

Architectural Drawing and Mathematical Modelling: Conics, GeoGebra and More

Original

Architectural Drawing and Mathematical Modelling: Conics, GeoGebra and More / Cumino, Caterina; Pavignano, Martino; Zich, Ursula. - In: PROCEEDINGS OF THE PME CONFERENCE. - ISSN 0771-100X. - ELETTRONICO. - 1:(2023), pp. 240-240. (Intervento presentato al convegno 46th Conference of the International Group for the Psychology of Mathematics Education tenutosi a Haifa (IL) nel July 16-21, 2023).

Availability:

This version is available at: 11583/2980475 since: 2023-07-18T14:13:59Z

Publisher:

The International Group for the Psychology of Mathematics Education (PME)

Published

DOI:

Terms of use:

This article is made available under terms and conditions as specified in the corresponding bibliographic description in the repository

Publisher copyright

(Article begins on next page)



PROCEEDINGS
OF THE
46th CONFERENCE
of the International Group for the
Psychology of Mathematics Education

Haifa, Israel | July 16 – 21, 2023



PME-46
MATHEMATICS EDUCATION
FOR GLOBAL SUSTAINABILITY

Volume 1

Editors: Michal Ayalon, Boris Koichu, Roza Leikin, Laurie Rubel and Michal Tabach



PROCEEDINGS

of the

46th Conference

of the International Group for the
Psychology of Mathematics Education

Haifa, Israel

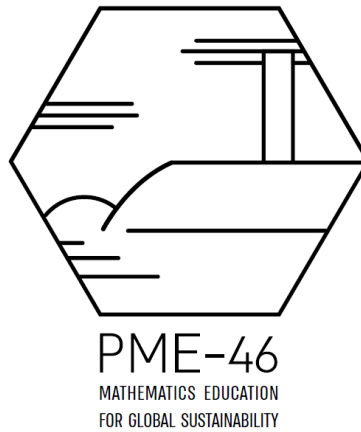
July 16 – 21, 2023

Editors:

Michal Ayalon, Boris Koichu, Roza Leikin, Laurie Rubel and Michal Tabach

Volume 1

Plenary Lectures
Working Groups
Seminar
Colloquium
National Presentation
Oral Communications
Posters



Cite as:

Michal Ayalon, Boris Koichu, Roza Leikin, Laurie Rubel & Michal Tabach (Eds.). (2023)
Proceeding of the 46th Conference of the International Group for the Psychology of
Mathematics Education (Vol. 2). University of Haifa, Israel: PME

Website: <https://pme46.edu.haifa.ac.il/>

The proceedings are also available via

<https://www.igpme.org/publications/current-proceedings/>

Copyright @ 2023 left to the authors

All rights reserved

ISSN: 0771-100X

ISBN: 978-965-93112-1-7

Printed by the University of Haifa

Logo Design: Sharon Spitz (<https://www.sharonspitz.com/>)

Cover design: Sharona Gil (Faculty of Education, University of Haifa)

TABLE OF CONTENTS

VOLUME 1

PREFACE	1-i
TABLE OF CONTENTS VOLUME 1	1-iv
TABLE OF CONTENTS VOLUME 2	1-xxv
TABLE OF CONTENTS VOLUME 3	1-xxx
TABLE OF CONTENTS VOLUME 4	1-xxxvi
THE PME 46 CONFERENCE COMMEETTES	1-xli

PLENARY LECTURES

LET'S TALK HISTORY	1-3
--------------------------	-----

Abraham Arcavi

TEACHING IN THE NEW CLIMATIC REGIME: STEPS TO A SOCIO-ECOLOGY OF MATHEMATICS EDUCATION	1-17
---	------

Alf Coles

IMPLEMENTATION OF COLLABORATIVE PROBLEM SOLVING: EXPERIENCES IN CHILE	1-35
--	------

Patricio Felmer

MATHEMATICAL SUBJECTIVATION: DEATH SENTENCE OR CHANCES FOR A TERRESTRIAL LIFE?	1-53
---	------

Paola Valero

RESEARCH FORUMS

HOW SOCIO-ECOLOGICAL ISSUES ARE URGING CHANGES IN CURRICULUM (AND BEYOND)	1-71
--	------

Andrea Amico, Chiara Andrà, Sean Chorney, Alf Coles, Luca Doria,
Tracy Helliwell, Jodie Hunter, Mariam Makramalla, Matteo Pezzutto,
Laurie Rubel, Armando Solares

INNOVATIVE RESEARCH APPROACHES TO MATHEMATICS TEACHER NOTICING	1-103
---	-------

Gabriele Kaiser and Thorsten Scheiner

ESTABLISHED AND EMERGING THEORETICAL PERSPECTIVES ON TEACHER NOTICING	1-104
Thorsten Scheiner and Gabriele Kaiser	
METHODOLOGICAL APPROACHES to the STUDY OF TEACHER NOTICING.....	1-109
Michal Ayalon, Karl W. Kosko, Nicole B. Kersting	
EXPLORING REPRESENTATIONS AND THEIR AFFORDANCES FOR SUPPORTING TEACHERS’ LEARNING TO NOTICE	1-113
Ceneida Fernandez, Alison Castro Superfine, Janet Walkoe	
NEW DIRECTIONS IN RESEARCH ON TEACHER NOTICING	1-118
Anton Bastian, Jessica Hoth, Macarena Larrain, Xinrong Yang	
TEACHER NOTICING: A PASSING FAD OR HERE TO STAY?	1-122
Ban Heng Choy	
PROBLEM SOLVING WITH TECHNOLOGY: MULTIPLE PERSPECTIVES ON MATHEMATICAL CONJECTURING	1-134
Shai Olsher, Dor Abrahamson, Abraham Arcavi, Ferdinando Arzarello, Daniel Chazan, Alison Clark-Wilson, Roza Leikin, Nathalie Sinclair and Michal Yerushalmy	
THEORY AND PRACTICE OF DESIGNING EMBODIED MATHEMATICS LEARNING.....	1-159
Alik Palatnik, Dor Abrahamson, Anna Baccaglini-Frank, Oi-Lam Ng, Anna Shvarts, Osama Swidan	
WORKING GROUPS	
THE CHALLENGES OF IDENTIFYING RESEARCH “AT THE FRONTIER” ...	1-191
Chiara Andrà, Domenico Brunetto, Scott Courtney, Andrea Maffia, Mariam Makramalla, Batseba Mofolo-Mbokane	
CONTRIBUTIONS FROM THE DIDACTIC-MATHEMATICAL KNOWLEDGE AND COMPETENCIES MODEL (DMKC MODEL) TO THE DEVELOPMENT OF THE MATHEMATICS TEACHERS’ RESEARCH AGENDA	1-193
Javier Díez-Palomar, Vicenç Font, Adriana Breda, Gemma Sala-Sebastià, Carlos Ledezma, Alicia Sánchez, Juan P. Vargas, Joaquim Giménez, Yuly Vanegas, Telesforo Sol, Diana Hidalgo-Moncada, Orlando García, Luisa Morales-Maure	

AN EMBODIED PERSPECTIVE ON DIVERSITY IN MATHEMATICS EDUCATION.....	1-195
Christina Krause, Anna Shvarts	
COMPREHENSION OF MATHEMATICAL TEXTS: TASKS AND LEARNING PROCESSES	1-197
Nadav Marco, Avital Elbaum-Cohen, Abraham Arcavi	
THE AFFORDANCES OF ADVANCED MATHEMATICS FOR SECONDARY MATHEMATICS TEACHING: COMPARING RESEARCH APPROACHES AND THEORETICAL PERSPECTIVES	1-199
Alon Pinto, Orly Buchbinder and Nick Wasserman	
CONCEPTUAL OVERLAP IN APPROACHES TO AFFECT: ATTITUDE, EMOTION, MOTIVATION AND WHAT ELSE?	1-201
Stanislaw Schukajlow, Pietro Di Martino, James Middleton	
INTERNATIONAL PERSPECTIVES ON PROOF: RECENT RESULTS AND FUTURE DIRECTIONS	1-203
Daniel Sommerhoff, Kotaro Komatsu	
POETIC METHODS IN MATHEMATICS EDUCATION	1-205
Susan Staats and Rachel Helme	
COLLOQUIUM	
Unraveling Strategies And (Mis)Interpretations Of Statistical Graphs – In Search Of The Potential Of Eye-Tracking Data	1-207
Organizer: Wim Van Dooren	
Discussant: Stefan Ufer	
SEMINAR	
Writing Pme Research Reports: A Seminar For Early-Career Researchers	1-210
Kotaro Komatsu, Chiara Andrà, Nicola Hodkowski, & Anselm R. Strohmaier	
ORAL COMMUNICATIONS	
INVESTIGATING THE CONSISTENCY BETWEEN STUDENTS' CONCEPTION OF PLACE VALUE AND A VIRTUAL MANIPULATIVE SUPPORTING (UN-)BUNDLING	1-213
Sophie Abdulkarim-Hoerster and Ulrich Kortenkamp	

