PROCEEDINGS OF THE 14TH ANNUAL CONFERENCE ON RESEARCH IN UNDERGRADUATE MATHEMATICS EDUCATION

EDITORS
STACY BROWN
SEAN LARSEN
KAREN MARRONGELLE
MICHAEL OEHRTMAN

PORTLAND, OREGON FEBRUARY 24 – FEBRUARY 27, 2011

PRESENTED BY

THE SPECIAL INTEREST GROUP OF THE MATHEMATICS ASSOCIATION OF AMERICA (SIGMAA) FOR RESEARCH IN UNDERGRADUATE MATHEMATICS EDUCATION

Copyright @ 2011 left to authors All rights reserved

CITATION: In (Eds.) S. Brown, S. Larsen, K. Marrongelle, and M. Oehrtman, *Proceedings of the 14th Annual Conference on Research in Undergraduate Mathematics Education*, Vol. #, pg #-#. Portland, Oregon.

FOREWORD

The research reports and proceedings papers in these volumes were presented at the 14th Annual Conference on Research in Undergraduate Mathematics Education, which took place in Portland, Oregon from February 24 to February 27, 2011.

Volumes 1 and 2, the RUME Conference Proceedings, include conference papers that underwent a rigorous review by two or more reviewers. These papers represent current important work in the field of undergraduate mathematics education and are elaborations of the RUME conference reports.

Volume 1 begins with the winner of the best paper award, an honor bestowed upon papers that make a substantial contribution to the field in terms of raising new questions or gaining insights into existing research programs.

Volume 3, the RUME Conference Reports, includes the Contributed Research Reports that were presented at the conference and that underwent a rigorous review by at least three reviewers prior to the conference. Contributed Research Reports discuss completed research studies on undergraduate mathematics education and address findings from these studies, contemporary theoretical perspectives, and research paradigms.

Volume 4, the RUME Conference Reports, includes the Preliminary Research Reports that were presented at the conference and that underwent a rigorous review by at least three reviewers prior to the conference. Preliminary Research Reports discuss ongoing and exploratory research studies of undergraduate mathematics education. To foster growth in our community, during the conference significant discussion time followed each presentation to allow for feedback and suggestions for future directions for the research.

We wish to acknowledge the conference program committee and reviewers, for their substantial contributions and our institutions, for their support.

