compared different methods of alternative clinical experience; family science nights and Saturday science (authentic teaching) against micro-teaching (peer teaching) in terms of self-efficacy in science teaching and teaching self-efficacy. There was no significant change in the overall means for science teaching efficacy for any of the groups and the mean scores for all groups dropped for personal science teaching efficacy.

tpd, att, bkg (TE)

Knappenberger, Naomi. (1998). *The effects of the interaction between cognitive style and instructional strategy on the educational outcomes for a science exhibit* (University of Virginia). DAI-A 60/01, p. 65, Jul 1999. [AAT 9916324]

This dissertation examines factors which may affect the educational effectiveness of science exhibits. The results of a multiple regression analysis indicated that there was a significant interaction between cognitive style and instructional strategy that affected visitors' posttest scores on a multiple-choice test of the content.

nfd, lsy (ALL)

Kostas, Nancy Ann. (1998). *A gender analysis of secondary school physics textbooks and laboratory manuals* (Lehigh University). DAI-A 58/11, p. 4223, May 1998. [AAT 9814969]

Secondary school physics textbooks and laboratory manuals were evaluated for gender balance. Only two textbooks had a balance of men/women, boys/girls in the illustrations, drawings and photographs, while all textbooks were gender balanced for accomplishments of scientists. All laboratory manuals had skills and motivating factors important to girls.

mat, gen, eqt, ats, sks (SE)

Kovanis, Loukea Nakos. (1998). *Alternative approaches to teaching chemistry to improve achievement and overall attitude toward chemistry* (Eastern Michigan University). MAI 36/06, p. 1451, Dec 1998. [AAT 1390263]

This study examined the effects of the new curriculum on achievement and general attitude of suburban college-preparatory high school chemistry students. The results indicate that there are some positive trends in both achievement and attitude resulting from the new curriculum.

cur, ach, ats, che (HS)

Laba, Karen Anne. (1998). *Influences on teachers' curricular choices in project-based science classrooms* (University of New Hampshire). DAI-A 59/04, p. 1057, Oct 1998. [AAT 9831954]

This case study revealed the underlying relationships between teachers' conceptions of the nature of science, their understanding of their role as science teachers and their expectations for appropriate and worthwhile student learning, and to describe the influence of these factors on their curricular choices within the project-based framework.

nas, att, cur, lrg, ped (TE)

Lee, James Daniel. (1998). *Future scientists? The effects of gender, identity processes and self-concepts on retention of science, mathematics and engineering students* (Indiana University). DAI-A 59/09, p. 3398, Mar 1999. [AAT 9907311]

This study examined social factors affecting the educational and career aspirations and choices of academically talented students--drawn from summer science, mathematics and engineering programs--who are at the initial stages of pursuing a career in science and technology. Important differences between girls and boys in identity processes were found. Suggestions for improving retention of talented students are made in light of these findings.

car, gen, ats, chs, bkg (PS)

Lee, Kathryn Martell. (1998). *Science teachers' utilization of Internet and inquiry-based laboratory lessons after an Internet-delivered professional development program* (Lehigh University). DAI-A 59/04, p. 1129, Oct 1998. [AAT 9831806]

This study explored an Internet-delivered professional development experience, which utilized multiple session interactive real-time data sources and semester-long sustained telementoring. Findings suggest that science teachers benefited from a sustained coaching experience for inquiry-based lesson delivery and preferred the telephone as a coaching tool for its efficiency and convenience.

inq, cbi, tpd, ped, att (TE)

Lemire, Claire. (1998). *Science teachers' use of educational technology* (California State University Long Beach). MAI 37/02, p. 428, Apr 1999. [AAT 1392034]

From this study's survey results, it was found unlikely that educational technology will be used more in science classrooms unless teaching strategies such as constructivism are utilized to link science students with educational technology.

edt, ped, cns, att, knt (SE)

Lemont, Kenda Jo. (1998). *Polarity, solutions, and separation science* (Michigan State University). MAI 37/02, p. 425, Apr 1999. [AAT 1392230]

To motivate the students and help solidify concepts, student-directed, hands-on, visual, and relevant laboratory experiments were incorporated into science lessons. The evaluation instruments indicated that scores were the same as those achieved in other units, but long-term retainment was considerable, as indicated by posttests and interviews.

cur, hos, lrg, ped, inq, lab (SE)

Levy, Jennifer Ann. (1998). *Relationship between Teton Science School programs and teachers' ability to teach about the environment* (Utah State University). MAI 37/03, p. 749, Jun 1999. [AAT 1392922]

This thesis presents an analysis of 1996/97 survey research data regarding the relationship between Teton Science School (TSS) programs and classroom teachers' ability to teach about the environment. Teachers who participated in TSS programs reported doing a great deal of teaching about the environment and having a positive attitude toward environmental education.

tpd, att, ene, knt (TE)

Little, Kathryn Wells. (1998). *Science education with or for Native Americans? An analysis of the Native American Science Outreach Network* (University of Washington). DAI-A 59/06, p. 2087, Dec 1998. [AAT 9836211]

This study investigated a summer institute for science teachers and Native American paraprofessionals and students in the Department of Chemistry at the University of Washington (UW) from 1992-1996. An Advisory Board that included equal representation of Tribes and Elders, families, school personnel, and University representatives

designed and monitored the program, and considered the effect on the students of every decision made.

eth, ntw, cur, eqt (PS, TE)

Lizarzaburu, Venecia Giocconcla. (1998). *La Selva, El Mar, El Bosque y El Desierto* (California State University Dominguez Hills). MAI 36/06, p. 1439, Dec 1998. [AAT 1390262]

This paper assessed how effective the La Selva, El Mar, El Bosque, y El Desierto project was in helping upper-elementary English-only students (n=17) learn about animals and their habitats in Spanish. The results indicated a statistically significant gain between pre- and posttest scores.

cur, ach, mce, bio (EL)

Loman, Karen Lynn. (1998). *The impact of an experiential science program on fourth-grade students' knowledge of and feelings about ecological science* (University of Missouri - Columbia). DAI-A 59/08, p. 2913, Feb 1999. [AAT 9904878]

The present study was designed to evaluate the impact of an experiential science program, EarthWorks, on fourth-grade students' understanding of ecological science and feelings toward science. The statistical analysis of students' understanding of key concepts related to ecology and students' feelings about science identified areas of statistical significance.

ats, cur, ene, kns (EL)

Lowery, Maye Norene Vail. (1998). *Construction of teacher knowledge in context: Preparing elementary teachers to teach mathematics and science* (Texas A&M University). DAI-A 59/04, p. 1127, Oct 1998. [AAT 9830954]

In this study of preservice teacher knowledge and pedagogical content knowledge of elementary mathematics and science, an extensive acquisition of teacher knowledge and pedagogical content knowledge was discovered through identified learning components. Patience, flexibility, and communication were identified as necessities for successful teaching.

knt, lsy, ped, tpd (TE)

Luebeck, Jennifer Lyn. (1998). *Distance-mediated mentoring: A telecommunication-supported model for novice rural mathematics and science teachers* (Montana State University). DAI-A 59/04, p. 1102, Oct 1998. [AAT 9830114]

This study investigated the effectiveness of an innovative distance-mediated mentoring program for rural novice mathematics and science teachers. Impact on mathematics and science teaching was accomplished by: sharing materials and activities; planning units and projects; locating resources; classroom and student concerns; long-range curriculum design, and improvement of teaching practices.

ntw, tpd, bkg (TE)

Luera, Gail Rose. (1998). *The effectiveness of environmental education programs from the perspectives of three stakeholders: Participants, sponsors, and professionals* (The University of Michigan). DAI-A 59/10, p. 3779, Apr 1999. [AAT 9909942]

This dissertation explored how different stakeholders of two environmental education programs determined program effectiveness. The results show that all levels of stakeholders perceived the two programs to be effective. A preliminary model for environmental education program evaluation and recommendations for future related research are presented.

ats, asm, ene, cur, nfd (K-12)

Luttig, Ernest Paul. (1998). *Enhancing student learning with powerpoint presentations* (Michigan State University). MAI 37/02, p. 425, Apr 1999. [AAT 1392238]

PowerPoint presentations were effectively used to introduce, reinforce or review various topics that were studied in College Prep Chemistry classes.

cbi, che, lrg (PS)

Lyon, Ellen Beth. (1998). *The effect of homogeneous and heterogeneous review pairs on student achievement and attitude when utilizing computer-assisted instruction in middle-level earth science classes* (The University of Texas At Austin). DAI-A 59/06, p. 1970, Dec 1998. [AAT 9838039]

This project investigated the influence of homogeneous review pairs and heterogeneous

cooperative learning groups using computer-assisted instruction on academic achievement and attitude toward science in eighth grade Earth science students. Achievement was not influenced by placement in homogeneous or heterogeneous pairs, regardless of academic assignment.

cbi, cpl, ats, ats, esg (MS)

Mackin, Joan E. (1998). *Investigation of selected outcomes of the Dynamic Physics learning environment: Understanding of mechanics concepts and achievement by male and female students* (The Pennsylvania State University). DAI-A 59/08, p. 2913, Feb 1999. [AAT 9901076]

In the Dynamic Physics learning environment students made above-average normalized gains in physics conceptual understanding when compared with a range of normalized gains from physics education studies. The sample of female students had significantly lower average scores. Groups with one or more female members earned higher averages in group assessments than all male groups.

cbi, ach, gen, cpl (PS)

Madore, Kimberly Ann. (1998). *Learning at a distance: The experiences and attributional style of secondary students in an audio-graphics teleconference chemistry course* (Memorial University of Newfoundland). MAI 37/03, p. 750, Jun 1999. [AAT MQ34203]

This study investigated the experiences of secondary students in audio-graphics teleconference chemistry program from the students' perspective. The results revealed a character profile of the distance learner as one who is organized, responsible, independent, and a mature individual. The majority of distance students attributed to their success in distance education chemistry to level of effort.

edt, lsy, chs, che (SE)

Maldonado-Rivera, Jose Gabriel. (1998). *An examination of the factors affecting the teaching and learning of evolution* (Columbia University). DAI-A 59/07, p. 2431, Jan 1999. [AAT 9838982]

The factors affecting the teaching and learning of evolution were examined in the public schools of Puerto Rico. The teaching of evolution was found to be completely neglected due to the religious beliefs of teachers, deficient pre-service training in particular poor training in history and philosophy of science, and deficient content and methods knowledge. Conceptual change teaching was found to be effective in transforming student views towards more scientific ones.

evo, bkg, bfs, ccg, nas, phe (K-12)

Mann, Shelley Donna. (1998). *Beliefs to practice in postsecondary science education: The value of research/the research value* (Simon Fraser University). DAI-A 60/07, p. 2436, Jan 2000. [AAT NQ37730]

The intent of this study was to examine how beliefs of postsecondary science educators about the nature of science, and of education, influence their pedagogical decisions. Findings indicate that the research culture, so dominant during the teachers' own education, continued to inform their beliefs, and was revealed in their teaching.

knt, att, nas, res, bfs, tpd (PS)

Marion, Virginia Frances. (1998). *An analysis of the relationship between teachers' acquisition of physics content knowledge and their level of science teaching efficacy* (The University of Akron). DAI-A 59/10, p. 3791, Apr 1999. [AAT 9911366]

This study investigated Project Inquiry, a two-year long multiphase study, designed to transform the delivery of science instruction to a hands-on, minds-on, constructivist approach. Results indicated that although there were significant positive gains in physics content knowledge and science teaching efficacy. The overall average gains in physics content knowledge were not predictive of gains in either Personal Science Teaching Efficacy or Science Outcome Expectancy construct.

tpd, cns, inq, phy, att, kns (TE)

Mars. ek, Christine Susan. (1998). *Effects on seventh-grade students' achievement and science anxiety of alternatives to conventional frog dissection* (Northern Illinois University). DAI-A 59/09, p. 3415, Mar 1999. [AAT 9906436]