CONSIDERATIONS FOR THE STUDY OF TEACHER'S BELIEFS FROM THEIR ACTIONS.....	1-214
Graciela Rubi Acevedo Cardelas, Luis Roberto Pino-Fan	
ENGAGING STUDENTS IN MATHEMATICAL MODELING THROUGH DYNAMIC LINKING OF VARIABLES IN M2STUDIO	1-215
Adeolu, A.S, Galluzzo, B.J., Zbiek, R.M., Chao, J., Brass, A.	
METAPHOR NETWORKS FOR EXPLORING FRACTION CONCEPTIONS	1-216
Aehee Ahn	
DOUBLE MOVE AS A STRATEGY FOR DEVELOPING LEARNERS' MATHEMATICS DISCOURSE AND UNDERSTANDING	1-217
Benadette Aineamani and Anthony A Essien	
FEATURES THAT PRE- SERVICE ELEMENTARY SCHOOL MATHEMATICS TEACHERS USE WHEN IMPLEMENTING THE PBL METHOD	1-218
Meirav Aish Yosef and Bat-seva Ilany	
THE PROCESS OF RECONTEXTUALIZATION IN A JOB-EMBEDDED PROFESSIONAL DEVELOPMENT	1-219
Burcu Alapala, Hala Ghousseini, & Rahul Panda	
THE COMPARISON OF INFINITE SETS DURING SCHOOL EDUCATION	1-220
Matthaios Antonopoulos	
ELEMENTARY SCHOOL TEACHERS' NOTICING OF MATHEMATICAL KNOWLEDGE FOR TEACHING IN THE CONTEXT OF PLANNING, INSTRUCTION, AND REFLECTION	1-221
Mitsue Arai, Daisuke Morita and Shohei Tachikawa	
AN INVESTIGATION ON NOVICE MATHEMATICS TEACHERS' RESPONSES TO HIGH POTENTIAL STUDENT THINKING	1-222
Zeynep Arslan, Damla Demirel, Mustafa Güler, & Derya Çelik	
AMPLIFIERS AND FILTERS AFFECTING TEACHER LEARNING OF STUDENT-CENTERED MATHEMATICS INSTRUCTION	1-223
Tuval Avishai, Alik Palatnik, Yifat Ben-David Kolikant	
A MATHEMATICS TEACHER EDUCATOR'S NOTICING	1-224
Müjgan Baki	
LEVERAGING <i>TOUCHTIMES</i> AS A TOOL FOR TEACHING	1-225
Sandy Bakos	
USING RASCH ANALYSIS TO IMPROVE THE SCORING RUBRIC OF A TRIGONOMETRY ASSESSMENT	1-226
Sarah Bansilal	

USING CONCEPT STUDY TO REORGANISE PRE-SERVICE TEACHERS' MATHEMATICS FOR TEACHING	1-227
Jonei Cerqueira Barbosa, Graça Luzia Dominguez Santos	
MATHEMATICS TEXTBOOKS: NATURE OF GEOMETRY TASKS AND THE OPPORTUNITY TO LEARN.....	1-228
Rúbia Barcelos Amaral	
USING A COMPARATIVE JUDGEMENT APPROACH TO ASSESS THE PROBLEM-SOLVING SKILLS OF PRIMARY SCHOOL PUPILS	1-229
Patrick Barmby, Colin Foster, Ian Jones, Joel Kelly, Jasmina Milinković	
DEVELOPMENT OF AN INSTRUMENT TO MEASURE TEACHER NOTICING FOR INCLUSIVE MATHEMATICS EDUCATION IN ALGEBRA...	1-230
Anton Bastian, Jonas Weyers, Natalie Ross, Johannes König, Gabriele Kaiser	
LEARNING THE CONCEPT OF DERIVATIVE.....	1-231
David Bednorz, Kristin Litteck, Daniel Sommerhoff, Aiso Heinze	
EXPLORING GLOBAL COMPETENCIES THROUGH A MATH & CP LENS ...	1-232
Marja Bertrand & Immaculate Namukasa	
TEACHERS' CONCEPTIONS OF THE ROLE OF MATHEMATICAL LITERACY TASKS	1-233
Masha Boriskovsky and Roza Leikin	
BUILDING MULTIPLICATIVE REASONING USING INTENSIVE QUANTITIES AND SPATIAL REASONING: A STORY OF CLIX MATH	1-234
Arindam Bose	
LANGUAGE DEMANDS AND SUPPORTS FOR LINGUISTICALLY DIVERSE (LD) STUDENTS IN INQUIRY-ORIENTED LINEAR ALGEBRA SMALL GROUP DISCUSSIONS	1-235
Ernesto D. Calleros	
THE IMPACT OF EDUCATIONAL OBSERVATION ON THE TEACHER NOTICING OF PRE-SERVICE MATHEMATICS TEACHERS IN MAINLAND CHINA	1-236
Yang Cao Yiru Chen Yicheng Wei and Qiaoping Zhang	
BOUNDARIES BETWEEN MATHEMATICS AND VISUAL ART TEACHING AND CURRICULUM.....	1-237
Chrysoula Choutou and Despina Potari	
INSTRUCTIONAL MATERIALS AS A STRATEGIC TOOL FOR MATHEMATICS MIDDLE MANAGER TO STEER INSTRUCTION	1-238

Ban Heng Choy & Yew Hoong Leong	
MATHEMATICAL MODELLING COMPETENCIES OF SECONDARY SCHOOL STUDENTS IN A VIRTUAL LEARNING ENVIRONMENT	1-239
Orit Cohen-Nissan and Zehavit Kohen	
ARCHITECTURAL DRAWING AND MATHEMATICAL MODELLING: CONICS, GEOGEBRA AND MORE	1-240
Caterina Cumino, Martino Pavignano, & Ursula Zich	
DIAGNOSTIC TEST AND PROFESSIONAL DEVELOPMENT	1-241
Isabelle Demonty and Joëlle Vlassis	
IDENTIFYING CREATIVE PROBLEM-SOLVING STRATEGIES USING EYE TRACKING	1-242
Adi Eraky, Roza Leikin, Bat-Sheva Hadad, Hagit Hel-Or, and Elie Abboud	
STUDENTS WITH LEARNING DISABILITIES EXPRESSING MATHEMATICAL CREATIVITY	1-243
Maya Ron Ezra and Esther S. Levenson	
WHY LESSONS BASED ON SIMILAR PROBLEMS TAUGHT BY THE SAME TEACHER CAN BE SO DIFFERENT?	1-244
Menucha Farber	
STRATEGY USE OF PREESCHOOL CHILDREN ESTIMATING LENGTHS	1-245
Sebastian Fricke & Jessica Hoth	
QUESTIONING ROUTINES IN MATHEMATICS PRESERVICE TEACHERS' DISCOURSE.....	1-246
Lizeka Gcasamba	
THE VISIBILITY OF MATHEMATICS IN PRINCIPALS' DISCUSSION OF STEM KNOWLEDGE AND PRACTICES	1-247
Vince Geiger, Kim Beswick, Cameron Meiklejohn, Vesife Hatisaru	
PROSPECTIVE PRESCHOOL TEACHERS' DESCRIPTIONS OF A TRIANGLE: THE CASE OF INDIA	1-248
Anna Neena George & Esther S. Levenson	
THE BASIC COGNITIVE CHARACTERISTICS OF ADOLESCENTS WITH DIFFERENCES IN MATHEMATICAL COMPETENCIES.....	1-249
Goldberg Orit, Leikin Roza, Rubinsten Orly	
COMPARING MATHEMATICIANS' AND MATHEMATICS TEACHERS' PEDAGOGICAL CLAIMS: WHERE IS THE STUDENT?	1-250
Myriam Goor and Alon Pinto	