Sincerely,

Stacy Brown, RUME Organizational Director & Conference Chairperson

Sean Larsen, RUME Program Chair

Karen Marrongelle RUME Co-coordinator & Conference Local Organizer

Michael Oehrtman RUME Coordinator Elect

CONFERENCE PROGRAM COMMITTEE

STACY BROWN, PROGRAM COMMITTEE CHAIRPERSON

KAREN MARRONGELLE , LOCAL ORGANIZER

JASON BELNAP

JENNIFER CHRISTIAN-SMITH

NICOLE ENGELKE

TIMOTHY FUKAWA-CONNELLY

HOPE GERSON

KAREN ALLEN KEENE

JESSICA KNAPP

SEAN LARSEN

MICHAEL OEHRTMAN

ALLISON TONEY

JOSEPH WAGNER

AARON WEINBERG

WITH MUCH APPRECIATION WE THANK THE CONFERENCE REPORT AND PROCEEDINGS REVIEWERS

JASON BELNAP SEAN LARSEN

STACY BROWN ELISE LOCKWOOD

TODD CADWALLADEROLSKER MICHAEL OEHRTMAN

JENNIFER CHRISTIAN-SMITH KEVIN MOORE

PAUL DAWKINS KYEONG HAH ROH

NICOLE ENGELKE ANNIE SELDEN

TIMOTHY FUKAWA-CONNELLY CRAIG SWINYARD

HOPE GERSON ALLISON TONEY

ESTRELLA JOHNSON HORTENSIA SOTO-JOHNSON

KAREN ALLEN KEENE JOSEPH WAGNER

JESSICA KNAPP AARON WEINBERG

YVONNE LAI

CONFERENCE PARTICIPANT LIST

Veda Abu-Bakare Louis Deaett

Aditya 'Adi' Adiredja Jason Dolor

Aina K. Appova Joseph Ediger

Homer Austin Jess Ellis

Jathan Austin Rob Ely

Anna Bargagliotti Nicole Engelke

Joanna Bartlo Sarah Enoch

Mary Beisiegel Jodi Fasteen

Jason Belnap Jill Faudree

Kavita Bhatia Leanna Ferguson

Tyler Blake Brian Fisher

Tim Boester Tim Fukawa-Connelly

William Bond Evan Fuller

Jim Brandt Gillian Galle

Stacy Brown Tyler Gaspich

Martha Byrne Tyler Gaspich

Todd CadwalladerOlsker Hope Gerson

Mindy Capaldi Sylvia Giroux

Laurie Cavey David Glassmeyer

Sergio Celis Jim Gleason

Danielle Champney Shiva Gol Tabaghi

Simin Chavoshi Zahra Gooya

Sean Chorney Mairead Greene

Warren Code Todd Grundmeier

Derron Coles Beste Gucler

Darcy Conant Taras Gula

Sandy Cooper Aviva Halani

Beth Cory Catherine Hart-Weber

Paul C Dawkins Mark Haugan

CONFERENCE PARTICIPANT LIST

Shandy Hauk Aaron Marmorsdtein

Krista Heim Karen Marrongelle

Francesca Henderson Sarah Marsh

Kate Horton Jason Martin

Aladar Horvath John Mayer

Estrella Johnson Carolyn McCaffrey

Gulden Karakok David Meel

Karen Allen Keene Pablo Mejia-Ramos

Rachael Kenney Kate Melhuish

Minsu Kim Kelly Mercer

Margaret Kinzel Vilma Mesa

Jessica Knapp David Miller

Libby Knott Briana Mills

Marina Kogan Melissa Mills

Janet Kolodner Susanna Molitoris Miller

Dave Kung Kevin C. Moore

OhHoon Kwon Ricardo Nemirovsky

Yvonne Lai Kristin Noblet

Elaine Lande Jennifer Noll

Bryan Lane Michael Oehrtman

Sean Larsen Jeanette Palmiter

Christy Larson Eric Pandiscio

Christine Latulippe Frieda Parker

Sandra Laursen Valerie Peterson

Elise Lockwood Costanza Piccolo

Tom Lougheed Kirthi Premadasa

Tim Lucas Jeffrey Rabin

Dann Mallet Sonya Redmond

Ami Mamolo Kathryn Rhoads

CONFERENCE PARTICIPANT LIST

Abdessamad Tridane

Lisa Rice Gail Tang

Kyeong Hah RohEva ThanheiserRebecca RossMatt ThomasSarah RoznerJohn Thompson

Aron Samkoff Anna Titova

David Meel Maria Trigueros

Milos Savic David Tsay

Vicki Sealey Carla van de Sande Annie Selden Margarita Vidrio

John Selden Sasha Wang

J. Michael Shaughnessy

Mary Shepherd

Claura Watkins

All Megan Wawro

Daula Shorter

Carole Simard

Aaron Wangberg

Laura Watkins

Megan Wawro

John Weber

Keith Weber

Ann Sitomer Thomas Wemyss

Michael Smith Ian Whitacre

Hortensia Soto-Johnson Tim Whittemore Natasha Speer Mark Yanotta Lyn Stallings Nissa Yestness

Stephen Strand Michelle Zandieh

April Strom Dov Zazkis
Heejoo Suh Rina Zazkis

George F. Sweeney

Craig Swinyard

Jason Samuels

Jen Szydlik

Michael Tallman

CONFERENCE PROCEEDINGS PAPERS

VOLUME 1 TABLE OF CONTENTS

BEST PAPER AWARD RECIPIENT: ANALYZING THE TEACHING OF ADVANCED MATHEMATICS COURSES VIA THE ENACTED EXAMPLE SPACE
THE EFFECTS OF ONLINE HOMEWORK IN A UNIVERSITY FINITE MATHEMATICS COURSE
A REPORT ON THE EFFECTIVENESS OF BLENDED INSTRUCTION IN GENERAL EDUCATION MATHEMATICS COURSES
USING CONCRETE METAPHOR TO ENCAPSULATE ASPECTS OF THE DEFINITION OF SEQUENCE CONVERGENCE
CONCEPTS FUNDAMENTAL TO AN APPLICABLE UNDERSTANDING OF CALCULUS
USING TOULMIN ANALYSIS TO LINK AN INSTRUCTOR'S PROOF-PRESENTATION AND STUDENT'S SUBSEQUENT PROOF-WRITING PRACTICES
COMPREHENDING LERON'S STRUCTURED PROOFS
A MULTI-STRAND MODEL FOR STUDENT COMPREHENSION OF THE LIMIT CONCEPT
SOCIOMATHEMATICAL NORMS: UNDER WHOSE AUTHORITY?