This study investigated long-term retention of frog internal anatomy between seventh-grade students (n=280) using an interactive CD tutorial,

a desktop microworld, and conventional frog dissection. There appeared to be a relationship between treatment and gender in terms of effect on science anxiety. For learning gain scores, some cases within the microworld treatment proved to be significant.

cbi, lab, bio, ats, ach, gen (MS)

Marx, Jeffrey David. (1998). *Creation of a diagnostic exam for introductory, undergraduate electricity and magnetism* (Rensselaer Polytechnic Institute). DAI-A 59/09, p. 3420, Mar 1999. [AAT 9908686]

To fill the need for a tool testing introductory, undergraduates' knowledge of basic concepts in electricity and magnetism (EM), the investigator developed a sixty-six item, multiple-choice diagnostic exam (DEEM) that gauged students' pre-instructional and post-instructional knowledge and helped identify common misconceptions.

alf, asm, phy, kns (PS)

Mathew, Nishi Mary. (1998). *The effect of electronic networking on preservice elementary teachers' science teaching self-efficacy and attitudes towards science teaching* (The University of Texas At Austin). DAI-A 59/06, p. 1891, Dec 1998. [AAT 9838043]

Preservice elementary teachers' science teaching efficacy and attitude towards science teaching are important determinants of whether and how they will teach science in their classrooms. Findings of this study revealed that prospective elementary teachers in an electronically networked group had better science teaching efficacy and personal science teaching efficacy as compared to the non-networked group of preservice elementary teachers.

att, ntw, tpd (EL)

McCammon, Constance L. (1998). *The effectiveness of cooperative learning in the primary classroom in relation to science education* (Texas Woman's University). MAI 37/01, p. 47, Feb 1999. [AAT 1390867]

This study compares cooperative learning behaviors between a first grade and a fourth grade and founds that first grade students may not be developmentally ready for cooperative learning groups.

cpl, chs, lth (EL)

McEneaney, Elizabeth H. (1998). *The transformation of primary school science and mathematics: A cross-national analysis. 1900-1995* (Stanford University). DAI-A 59/08, p. 3235, Feb 1999. [AAT 9901555]

Multivariate statistical analyses found the construction of modern curricular materials is highly sensitive to various kinds of organizational, cultural, and professional linkages to world society. The trends found in science and mathematics are most accurately seen as part of a wider shift in curricular content, cutting across all subject areas and extending through university-level curricula.

mat, cul, bkg, ref (EL)

McLoughlin, Andrea Sabatini. (1998). *The politics of learning to teach: The juxtaposition of reform, risk-taking, and survival for a prospective science teacher* (The Pennsylvania State University). DAI-A 59/08, p. 2913, Feb 1999. [AAT 9901091]

This naturalistic case study examined a reform-oriented preservice science teacher's beliefs and actions during a year of field practica. Inductive data analysis indicated that tacit beliefs interacted with significant events of the field experiences to direct the participant's learning-to-teach process in non-educative ways.

bkg, tpd, att, ref (TE)

McPhail, Cynthia Leigh. (1998). *Child second language interaction in science-based tasks* (State University of New York At Buffalo). DAI-A 59/05, p. 1435, Nov 1998. [AAT 9833623]

This study examined the questions of whether students' speech act behavior and language use would vary by linguistic grouping. Second grade Puerto Rican native speakers of Spanish, and native English speakers completed sets of paired, hands-on, science activities.

mce, cid, cpl, hos (EL)

McWhirter, Lisa Jo. (1998). *Conceptual development and retention within the learning cycle* (The University of Oklahoma). DAI-A 59/09, p. 3395, Mar 1999. [AAT 9905620]

Forty-eight sixth-grade students and one teacher at an urban middle school participated in this study of the learning cycle. Individual's

assimilation, disequilibration, accommodation and organization may not correlate with the phases of the learning cycle.

lth, lrg, phe, ped (MS)

Merkel, Jennifer Beth. (1998). *Inquiry-oriented science programs: New views on the implementation process* (University of Southern California). DAI-A 59/05, p. 1448, Nov 1998. [AAT 9835171]

This study described the policy context, patterns of implementation and individual change pathways of teachers in an inquiry-oriented science program for elementary level school students over a two year period of time.

inq, cur, att (EL)

Mishra, Punyashloke. (1998). *Flexible learning in the periodic system with multiple representations: The design of a hypertext for learning complex concepts in chemistry* (University of Illinois At Urbana-Champaign). DAI-A 59/11, p. 4057, May 1999. [AAT 9912322]

This study looked at the development of a hypertext multi-media educational computer program. FLiPS (Flexible Learning in the Periodic System) is based on Cognitive Flexibility Theory that emphasizes the use of multiple representations for advanced learning in complex domains.

cbi, rem, lth, che (HS, PS)

Monhardt, Leigh Christopher. (1998). *The effect of teaching strategies focusing on student ideas, parent partnerships, and children's literature on elementary students' perceptions about and attitudes toward science* (The University of Iowa). DAI-A 59/09, p. 3395, Mar 1999. [AAT 9904326]

This study evaluated whether elementary school students would perceive changes in their science instruction when teachers and parents attempted to reform the science curriculum as part of the Science PALs project that encompassed four years. At the 5-6 grade level both male and female students in implement or classrooms responded in the desired direction in 8 out of 10 comparisons.

ats, cur, ref, ped (EL)

Morris, Keith Alan. (1998). *A constructivist approach to exploring physical and chemical changes in the junior high science classroom* (Michigan State University). MAI 37/02, p. 425, Apr 1999. [AAT 1392243]

This study evaluated the effectiveness of instructional materials created for a junior high science classroom as students explored concepts of physical and chemical changes of matter through hands-on laboratory investigations.

cns, mat, hos, lab, cur (MS)

Moss, David M. (1998). *Examining student conceptions of the nature of science from two project-based classrooms* (University of New Hampshire). DAI-A 59/04, p. 1113, Oct 1998. [AAT 9831962]

This study found that precollege participants held fully formed conceptions of the nature of science for approximately 40 percent of the premises. Participants held more complete understandings of the nature of scientific knowledge than the nature of the scientific enterprise.

nas, kns (SE)

Mueller, Andrea Christiane. (1998). *A desire to inquire: Children experience science as adventure* (The University of British Columbia). DAI-A 59/12, p. 4363, Jun 1999. [AAT NQ34595]

This study explored the nature of children's (Grade 6/7) participation in elementary school science in British Columbia, Canada. Spaces of inquiry were identified within a dynamic interdependence of learners and environment. These spaces were: generative, rehearsal, and performative.

inq, ats, bkg (EL)

Mullinnix, Debra Lynn. (1998). *The effect of science-technology-society issue instruction on the attitudes of female middle school students toward science* (University of Houston). DAI-A 59/03, p. 714, Sep 1998. [AAT 9828328]

This study examined the effect science-Technology-society issue instruction had on the attitudes of female middle school students toward science in comparison to male middle school students and to female middle school students who experienced traditional science instruction.

ats, sts, gen (MS)

Mullins, Joyce A. (1998). *How field trips in natural areas associated with museums, arboreta, and aquariums impact the educational experiences of teachers and students* (The University of Southern Mississippi). DAI-A 59/07, p. 2431, Jan 1999. [AAT 9840837]

This study exposed the variety of perspectives from which teachers (n=17), students (n=349), and museum instructors (n=9) use natural settings associated with museums, arboreta and aquaria to enhance educational experiences. Also examined were obstacles to and reasons for conducting field trips. A model was developed for constructing field trips designed to incorporate unstructured time for students to explore, reflect, and develop relationships.

fsd, nfd, ats, att (K-12)

Nass, Jennifer Johanna. (1998). *The Manduca Project for Middle School: The development and pilot testing of a new science curriculum* (The University of Arizona). DAI-A 59/05, p. 1448, Nov 1998. [AAT 9831844]

This dissertation describes the development and pilot-testing of an inquiry-driven science curriculum, The Manduca Project for Middle School, which is built around investigations of the tobacco hornworm. Results of the study indicated no measurable post-treatment effect on science attitude and dramatic post-treatment improvements in science concept acquisition.

cur, inq, lrg, ats, mat (MS)

Nelson, William Roger. (1998). *Enhancing teaching style variety in the middle school science classrooms at the Pittsgrove Township school district* (Nova Southeastern University). DAI-A 59/11, p. 4111, May 1999. [AAT 9913301]

The goal of this project was to enhance teaching style variety in middle school science classrooms by enhancing science teacher awareness of the impact of lesson planning, teaching styles, accommodations of student learning styles, and reflective practices. The project began to move the teaching style paradigm from one that has been teacher centered to one that is student centered.

lsy, tpd, ped (MS)

Nieland, Joni Jean. (1998). *Developing a school wilderness area into a self-guided, interpretive learning center* (Southwest State University). MAI 37/01, p. 47, Feb 1999. [AAT 1391116]

This paper is the documentation of the process used to develop a 22 acre wilderness area into an outdoor learning center located on school property and utilized by the teachers and students in the school district, clubs and groups within the community, and tourists visiting the area

nfd, fsd, ene (ALL)

Novemsky, Lisa Forman. (1998). *Second teaching: An exploration of cognitive factors in small group physics learning* (Rutgers the State University of New Jersey - New Brunswick). DAI-A 59/05, p. 1515, Nov 1998. [AAT 9834120]

This study explored introductory physics teaching using traditional instruction followed by structured small group activities designed to facilitate the learning process for students who find a physics optic (way of seeing) and physics language foreign. Male gains in language clarity were closely coupled with physics learning whereas female gains in the two measures were not coupled.

cpl, cid, phy, gen (PS)

O'Neill, David Kevin. (1998). *Engaging science practice through science practitioners: Design experiments in K-12 telementoring* (Northwestern University). DAI-A 59/05, p. 1515, Nov 1998. [AAT 9832654]

This dissertation reports on a set of design experiments conducted around 'telementoring,' the use of telecommunications to support the development of mentoring relationships between students in school and adults in workplaces. Teams of students who invested greater effort in sustaining their telementoring relationships were significantly more likely to produce sophisticated arguments about their research.

ntw, sks, res, car (K-12)

Ollerenshaw, Jo Anne. (1998). *A study of the impact of a supplemental storytelling (oral narrative) strategy on fourth-grade students' understanding of the physics of sound* (The University of Iowa). DAI-A 59/08, p. 2913, Feb 1999. [AAT 9904310]

This study examined an instructional treatment designed to facilitate fourth-grade students' change in science understanding through narrative practice. Also examined was the extent to which students incorporated increasingly complex science content (physics of sound) into narratives. Students in the treatment group outperformed students in the comparison group.

ccg, ped, phy (EL)

Orloff, Teresa Lynn. (1998). *Women in science: What keeps them interested?* (University of Cincinnati). DAI-A 59/05, p. 1448, Nov 1998. [AAT 9833736]

This study found that the relative order of importance of interest and persistence of females in science were: (1) science teachers (2) parents (3) summer/extracurricular science programs, (4) mentors, and (5) media. Results suggest that the discomfort that elementary teachers have in teaching science and the little time spent teaching science minimize the influence elementary teachers have on female interest and persistence in science.

gen, ats, car, bkg (ALL)

Osmundson, Ellen. (1998). *Children as scientists: Adding, connecting and elaborating ideas on the way to conceptual development* (University of California Los Angeles). DAI-A 60/01, p. 67, Jul 1999. [AAT 9917224]

This study explored how children develop and construct their ideas and alternative frameworks in science. Alternative conceptions and prior understandings did not disappear as children developed their ideas about light. Ideas were used and reused to provide support the gradual process of cognitive development of children's ideas.

alf, cns, lth, ccg, phe (EL)

Ostgaard, Marjorie Margaret. (1998). *Benefits of the space program* (Southwest State University). MAI 37/01, p. 47, Feb 1999. [AAT 1391792]

This project determined whether middle school students would have an increased awareness and a more positive attitude toward the United States Space Program after being informed of its applied technologies and numerous spinoff products. There were significant increases between pre and post surveys.