INTER-PROBLEM FLEXIBILITY IN WORKING BACKWARDS	1-251
Gretzschel, Isabelle; Assmus, Daniela; Fritzlar, Torsten	
EXPLORING PRESERVICE MATHEMATICS TEACHERS' COGNITIVE JOURNEY IN UNDERSTANDING CONVERGENCE OF INFINITE SERIES USING DIRECT COMPARISON TEST	1-252
Guinever G. Vera & Catherine P. Vistro-Yu	
PROMOTING MATHEMATICAL MODELLING COMPETENCIES AMONG LEADING TEACHERS	1-253
Hadas Handelman and Zehavit Kohen	
VISUAL PROOFS FROM HIGH SCHOOL STUDENTS AND TEACHERS' PERSPECTIVES	1-254
Raz Harel and Nadav Marco	
ASSESSING MATHEMATICAL CRITICAL THINKING SKILLS – AN ESSAY-TEST USING THE EXAMPLE OF THE MEAT BAN IN SCHOOLS	1-255
Jannik Heckmann, Jonathan Runde, Alexander Salle	
MATHEMATICAL CONNECTIONS AND CONTEXTS IN PROSPECTIVE ELEMENTARY TEACHER TRAINING	1-256
Juan Pablo Vargas Herrera, Joaquín Giménez, Yuly Vanegas	
EXAMINING ACCURACY AND STRATEGY CHOICE ON THE ESTIMATION OF LENGTH	1-257
Ricarda Holland, Jessica Hoth & Aiso Heinze	
MATHEMATICS TEACHING STYLES OF TAIWANESE PRE-SERVICE ELEMENTARY SCHOOL TEACHERS: TEXT MINING AS THE METHOD OF ANALYSIS	1-258
Chia-Jui Hsieh	
USING RELAY JOINT TEACHING IN A MATHEMATICS PROFESSIONAL LEARNING COMMUNITY – A CASE STUDY OF ONE ELEMENTARY TEACHER'S QUESTIONING SKILLS	1-259
Kai-ju Hsieh	
FOSTERING MATHEMATICAL KNOWLEDGE THROUGH USAGE OF META-COGNITIVE STRATEGIES: AN EXPLORATIVE STUDY	1-260
Meenakshi Ingole, Aliya Bukusheva	
A MODE STUDY ON PAPER- AND COMPUTER-BASED MATHEMATICS TESTS IN THE CONTEXT OF TIMSS 2019: THE CASE OF GERMANY	1-261
Armin Jentsch, Christin Beese	

INTERPLAY BETWEEN MODES IN MATHEMATICS TEXTBOOKS	1-262
Helena Johansson, Malin Norberg, and Magnus Österholm	
COMPARING SELF-REPORTS AND KNOWLEDGE TESTS FOR ASSESSING MATHEMATICS TEACHERS' TPACK.....	1-263
Alina Kadluba, Andreas Obersteiner	
AN EVALUATION FRAMEWORK FOR EXPLANATORY VIDEOS IN FLIPPED MATHEMATICAL MODELLING EDUCATION	1-264
Gabriele Kaiser & Mustafa Cevikbas	
INTEGRATING CORE COMPETENCIES IN INSTRUCTION OF PRIMARY MATHEMATICS	1-265
Penina Kamina and Mary A. Ochieng	
HOW DOES A FACILITATOR SUPPORT TASK DESIGN DURING SCHOOL- BASED LESSON STUDY?	1-266
Hyomin Kang	
PSLE MATHEMATICS TASKS AS IMPETUS FOR TEACHERS' REFORM IN THEIR INSTRUCTIONAL PRACTICE	1-267
Berinderjeet Kaur, Jahangeer Mohamed Jahabar, Tong Cherng Luen	
AUSTRALIAN MATHEMATICS TEACHERS' KNOWLEDGE, BELIEFS AND ATTITUDES TOWARDS MANIPULATIVES.....	1-268
Victoria Kennard	
ENGAGING ALL LEARNERS BY RECRUITING AND RETAINING MINORITIZED MATHEMATICS TEACHERS	1-269
Nick Kim, Lynn Hodge	
A TASK DESIGN FRAMEWORK to TRANSFORM GENDERED VIEWS OF MATHEMATICS	1-270
Yuriko Kimura	
DESIGNING OPPORTUNITIES FOR MATHEMATICAL LEARNING AND COMPUTATIONAL THINKING THROUGH FAMILY STORIES.....	1-271
Shande King, Lynn Hodge, Elizabeth Yoon, Rebecca Layton, Nick Kim	
FUNDAMENTAL ABILITIES OF JAPANESE STUDENTS FOR LEARNING MATHEMATICAL PROOFS IN GRADES 5 TO 7	1-272
Yutaka Kondo	
INVESTIGATING THE IMPACT OF NEWSPAPER PREPARATION METHOD ON THE TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE OF PRE-SERVICE MATHEMATICS TEACHERS.....	1-273

Mehmet Kasım Koyuncu	
THE ROLE OF CONSIDERING STATISTICAL VARIATION IN DATA-BASED ARGUMENTATION: AN EXPLORATORY STUDY	1-274
Jens Krummenauer, Franziska Gutensohn, Johanna Aichele, Maria Emhart, & Sebastian Kuntze	
IS TEACHER NOTICING OF STUDENTS' THINKING SUFFICIENT?	1-275
Sebastian Kuntze, Sigal Rotem, Yael Nurick, Marita Friesen, Jens Krummenauer	
PSYCHOMETRIC EVIDENCE OF THE BRAZILIAN MATHEMATICS ANXIETY SCALE FOR PEDAGOGY STUDENTS	1-276
Sintria Labres Lautert, João dos Santos Carmo, Marcelo Henrique Oliveira Henklain, Ernani Martins dos Santos, Guilherme Henrique Gomes da Silva and Diogo Emmanuel Lucena dos Santos	
THE USE OF 3D DESIGN AND PRINTING ACTIVITIES TO DEVELOP MATHEMATICAL MODELLING COMPETENCIES	1-277
Laura Levin and Igor M. Verner	
THE RELATIONSHIP BETWEEN SUBJECTIVE NORM AND MATHEMATICS LEARNING INTENTION: A PLANNED BEHAVIOR MODEL FOR ELEMENTARY SCHOOL STUDENTS	1-278
Su-Wei Lin, Goung-Horng Su, Ming-Chi Tseng	
EXAMINATION OF DIFFERENT COGNITIVE-STYLE STUDENTS ON SOLVING MATHEMATICS PROBLEMS	1-279
Hao-Yi Liu, Hui-Yu Hsu	
PRESERVICE TEACHERS' EPISTEMOLOGICAL BELIEF ON CLOSE-ENDED AND OPEN-ENDED PROBLEM SOLVING	1-280
Yixuan Liu and Yiming Cao	
PRACTICES ON STATISTICAL INFERENCE PROPOSED IN THE CHILEAN MATHEMATICS CURRICULUM	1-281
Jesús Guadalupe Lugo-Armenta, Luis R. Pino-Fan	
TEACHER EXPLANATIONS OF GRADE 8 OPERATIONS ON INTEGERS	1-282
Judah Makonye	
ENHANCING TEACHERS' PCK FOR MULTIPLICATIVE THINKING TO SUPPORT MATHEMATICS LEARNING	1-283
Mayamiko Malola, Wee Tiong Seah, Max Stephens	
PATHWAYS OF ATTENTION: TECHNOLOGY AND TENSIONS	1-284