TRANSITIONING FROM CULTURAL DIVERSITY TO CULTURAL COMPETENCE IN MATHEMATICS INSTRUCTION	
Shandy Hauk, Nissa Yestness, & Jodie Novak	.120
WHAT DO WE SEE? REAL TIME ASSESSMENT OF MIDDLE AND SECONDARY TEACHERS' PEDAGOGICAL CONTENT KNOWLEDGE	.143
WHAT DO LECTURE TEACHERS BRING TO A STUDENT-CENTERED CLASSROOM A CATALOGUE OF LECTURE TEACHER MOVES	
HOW DO MATHEMATICIANS MAKE SENSE OF DEFINITIONS?	.163
SPANNING SET AND SPAN: AN ANALYSIS OF THE MENTAL CONSTRUCTIONS OF UNDERGRADUATE STUDENTS	.176
STUDENT APPROACHES AND DIFFICULTIES IN UNDERSTANDING AND USE OF VECTORSOh Hoon Kwon	.187
IMPROVING THE QUALITY OF PROOFS FOR PEDAGOGICAL PURPOSES: A QUANTITATIVE STUDY Yvonne Lai, Juan Pablo Mejía-Ramos, and Keith Weber	.203
COMMUNICATION ASSESSMENT CRITERIA IS NOT SUFFICIENT FOR INFLUENCI STUDENTS' APPROACHES TO ASSESSMENT TASKS – PERSPECTIVES FROM A DIFFERENTIAL EQUATIONS CLASS	
AN EXPLORATION OF THE TRANSITION TO GRADUATE SCHOOL IN MATHEMATICS	.227
STUDENTS' REINVENTION OF FORMAL DEFINITIONS OF SERIES AND POINTWIS CONVERGENCE	SE .239
Jason Martin, Michael Oehrtman, Kyeong Hah Roh, Craig Swinyard, and Catherine Hart-We	ber
INQUIRY-BASED AND DIDACTIC INSTRUCTION IN A COMPUTER-ASSISTED CONTEXT	.255
John C. Mayer, Rachel D. Cochran, Jason S. Fulmore, Thomas O. Ingram, Laura R. Stansell, William O. Bond	and

CONFERENCE PROCEEDINGS PAPERS

VOLUME 2 TABLE OF CONTENTS

PROMOTING SUCCESS IN COLLEGE ALGEBRA BY USING WORKED EXAMPLES I WEEKLY ACTIVE GROUP SESSIONS	
David Miller and Matthew Schraeder	
MATHEMATICIANS' PEDAGOGICAL THOUGHTS AND PRACTICES IN PROOF PRESENTATION	.283
RELATIONSHIPS BETWEEN QUANTITATIVE REASONING AND STUDENTS' PROBLEM SOLVING BEHAVIORS Kevin C. Moore	.298
THE PHYSICALITY OF SYMBOL USE	.314
FROM INTUITION TO RIGOR: CALCULUS STUDENTS' REIVENTION OF THE DEFINITION OF SEQUENCE CONVERGENCE	.325
HOW INTUITION AND LANGUAGE USE RELATE TO STUDENTS' UNDERSTANDIN OF SPAN AND LINEAR INDEPENDENCE	
THE INTERNAL DISCIPLINARIAN: WHO IS IN CONTROL?	.354
THE IMPACT OF TECHNOLOGY ON A GRADUATE MATHEMATICS EDUCATION COURSE CONTRIBUTED RESEARCH REPORT	.369
MATHEMATICAL KNOWLEDGE FOR TEACHING: EXEMPLARY HIGH SCHOOL TEACHERS' VIEWS	.381
STUDENT TEACHER AND COOPERATING TEACHER TENSIONS IN A HIGH SCHOOM MATHEMATICS TEACHER INTERNSHIP: THE CASE OF LUIS AND SHERI	
PROMOTING STUDENTS' REFLECTIVE THINKING OF MULTIPLE QUANTIFICATIONS VIA THE MAYAN ACTIVITY	.414