ats, cur, sts, esg (MS)

Parker, Mary Jo. (1998). *The effects of a shared, Intranet science learning environment on the academic behaviors of problem-solving and metacognitive reflection* (Baylor University). DAI-A 59/11, p. 4046, May 1999. [AAT 9912894]

This study investigated the effects of a shared, Intranet science environment on the academic behaviors of 9th and 10th grade biology students (N=78). Significant differences were found in problem-solving and metacognitive reflection. Lack of gender differences suggests an equalizing effect from a cooperative, collaborative nature of Intranet environments.

pbs, ntw, sks, gen, edt, bio (HS)

Petrosino, Anthony J. Jr. (1998). *At-risk children's use of reflection and revision in hands-on experimental activities* (Vanderbilt University). DAI-A 59/03, p. 725, Sep 1998. [AAT 9827617]

This study investigated the incorporation of reflection and revision in hands-on science instruction that emphasized experimentation using model rockets. Low achieving sixth grade summer school students (n = 23) scored low at first with traditional hands-on instruction but improved significantly upon reflection and revision of their experiments

chs, hos, sks, ped (MS)

Plohocki, Barbra A. (1998). *National chemistry teacher safety survey* (Lehigh University). DAI-A 58/11, p. 4224, May 1998. [AAT 9814983]

Secondary school chemistry teachers (n=303) responded to a survey developed about science laboratory safety. Many indicated that they were not adequately instructed on the collegiate level in science laboratory safety and rely on common sense and self-study.

knt, lab, che, tpd (SE)

Pollock, Kathy Rita. (1998). *A unit on photosynthesis and cellular respiration for secondary biology students* (Michigan State University). MAI 37/02, p. 425, Apr 1999. [AAT 1392251]

A unit on photosynthesis and cellular respiration was developed for a high school Biology I course. Student scores on the posttest demonstrated a marked increase in understanding of key concepts.

cur, mat, bio, ach (HS)

Pulver, Eric J. (1998). *The physics of sound and music* (Michigan State University). MAI 37/02, p. 425, Apr 1999. [AAT 1392254]

A new unit on sound and music was developed to supplement the existing wave unit in a physics class. Student understanding was increased due to the additional experiments and other activities provided.

cur, mat, phy, ach (HS)

Rahm, Jrene. (1998). *Growing, harvesting, and marketing herbs: Ways of talk and thinking about science in a garden* (University of Colorado At Boulder). DAI-A 60/01, p. 67, Jul 1999. [AAT 9916826]

This case study examined the kinds of learning opportunities in science provided by an inner-city youth gardening program. Findings suggest that such work was perceived as science only when framed in terms of conducting an experiment, engaging in observations, or implying use of tools and team-work.

nfd, fsd, lrg, ats, nas (K-12)

Raiford, Lisa Renee. (1998). *The influence of the international baccalaureate experimental science program format on classroom learning environment and student attitudes toward the subject of science* (University of Florida). DAI-A 60/02, p. 381, Aug 1999. [AAT 9919636]

This study examined the classroom learning environments and science attitudes of twelfth grade students (n=82) in three science classrooms. Results suggest that science students preferred more personalized teacher-student interactions and that more positive science attitudes may result in greater participation in physics classes.

bkg, ats, cid, phy (HS)

Rea-Ramirez, Mary Anne. (1998). *Models of conceptual understanding in human respiration and strategies for instruction* (University of Massachusetts). DAI-B 59/10, p. 5196, Apr 1999. [AAT 9909208]

The study analyzed how middle school students learn about human respiration in one-on-one tutoring interviews. All students in this study were successful in constructing mental models of a complex concept, respiration, and in successfully applying these mental models to transfer problems.

lrg, cns, rem, bio (MS)

Rearden, Kristin Theresa. (1998). *Beginning secondary science teachers' classroom roles and instructional methods: An exploratory study of conflicts within practical theories* (Texas A&M University). DAI-A 59/08, p. 2914, Feb 1999. [AAT 9903187]

This research examined the practical theories of 27 beginning secondary science teachers. Most of the teachers alluded to an Executive-type approach to teaching. Sources of conflict included difficulty with meeting the students' individual needs and the inability to match views of the nature of science with instruction.

knt, att, ped, cht, nas (SE)

Riley, Wayne David. (1998). *Characterizing the successful student in general chemistry and physical science classes in terms of Jung's personality types as identified by the Myers-Briggs Type Indicator* (Middle Tennessee State University). DAI-A 59/07, p. 2431, Jan 1999. [AAT 9842090]

This study correlated the Myers-Briggs Type Indicator, a measure of students' personality type with performance in general chemistry (n=1041). The data suggest that students with certain personality traits may be favored in a chemistry class due the structure of the instruction and the presentation of the subject matter.

chs, che, ach (PS)

Robertson, William Oren. (1998). *The utilization of NASA and other Internet aerospace web sites by coordinators of Tennessee Space Week* (Oklahoma State University). DAI-A 59/10, p. 3727, Apr 1999. [AAT 9909084]

This study found that the number of computers connected to the Internet is presently too small to determine the success of the Tennessee Space Week classroom curriculum. In those schools where the Internet is utilized, coordinators do access and integrate NASA and other Internet

aerospace Web sites within classroom instruction.

cbi, cur, esg (K-12)

Robin, Regina Spires. (1998). *Science for children and the untutored in eighteenth-century England* (City University of New York). DAI-A 59/09, p. 3622, Mar 1999. [AAT 9908354]

This study examined successful authors who sought to simplify scientific material while conserving sophisticated language and complex ideas. This study addresses the gap between children's literature and the popularization of science.

lit, his, sts (GEN)

Robinson, Janet Bond. (1998). *Theory-into-practice research: Effective learning environments for introductory chemistry* (The University of Iowa). DAI-A 59/05, p. 1515, Nov 1998. [AAT 9834506]

This research looked at student learning in introductory college chemistry. At first the course served as gatekeeper, by using relative grading, rapid coverage of content, and little attention to student concerns. The consequences of the gatekeeper function were the most serious impediments to student learning of chemistry.

bkg, lrg, che (PS)

Ross, Donna Louise. (1998). *Influences of block scheduling on secondary science teaching practices* (University of Washington). DAI-A 60/01, p. 93, Jul 1999. [AAT 9916710]

This case study explored the instructional and attitudinal changes that accompany the restructuring of the daily schedule into 100-minute periods. Positive attitudes toward block scheduling were found. Test scores and grades were not strongly influenced. Teachers met more of the state science standards and spent more time interacting with small groups during the block schedule.

bkg, ats, ach, cid (SE)

Salyer, Barbara Ann. (1998). *Traversing the educational ladder: Perspectives on science curriculum reform* (The University of Texas at Austin). DAI-A 59/06, p. 1893, Dec 1998. [AAT 9838108]

This case study examined the experiences, beliefs, and perceptions of stakeholders in one Texan school district and in the state education agency as they worked toward reform in the secondary science curriculum. Teachers' concerns about their science backgrounds, lack of information about the new approach, and lack of communication posed serious barriers to the success of the reform.

ref, att, cur (SE)

Sandoval, William A. (1998). *Inquire to explain: Structuring inquiry around explanation construction in a technology-supported biology curriculum* (Northwestern University). DAI-A 59/12, p. 4353, Jun 1999. [AAT 9913882]

A model of inquiry as the coordination of argumentative and investigative knowledge was the basis for the design of an inquiry-based curriculum for evolutionary biology using software supports. This design showed improvement in students' use of data in their explanations.

inq, evo, cbi, sks (PS)

Saul, Jeffery Mark. (1998). *Beyond problem-solving: Evaluating introductory physics courses through the hidden curriculum* (University of Maryland College Park). DAI-A 59/06, p. 1971, Dec 1998. [AAT 9836477]

This study compared the effectiveness of traditional instruction with University of Washington's Tutorials, University of Minnesota's Group Problem Solving & Problem Solving Labs, and Dickinson College's Workshop Physics in ten undergraduate institutions. The three research-based curricula were more effective for helping students learn velocity graphs, Newtonian concepts of force and motion, harmonic oscillator motion, and interference.

cur, pbs, phy, asm (PS)

Saunders, Georgianna L. (1998). *Relationships among epistemological beliefs, implementation of instruction, and approaches to learning in college chemistry* (The University of Oklahoma). DAI-A 59/07, p. 2432, Jan 1999. [AAT 9839804]

This study investigated relationships among students' (n=232) epistemological beliefs and

approaches to learning, and examined the possible influence of teachers' (n=5) implemented instruction on students' beliefs and learning approaches. Students who believed in an external knowledge authority were more likely to memorize information than to 'make sense' of information.

lsy, phe, che (PS)

Sawatzky, Victor Frank. (1998). *A comparison of the treatment of heat and temperature at the middle school level in Germany/Bavaria and Canada/Manatoba* (The University of Manitoba). MAI 37/02, p. 425, Apr 1999. [AAT MQ32958]

This thesis compares curricular and textual documents from Germany/Bavaria and Canada/Manitoba with regard to the central topic of heat and temperature. This comparison revealed the importance of recognizing the differences in age and societal background when selecting concepts.

cul, phy, mat, cur (MS)

Saxena, Jeeta Lakhani. (1998). *Determining the environmental training needs and training preferences of tribal officials on reservations in the United States* (West Virginia University). DAI-A 60/01, p. 45, Jul 1999. [AAT 9916470]

This study determined the priority environmental management training needs (drinking water, wastewater, and solid waste), classroom training system preferences and related cultural factors of Native American tribal officials (n=18) with environmental responsibilities living on reservations in the United States.

eth, ene, sts (AD)

Schepige, Adele Catherine. (1998). *A case study investigating the process of implementing the recommendations of the 'National Science Education Standards' by a fourth-grade elementary teacher* (Portland State University). DAI-A 59/08, p. 2914, Feb 1999. [AAT 9904057]

This case study of a teacher found six influences in the development of an inquiry-based science program: colleagues, reading materials, school context, student behavior, the participant observer, and experimentation. Children's literature was integrated with science in different ways for different reasons

ref, inq, int, att, bkg, mat (EL)

Schleyer, Claudia Janette. (1998). *A comparison of cognitive skills utilized in high school physical education, English, mathematics, and science programs* (Texas A&M University-Kingsville). DAI-A 59/10, p. 3774, Apr 1999. [AAT 9909716]

This study of 63 teachers found that English, math, and science share common cognitive skills; physical education (PE) shares common cognitive concepts with math and science; teachers in four disciplines have positive attitudes toward the value of PE, the role of cognitive learning in PE, and integration of PE with other subject areas.

int, att (HS)

Schwarz, Christine Virginia. (1998). *Developing students' understanding of scientific modeling* (University of California Berkeley). DAI-A 60/03, p. 694, Sep 1999. [AAT 9923043]

This study found that students had a significantly better understanding of the nature and utility of models after completing the Model-Enhanced ThinkerTools curriculum. Improvements were seen in students' conceptual models of force and motion as well as their inquiry skills and epistemological beliefs about the nature of science.

rem, nas, cbi, inq, phe, cur (MS)

Scott, Gary. (1998). *Toward an understanding of middle school students' problem-solving strategies: Establishing a foundation for teacher inquiry* (University of California Los Angeles). DAI-A 59/02, p. 450, Aug 1998. [AAT 9823555]

In this study students (n=495 student pairs) from two middle schools were given a 'hands-on' experience in solving a real-world forensics problem. Approximately twice as many groups correctly solving the problem used an evidence-based approach compared to groups that missed the answer. Trial and error and menu-based were the dominant problem-solving strategies.

pbs, sks, sts (MS)

Seatter, Carol Eunice Scarff. (1998). *An analysis of the concept of teaching in elementary school science*

education (Simon Fraser University). DAI-A 60/06, p. 1970, Dec 1999. [AAT NQ37754]