Ami Mamolo Sheree Rodney Diane Tepylo	
CHANGES IN TEACHERS' CONCEPTIONS WHILE USING MULTIPLE OUTCOME TASKS	1-285
Fatena Marjeh and Roza Leikin	
MATHEMATICS CLASSROOM EXPERIENCES OF PROSPECTIVE PRIMARY SCHOOL AND SPECIAL EDUCATION TEACHERS.....	1-286
María Victoria Martínez, Rubén Balboa, Constanza San Martín, Eder Pinto, Yerko Manzano, María Karina Lozic, David Maximiliano Gómez	
VARIATION OF TEACHERS' EXAMPLE USE WITHIN A MATHEMATICS DEPARTMENT: AFFORDANCES FOR LEARNING IN DIFFERENT CLASSES IN THE INTRODUCTION OF FUNCTIONS.....	1-287
Kathryn McLachlan and Anthony A Essien	
DO STUDENTS VALUE MODELLING WITH EXPERIMENTS?.....	1-288
Marielena Menzel, Michael Jonscher, Stefanie Rach, Sebastian Geisler	
DEVELOPMENT OF AN INSTRUMENT TO ASSESS STATISTICAL REASONING IN UNDERGRADUATE MECHANICAL ENGINEERING	1-289
James A. Middleton	
USING PATTERNING TASKS FOR ASSESSMENT OF EARLY VISUAL LITERACY	1-290
Jasmina Milinković, Svetlana Počuča	
SMARTPHONES: BRIDGING MATHEMATICS and SCIENCE WITH NOVEL TECHNOLOGY	1-291
Marina Milner-Bolotin and Valery Milner	
THE BRIDGING ROLE OF THE CONJECTURE IN THE TRANSITION TO ADVANCED MATHEMATICAL THINKING.....	1-292
Annamaria Miranda	
TEACHING APPROACHES TO THE DERIVATIVE CONCEPT: USING THE GOAL-ACTION MODEL TO COMPARE THREE TEACHERS' TEACHING APPROACHES	1-293
Amira Mohammad Abed, Michal Ayalon and Anatoli Kouropatov	
PROBLEM POSING AND PROBLEM SOLVING BY PROSPECTIVE TEACHERS: AN ANALYSIS OF THE INFLUENCE OF THE CONTEXT	1-294
Lidia Molina, Irene Ferrando and Carlos Segura	
IMPROVING STRATEGIC COMPETENCE IN YOUNG LEARNERS	1-295
Samantha Morrison & Corin Mathews	

COMMUNICATING 21ST-CENTURY COMPETENCIES WHILE BRIDGING BETWEEN CONTEMPORARY AND SCHOOL MATHEMATICS	1-296
Nitsa Movshovitz-Hadar, Ruti Segal, Karni Shir, Atara Shriki, Mira Fell	
LEARNING TO TEACH SIMILARITY IN A LESSON STUDY	1-297
Lisnet Mwadzaangati and Jill Adler	
PROCESSES OF UTILIZING ACADEMICS MATHEMATICS IN SECONDARY MATHEMATICS TEACHING.....	1-298
Yocheved Mytlis and Alon Pinto	
LEARNING TO TEACH VIA MOOC: FROM A DIFFERENT ANGLE – MATHEMATICS TEACHING PRACTICES	1-299
Talli Nachlieli and Irit Lavie	
MATHEMATICAL MODELLING INSTRUCTION BY PRE-SERVICE TEACHERS	1-300
Ortal Nitzan-Tamar and Zehavit Kohen	
A DESIGN BASED STUDY: GAME MATERIAL DEVELOPMENT EXPERIENCES OF MATHEMATICS TEACHER CANDIDATES	1-301
Özdemir, Bilal Özçakir	
IMPLEMENTATION OF INSTRUCTIONAL DESIGN ARRANGED WITH AUGMENTED REALITY IN TEACHING THE SUBJECT OF 6TH GRADE GEOMETRIC OBJECTS	1-302
Ahmet Şükrü ÖZDEMİR and Özlem İNCE	
AN EVALUATION OF STATISTICS LESSONS AT SECONDARY SCHOOL WITH REGARD TO GAISE REPORT-II.....	1-303
Zeynep Medine ÖZMEN, Adnan BAKİ, Bülent GÜVEN, Beyda TOPAN, Esra BUKOVA-GÜZEL, Ramazan GÜRBÜZ	
FUNCTIONS AND THEIR GRAPHS IN HIGH SCHOOL MATHEMATICS IN NEPAL.....	1-304
Santosh Pathak	
INTERROGATING STUDENTS’ RESPONSES TO ASSESSMENT TASKS: A FOCUS ON THE FRACTION TWO-THIRDS.....	1-305
Catherine Pearn	
DEVELOPMENT OF UNIVERSITY STUDENTS’ MATHEMATICAL BELIEFS N INTERDISCIPLINARY MATHEMATICS CURRICULUM	1-306
Aihui Peng	

AN ANALYSIS OF VIDEOS PRODUCED DURING THE PANDEMIC FROM MAYER’S MULTIMEDIA LEARNING PERSPECTIVE	1-307
PERES, Gilmer J, PAGANI, Erica M. L.	
EXPANDING THE SINE CONCEPT FROM A RATIO IN A RIGHT-ANGLE TRIANGLE TO A CYCLIC FUNCTION: THE CASE OF ANGLES GREATER THAN 360^0	1-308
Tagil Perlmutter and Michal Tabach	
STUDENTS ATTITUDES TOWARDS METACOGNITIVE SKILLS FOR STRATEGIC MATH PROBLEMS	1-309
Yelena Portnov-Neeman & Miriam Amit	
WHAT’S YOUR PROBLEM? – ADAPTING DEWEY TO INFORM MATHEMATICAL INSTRUCTION IN HIGH SCHOOL	1-310
Daniel Pötz, Christina Krause	
INTEGRATING COMPUTATIONAL THINKING WITH ABSTRACTION IN CONTEXT: A PROJECT PROPOSAL	1-311
Theresa B. Probadora & Angela Fatima H. Guzon	
PST’S PERCEPTIONS OF TOPIC DIFFICULTY: PD PREDICTOR OF PST’S.....	1-312
Livhuwani Petrus Ramabulana	
ENACTIVISM AND REFLEXIVITY: SOME CONSIDERATIONS IN RESEARCH ON MATHEMATICS EDUCATION	1-313
Paola Ramirez	
HYBRID TEACHING IN MATHEMATICS CLASSES: STUDENTS' PERSPECTIVE	1-314
Suha Rawashdi & Michal Ayalon	
TOWARDS A COGNITIVE PROCESS FRAMEWORK ON THE LEARNING MECHANISMS OF DIGITAL TOOLS IN MATHEMATICS	1-315
Frank Reinhold, Timo Leuders, Katharina Loibl, Matthias Nückles, Maik Bееge, & Jan M. Boelmann	
IMPROVING MATHEMATICS TEACHER EDUCATORS’ PRACTICE THROUGH COLLEGIAL OBSERVATION AND JOINT REFLECTION.....	1-316
Karen Reitz-Koncebovski	
STUDENTS WITH LEARNING DISABILITIES EXPRESSING MATHEMATICAL CREATIVITY	1-317
Maya Ron Ezra and Esther S. Levenson	
LESSON PLAYS TO ENVISION DISCUSSION FACILITATION.....	1-318