HOW MATHEMATICIANS USE DIAGRAMS TO CONSTRUCT PROOFSAron Samkoff, Yvonne Lai, and Keith Weber	430
WHERE IS THE LOGIC IN STUDENT-CONSTRUCTED PROOFS?	445
READING ONLINE MATHEMATICS TEXTBOOKS	457
EXPLORING THE VAN HIELE LEVELS OF PROSPECTIVE MATHEMATICS TEACHERS	473
DYNAMIC VISUALIZATION OF COMPLEX VARIABLES: THE CASE OF RICARDO	488
EFFECTIVE STRATEGIES THAT UNDERGRADUATES USE TO READ AND COMPREHEND PROOFS	504
STUDENT UNDERSTANDING OF INTEGRATION IN THE CONTEXT AND NOTATION OF THERMODYNAMICS: CONCEPTS, REPRESENTATIONS, AND TRANSFER	
EXTENDING A LOCAL INSTRUCTIONAL THEORY FOR THE DEVELOPMENT OF NUMBER SENSE TO RATIONAL NUMBER	532

CONTRIBUTED RESEARCH REPORTS

VOLUME 3 TABLE OF CONTENTS

MAKING THE FAMILIAR STRANGE: AN ANALYSIS OF LANGUAGE IN
POSTSECONDARY CALCULUS TEXTBOOKS THEN AND NOW9
Veda Abu-Bakare
THE EFFECTIVENESS OF BLENDED INSTRUCTION IN GENERAL EDUCATION
MATHEMATICS COURSES13
Anna E. Bargagliotti, Fernanda Botelho, Jim Gleason, John Haddock, and Alistair Windsor
OBSTACLES TO TEACHER EDUCATION FOR FUTURE TEACHERS OF POST-
SECONDARY MATHEMATICS19
Mary Beisiegel
Tully Belsieger
DESIGNING AND IMPLEMENTING A LIMIT DIAGNOSTIC TOOL24
Timothy Boester
ASSESSING ACTIVE LEARNING STRATEGIES IN TEACHING EQUIVALENCE
RELATIONS29
Jim Brandt
CLIDATEVING MATHEMATICS DEDADTMENTS TO IDENTIFY
SURVEYING MATHEMATICS DEPARTMENTS TO IDENTIFY CHARACTERISTICS OF SUCCESSFUL PROGRAMS IN COLLEGE
CALCULUS33
Marilyn Carlson, Chris Rasmussen, David Bressoud, Michael Pearson, Sally Jacobs,
Jessica Ellis, and Eric Weber
FRANSLATING DEFINITIONS BETWEEN REGISTERS AS A CLASSROOM
MATHEMATICAL PRACTICE
Paul Dawkins
THE ROLE OF CONJECTURING IN DEVELOPING SKEPTICISM: REINVENTING
THE DIRICHLET FUNCTION
Brian Fisher
ΓOULMIN ANALYSIS: A TOOL FOR ANALYZING TEACHING AND
PREDICTING STUDENT PERFORMANCE IN PROOF-BASED CLASSES47
Timothy Fukawa-Connelly

A MULTI-STRAND MODEL FOR STUDENT COMPREHENSION OF THE LIMIT	
Gillian Galle	
AUTHORITY IN THE NEGOTIATION OF SOCIOMATHEMATICAL NORMS Hope Gerson and Elizabeth Bateman	57
STUDENT UNDERSTANDING OF EIGENVECTORS IN A DGE: ANALYSING SHIFTS OF ATTENTION AND INSTRUMENTAL GENESIS	61
UNIVERSITY STUDENTS' UNDERSTANDING OF FUNCTION IS STILL A PROBLEM!	65
Zahra Gooya and Mehdi Javadi	
THE LIMIT NOTATION: WHAT IS IT A REPRESENTATION OF? Beste Güçler	68
STUDENT OUTCOMES FROM INQUIRY-BASED COLLEGE MATHEMATICS COURSES: BENEFITS OF IBL FOR STUDENTS FROM UNDER-SERVED GROUPS	72
GROUPS	/3
ON EXEMPLIFICATION OF PROBABILITY ZERO EVENTS	78
DIFFERENCES IN BELIEFS AND TEACHING PRACTICES BETWEEN INTERNATIONAL AND U.S. DOMESTIC MATHEMATICS TEACHING ASSISTANTS	82
Minsu Kim	
IMPROVING THE QUALITY OF PROOFS FOR PEDAGOGICAL PURPOSES: A QUANTITATIVE STUDY	88
Yvonne Lai, Juan-Pablo Mejia Ramos and Keith Weber	
PUTTING RESERCH TO WORK: WEB-BASED INSTRUCTOR SUPPORT	
MATERIALS FOR AN INQUIRY ORIENTED ABSTRACT ALGEBRA CURRICULUM	02
Sean Larsen, Estrella Johnson and Travis Scholl	94
CTUDENTS' MODELING OF LINEAD SYSTEMS, THE DENTAL CAD	
STUDENTS' MODELING OF LINEAR SYSTEMS: THE RENTAL CAR PROBLEM	96
Christine Larson and Michelle Zandieh	