This thesis examines constructivist theory in terms of its potential to hinder the development of scientific reasoning in children. Reasoning in science is compared with children's common-sense reasoning in an attempt to further understand the phenomenon of children's science.

cns, lth, phe, lit, alf, ccg (K-12)

Shaklee, Janie Mefford. (1998). *Elementary children's epistemological beliefs and understandings of science in the context of computer-mediated video conferencing with scientists* (University of Northern Colorado). DAI-A 59/08, p. 2854, Feb 1999. [AAT 9902429]

Students were found to have increased their understanding of science based in this brief contact with scientists. Results of the epistemological investigation were inconclusive. Further study, with a larger sample size, was recommended.

nas, ntw, phe, cbi (EL)

Shih, Ching-Chun. (1998). *Relationships among student attitudes, motivation, learning styles, learning strategies, patterns of learning, and achievement: A formative evaluation of distance education via web-based courses* (Iowa State University). DAI-A 59/11, p. 4099, May 1999. [AAT 9911641]

Students (N=99) with different backgrounds and with different learning styles learned equally well in Web-based courses. Students were more interested in checking their grades than in communicating with the class and instructors via e-mail, discussion netforum or chat netforum. Motivation and learning strategies explained more than one-third of student achievement

edt, lsy, ats, ach, cbi (PS)

Shimizu, Kinya. (1998). *The effect of inquiry science activity in educational productivity* (University of Illinois at Chicago). DAI-A 59/12, p. 4354, Jun 1999. [AAT 9915008]

This is a study of the effect of inquiry science activity on the science achievement of junior high school students. Results failed to support the effectiveness of the hands-on science teaching. However, when teachers emphasized the scientific inquiry skill in the lower grade, the effect of inquiry emphasis had a significant impact.

inq, ach, hos, sks, ped (MS)

Silcox, Pamela Erin. (1998). *A comparison of women pursuing traditional and nontraditional science majors* (The University of Western Ontario). MAI 37/01, p. 36, Feb 1999. [AAT MQ30684]

This study found that women (N=135) in traditional and nontraditional science majors did not differ on the variables of career self-efficacy, attitudes toward feminism and self-esteem, although nursing students did have significantly higher self-esteem than the nontraditional academic majors and the Occupational Therapy students.

car, gen, ats, chs (PS)

Sillman, Kathleen Anderson. (1998). *Metaphor: A tool for monitoring prospective elementary teachers' developing metacognitive awareness of learning and teaching science* (The Pennsylvania State University). DAI-A 60/01, p. 102, Jul 1999. [AAT 9915951]

The main emergent findings of this study of preservice teachers were that participants' reflections indicated a focus on student-centered beliefs about teaching and learning. The extent of learning to teach science and putting those beliefs into action depended on the prospective teachers' personal histories as science learners and on their perceptions of the environment influenced by their cooperating teachers.

att, lth, bkg, tpd (TE)

Slaughter, Jeanne Marie. (1998). *Content construction: How content becomes curriculum in secondary science classrooms* (The University of Arizona). DAI-A 59/08, p. 2918, Feb 1999. [AAT 9901763]

Factors found to influence two teachers as they incorporated new content into their teaching included internal factors: the teachers' past experiences with science, personal content knowledge, confidence, and beliefs about science, learning and science teaching; and external factors: students' abilities, time constraints, and physical classroom limitations.

cur, att, knt, bkg (SE)

Slough, Scott Wayne. (1998). *High school science teachers' perceptions of telecommunications utilizing a concerns-based adoption model* (University of Houston). DAI-A 59/08, p. 2914, Feb 1999. [AAT 9903988]

This study described high school science teachers' (n=24) perceptions of telecommunications. Telecommunications can be implemented successfully in a variety of high school science classrooms with adequate infrastructure support and sufficient professional development opportunities, including classes taught by females and teachers who had not been computer experts.

att, edt, bkg, tpd (HS)

Smith, Brian Keith. (1998). *Classroom cinema: Explaining behavior using video as data* (Northwestern University). DAI-A 59/12, p. 4409, Jun 1999. [AAT 9913889]

This study developed a better understanding of how technology supports student inquiry in high school science classrooms. The dissertation describes an investigation model that attempts to capture the expert strategies involved in observing and explaining complex, visual processes.

edt, inq, lrg, sks, pbs (HS)

Smith, Shane Harvie. (1998). *The change in students' understanding of the mole concept in introductory college chemistry* (The University of Southern Mississippi). DAI-A 59/07, p. 2432, Jan 1999. [AAT 9840841]

This study found a significant relationship between introductory chemistry students' (n=180) understanding of the mole concept and their cognitive level. There was no significant relationship between students' understanding of the mole concept and the type of class, or the number of lectures. Students of all cognitive levels retained misconceptions at semester's end.

kns, alf, che (PS)

Smith, Wade Clay Jr. (1998). *Student perceptions of their biology teacher's interpersonal teaching behaviors and student achievement and affective learning outcomes* (Texas Tech University). DAI-A 59/07, p. 2331, Jan 1999. [AAT 9842003]

Results indicate that the Questionnaire on Teacher Interactions is a society/culturally sensitive instrument that needs to be normed to a particular society/culture before it is used to affect teachers' and students' educational environments.

asm, ats, bkg, cid, eth (HS)

Smithson, John Lawrence. (1998). *The effects of paradigmatic orientations of education research and discourse* (The University of Wisconsin - Madison). DAI-A 60/03, p. 685, Sep 1999. [AAT 9903098]

This essay presents an examination of contemporary disputes over methodological and epistemological foundations underlying inquiry within the field of education research; investigating the obstacles to communication and understanding found in scholarly exchanges occurring across competing paradigmatic orientations. A model of dialogue, based upon characteristics of convergence, divergence, inclusive and critical traits, is adopted and applied to a sample of cross-paradigmatic exchanges found in recent educational research journals.

res, phe (GEN)

Sohan, Donna Elizabeth. (1998). *The relationship of knowledge, attitudes and perceptions regarding biotechnology in college students* (Texas A&M University). DAI-A 59/08, p. 2888, Feb 1999. [AAT 9903202]

This study found that despite a low awareness or knowledge of biotechnology, undergraduate students (n>3000) were accepting of specific applications or products of biotechnology. A majority of students identified mass media as their major sources of biotechnology. Students indicated that biotechnology information is needed and is appropriate for high school students.

kns, sts, lit, bio ats (PS)

Sopko, Linda Diane. (1998). *A science methods course in a professional development school context: A case study of student teachers* (Texas A&M University). DAI-A 59/08, p. 2935, Feb 1999. [AAT 9903203]

This case study found that student teachers were able to transfer knowledge of inquiry-based instructional strategies into their science lessons. Student teachers in grades four and five believed

they were unable to teach science at the desired degree due to preparing students for standardized tests in language arts and math

inq, knt, att (EL)

Spitulnik, Michele Wisnudel. (1998). *Construction of technological artifacts and teaching strategies to promote flexible scientific understanding* (The University of Michigan). DAI-A 59/10, p. 3780, Apr 1999. [AAT 9910028]

This study found that students built inquiry understanding by defining problems, constructing models and developing positions, and built epistemic understanding by describing the purposes of models as generalizing phenomena, testing hypotheses and making predictions. However, students demonstrated difficulty in using evidence to defend scientific arguments.

inq, rem, lrg, sks, nas, tec (SE)

Steffy, Herbert Lloyd. (1998). *Documenting changes in a middle school science classroom: An action research case study* (University of Central Florida). DAI-A 59/03, p. 776, Sep 1998. [AAT 9827991]

This study reports classroom changes occurring during a case study of reformed science teaching. Changes were informed by student perceptions to assist the reform process, effectively incorporated computer technology into a core academic subject classroom, and resulted in making the learning process enjoyable for students.

ref, ats, cbi (MS)

Tai, Robert H. (1998). *Experience, gender, and performance: Connecting high school physics experience and gender differences to introductory college physics performance* (Harvard University). DAI-A 59/04, p. 1114, Oct 1998. [AAT 9830074]

This study found that college physics students benefited from being taught fewer topics in greater depth in high school physics and from having fewer labs in high school. College females did better than males in non-calculus physics, but this trend was clearly reversed for calculus-based physics.

bkg, gen, ach, phy, lab (HS, PS)

Taylor. Rosalee. (1998). *Stories in the elementary science classroom* (Texas Woman's University). MAI 36/05, p. 1230, Oct 1998. [AAT 1389756]

Findings suggest that using a story to explain scientific concepts enhances the retention of concepts. Recommendations are to continue using stories at the elementary level to encourage learning and retention of scientific concepts.

ped, lrg (EL)

Templin, Mark Arnold. (1998). *Science discourse in a middle-grade classroom attempting learning community-centered science instruction* (The University of Michigan). DAI-A 59/07, p. 2432, Jan 1999. [AAT 9840658]

Analysis of discourse indicated that middle school students increasingly developed independence from the teacher in selecting, developing, and using material and conceptual tools, built on each other's ideas during discussion and debate, and progressed from describing observations in common sense language to integrating scientific concepts.

cid, lrg, cpl (MS)

Tien, Lydia Tsing. (1998). *Fostering expert inquiry skills and beliefs about chemistry through the MORE laboratory experience* (University of California Berkeley). DAI-A 59/08, p. 2915, Feb 1999. [AAT 9902256]

College students experiencing the Model-Observe-Reflect-Explain (MORE) classroom achieved significant gains in all areas compared to the control groups. Students in the MORE class recognized the complex dynamic processes typical of scientific practice, developed more sophisticated inquiry skills, and practiced modeling and reflection in the laboratory.

lab, inq, rem, sks, ped, che (PS)

Titus, Aaron Patrick. (1998). *Integrating video and animation with physics problem-solving exercises on the World Wide Web* (North Carolina State University). DAI-A 59/12, p. 4395, Jun 1999. [AAT 9914763]

Students had more difficulty solving computerized visual problems compared to traditional problems. Survey responses revealed that students had difficulty determining what

was needed to solve a problem when it was not explicitly given to them in the text of the question. By analyzing think-aloud problem-solving interviews, it was found that multimedia-focused problems required solid conceptual understanding.

pbs, cbi, sks, phy (PS)

Toolin, Regina Elizabeth. (1998). *The influence of prior knowledge, a science methods course, and student teaching on preservice teachers' developing philosophy and practice of teaching science in elementary school* (The University of Wisconsin - Madison). DAI-A 59/05, p. 1451, Nov 1998. [AAT 9813748]

This study examined two preservice teachers' knowledge, experiences, and beliefs about science, teaching, learning and the social conditions of schools in the context of a science methods course and student teaching.

tpd, bkg, att, knt (EL)

Trax, Mark Francis. (1998). *Views of collaboration among administrators and teachers involved in science education reform* (The University of Iowa). DAI-A 59/05, p. 1516, Nov 1998. [AAT 9834524]

Support for collaboration and science education reform depended on a district's overall organizational style (classified as top-down, bottom-up, or a combination), was connected to the level of commitment of the sciences teachers and administrators, was linked to the level of solidarity for that support among teachers and administrators, and was demonstrated by the allocation of resources.

att, ref, bkg, ntw (K-12)

Turner, Della Rose. (1998). *Achievements of cross-age teaching* (Texas Woman's University). MAI 36/05, p. 1230, Oct 1998. [AAT 1389759]

This study examined cross-age teaching and its positive impact on the student doing the teaching. This study also measured the achievement of the cross-age student, including demonstration skills, vocabulary, and understanding of subject material being demonstrated.

ach, ped, sks, kns (MS)

Von Secker, Clare Elaine. (1998). *Using hierarchical linear growth models to evaluate protective mechanisms that mediate science achievement* (University of Maryland College Park). DAI-A 60/03, p. 717. Sep 1999. [AAT 9921644]

Positive attitudes, high expectations, and more intense science course-taking had positive effects on achievement of all students, although they were not equally protective in all social contexts. Effects associated with authoritative parenting and peer influences were negative, regardless of social context.

ach, bkg (K-12)