Sigal-Hava Rotem	
AGENCY IN THE EXPLORATIVE PEDAGOGICAL DISCOURSE WITHIN A MINORITIZED TEACHERS PROFESSIONAL LEARNING COMMUNITY	1-319
Soryna Sabbah, Einat Heyd-Metzuyanim & Areej Mawasi	
REPRESENTATIONS IN PROBLEM-SOLVING PROCESSES WITHIN AN ENRICHMENT PROGRAM FOR PRIMARY SCHOOL CHILDREN.....	1-320
Sebastian Schorcht, Franziska Peters	
EFFECTS OF SHORT INSTRUCTIONS ON SOLVING OPEN MODELLING PROBLEMS	1-321
Stanislaw Schukajlow, Janina Krawitz, Jonas Kanefke and Katrin Rakoczy	
ASSESSING THE DIAGNOSTIC COMPETENCE OF IN-SERVICE TEACHERS DURING MODELLING INSTRUCTION	1-322
Liron Schwartz-Aviad and Zehavit Kohen	
CREATIVITY AS A PATH INTO A GROWTH MINDSET	1-323
Lilach Shaham, & Esther S. Levenson	
FIRST- AND SECOND-GRADE PROSPECTIVE TEACHERS RECONSTRUCTING A DEFINITION OF POLYGON DIAGONALS	1-324
Huda Shayeb, Juhaina Awawdeh Shahbari, Aehsan Haj-Yahya	
THE EFFECTIVENESS OF TEACHER PROFESSIONAL LEARNING COMMUNITY OF SELF-REGULATION LEARNING FOR JUNIOR HIGH SCHOOL MATHEMATICS TEACHERS.....	1-325
Shih-Yu Yang, Chang-Hua Chen, Erh-Tsung Chin	
MONOLOGICAL AND DIALOGICAL ASPECTS IN THE WORK OF MATHEMATICIANS	1-326
Shoval Tamar and Tabach Michal	
PRE-SERVICE MATHEMATICS TEACHERS' SPECIALISED KNOWLEDGE FOR TEACHING THE CONCEPT OF A FUNCTION	1-327
Edgar J. Sintema	
EYE-TRACKING VISUAL AND TEXTUAL INFORMATION – WHAT MATTERS IN BAYESIAN SITUATIONS?.....	1-328
Julia Sirock, Georg Bruckmaier, Stefan Krauss, Markus Vogel	
MODELS AND METAPHORS: CHANGING PERCEPTIONS OF MATHEMATICS IN PRE-SERVICE TEACHERS WITH MATHS ANXIETY	1-329
Jo Skelton and Sarah Frodsham	

IN-SERVICE MATHEMATICS TEACHERS' CONCEPTIONS OF REASONING AND PROOF	1-330
Mária Slavičková, Jakub Michal, Jarmila Novotná	
THE EFFECTIVENESS OF LEARNING PROGRESS MONITORING: A META-ANALYSIS	1-331
Daniel Sommerhoff, Amelie Fuchs, Anika Radkowsch	
HOME NUMERACY ACTIVITIES PERFORMED BY DEAF AND HEARING CHILDREN: AN EXPLORATORY STUDY	1-332
Alina Galvão Spinillo, Paula Gusmão and Marly Cavalcante de Albuquerque	
READING AND CALCULATING IN WORD PROBLEM SOLVING	1-333
Anselm R. Strohmaier, Christian Schons, Alina Knabbe, and Markus Vogel	
AN ANALYSIS OF THE SOUTH KOREAN MATHEMATICS CURRICULUM: THE DEMOCRATIC PERSPECTIVE.....	1-334
Emily S. W. Sum	
INFLUENCE OF LINEAR FUNCTION EXPRESSION AND VARIABLE SYMBOLS ON STUDENTS' PROBLEM SOLVING	1-335
Chia-Wei Sun, Hui-Yu Hsu	
SCIENCE EDUCATION STUDENTS' USE OF UNNECESSARY BRACKETS: EXPLORING THE SPAN OF USES AND REFLECTIONS ON STUDENTS' STRUCTURE SENSE	1-336
Athina Thoma, Ioannis Papadopoulos, Mustafa Güler	
CONCEPTUAL KNOWLEDGE OF PERMUTATION.....	1-337
Charlott Thomas and Birte Pöhler	
INTRODUCING PATTERNS TO YOUNG CHILDREN WITH AUTISM.....	1-338
Helen Thouless	
GROUNDING THE PROCEPT OF POLYNOMIALS OPERATION THROUGH EMBODIED INTERACTION	1-339
Tai-Yih Tso and Feng-Lin Lu	
LEARNING GEOMETRY REASONING WITH EMBODIED DYNAMIC VISUALIZATION	1-340
Tai-Yih Tso, Shu-Hao Hsu and Feng-Lin Lu	
DO FUTURE PRIMARY TEACHERS IN TAIWAN HAVE SUFFICIENT BASIC COMPUTATIONAL CAPABILITIES?	1-341
Yun-Chi Tsou and Chia-Jui Hsieh	

EVALUATION OF MIDDLE SCHOOL MATHEMATICS TEACHERS' TEACHING EXPERIMENTS IN TERMS OF GRAPH LITERACY	1-342
Sefa UYANIK, Zeynep Medine OZMEN	
NON-ROUTINE PROBLEM SOLVING AND CREATIVITY AMONG TALENTED MATH STUDENTS FROM A MULTI-AGE PERSPECTIVE	1-343
Uziel Odelya, Amit Miriam	
DIFFERENCES IN STUDENTS WHO EXCEL IN SCHOOL MATHEMATICS IN TAIWAN AND ISRAEL	1-344
Ilana Waisman, Hui-Yu Hsu, Roza Leikin	
THE INITIAL STAGE TO CONSTRUCT THE CONCEPTS OF TIME: OBSERVING A CLOCK FROM THE VIEWPOINT OF PERSONIFICATION.....	1-345
Keiko WATANABE	
POTENTIAL OPPORTUNITIES AND CHALLENGES IN THE INTEGRATION OF EXECUTIVE FUNCTION PROCESSES IN MATHEMATICS EDUCATION	1-346
David C. Webb	
PRESERVICE MATHEMATICS TEACHERS NOTICING IN CHINA	1-347
Yicheng Wei Yiru Chen Yang Cao and Qiaoping Zhang	
ASSESSMENT OF REFLECTION SKILLS EMBEDDED IN MATHEMATICAL LITERACY	1-348
Kai-Lin Yang, Chien-Heng Chen, Wan-Rou Wu and Yun-Zu Chen	
COMPARISON OF EQUIVALENT FRACTIONS WITH DIFFERENT REPRESENTATIONS	1-349
Chen-Yu Yao, Hui-Yu Hsu, Tsu-Jen Ding	
EXPLORING GRADE 11 STUDENTS' METACOGNITIVE PROCESSES IN SOLVING NON-ROUTINE PROBLEMS IN GEOMETRY	1-350
Beegoo Yashwini, Angateeah Khemduth Singh	
ADOPTING THE READING TO LEARN APPROACH IN THE TEACHING OF MATHEMATICAL WORD PROBLEMS	1-351
Antonia Y.T. Yip	
INTEGRATING TECHNOLOGICAL TOOLS IN MATHEMATICS EDUCATION IN THE CONTEXT OF HYBRID TEACHING DURING THE COVID-19 PANDEMIC	1-352
Ruba Zaarura and Michal Ayalon	

A STUDY ON THE DETERMINATION INDICATORS FOR MATHEMATICAL LITERACY QUESTION: FROM THE PERSPECTIVES OF THE SCHOOL TEACHERS	1-353
Yu-Zhen Zhang, Min-Hsuan Wey, Chia-Jui Hsieh	
HOW DO TEACHERS ANTICIPATE STUDENTS' RESPONSES IN PROBLEM-SOLVING LESSONS?	1-354
Rachel Zaks	
POSTERS	
CONSIDERATIONS FOR THE STUDY OF TEACHER'S BELIEFS FROM THEIR ACTIONS	1-356
Graciela Rubi Acevedo Cardelas, Luis Roberto Pino-Fan	
MATHEMATICAL PROBLEM POSING AND PROBLEM SOLVING BY ELEMENTARY SCHOOL CHILDREN: A TEACHING EXPERIMENT.....	1-357
Neila Agranionih, Sirlene da Silva and Alina Galvão Spinillo	
FEATURES THAT PRE- SERVICE ELEMENTARY SCHOOL MATHEMATICS TEACHERS USE WHEN IMPLEMENTING THE PBL METHOD	1-358
Meirav Aish Yosef and Bat-seva Ilany	
SUPPORTING PRE-SERVICE TEACHERS' SKILL OF CRAFTING A PEDAGOGICAL RESPONSE THAT BUILDS ON CHILDRENS' MATHEMATICAL THINKING.....	1-359
Burcu Alapala	
IDENTIFYING TEACHERS' NEEDS IN INCLUSIVE MATHEMATICS CLASSES	1-360
Bital Amir & Esther Levenson	
SUSTAINABILITY IN MATHEMATICAL CLASSES: TENSIONS OF A TEACHER EMPLOYING AN INTERDISCIPLINARY GAME.....	1-361
Chiara Andrà and Matteo Pezzutto	
'DOING DIFFERENCE' IN MATHEMATICS EDUCATION	1-362
Anna Hummel and Simone Reinhold	
MEASURING PROPORTIONAL REASONING IN GRADES 5 TO 7: WHAT DEVELOPS AND WHAT DOES NOT?	1-363
Ildikó Bereczki and Csaba CsíkoZ	
PROGRESSION TOWARDS USE OF FORMAL MATHEMATICAL REGISTER: EXTENT OF STRUCTURE FRAMEWORK	1-364