INQUIRY-BASED COLLEGE MATHEMATICS CLASSES	.101
STUDENTS PERCEPTIONS OF AN EXPLICIT CRITERION REFERENCED ASSESSMENT ACTIVITY IN A DIFFERENTIAL EQUATIONS CLASS	.105
REACHING OUT TO THE HORIZON: TEACHERS' USE OF ADVANCED MATHEMATICAL KNOWLEDGE	.109
STUDENTS' REINVENTION OF FORMAL DEFINITIONS OF SERIES AND POINTWISE CONVERGENCE	.114
Hart-Weber	
AN ANALYSIS OF EXAMPLES IN COLLEGE ALGEBRA TEXTBOOKS FOR COMMUNITY COLLEGES: OPPORTUNITIES FOR STUDENT LEARNING	.119
Vilma Mesa, Heejoo Suh, Tyler Blake, and Tim Whittemore	
PROMOTING SUCCESS IN COLLEGE ALGEBRA BY USING WORKED EXAMPLES IN WEEKLY ACTIVE GROUP SESSIONS	.125
RELATIONSHIPS BETWEEN QUANTITATIVE REASONING AND STUDENTS PROBLEM SOLVING BEHAVIORS	
THE PHYSICALITY OF SYMBOL USE: PROJECTING HORIZONS AND TRAVERSING IMPROVISATIONAL PATHS ACROSS INSCRIPTIONS AND NOTATIONS	.134
FROM INTUITION TO RIGOR: CALCULUS STUDENTS' REIVENTION OF THE	E
DEFINITION OF SEQUENCE CONVERGENCE Michael Oehrtman, Craig Swinyard, Jason Martin, Catherine Hart-Weber, and Kyeong Hah Roh	
HOW INTUITION AND LANGUAGE USE RELATE TO STUDENTS' UNDERSTANDING OF SPAN AND LINEAR INDEPENDENCE Frieda Parker	.142

THE IMPACT OF TECHNOLOGY ON A GRADUATE MATHEMATICS EDUCATION COURSE	147
Robert A. Powers, David M. Glassmeyer, and Heng-Yu Ku	
STUDENT TEACHER AND COOPERATING TEACHER TENSIONS IN A HIGH SCHOOL MATHEMATICS TEACHER INTERNSHIP: THE CASE OF LUIS AND SHERI1	152
Kathryn Rhoads, Aron Samkoff, and Keith Weber	
PROMOTING STUDENTS' REFLECTIVE THINKING OF MULTIPLE QUANTIFICATIONS VIA THE MAYAN ACTIVITY1 Kyeong Hah Roh and Yong Hah Lee	156
HOW MATHEMATICIANS USE DIAGRAMS TO CONSTRUCT PROOFS	161
EXPLORING THE VAN HIELE LEVELS OF PROSPECTIVE MATHEMATICS TEACHERS1	165
Carole Simard and Todd A. Grundmeier	
CLASSROOM ACTIVITY WITH VECTORS AND VECTOR EQUATIONS: INTEGRATING INFORMAL AND FORMAL WAYS OF SYMBOLIZING R_{n} 1 George Sweeney	170
CHANGING MATHEMATICAL SOPHISTICATION IN INTRODUCTORY COLLEGE MATHEMATICS COURSES	175
INDIVIDUAL AND COLLECTIVE ANALYSIS OF THE GENESIS OF STUDENT REASONING REGARDING THE INVERTIBLE MATRIX THEOREM IN LINEAR ALGEBRA	179
USING THE EMERGENT MODEL HEURISTIC TO DESCRIBE THE EVOLUTION OF STUDENT REASONING REGARDING SPAN AND LINEAR INDEPENDENCE	185