Voska, Kirk William. (1998). *Identification and analysis of student conceptions used to solve chemical equilibrium problems* (University of Northern Colorado). DAI-A 59/08, p. 2915, Feb 1999. [AAT 9902431]

This study identified conceptions college students used when solving chemical equilibrium problems that applied Le Chatelier's principle. Eleven prevalent incorrect conceptions were identified. Students consistently selected correct answers more frequently (53% of the time) than they provided correct reasons (33% of the time).

alf, che, asm (PS)

Waayers, Dirk P. (1998). *The relationship between computer-based learning of solar system information and student achievement* (California State University Dominguez Hills). MAI 37/02, p. 429, Apr 1999. [AAT 1392532]

This study found that the computer-based drill and practice game of solar system information called Space Colonies significantly increased knowledge of the solar system.

cbi, ach, esg (K-12)

Walker, Cynthia Marie. (1998). *Using contrasting pedagogical approaches to detect differential item functioning in the Third International Mathematics and Science Study* (University of Illinois At Urbana-Champaign). DAI-A 59/11, p. 4117, May 1999. [AAT 9912416]

This study examined whether students taught in a more constructivist classroom would have a higher probability of obtaining the correct answer to mathematics items that required a student to reason mathematically. Confirmatory factor analyses were conducted on the multiple choice

items utilized by Third International Mathematics and Science Study (TIMMS) researchers.

ach, asm, cns, sks, kns (K-12)

Wallace, Jill Y. (1998). *Mentoring in a computational problem-solving environment* (The University of New Mexico). DAI-A 59/03, p. 794, Sep 1998. [AAT 9826663]

High school students (N=174), engaged in computational science project work were the subjects in this study of academic mentoring in a computational problem solving environment. The results suggest that mentored students received significantly higher computational science project scores than non-mentored students.

pbs, ntw, bkg (HS)

Wang, Hsingchi. (1998). *Science in historical perspectives: A content analysis of the history of science in secondary school physics textbooks* (University of Southern California). DAI-A 60/02, p. 381, Aug 1999. [AAT 9919122]

This study investigated both the extent that the history of science was included in four high school physics textbooks. History passages were found to be aligned with the foci of educational standards. Most history of science examples were superficial, lacking in-depth elaboration, and examples of the process of science made little use of historical approaches.

mat, his, phy, ref (HS)

Warnick, Brian K. (1998). *The effects of using agricultural applications in teaching high school biology on student achievement as measured by a state core competency test* (Utah State University). MAI 37/01, p. 24, Feb 1999. [AAT 1391054]

This study measured the effectiveness of teaching biology using agricultural applications by comparing a treatment group to a control group. Statistical differences were found in the areas of gender, agricultural involvement, perceptions of agriculture, and GPA, but not on performance on the standardized competency test.

int, ach, bio, sts, ats (HS)

Weld, Jeffrey Donn. (1998). *The effects of national cash awards for science teaching on recipients and their peers* (The University of Iowa). DAI-A 59/05, p. 1516, Nov 1998. [AAT 9834531]

This study found that award winning science teachers perceived awards to result from, rather than to inspire, good teaching. Their motivation derived from student achievement and a job well done. Award winners perceived awards as difficult to win, minimally motivating, and frequently causing dissension among peers.

att, tpd (SE)

Wells, Franklin Brian. (1998). *The effect of the use of concept maps on community college students' conceptual understanding of biology course content* (Texas A&M University-Commerce). DAI-A 59/07, p. 2433, Jan 1999. [AAT 9839954]

The use of concept maps, as advance organizers, was an effective method for improving student learning in general biology classes. A positive relationship existed between students' cognitive developmental level and conceptual understanding.

rem, lrg, bio (PS)

Wessel, Warren Edward. (1998). *Knowledge construction in high school physics: A study of student/teacher interaction* (The University of Regina). DAI-A 60/02, p. 382, Aug 1999. [AAT NQ35822]

Nine grade 12 physics students had experiential knowledge that interfered with conceptual knowledge. Concrete examples did not guarantee conceptual understanding of a given phenomenon. Students used algorithms indiscriminately without knowing if answers were reasonable, plus they did not understand the complex process of vector mathematical representation.

cns, kns, phy, rem (HS)

Whitfield, Frank Albert. (1998). *Policy efforts used to develop awareness aimed at increased students' scientific literacy and career choices in mathematics, science and engineering* (Peabody College For Teachers of Vanderbilt University). DAI-A 59/12, p. 4381, Jun 1999. [AAT 9916009]

This study examined a talent pool of African American students who were academically able to pursue a career in a math-based major. Results found that although an appreciable number of students were academically able to enter math

related majors, many were reluctant to choose this career direction.

eth, lit, car, ats (PS)

Wieseman, Katherine Claire. (1998). *A case study of primary teachers' personal theories and understandings of standards-based science education reform* (University of Georgia). DAI-A 59/10, p. 3780, Apr 1999. [AAT 9908653]

This study was designed to contribute to current understandings of teachers' perspectives of science education reform, and to describe the relationships between the personal theories about science teaching and learning held by three 'unique' experienced primary teachers and their understandings of a state-level standards-based vision of school science.

att, ref, cur, ped (EL)

Willcox, Jacqueline Kay. (1998). *Science experiences of six elementary student teachers: A case study* (The University of North Dakota). DAI-A 60/02, p. 343, Aug 1999. [AAT 9917886]

This study found that four out of six student teachers studied ranked science third or lower in a rank order of subjects they enjoyed teaching. At the end of their student teaching experience, three of the student teachers were eager to teach science and had a vision of how they would do so, but the other three were not sure how they would teach science.

att, tpd, ped, cur (TE, EL)

Williams, Karen Ann. (1998). *An investigation of meaningful understanding and effectiveness of the implementation of Piagetian and Ausabelian theories in physics instruction* (The University of Oklahoma). DAI-A 59/01, p. 77, Jul 1998. [AAT 9822813]

This study examined college physics students' (n=25) overall (concept + problem solving + mental model) meaningful understanding of force, density/Archimedes' principle, and heat. Also examined were students' meaningful understanding as measured by conceptual questions, problems, and mental models. Students were able to increase their meaningful understanding.

lth, phy, kns, lrg, rem, alf (PS)

Wingfield, Mary E. (1998). *The effect of site-based preservice experiences on elementary science teaching self-efficacy beliefs* (University of Houston). DAI-A 59/03, p. 776, Sep 1998. [AAT 9828336]

This descriptive study identified factors in site based experiences that affected preservice elementary teachers' (n=131) self-efficacy as measured by the Science Teaching Efficacy Belief Instrument. Results indicate that these experiences had a significant positive impact on the preservice teachers' self-efficacy.

att, bkg, tpd (TE, EL)

Wissing, Dennis Robert. (1998). *The nature of undergraduates' conceptual understanding of oxygen transport and utilization in humans: Can cardiopulmonary simulation software enhance learning of propositional knowledge and/or diagnose alternative conceptions in novices and intermediates?* (The Louisiana State University and Agricultural and Mechanical College). DAI-A 60/03, p. 695, Sep 1999. [AAT 9922127]

Results of this study suggest that computer simulation, clinical interviews, and concept mapping may be an effective instructional method for assessing conceptual development and diagnosing alternative conceptions in undergraduates enrolled in a cardiopulmonary science program.

cbi, alf, asm, kns, rem, bio (PS)

Wittman, Michael Carl. (1998). *Making sense of how students come to an understanding of physics: An example from mechanical waves* (University of Maryland College Park). DAI-A 60/03, p. 695, Sep 1999. [AAT 9921649]

This dissertation developed curriculum materials that replaced traditional recitation instruction and that were designed to facilitate a more complete and appropriate understanding of wave physics. Findings suggest that research-based instructional materials were more effective than the traditional lecture setting in helping students apply appropriate reasoning elements to the physics of waves.

mat, cur, phy, ped, lrg (PS)

Wood, Kevin Ashley. (1998). *Preparation for college chemistry: High school and college perspectives* (Texas Woman's University). MAI 36/05, p. 1231, Oct 1998. [AAT 1389761]

This study compared the subject matter presented in a high school chemistry course to the expectations of subject matter knowledge of college chemistry professors teaching a college general chemistry class. Areas where discrepancies existed were identified and solutions proposed.

cur, che (HS, PS)

Wozny, Paul David. (1998). *A view into performance assessment in science* (University of Alberta). DAI-A 59/07, p. 2294, Jan 1999. [AAT NQ29135]

This collaborative research project involved the design, implementation, and analysis of five sets of performance assessment activities with a group of eight science teachers at an urban composite high school in Alberta.

asm, tpd (HS)

Wright, Katharine Jane. (1998). *The effects of cooperative learning on science academic achievement of fourth graders* (Central Missouri State University). MAI 37/03, p. 729, Jun 1999. [AAT 1393108]

This study was designed to investigate the effectiveness of cooperative learning on the science academic achievement of fourth graders.

cpl, ach (EL)

York, Kimberly Jane. (1998). *Efficacy of the World Wide Web in K-12 environmental education* (Michigan State University). DAI-A 60/03, p. 713, Sep 1999. [AAT 9922395]

This exploratory study investigated teachers' attitudes toward using the Web to share environmental education resources. A few respondents reported that they currently use the Web to find curricular resources. More than 86% of those responding to the Web-based survey indicated that they would visit and use an environmental education Web site designed specifically for teachers.

att, edt, ntw, ene (K-12)

Zerbe, Michael James. (1998). *Toward a cultural studies-based pedagogy for the rhetoric of science* (Purdue University). DAI-A 60/03, p. 731, Sep 1999. [AAT 9921115]

This study proposed, justified, and theorized a cultural studies-based pedagogy for the rhetoric of science that is useful in writing across the curriculum courses. Conceptions of literacy as perceived by humanities scholars and scientific literacy as perceived by scientists and science educators are discussed.

ped, lit, nas, int (K-12)

Dissertations and Theses by Institution

This list consists of 110 institutions that produced research dissertations and theses in the area of science education for the year 1998.

Arizona State University
Burke; Dawes
Auburn University
Cromwell; Dharmadasa; Good; Hauge
Ball State University
D. Brown
Baylor University
Parker
Boston University
Bodwell; Hatton
California State University Dominguez Hills
Lizarzaburu; Waayers
California State University Long Beach
Lemire
Central Missouri State University
Wright
City University of New York
Robin
The Claremont Graduate University
Figueroa
Columbia University
Ealy; Maldonado-Rivera
Columbia University Teachers College
Chou
Cornell University
Iuli
Eastern Michigan University
Kovanis
Florida International University
Almeida; Chung-Schickler
The Florida State University
Eaglin
Georgia State University
C. Carter; Dunkerly-Kolb
Harvard University
Chen; Tai
Illinois State University
Ding
Indiana University
Kao; J. Lee
Indiana University of Pennsylvania
Jolly
Iowa State University
Akpan; Shih
Kent State University
Buck; Grant
Lehigh University
Kostas; K. Lee; Plohocki
The Louisiana State University and Agricultural and Mechanical College
Aguillard; Britton; Wissing
Loyola University of Chicago
Coates
Memorial University of Newfoundland
Madore
Michigan State University
Alshannag; Cajas; Canestraight; Chorny; Dallas; Decker; Hoikka; Hunt; Lemont; Luttig; Morris; Pollock; Pulver; York
Middle Tennessee State University
Riley
Montana State University
Luebeck
North Carolina State University
Johnson; Titus
Northern Arizona University
Dean; Heide
Northern Illinois University
Hines; K. King; Marszalek
Northwestern University
O'Neill; Sandoval; B. Smith
Nova Southeastern University
Nelson
The Ohio State University
Chang
Oklahoma State University
Eskridge; Horn; Robertson
Oregon State University
Barrett; Dickinson
Pacific Lutheran University
Halsted
Peabody College For Teachers of Vanderbilt University
Whitfield
The Pennsylvania State University
Crane; Hug; Mackin; McLoughlin; Sillman
Portland State University
Schepige