Thulelah Blessing Takane	
HOW 4 TH -GRADERS WORK ON APP-BASED BALANCE SCALES TASKS	1-365
Michelle Bräuer and Torsten Fritzlar	
EARLY DETECTION OF RISK FOR MATH LEARNING DIFFICULTIES BASED ON SYMBOLIC AND NON-SYMBOLIC TASKS	1-366
Danilka Castro Cañizares, Pablo Dartnell and David Maximiliano Gómez	
EXPLORING TEACHER’S SELF-REGULATED TEACHING IN MATHEMATICS: TAKING DISCOURSE ANALYSIS AS AN APPROACH	1-367
Chang-Hua Chen and Chia-Hui Lin	
A LONG-TERM INVESTIGATION ON JUNIOR HIGH SCHOOL STUDENTS’ PERSPECTIVES ON WHAT TEACHERS SHOULD DO TO ENHANCE THEIR MATH LEARNING MOTIVATION	1-368
Chang-Ming Chiang, Ting-Ying Wang, Feng-Jui Hsieh	
WHAT CAN A MOBILE SOFTWARE APPLICATION (APP) DO IN THE MATHEMATICS CLASSROOM?	1-369
Ching-Wen Chiu, Chia-Jui Hsieh, Jia-Ming Ying	
EXPLORING THE KNOWLEDGE SOURCES OF MATH EDUCATION STUDENTS	1-370
Noa Cohen -Eliyahu, Alik Palatnik	
SPATIAL REASONING IN GEOMETRY AND CARTOGRAPHY	1-371
Tsu-Jen Ding, Hui-Yu Hsu, Chen-Yu Yao	
MATHEMATICAL MODELLING AND CODING OF SOCIAL JUSTICE ISSUES: SUPPORTING STEM IDENTITY	1-372
Andrew DiVito, Robyn Ruttenberg-Rozen	
PROMOTING CREATIVE THINKING IN SCHOOLCHILDREN WITH APPLIED PROBLEMS IN MATHEMATICS	1-373
Lea Dorel	
ALGORITHM IN MIDDLE SCHOOL MATHEMATICS TESTBOOKS	1-374
Nisa Efe, Emel Ozdemir Erdogan	
INTEREST DEVELOPMENT WHEN MODELLING DISEASES	1-375
Michael Fischer, Christina Krause, Gunther Leobacher	
CONSTRUCTIVELY ALIGNED TEACHING FRAMEWORK: A CASE FOR MATHEMATICAL TEACHING FRAMEWORK	1-376
Lizeka Gcasamba	

MEASURING EXECUTIVE FUNCTIONS IN GENERAL AND SPECIFIC MIDDLE-SCHOOL LEVEL GEOMETRY CONTEXT	1-377
Hissen Ghadban, Leah Nachmias, Michal Ayalon, Tali Leibovich-Raveh	
A STUDY OF THE IMPACT OF MATHEMATICS TEACHER ON THE VALUE FORMATION OF FIRST GRADE JUNIOR HIGH SCHOOL STUDENTS	1-378
Hiroshi ISHII	
THE PROFESSIONAL DEVELOPMENT OF ELEMENTARY TEACHERS OF MATHEMATICS TEACHING BY CO-LEARNING INQUIRY PROCESS.....	1-379
Wei-Min Hsu	
REVISITING TPACK: A DIALOGUE BETWEEN PEDAGOGY AND TECHNOLOGY - AN EMPHASIS ON RATIO AND PROPORTION.....	1-380
Cohen Dorit, Klemer Anat & Ilany Bat-Sheva	
SPANISH AND GERMAN PRE-SERVICE TEACHER'S ANALYSES OF A TEACHING-LEARNING SITUATION ON FRACTION OPERATIONS	1-381
Pedro Ivars, Sebastian Kuntze, Jens Krummenauer	
A NUMBER TALK QUESTIONING FRAMEWORK FOR ADVANCING RESEARCH AND TEACHER DEVELOPMENT	1-382
Candace Joswick, Kimberly Conner, and Brandon McMillan	
THE EFFECT OF MATH CLINIC USING K-UTF PROGRAM TO REDUCE MATH ANXIETY	1-383
Sang Sook Choi-Koh & Jeong Hyeon Kim	
REFLECTING ON PRE-SERVICE TEACHERS' OBSERVATIONS FROM SCHOOL INTERNSHIPS BASED ON REPRESENTATIONS OF PRACTICE	1-384
Jens Krummenauer, Sebastian Kuntze	
PRE-SERVICE TEACHERS' VIEWS ON INTERACTION IN THE MATHEMATICS CLASSROOM AS REFLECTED IN TEACHER-DESIGNED CLASSROOM CARTOONS.....	1-385
Sebastian Kuntze, Jens Krummenauer	
PROSPECTIVE TEACHERS' REFLECTIONS ON THE INCLUSION OF MATHEMATICAL MODELLING IN TWO TRANSITIONAL TEACHING CONTEXTS.....	1-386
Carlos Ledezma, Vicenç Font, Alicia Sánchez, and Elizabeth Montoya-Delgadillo	

THE CHARACTERISTICS OF MATHEMATICAL MODELLING IN THE INQUIRY-BASED CLASSES.....	1-387
Chang Yeon Lee	
CODING IN MATHEMATICS CLASSROOM AND STUDENTS’ AFFECTIVE ENGAGEMENT	1-388
Yujin Lee, Sun Hee Kim	
LATENT CLASS AND PROFILE ANALYSIS ON PRIMARY SCHOOL STUDENTS’ MATHEMATICAL MINDSET	1-389
Yuan-Horng Lin	
CLASSROOM PROFILES OF LEVEL AND HETEROGENEITY IN STUDENT-REPORTED INSTRUCTIONAL QUALITY	1-390
Christian Lindermayer, Timo Kosiol, Stefan Ufer	
PATHWAYS OF ATTENTION: TECHNOLOGY AND TENSIONS.....	1-391
Ami Mamolo, Sheree Rodney, Diane Tepylo	
DATAVIZ DESIGN: A STUDY OF INTENTIONS.....	1-392
Ami Mamolo, Sheree Rodney, kechi Ibeh	
INVESTIGATING STRATEGIES FOR SECONDARY MATHEMATICS TEACHERS LEARNING ON FORMATIVE ASSESSMENT	1-393
Hila Mayerowicz and Michal Ayalon	
INTEGRATING EDUCATION FOR SUSTAINABLE DEVELOPMENT WITH MATHEMATICS TEACHING: PRESENTATION OF A TYPICAL ACTIVITY	1-394
Christina Misailidou	
STUDYING ADVANCED MATHEMATICS THROUGH A HYBRID MOOC	1-395
Halima Shakia and Zehavit Kohen	
A MATHEMATICS TEACHER EDUCATOR’S NOTICING.....	1-396
Müjgan Baki	
EXPLORING A LESSON STUDY FRAMEWORK	1-397
Leah Nillas and Asmamaw Yimer	
CARTOON-BASED VIGNETTES AS A STIMULUS FOR REFLECTION	1-398
Yael Nurick, Sebastian Kuntze, Sigal-Hava Rotem	
MEASURING LONGITUDINAL PERFORMANCE AT THE MATH MINDS INITIATIVE: AN INTERVENTION AT THE ELEMENTARY LEVEL	1-399
Armando Paulino Preciado Babb & Mawuli Kofi Tay	