PRELIMINARY RESEARCH REPORTS

VOLUME 4 TABLE OF CONTENTS

COURSES	8
Homer W. Austin	
EXAMINING PERSONAL TEACHER EFFICACY BELIEFS AND SPECIALIZED CONTENT KNOWLEDGE OF PRE-SERVICE TEACHERS IN MATHEMATICAL CONTEXTS	.11
Jathan Austin	
THE EFFECTS OF ONLINE HOMEWORK IN A UNIVERSITY FINITE MATHEMATICS COURSE	.20
BUILDING KNOWLEDGE WITHIN CLASSROOM MATHEMATICS DISCUSSIONS	.24
Jason K. Beinap	
USING THINK ALOUDS TO REMOVE BOTTLENECKS IN MATHEMATICS Kavita Bhatia and Kirthi Premadasa	.28
AN INVESTIGATION OF STUDENTS' PROOF PREFERENCES: THE CASE OF INDIRECT PROOF	.31
COUNTING PROBLEM STRATEGIES OF PRESERVICE SECONDARY TEACHERS	.37
Todd CadwalladerOlsker, Scott Annin, and Nicole Engelke	
HOW DO MATHEMATICIANS MAKE SENSE OF DEFINITIONS? Laurie Cavey, Margaret Kinzel, Thomas Kinzel, Kathleen Rohrig, Sharon Walen	.41
MATERIAL AGENCY: QUESTIONING BOTH ITS ROLE AND MEDIATIONAL SIGNIFICANCE IN MATHEMATICS LEARNING	.44

THE IMPACT OF INSTRUCTION DESIGNED TO SUPPORT DEVELOPMENT OF STOCHASTIC UNDERSTANDING OF PROBABILITY DISTRIBUTION49
Darcy L. Conant
SUPPLEMENTAL INSTRUCTION AND RELATED RATES PROBLEMS55 Nicole Engelke and Todd CadwalladerOlsker
EXPLORING STUDENTS' SPONTANEOUS AND SCIENTIFIC CONCEPTS IN UNDERSTANDING SOLUTIONS TO LINEAR SINGLE DIFFERENTIAL
EQUATIONS
CONCEPTS FUNDAMENTAL TO AN APPLICABLE UNDERSTANDING OF CALCULUS
Leann Ferguson and Richard Lesh
HOW DO IPADS FACILITATE SOCIAL INTERACTION IN THE CLASSROOM?
Brian Fisher and Timothy Lucas
EVALUATING MATHEMATICAL QUALITY OF INSTRUCTION IN ADVANCED MATHEMATICS COURSES BY EXAMINING THE ENACTED EXAMPLE SPACE
Timothy Fukawa-Connelly and Charlene Newton
TECHNOLOGIZING MATH EDUCATION: THE CASE OF MULTIPLE REPRESENTATIONS
DETERMINING MATHEMATICAL ITEM CHARACTERISTICS CORRESPONDING WITH ITEM RESPONSE THEORY ITEM INFORMATION CURVES
ASSESSING THE EFFECTIVENES OF AN ON-LINE MATH REVIEW AND PRACTICE TOOL IN FOUNDATIONAL MATHEMATICS
THE NATURE AND EFFECT OF INDIOSYNCRATIC EXAMPLES IN STUDENT REASONING ABOUT LIMITS OF SEQUENCES
TRANSITIONING FROM CULTURAL DIVERSITY TO INTERCULTURAL COMPETENCE IN MATHEMATICS INSTRUCTION

THE TREATMENT OF COMPOSITION IN THE SECONDARY AND EARLY COLLEGE MATHEMATICS CURRICULUM98 Aladar Horvath
WHAT DO WE SEE? REAL TIME ASSESSMENT OF MIDDLE AND SECONDARY TEACHERS' PEDAGOGICAL CONTENT KNOWLEDGE AND SOCIOMATHEMATICAL NORMS
Billy Jackson, Lisa Rice, and Kristin Noblet NAVIGATING THE IMPLEMENTATION OF AN INQUIRY-ORIENTED TASK IN A COMMUNITY COLLEGE
LINKING INSTRUCTOR MOVES TO CLASSROOM DISCOURSE AND STUDENT LEARNING IN DIFFERENTIAL EQUATIONS CLASSROOMS
UNDERSTANDING AND OVERCOMING DIFFICULTIES WITH BUILDING MATHEMATICAL MODELS IN ENGINEERING: USING VISUALIZATION TO AID IN OPTIMIZATION COURSES
STUDENT APPROACHES AND DIFFICULTIES IN UNDERSTANDING AND USE OF VECTORS
A SYSTEMIC FUNCTIONAL LINGUISTICS ANALYSIS OF MATHEMATICAL SYMBOLISM AND LANGUAGE BEGINNING ALGEBRA TEXTBOOKS128 Elaine Lande
STUDENT USE OF SET-ORIENTED THINKING IN COMBINATORIAL PROBLEM SOLVING
CONCEPTUAL WRITING AND ITS IMPACT ON PERFORMANCE AND ATTITUDE
AN EXPLORATION OF THE TRANSITION TO GRADUATE SCHOOL IN MATHEMATICS