Purdue University
W. Hunter; Jones; Zerbe
Rensselaer Polytechnic Institute
Bauchspies; Marx
Rutgers the State University of New Jersey - New Brunswick
Beeber; Novemsky
San Diego State University
Figueroa
San Jose State University
Cody
Simon Fraser University
Mann; Seatter
Southwest State University
Nieland; Ostgaard
Stanford University
McEneaney
State University of New York At Binghamton
Firenze
State University of New York At Buffalo
Agairre-Ortiz ; Dudley; Guarino; McPhail
State University of New York At Stony Brook
Ely
Texas A&M University
Foster; Lowery; Rearden; Sohan; Sopko
Texas A&M University-Commerce
Essary; Wells
Texas A&M University-Kingsville
Schleyer
Texas Southern University
E. Hunter
Texas Tech University
W. Smith
Texas Woman's University
Allen; Baucum; McCammon; Taylor; Turner; Wood
The University of Akron
Marion
The University of Alabama
Dawson
University of Alberta
Wozny
The University of Arizona
Nass; Slaughter
The University of British Columbia
Brigden; Brooks; Mueller
University of Calgary
Jasper
University of California Berkeley
Adams; Bell; Davis; Schwarz; Tien
University of California Los Angeles
Osmundson; Scott
University of Central Florida
Jadonath; Steffy
University of Cincinnati
Orloff
University of Colorado At Boulder
Rahm
University of Florida
Dwyer; Raiford
University of Georgia
T. Carter; Holschuh; Wieseman
University of Houston
Bailer; Harrell; M. King; Mullinnix; Slough; Wingfield
University of Idaho
Carr; Klett
University of Illinois At Chicago
Shimizu
University of Illinois At Urbana-Champaign
Huang; Mishra; Walker
The University of Iowa
Brockmeyer; Guilbert; Monhardt; Ollerenshaw; Robinson; Trax; Weld
University of Kentucky
Ballard
The University of Manitoba
Sawatzky
University of Maryland College Park
Saul; Von Secker; Wittman
University of Massachusetts
Gibson; Keller; Rea-Ramirez
The University of Michigan
Bos; Breen; Luera; Spitulnik; Templin
The University of Mississippi
Dardis; Hulley
University of Missouri - Columbia
Brent; Y. Kim; Loman
The University of Nebraska - Lincoln
Dierberger
University of New Hampshire
Laba; Moss
The University of New Mexico
Wallace
University of New Orleans
Gatlin
The University of North Dakota
Willcox
University of North Texas
Burns
University of Northern Colorado
Shaklee; Voska
The University of Oklahoma
Graves; McWhirter; Saunders; Williams

University of Pittsburgh
Cavalli-Sforza; Feather
The University of Regina
Wessel
University of South Dakota
Chien
University of South Florida
Cavanaugh
University of Southern California
Merkel; Wang
The University of Southern Mississippi
Mullins; S. Smith
The University of Texas At Austin
Arburn; N. Brown; Finley; Hefty; Kaspar; H. Kim; Klepper; Lyon; Mathew; Salyer
The University of Utah
Hayes
University of Virginia
Knappenberger
University of Washington
Chastain; Freed; Gillette; Little; Ross
The University of Western Ontario
Karrow; Silcox
The University of Wisconsin - Madison
Joseph; Smithson; Toolin
Utah State University
Levy; Warnick
Vanderbilt University
Brophy; Petrosino
Walden University
Bradford
Wayne State University
Ismail
West Virginia University
Saxena
Western Michigan University
Discenna

Trends in Selected Topics of Science Education Research

This section contains a small collection of summaries of research reported in 1998 pertaining to specific topics in science education. Each author chose a particular subject code from the *Key to Codes* (see page *ix*), considered all of the dissertations, journal articles, and research papers listed in this compilation related to the subject code, and then wrote a brief summary of the documents. In writing the summaries, authors were asked to consider the major findings from research, any issues arising from the current studies (or from a lack of studies), and possible directions for future research. Each of the subjects selected for review in this section necessarily contains a limited number of documents for review and reflects the author's interests. These summaries represent only a sampling of important subjects of contemporary relevance in science education.

Index of Summaries:

Concept Representation and Modeling in Science

Judith Sulkes Ridgway
The Ohio State University

When reviewing trends in science education research, it is striking to see the variety of models and representations and their diverse applications. The "rem" code used in this book is a catchall for anything that is used or produced by the students, teachers, or software developers to represent their ideas and intangible concepts as well as imperceptible objects and scientific processes. The 1998 science education publications reflect this diversity. Researchers reported how teachers and students use three-dimensional, computer, or conceptual models to analyze students' ideas, improve content understanding, and teach scientific processes. Concept representations were investigated in terms of concept maps, abstract picture language, and visual images. Teachers used these for assessment, advanced organizers, and interview tools. Three emergent themes seem to be that when models or representations are used: (1) students have enhanced learning of scientific principles, (2) students gain an appreciation of scientists' work habits, and (3) these tools can appear in many formats.

Educators have found that models and conceptual representations can make abstract concepts more accessible. Intangible scientific concepts have been a problem for both teachers and students. Whether they are used by children in the sixth grade, community college students, or teachers, research indicates that the tools effectively help users improve performance and decrease apprehension about the scientific concepts (Czerniak & Haney, 1998; Ealy, 1998; Jolly, 1998; Wells, 1998). For example, Czerniak and Haney (1998) examined how teachers anxiety changed as a result of using concept maps in a physical science class, and Raghaven, Sartoris and Glaser(1998) studied the impact of the Model-Assisted Reasoning in Science (MARS) Curriculum on children's understanding of mass.

Several of the studies indicate that students better understand the nature of science if they have the opportunity to interact with models or visually represent their ideas (Kipnis, 1998; Schwartz & White, 1998; Schwartz, 1998; Spitulnik, 1998; Tien, 1998). The research findings demonstrate that students who have had an opportunity to develop or use models gain an appreciation of the scientific thought processes used to develop models and are able to apply these scientific process skills themselves. In fact, Tien (1998) found that students in the Model-Observe-Reflect-Explain (MORE) classroom were able to improve their inquiry skills and represent their reflections related to laboratory exercises.

Educators have employed or developed models and representations in a variety of formats. In 1998, journal articles discussed how to use computer simulations, abstract picture language, and role playing to explain scientific concepts (Khoo & Koh, 1998; Resnick & Wilensky, 1998; Stylianidou & Boohan, 1998). Several dissertations discussed the use of electronic images to help students understand concepts, such as molecular structures, that would not otherwise have been visually accessible (Ealy, 1998; Graves, 1998; Hunter, 1998). Although many studies investigated new technologies, researchers continued to explore pencil and paper, three dimensional, and conceptual models.

Areas that researchers might pursue in the future include:

- Student generated visual representations for reflection before, during, and after instruction.
- Integration of student reflective representations into computer activities.
- Long term affective and cognitive effects of models and representations.
- Teacher training for the facilitation of student created representations, such as concept maps.

References

Czerniak, C. M., & Haney, J. J. (1998). The effect of collaborative concept mapping on elementary

preservice teachers' anxiety, efficacy, and achievement in physical science. *Journal of Science Teacher Education, 9*(4), 303-320.

Ealy, J. B. (1998). *Evaluation of a constructivist use of molecular modeling in first year college chemistry.* Columbia University.

Graves, A. P. (1998). *An investigation comparing traditional recitation instruction to computer tutorials which combine three-dimensional animation with varying levels of visual complexity, including digital video, in teaching various chemistry topics.* The University of Oklahoma.

Hunter, W. J. F. (1998). *Student participation in World Wide Web-based curriculum development of general chemistry.* Purdue University.

Jolly, A. B. (1998). *The effectiveness of learning with concept mapping on the science problem-solving of sixth grade children.* Indiana University of Pennsylvania.

Khoo, G. S., & Koh, T. S. (1998). Using visualization and simulation tools in tertiary science education. *Journal of Computers in Mathematics and Science Teaching, 17*(1), 5-20.

Kipnis, N. (1998). Theories as models in teaching physics. *Science and Education, 7*(3), 245-260.

Raghavan, K., Sartoris, M. L., & Glaser, R. (1998). Impact of the MARS curriculum: The mass unit. *Science Education, 82*(1), 53-91.

Resnick, M., & Wilensky, U. (1998). Diving into complexity:Developing probabilistic decentralized thinking through role-playing activities. *Journal of Learning Sciences, 7*(2), 153-172.

Schwartz, C., & White, B. (1998). *Fostering middle school students' understanding of scientific modeling.* Paper presented at the Annual Meeting of the American Educational Research Associato. (San Diego, CA, April, 1998). [SE061794]

Schwartz, C. V. (1998). *Developing students' understanding of scientific modeling.* University of California Berkeley.

Stylianidou, F. & Boohan, R. (1998). Understanding why things happen: Case-studies of pupils using an abstract picture language to represent the nature of changes. *Research in Science Education,28*(4), 447-62.

Spitulnik, M. W. (1998). *Construction of technological artifacts and teaching strategies to promote flexible scientific understanding.* The University of Michigan.

Tien, L. T. (1998). *Fostering expert inquiry skills and beliefs about chemistry through the MORE laboratory experience.* University of California Berkeley.

Wells, F. B. (1998). *The effect of the use of concept maps on community college students' conceptual understanding of biology course content.* Texas A&M University-Commerce.

Evolution Education

Suzanne Shaw Drummer
The Ohio State University

Although the number of research studies being conducted in evolution education is small, it is growing. Recent events have shown that the still strong creationist faction is affecting the way we teach science (Moore, 1998a; Moore, 1998b; Moore, 1998c). In the 1997 edition of the *Annual Summary of Research in Science Education* (Haury & McCann, 1998) there were 3 citations for research involving evolution education. The issues studied were misconceptions, the effect of the creationist movement on science education, and treatment of evolution in textbooks. In 1998 the number of research papers on this topic increased significantly as well as the number of different areas of research interest.

Misconceptions and student knowledge about evolution are still important areas of research (Ferrari & Chi, 1998). The history and effects of the creationist movement on evolution education is also a continuing topic of interest (Rudolph & Stewart, 1998). New topics include those dealing with how to best teach evolution, how evolution is being treated in state standards (Lerner, 1998), and what conditions affect teachers in their approach or lack of approach to teaching evolution.

In light of recent events, two research issues stand out as immediately crucial to our efforts in science education: teachers' knowledge and beliefs about evolution, and identifying effective instructional techniques for presenting evolution. Teachers have been shown to have generally poor backgrounds in knowledge about the topic of evolution. Many pre-service teachers as well as practicing science teachers consider themselves creationists (Aguillard, 1998). They feel that unless they can at least teach creation and evolution equally they cannot teach either.

This issue relates to state standards also. Teachers in states with strong state standards in evolution have legal obligations to teach this subject. They are also given a strong argument to use when students and parents complain about teaching evolution. Many teachers do not teach evolution or touch on it only lightly because they are afraid of repercussions from students, parents, and even administration. When standards are strongly worded in favor of evolution they can be used to back up any arguments on what should be taught (Lerner, 1998).

Other important issues fit in the category of how evolution can be taught so that the most students understand the concepts. One of the best texts that came out in 1998 on this topic is *Teaching About Evolution and the Nature of Science* published by the National Academy of Sciences (Working Group on Teaching Evolution, 1998). Most articles written about this topic are not research articles but "how to" articles taken from journals like *The Science Teacher* and *The American Biology Teacher*. These articles provide many hands-on and minds-on activities to use in teaching about evolution.

The research papers tie in with these articles. An understanding of evolution seems to be tightly bound to an understanding of the nature of science. To overcome the faulty science of creationism students need to have a thorough understanding of the true nature of science. They need to learn how to examine evidence and draw conclusions. Sufficient evidence needs to be provided so that students have the opportunity to develop new conceptions to replace their inaccurate conceptions (Ferrari & Chi, 1998).