SELF-REGULATED LEARNING WHILE SOLVING MATHEMATICAL PROBLEMS: EXAMINING DIFFERENCES BETWEEN MATHEMATICALLY GIFTED AND TYPICAL ACHIEVERS' STUDENTS	1-400
Nurit Paz-Baruch, Hala Hamud	
GEOMETRIC REASONING USED IN CHILEAN MATHEMATICS TEXTBOOKS: THE CASE OF SEVENTH AND EIGHTH GRADE	1-401
Guadalupe Morales-Ramírez, Luis R. Pino-Fan and Víctor Larios Osorio	
DEVELOPMENT AND EVALUATION OF OPEN EDUCATIONAL RESOURCES TO IMPROVE TEACHERS' KNOWLEDGE ON SPATIAL ABILITIES	1-402
Silke Ruwisch & Cathleen Heil	
WHATSAPP GROUP + BAGRUT = BAGROUP: TEACHERS' PERSPECTIVES.....	1-403
Ruti Segal and Yaniv Biton	
MATHEMATICS ANXIETY AND NUMBER SENSE IN CHILDREN: AN EVENT-RELATED POTENTIAL STUDY	1-404
I-Hsuan Shen, Tai-Yih Tso, Chia-Ling Chen	
LONGITUDINAL IMPACT OF MATHEMATICS NEWS SNAPSOTS ON STUDENTS' VIEWS OF MATHEMATICS.....	1-405
Boaz Silverman, Ruti Segal, Atara Shriki, Nitsa Movshovitz-Hadar	
ON THE REASONING OF PRE-SERVICE TEACHERS WHEN SOLVING OPEN-ENDED GEOMETRIC PUZZLES	1-406
Ilya Sinitsky	
AN ACTIVITY THEORY PERSPECTIVE ON STUDENT-REPORTED CONTRADICTIONS TO UNDERSTAND COLLABORATION DURING PROBLEM SOLVING IN PRIMARY SCHOOL MATHEMATICS.	1-407
Julie Smith	
ELEMENTARY STUDENTS' (IN)FLEXIBLE STRATEGY USE IN WORD PROBLEMS AS REVEALED BY EYE-TRACKING	1-408
Nikolett Turzó-Sovák, Fanni Biró, Csaba Csíkos	
PRESERVICE TEACHERS' PEDAGOGICAL REASONING FOR INTEGRATING DIGITAL GRAPHING TOOLS IN EXPONENTIAL AND LOGARITHMIC FUNCTIONS	1-409
Ting-Ying Wang	
EXPLORING AN ALTERNATIVE ANALYTIC FRAMEWORK UNDER THE HOLISTIC PSYCHOLOGY OF EMOTION AND COGNITION	1-410

Tsung-Ju Wu, Fou-Lai Lin	
PEREZHIVANIE AS A BRIDGING CONCEPT FOR VYGOTSKYAN AND PHENOMENOLOGICAL LENSES	1-411
Andonis ZAGORIANAKOS	
WHY DO REAL ANALYSIS? LECTURE ‘WHY’ STORIES AND TENSIONS ...	1-412
Anna Zarkh and Kaya Poff	
NUMBER INTERVIEWS AS ASSESSMENT TOOLS FOR REVEALING MISCONCEPTIONS IN NUMBER	1-413
Natasha Ziebell, Cath Pearn	
NATIONAL PRESENTATION	1-415
Michal Ayalon and Roza Leikin, Abdelrahman Affan and Michael N. Fried, Abdelrahman Affan and Michael N. Fried, Jason Cooper and Boris Koichu, Ruhama Even, Zehavit Kohen, Esther S. Levenson, Nitsa Movshovitz-Hadar and Abraham (Avi) Berman, Talli Nachlieli and Einat Heyd-Metzuyanin, Elena Naftaliev and Marita Barabash	

TABLE OF CONTENTS

VOLUME 2

RESEARCH REPORTS (A-G)

CONNECTING REPRESENTATIONS FOR COMMUTATIVITY: STUDENTS' RICH DISCOVERIES IN A MULTI-REPRESENTATION TOOL WITH NON-EXPLICIT ARTICULATIONS	2-3
Malina Abraham and Susanne Prediger	
REVEALING COGNITIVE PROCESSES WHEN COMPARING BOX PLOTS USING EYE-TRACKING DATA—A PILOT STUDY	2-11
Martin Abt, Frank Reinhold and Wim Van Dooren	
WHAT DIFFERENCE DOES TEACHER KNOWLEDGE MAKE? A FEASIBILITY STUDY ON USING ELEMENTS OF COMPREHENSION AS INDICATORS FOR SCHOOL-RELATED CONTENT KNOWLEDGE	2-19
Carina Albu and Anke Lindmeier	
DECISIONS OF AN ADAPTIVE ENGINE FROM A DIDCATICAL PERSPECTIVE.....	2-27
Karin Alush, Shai Olsher and Yaniv Biton	
IS BEAUTIFUL ALSO TRANSPARENT? STUDENTS LEARN FROM GRAPHS ABOUT WATER POLLUTION	2-35
Andrea Amico and Luca Doria	
DYNAMIC INTERACTIVE MEDIATORS IN DISCOURSE ON INDETERMINATE QUANTITIES: A CASE STUDY	2-43
Samuele Antonini, Chiara Bonadiman and Bernardo Nannini	
FROM INTERPRETATIVE KNOWLEDGE TO SEMIOTIC INTERPRETATIVE KNOWLEDGE IN PROSPECTIVE TEACHERS' FEEDBACK TO STUDENTS' SOLUTIONS	2-51
Miglena Asenova, Agnese Del Zozzo and George Santi	
ALGEBRAIC DISCOURSE DEVELOPMENT IN A SPREADSHEET ENVIRONMENT AND DISCURSIVE-COMPUTER ROUTINES	2-59
Tamar Aviram, Michal Tabach and Einat Heyd-Metzuyanim	
MEANING-MAKING THROUGH QUESTIONING IN AN AUGMENTED REALITY ENVIRONMENT	2-67
Sara Bagossi, Yana Kovarsky Boev and Osama Swidan	

ADAPTIVE STRATEGY USE IN PATTERN-RECOGNITION OF FIRST GRADERS WITH AND WITHOUT RISK OF DEVELOPING MATHEMATICAL DIFFICULTIES: AN EYE-TRACKING STUDY	2-75
Lukas Baumanns, Demetra Pitta-Pantazi, Constantinos Christou, Achim J. Lilienthal, Anna Lisa Simon and Maike Schindler	
PROSPECTIVE UNIVERSITY STUDENTS IN MATHEMATICS REFLECTING ON UNCERTAINTY: RESULTS AND COMPARISONS	2-83
Francesco Beccuti	
PRESERVICE TEACHERS' ADAPTIVE TEACHING OF FRACTIONS: A VIGNETTE-BASED EXPERIMENTAL STUDY	2-91
Sara Becker, Andreas Obersteiner and Anika Dreherl	
THE ROLE OF IMPLICIT THEORETICAL ASSUMPTIONS IN EMPIRICAL RESEARCH.....	2-99
Ewa Bergqvist and Magnus Österholm	
TO JOIN SEEING AND DOING: CREATING A FORMULA WITH A VIRTUAL AND A PHYSICAL 3D-PUZZLE	2-107
Angelika Bikner-Ahsbahs and Marit Hvalsøe Schou	
THE RECONSTRUCTION OF MATHEMATICAL INTERPRETATIONS – ACTIONS OF PRIMARY SCHOOL CHILDREN ON DIGITAL AND ANALOGUE MATERIAL	2-115
Lara Kristina Billion	
SECONDARY SCHOOL STUDENTS INTERPRETING AND COMPARING DOTPLOTS: AN EYE-TRACKING STUDY	2-123
Lonneke Boels and Wim Van Dooren	
TEACHING EDUCATION FOR SUSTAINABLE DEVELOPMENT- CHALLENGES AND SUCCESSES OF PRE-SERVICE MATHEMATICS TEACHERS	2-131
Rita Borromeo Ferri and Sabine Wiegand	
CULTURAL ASPECTS IN THE CONCEPTUALIZATION OF ACTIVE, BODILY EXPERIENCE MATHEMATICS LEARNING ACTIVITIES.....	2-139
Alessandra Boscolo	
STUDENTS' MATHEMATICAL WELLBEING DURING A CULTURALLY SUSTAINING MATHEMATICS PEDAGOGY PROFESSIONAL DEVELOPMENT INITIATIVE	2-147
Alexandra Bowmar, Julia Hill, Generosa Leach and Jodie Hunter	