INQUIRY-BASED AND DIDACTIC INSTRUCTION IN A COMPUTER-ASSISTED CONTEXT
John C. Mayer, Rachel D. Cochran, Jason S. Fulmore, Thomas O. Ingram, Laura R. Stansell, and William O. Bond
DO LERON'S STRUCTURED PROOFS IMPROVE PROOF COMPREHENSION
Juan Pablo Mejia-Ramos, Evan Fuller, Keith Weber, Aron Samkoff, Kathryn Rhoads, Dhun Doongaji, and Kristen Lew
TEACHING APPROACHES OF COMMUNITY COLLEGE MATHEMATICS FACULTY: DO TEACHING CONCEPTIONS AND APPROACHES RELATE TO CLASSROOM PRACTICES?
Vilma Mesa and Sergio Celis
USING ANIMATIONS OF TEACHING TO PROBE THE DIDACTICAL CONTRACT IN COMMUNITY COLLEGE MATHEMATICS
MATHEMATICS FACULTY'S EFFORTS TO IMPROVE THE TEACHING OF UNDERGRADUATE MATHEMATICS
MATHEMATICIANS' PEDAGOGICAL THOUGHTS AND PRACTICES IN PROOF PRESENTATION
GEOMETRIC CONSTRUCTIONS TO ACTIVATE INDUCTIVE AND DEDUCTIVE THINKING AMONG SECONDARY TEACHERS
THE INTERNAL DISCIPLINARIAN: WHO IS IN CONTROL?
MATHEMATICAL KNOWLEDGE FOR TEACHING: EXEMPLARY HIGH SCHOOL TEACHERS' VIEWS
ANALYSIS OF UNDERGRADUATE STUDENTS' COGNITIVE PROCESSES WHEN WRITING PROOFS ABOUT INEQUALITIES
WHERE IS THE LOGIC IN PROOFS? 191 Milos Savic

READING ONLINE MATHEMATICS TEXTBOOKS	195
CALCULUS FROM A VIRTULA NAVIGATION PROBLEM1 Olga Shipulina	199
CONSTRUCT ANALYSIS OF COMPLEX VARIABLES: HYPOTHESES AND HISTORICAL PERSPECTIVES	204
Hortensia Soto-Johnson and Michael Oehrtman	
SPANNING SET: AN ANALYSIS OF MENTAL CONSTRUCTIONS OF UNDERGRADUATE STUDENTS	210
María Trigueros, Asuman Oktaç, and Darly Ku	
THE CONSTRUCTION OF LIMIT PROOFS IN FREE, OPEN, ONLINE, HELP FORUMS	213
Carla van de Sande and Kyeong Hah Roh	
THE VAN HIELE THEORY THROUGH THE DISCURSIVE LENS: PROSPECTIVI TEACHERS' GEOMETRIC DISCOURSES	
FUNCTION COMPOSITION AND THE CHAIN RULE IN CALCULUS	220
EFFECTIVE STRATEGIES THAT UNDERGRADUATES USE TO READ AND COMPREHEND PROOFS	225
Keith Weber and Aron Samkoff	
STUDENT UNDERSTANDING OF INTEGRATION IN THE CONTEXT AND NOTATION OF THERMODYNAMICS: CONCEPTS, REPRESENTATIONS, AND TRANSFER	229
Thomas M. Wemyss, Rabindra A. Bajracharya, John R. Thompson, and Joseph F. Wagner	
EXTENDING A LOCAL INSTRUCTIONAL THEORY FOR THE DEVELOPMENT OF NUMBER SENSE TO RATIONAL NUMBER	
A TRIGONOMETRY RECITATION EXPERIENCE FOR PRE-SERVICE SECONDARY MATH TEACHERS	239
REDEFINING INTEGRAL: PREPARING FOR A NEW APPROACH TO UNDERGRADUATE CALCULUS	243