One other approach that seems to be supported is to let students study the history of the creation-evolution argument (Moore, 1998c). This argument can be examined from two points of view. The historical debates and social issues from the time of Darwin's publication of *On the Origin of Species* can be studied (Darwin, 1993). Students can determine where the arguments arose and how they changed over time (Rudolph & Stewart, 1998). The other possibility is to have students look at the beliefs of various world religions as they pertain to evolution and the creation of the world (Bartelt, 1998). Both approaches are aimed at opening the minds of students to be more tolerant of alternative perspectives.

The teaching and learning of evolution should be a fruitful area of study for the future. Past studies have shown a great difficulty in teaching true understanding of the concepts. Student misconceptions are abundant

in this area. Teachers need to be given the skills to improve their teaching of evolution as well as their attitudes on how and whether it should be taught (Firenze, 1998).

Areas for future research:

- Changes in state standards involving the teaching of evolution.
- Reflection of standards in textbooks.
- Teacher attitudes and knowledge in the area of evolution education.
- Best practices for teaching evolution.
- Relationship of student understanding to inclusion of religious and/or historical perspectives in instruction.

References

Aguillard, D. W. (1998). *An analysis of factors influencing the teaching of biological evolution in Louisiana public secondary schools* (Doctoral dissertation, The Louisiana State University, 1998). *Dissertation Abstracts International*, 60 (03), A693.

Bartelt, K. (1998). Changing the Public's Perception of Evolution–Christian Origins of Evolutionary Thought. *Reports of the National Center for Science Education, 18*(1), 12-15,18.

Darwin, C. (1993). *On the Origin of Species*. New York: Modern Library.

Ferrari, M., & Chi, M. T. H. (1998). The Nature of Naive Explanations of Natural Selection. *International Journal of Science Education, 20*(10), 1231-56.

Firenze, R. F. (1998). *The identification, assessment, and amelioration of perceived and actual barriers to teachers' incorporation of evolutionary theory as a central theme in life science classes through a two-week institute and follow-up studies* (Doctoral dissertation, State University of New York At Binghamton, 1998). *Dissertation Abstracts International*, 58 (12), A4605.

Haury, D. L. & McCann, W. S. (Eds.). (1998). *Annual Summary of Research in Science Education 1997*. Columbus, OH: ERIC Clearinghouse for Science, Mathematics, and Environmental Education.

Lerner, L. S. (1998). K-12 Science Standards, State by State. *Reports of the National Center for Science Education, 18*(1), 25-26.

Moore, R. (1998a). Creationism in the United States II. The Aftermath of the Scopes Trial. *American Biology Teacher, 60*(8), 568-77.

Moore, R. (1998b). Creationism in the United States III: The Ban on the Teaching of Evolution Reaches the U.S. Supreme Court. *American Biology Teacher, 60*(9), 650-61.

Moore, R. (1998c). Creationism in the United States: I. Banning Evolution From the Classroom. *American Biology Teacher, 60*(7), 486-98,500-02.

Rudolph, J. L., & Stewart, J. (1998). Evolution and the Nature of Science: On the Historical Discord and Its Implications for Education. *Journal of Research in Science Teaching, 35*(10), 1069-89.

Working Group on Teaching Evolution, N. A. S. (1998). *Teaching about Evolution and the Nature of Science*. Washington, DC: National Academy Press.

Constructivist Views of Teaching and Learning in Science

Youngsun Kwak
The Ohio State University

Over the past several years, educational research undertaken from a constructivist perspective has encompassed a wide range of phenomena, from probing the actual content of student conceptions or mental stages to the study of learning environments and "sociological analysis of the microculture established by the classroom community" (Cobb & Bauersfeld, 1995, p. 2). Research relating to constructivism published in 1998 reflects this broad scope of interest as well. Three themes underlying this research seem to be: (1) attempts to further understand constructivism as an epistemology; (2) attempts to further understand constructivist pedagogical practices; and (3) studies of the benefits of constructivist epistemologies and teaching techniques for students and teachers.

One of the issues of greatest importance in science education seems to be found in showing the connection between a constructivist philosophy (epistemology and ontology) and learning (with students) or pedagogical orientations (with teachers). Expounding the epistemological and ontological assumptions of constructivism, researchers and philosophers of science have been expanding the meaning of constructivism from an epistemological stand to teaching and learning practices (Matthews, 1998; Rodriguez, 1998; Staver, 1998). Along this line, researchers reported that a constructivist teaching approach has a positive effect on the improvement of students' perceptions of the nature of science (Jelinek, 1998; Lin, 1998). Books and research articles also exemplified local curriculum reform efforts as well as teacher professional development programs that are designed to implement constructivist instructional practices recommended by state standards (Norman, et al., 1998; Shymansky et al., 1998).

Studies on constructivist pedagogical practices have focused on investigating the effects on students' conceptual understanding and achievement of such instructional strategies as collaborative concept mapping, use of analogies, educational technology coupled with social constructivist pedagogy, and hands-on investigations (Ritchie, 1998; Sneider & Ohadi, 1998; Carter, 1998, Morion, 1998); comparisons between constructivist and traditional (or objectivist) classroom environments in terms of student achievement and conceptual development (Chou, 1998, Ealy, 1998; Freed, 1998, Gatlin, 1998); and constructing mental models of students' conceptual understanding (Bischoff & Anderson, 1998; Osmundson, 1998; Rea-Ramirez, 1998; Seatter, 1998). Other studies explored student-teacher interactions during knowledge construction, in which experimental interventions were modeled after a Vygotskian approach or social constructivist whole class discussions (Dawson et al., 1998; Wessel, 1998).

Against this constructivist epistemology as a theoretical backdrop, the effects of constructivist teaching on students' achievement, motivation or teachers' pedagogical beliefs change were also examined. Sample topics included the effects of a constructivist teaching strategy on students' conceptual change or scientific reasoning improvement (students' learning), changes in teachers' pedagogical beliefs under the influence of teacher education programs where constructivist teaching methods are advocated, and the role of language and culture in learning in addition to making connections between multicultural education and sociocultural (or sociotransformative) constructivism (social/cultural issues). Conceptual change research remains a continuing topic of interest but the focus seems to have shifted from documenting misconceptions toward exploring the influences of student epistemologies on the degree of conceptual change and how to facilitate teachers' pedagogical conceptual change or students' conceptual change using a context-rich environment, technology, metacognition, and implementation of a Vygotskian approach (Scott, 1998; Sprod, 1998). Research on instructional strategies, students' conceptual changes, and classroom learning environments also take social and cultural issues into consideration.

On the other hand, there still exists a broad range of interpretation of what constructivism actually is,

and much confusion about whether constructivism is a worthwhile construct. For example, Gough (1998) contends that "methods of constructivism science education research are not applicable to either subjects or subject matters of environmental education" and he recommends poststructuralist methodologies as an alternative framework. Researchers also criticized on both theoretical and empirical grounds the Vygotskian legacy in terms of its application in actual schooling (van der Veer, 1998) as well as the potential of constructivist theory "to hinder the development of scientific reasoning in children" (Seatter, 1998).

Constructivism is a topic that seems destined to remain in the science education literature for some time, with fruitful results. There is certainly much that remains to be elucidated about constructivism, both as an epistemology and as a theory of teaching and learning. Directions or recommendations for future research areas are:

- Relationship between constructivism as an epistemology and constructivism as peda-gogical beliefs, among both students and teachers.
- The influences of teachers' constructivist pedagogical beliefs on students' achievement—cognitive as well as social aspects.
- Examples of constructivist classroom environments.
- More exploration of practical aspects of constructivist teaching and learning.
- Model development of constructivist learning situations.
- The influence of constructivist teacher education program on classroom practices as well as students' learning achievement.

References

Bischoff, P. J. & O. R. Anderson (1998). A case study analysis of the development of knowledge schema, ideational networks, and higher cognitive operations among high school students who studied ecology. *School Science and Mathematics, 98*(5), 228-237.

Carter, Timothy Lewis (1998). Enhancing students' science text learning and motivation through analogies. University of Georgia. *Dissertation Abstracts International.*

Chou, Chiu-Hsiang (1998). The effectiveness of using multimedia computer simulations coupled with social constructivist pedagogy in a college introductory physics classroom. Columbia University Teachers College. *Dissertation Abstracts International.*

Cobb, P., & Bauersfeld, H. (1995). Introduction: The coordination of psychological and sociological perspectives in mathematics education. In P. Cobb and H. Bauersfeld (Eds.), *The emergence of mathematical meaning: Interaction in classroom cultures* (pp. 1-16). Hillsdale, NJ: Lawrence Erlbaum Associates.

Dawson, V. M. & P. C. Taylor (1998). Establishing open and critical discourses in the science classroom: Reflecting on initial difficulties. *Research in Science Education, 28*(3), 317-336.

Ealy, Julie Bowen (1998). Evaluation of a constructivist use of molecular modeling in first year college chemistry. Columbia University. *Dissertation Abstracts International.*

Freed, Andrea Beth (1998). Constructing constructivism: The voyage of elementary science teachers. University of Washington. *Dissertation Abstracts International.*

Gatlin, Linda Sue (1998). The effect of pedagogy informed by constructivism: A comparison of student achievement across constructivist and traditional classroom environments. University of new Orleans. *Dissertation Abstracts International.*

Gough, N. (1998). Rethinking the subject: (De)constructing human agency in environmental education research. *Environmental Education Research, 5*(1), 35-48.

Marion, Virginia Frances (1998). An analysis of the relationship between teachers' acquisition of physics content knowledge and their level of science teaching efficacy. The University of Akron. *Dissertation Abstracts International.*

Matthews, M. R. (1998). In defense of modest goals when teaching about the nature of science. *Journal of Research in Science Teaching, 35*(2), 161-74.

Norman, J., M. Stein, et al. (1998). The effect of the Detroit Urban Systemic Initiative on perceived instructional practice and curriculum adequacy. Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (71st, San Diego, CA, April 19-22, 1998). [SE061314]

Osmundson, Ellen (1998). Children as scientists: Adding, connecting and elaborating ideas on the way to conceptual development. University of California Los Angeles. *Dissertation Abstracts International.*

Rea-Ramirez, Mary Anne (1998). Models of conceptual understanding in human respiration and strategies for instruction. University of Massachusetts. *Dissertation Abstracts International.*

Ritchie, S. M. (1998). The teacher's role in the transformation of students' understanding. *Research in Science Education, 28*(2), 169-85.

Rodriguez, A. J. (1998). Strategies for counterresistance: Toward sociotransformative constructivism and learning to teach science for diversity and for understanding. *Journal of Research in Science Teaching, 35*(6), 589-622.

Scott, P. (1998). Teacher talk and meaning making in science classrooms: A Vygotskian analysis and review. *Studies in Science Education, 32*, 45-80.

Seatter, Carol Eunice Scarff (1998). An analysis of the concept of teaching in elementary school science education. Simon Fraser University (Canada). *Dissertation Abstracts International.*

Shymansky, Lee, et al. (1998). Students' perceptions and supervisors' rating as assessments of interactive-constructivist science teaching in elementary school. Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (April 19-22, 1998). [SE061357]

Sneider, C. I. & M. M. Ohadi (1998). Unraveling students' misconceptions about the Earth's shape and gravity. Science Education, 82(2), 265-284.

Sprod, T. (1998). "I can change your opinion on that": Social constuctivist whole class discussions and their effect on scientific reasoning. *Research in Science Education, 28*(4), 463-80.

Staver, J. R. (1998). Constructivism: Sound theory for explicating the practice of science and science teaching. *Journal of Research in Science Teaching, 35*(5), 501-20.

van der Veer, R. (1998). From concept attainment to knowledge formation. *Mind, Culture, & Activity, 5*(2), 89-94.

Wessel, Warren Edward (1998). Knowledge construction in high school physics: A study of student/teacher interaction. University of Regina (Canada). *Dissertation Abstracts International.*

Computer-Based Learning in Science Education

Lynda C. Titterington
The Ohio State University

The proponents of computer-based instruction (CBI) cite numerous advantages for using computers in the classroom to enrich learning experiences for students. In addition to harnessing the patience of a computer for drill and practice exercises, the use of computers in education has been promoted as a means to transform learning from the memorization of facts to student-centered problem-solving; to increase student motivation through flexibility and choice; and to provide individualized learning through instant feedback. Other proponents of educational technology tout the potential of the World Wide Web to increase collaboration among teachers and students and to provide access to online museums, libraries, and real data resources.

Computer-based instruction was the topic of 50 journal articles and dissertations published in 1998. Over half of the articles and dissertations (26 studies) compared CBI to traditional teaching and found that the use of computer simulations and visual improved student performance on achievement tests. For example, Swaak & van Joolingen (1998) showed a considerable gain in intuitive physics understanding after students completed a computer simulation on oscillation and several studies (Ealy ,1998; Graves, 1998; and Hunter, 1998) indicated that molecular modeling programs enhanced student understanding in chemistry.

Other studies attempted to examine the effects of simulations and visual modeling on students' understanding of complex processes. Schwartz (1998), for example, found that the use of modeling software improved students' conceptual models of force and motion in physics, as well as their inquiry skills and epistemological beliefs about the nature of science. In another study, Chou (1998) coupled computer simulations with a conceptual change learning environment with results that indicated improved scores on the achievement test with respect to the control (traditional lecture) courses.

Emerging from the simulations is a trend toward incorporating learning theory and higher order thinking skills into computer-based instruction. For example, Windschitl & Andre (1998) compared the effects of a constructivist versus objectivist learning environment using a computer simulation of the human cardiovascular system.

Two other studies found that combining CBI and cooperative groups enhances learning: (Luttig• 1998; and Lyon 1998). Bos (1998) considered the availability of the Web to motivate student learning and thinking and their ability to evaluate Web sites for content. Davis's results on self-reflection suggests that designers of CBI learning environment should provide students with the opportunity to reflect upon their learning. Other studies incorporated written and oral discourse: through email and bulletin boards (Collins, 1998), computer conferencing (Robinson, 1998), and student publishing (Eriksen & Lehrer, 1998).

Only one study explored the potential of the Internet to provide access to online resources. Orfinger (1998) conducted a qualitative study that showed that virtual museum visits can have comparable educational value to actual science museum field trips. Of the nine Web-based studies, one study (Murfin & Go) described how learning genetics from the web allowed students to collaborate with scientists and gather real data. The dearth of highly developed Web-based studies may be explained by the results encountered by Robertson (1998) who found that the number of computers connected to the Internet was too small to determine the success of an online curriculum.

Areas for future research:

- Inquiry models that use real data
- Project-based learning
- Distance learning
- Barriers to Web-based education
- Qualitative studies to examine students' communication skills

References

Bos, N. D. (1998). *Affordances of students' using the World Wide Web as a publishing medium in project based learning environments.* The University of Michigan.

Chou, C.-H. (1998). *The effectiveness of using multimedia computer simulations coupled with social constructivist pedagogy in a college introductory physics classroom.* Columbia University Teachers College.

Ealy, J. B. (1998). *Evaluation of a constructivist use of molecular modeling in first year college chemistry.* Columbia University.

Erickson, J. and R. Lehrer (1998). "The evolution of critical standards as students design hypermedia documents." *Journal of the Learning Sciences 7*(3-4), 351-386.

Graves, A. P. (1998). *An investigation comparing traditional recitation instruction to computer tutorials which combine three-dimensional animation with varying levels of visual complexity, including digital video in teaching various chemistry topics.* The University Of Oklahoma.

Hunter, W.J.F. (1998). *Student participation in world wide web-based curriculum development of general chemistry.* Purdue University.

Luttig, E.P. (1998). *Enhancing student learning with Powerpoint presentations.* Michigan State University.

Lyon, E.B. (1998). *The effect of homogeneous and heterogeneous review pairs on student achievement and attitude when utilizing computer-assisted instruction in middle-level earth science classes.* The University Of Texas At Austin.

Murfin, B. and V. Go (1998). *A model for the development of Web-based, student-centered science education resources.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (71st, San Diego, CA, April 19-22, 1998). [SE061349]

Orfinger, B. (1998). "Virtual science museums as learning environments: Interaction for education." *Informal Learning Review*(33), 1,8-13.

Robinson, P. (1998). "A necessary evil: A phenomenological study of student experiences of computer conferencing." *Bulletin of Science, Technology and Society, 18*(1), 38-46.

Schwarz, C.V. (1998). *Developing students' understanding of scientific modeling.* University Of California, Berkeley.

Swaak, J., W. R. van Joolingen, et al. (1998). "Supporting simulation-based learning: The effects of model progression and assignments on definitional and intuitive knowledge." *Learning & Instruction, 8*(3), 235-252.

Windschitl, M. and T. Andre (1998). "Using computer simulations to enhance conceptual change: The roles of constructivist instruction and student epistemological beliefs." *Journal of Research in Science Teaching, 35*(2), 145-60.

Integrating Science With Other Subjects

Hyonyong Lee
The Ohio State University

Integrated or interdisciplinary approaches to curriculum in science education are not new. As LaPorte and Sanders (1996) observed, "all of the national reports on school reform in the 1980s and '90s noted the need for new approaches to the teaching of science and mathematics" (p. 16). Several documents emphasize these approaches as a necessary component of national education reform (American Association for the Advancement of Science, 1989, 1993, 1998; International Technology Education Association, 1996; National Council of Teachers of Mathematics, 1989, 1991; National Research Council, 1996; National Science Teachers Association; 1992, 1997).

One tendency in science education is to integrate science and mathematics or mathematics, science, and other subjects (e.g., technology). These trends have influenced the elementary and secondary school curriculum. In 1998 several researchers developed theoretical models to integrate science with mathematics and/or technology education (Berlin & White, 1998; Huntley, 1998; Lonning, et al., 1998; Roebuck and Warden, 1998). For example, Huntley (1998) proposed the Mathematics/Science Continuum as an alternative theoretical framework for defining integrated mathematics and science. In addition, a continuum model of integration as a theoretical model was proposed as a tool for curriculum developers as they create new integrated mathematics and science curricula (Lonning, et al., 1998).

In 1998, several studies examined how integrating science with other disciplines affects students at various educational levels. Integration of science and other disciplines had a positive impact on students' achievement (Alspaugh & Harting, 1998; Dallas, 1998; Lonning, et al., 1998; Ross & Hogaboam-Gray, 1998; Schepige, 1998; Warnick, 1998, Westbrook, 1998), motivation (Ross & Hogaboam-Gray, 1998), attitude (Penner, et al., 1998; Schleyer, 1998), and learning (Bailey & Watson, 1998; Carle & Krest, 1998; Penner, et al., 1998; Warnick, 1998). For instance, Ross & Hogaboam-Gray (1998) concluded that the curriculum integration of mathematics, science, and technology had a beneficial impact on 9th grade students' achievement and motivation.

Even though several articles and dissertations indicated the possible positive results of an interdisciplinary approach to curriculum, some problems related to this topic can be identified based on the literature. First, as Berlin and White (1998) observe, "the literature is vague on what constitutes 'integration' as indicated by the plethora of terms used to describe it (e.g., connected, coordinated, correlated, cross-disciplinary, interrelated, multidisciplinary and unified). This vagueness indicates the absence of an agreed-upon theoretical view, which is needed to provide a language and conceptualisation of integrated science and mathematics education to direct research" (p. 500).

Second, while educational trends have promoted the development of integrated school curricula and instructional activities, many teachers still lack basic conceptions and ideas about integration. They need to participate in inservice education which models interdisciplinary lessons and uses appropriate materials and teaching methods (Adams, 1998; Alspaugh & Harting, 1998; Hepburn & Gaskell, 1998; Lehman and McDonald, 1988; Roebuck and Warden, 1998; Watanabe & Huntley, 1998).

A past concern with integrated curricula has been that the activities developed by researchers and educators do not connect both science and other subject(s) to the real world very well, curricular materials do not stimulate student thinking, and the idea of integration has not encouraged teacher initiative. Thus, it has been argued that curricular activities should include more applications of science principles to solve real world problems, and that a range of integration characteristics should be developed in order to become more useful tools for teaching and learning science (LaPorte & Sanders, 1996; Good, 1996; Venville, et al., 1998; Wolfinger, 1994).

Overall, interdisciplinary or integration based instruction seems to provide a better chance for students to understand the connections between science and other disciplines. Integrated or interdisciplinary approaches to curriculum in science education should be a crucial area of study for the future.

Areas for future research:

- Developing school curriculum (or materials) and instructional models (or activities) with more sophisticated integrated approaches.
- Studying the effects of technology-based integration programs on students' learning of science and other subjects.
- Providing inservice and preservide education for disseminating integration techniques and practices.
- Studying the effects of integrating science with other disciplines on students' learning.
- Assessing teacher attitudes and knowledge in the area of integration.
- Studying contextual barriers in implementing interdisciplinary or integrated based instructions and possible solution methods.

Reference

Adams, T. L. (1998). Prospective elementary teachers' mathematics subject matter knowledge: The real number system. *Action in Teacher Education, 20*(2), 35-48.

Alspaugh, J. W., & Harting, R. D. (1998). Interdisciplinary team teaching versus departmentalization in middle schools. *Research in Middle Level Education Quarterly, 21*(4), 31-42.

American Association for the Advancement of Science. (1989). *Science for all Americans.* New York: Oxford University Press.

American Association for the Advancement of Science. (1993). *Benchmarks for science literacy.* New York: Oxford University Press.

American Association for the Advancement of Science. (1998). *Blueprints for reform.* New York: Oxford University Press.

Bailey, S., & Watson, R. (1998). Establishing basic ecological understanding in younger pupils: A pilot evaluation of a strategy based on drama/role play. *International Journal of Science Education, 20*(2), 139-152.

Berlin, D. F., & White, A. L. (1998). Integrated science and mathematics education: Evolution and implications of a theoretical model. In B. J. Fraser & K. G. Tobin (Eds.), *International Handbook of Science Education* (pp. 499-512). Dordrecht, Netherlands: Kluwer Academic Publishers.

Carle, D. O., & Krest, M. (1998). Facilitating research between the library and the science writing classroom. *Journal of College Science Teaching, 27*(5), 339-342.

Dallas, S. J. (1998). *Broadening the scope: Incorporating biochemical concepts into the high school chemistry curriculum.* Unpublished master dissertation, Michigan State University.

Good, B. A. (1996). *Characteristics of science and mathematics integration: Activities recommended in teachers' manuals for four elementary science textbook series.* Unpublished doctoral thesis, The Ohio State University.

Hepburn, G., & Gaskell, P. J. (1998). Teaching a new science and technology course: A sociocultural perspective. *Journal of Research in Science Teaching, 35*(7), 777-789.

Huntley, M. A. (1998). Design and implementation of a framework for defining integrated mathematics and science education. *School Science and Mathematics, 98*(6), 320-327.

International Technology Education Association. (1996). *Technology for all Americans: A rationale and structure for the study of technology.* Reston, VA: Author.

LaPorte, J. E., & Sanders, M. (1996). *Technology science mathematics: Connection activities binder.* (Vol. 52). Peoria, IL: Glencoe/McGraw-Hill.

Lehman, J. R., & McDonald, J. L. (1988). Teachers' perceptions of the integration of mathematics and science. *School Science and Mathematics, 88*(8), 642-649.

Lonning, R. A., DeFranco, T. C., & Weinland, T. P. (1998). Development of theme-based, interdisciplinary, integrated curriculum: A theoretical model. *School Science and Mathematics, 98*(6), 312-318.

National Council of Teachers of Mathematics. (1989). *Curriculum and evaluation standards for school mathematics.* Reston, VA: Author.

National Council of Teachers of Mathematics. (1991). *Professional standards for teaching mathematics.* Reston, VA: Author.