THE SUPPORTING EFFECT OF DIFFERENT VISUALIZATIONS FOR JUDGING COVARIATION AS PART OF BAYESIAN REASONING.....	2-155
Theresa Büchter, Andreas Eichler, Katharina Böcherer-Linder and Markus Vogel	
PRE-SERVICE TEACHERS' CURRICULAR NOTICING WHEN PROVIDING FEEDBACK ON PEERS' LESSON PLANS.....	2-163
Michael Cavanagh and Dung Tran	
PROSPECTIVE MATHEMATICS TEACHERS' LEARNING THROUGH GENERATIVE METAPHORS.....	2-171
Olive Chapman	
UNDERGRADUATE STUDENTS' UNDERSTANDING OF THE CONCEPT OF DERIVATIVES IN MULTIVARIABLE CALCULUS	2-179
Hangyun Cho and Oh Nam Kwon	
SHARED EXPECTATIONS? AN EXPLORATION OF THE EXPECTATIONS BETWEEN PRIMARY MATHEMATICS LEADERS AND TEACHERS.....	2-187
Kate Copping, Natasha Ziebell and Wee Tiong Seah	
MULTIDIRECTIONAL SHIFTS IN ELEMENTARY TEACHERS' MATH TEACHER IDENTITY: UNDERSTANDING THE ROLE OF INSTRUCTIONAL COACHING	2-195
Dionne Cross Francis, Pavneet Kaur Bharaj, Kathryn Habib, Anna Gustaveson, Anna Hinden and Ji Hong	
PROSPECTIVE TEACHERS' DEVELOPMENT OF GOAL STATEMENTS AND ALIGNMENT TO A TECHNOLOGY-INFUSED LESSON	2-203
Jon D. Davis	
THE <i>DIALOGUE</i> BETWEEN MATHEMATICS EDUCATION AND ANTHROPOLOGY: THE CASE OF TERTIARY TRANSITION.....	2-211
Pietro Di Martino and Caterina Di Pasquale	
EXAMINING THE ROLE OF FACILITATORS IN THE CONTEXT OF PLANNING AN INQUIRY-BASED MATHEMATICS LESSON	2-219
Liping Ding, Svein Arne Sikko and Charlotte Krog Skott	
APPLYING A CONSTRUCTIVIST PROGRESSION TO CHINESE STUDENTS: DO EARLY ERRORS INDICATE LATER REASONING?.....	2-227
Rui Ding, Ron Tzur and Bingqian Wei	
PRESCHOOL CHILDREN'S REPRESENTATION OF DIVISION WORD PROBLEMS THROUGH DRAWINGS.....	2-235
Ann Downton and Andrea Maffia	

MATHEMATICAL KNOWLEDGE FOR TEACHING FOR COLLEGE ALGEBRA AT COMMUNITY COLLEGES	2-243
Irene Durancyk, Vilma Mesa, Inah Ko and VMQI Team	
THE EFFECTS OF DIFFERENT TEACHING APPROACHES ON ENGINEERING STUDENTS' MODELLING COMPETENCY	2-251
Rina Durandt, Werner Blum and Alfred Lindl	
LOST AND FOUND IN TRANSITIONING BETWEEN MULTIPLE COMPUTERIZED VISUALISATIONS DURING STATISTICAL MODELING	2-259
Michal Dvir and Susanne Schnell	
THE BODY PROBABLY UNDERSTANDS	2-267
Dafna Efron	
MAPPING THE EARLY ALGEBRAIC DISCOURSE OF SEVENTH-GRADE STUDENTS	2-275
Avital Elbaum-Cohen, Lara Shahla Demirdjian, Einat Heyd-Metzuyanin and Michal Tabach	
CONTEXTS FOR ACCUMULATION	2-283
Dafna Elias, Tommy Dreyfus, Anatoli Kouropatov and Lia Noah-Sella	
CROSS-COMMUNITY COLLABORATIVE TASK DESIGN	2-291
Adi Eraky, Ronnie Karsenty and Alon Pinto	
FROM TEACHER PROFESSIONAL DEVELOPMENT TO TEACHER PERSONAL-PROFESSIONAL GROWTH: THE CASE OF EXPERT SCIENCE AND MATHEMATICS TEACHERS	2-299
Anat Even-Zahav and Mirela Widder	
'LESS THAN NOTHING' – A STUDY ON STUDENT'S LEXICAL MEANS FOR NEGATIVE NUMBERS	2-307
Melina Fabian	
DEVELOPING ACCUMULATIVE THINKING	2-315
Gilat Falach, Anatoli Kouropatov and Tommy Dreyfus	
WHAT DO STUDENTS LEARN ABOUT THE DISCIPLINE OF MATHEMATICS IN UPPER-SECONDARY CLASSES?	2-323
Patrick Fesser, Niklas Hergeselle and Stefanie Rach	
AN INTERVIEW STUDY ON THE REVERSAL ERROR WITH PRIMARY SCHOOL STUDENTS	2-331
Torsten Fritzlar	

GIOELE’S ATTEMPT TO INCORPORATE THE “SOLVE IT” RITUAL IN HIS MEANINGFUL DISCOURSE ON EQUATIONS	2-339
Silvia Funghi, Anna Baccaglini-Frank and Samuele Antonini	
ADDITIVE WORD PROBLEMS IN GERMAN 1 ST AND 2 ND GRADE TEXTBOOKS	2-347
Laura Gabler, Felicitas von Damnitz and Stefan Ufer	
STUDENTS’ INTEREST WHEN COMBINING MODELLING AND EXPERIMENTATION – IS IT WORTH THE EFFORT?.....	2-355
Sebastian Geisler and Stefanie Rach	
REPLICATION OF A POSITIVE PSYCHOLOGY INTERVENTION TO REDUCE MATHEMATICS RELATED SHAME	2-363
Lara Gildehaus and Lars Jenßen	
MATHEMATICS-SPECIFIC MOTIVATIONS FOR CHOOSING A MATHEMATICS TEACHING DEGREE STUDY PROGRAMME	2-371
Robin Göller	
SELECTING DIGITAL TECHNOLOGY: A REVIEW OF TPACK INSTRUMENTS.....	2-379
Peter Gonscherowski and Benjamin Rott	
REVEALING MODES OF KNOWING ABOUT DENSITY	2-387
Juan Manuel González-Forte, Ceneida Fernández, Xenia Vamvakoussi, Jo Van Hoof and Wim Van Dooren	
“THIS IS CLEARLY INCORRECT, WHY DOES IT WORK?”: ON DIVISION OF FRACTIONS AND CONTINGENCY	2-395
Canan Güneş, Andrew Kercher and Rina Zazkis	
INVESTIGATING THE ROBUSTNESS OF INTUITIVE CONCEPTIONS AMONG ADULTS AND TEACHERS THROUGH PRODUCTION TASKS	2-403
Katarina Gvozdic, Stéphanie Naud and Emmanuel Sander	

TABLE OF CONTENTS

VOLUME 3

RESEARCH REPORTS (H-O)

FACILITATING LEARNERS' APPRECIATION OF THE AESTHETIC QUALITIES OF FORMAL PROOFS: A CASE STUDY ON A PAIR OF JUNIOR HIGH SCHOOL STUDENTS	3-3
--	-----

Hayato Hanazono

CO-LEARNING THE DIFFERENCE MEANING FOR MORE-THAN SITUATIONS WITH/FROM A STRUGGLING STUDENT	3-11
--	------

Cody Harrington, Ron Tzur, Emine B. Dagli, Dennis DeBay,
and Megan Morin

THE ROLES PRESERVICE TEACHERS ADOPT IN MODELLING-RELATED PROBLEM POSING	3-19
---	------

Luisa-Marie Hartmann, Stanislaw Schukajlow, Mogens Niss
and Uffe Thomas Jankvist

THE COMPLEXITY OF GRAMMAR IN STUDENTS' TALK: VARIATIONSIN EXPRESSING FUNCTIONAL RELATIONSHIPS BETWEEN TWO QUANTITIES.....	3-27
---	------

Kerstin Hein and Katharina Zentgraf

MATHEMATICS TEACHER EDUCATORS IN AN UNKNOWABLE WORLD: TEACHING MATHEMATICS FOR CLIMATE JUSTICE	3-35
--	------

Tracy Helliwell and Gil Schwarts

EXPLORING DEVELOPING PATTERNS OF MATHEMATICAL IDENTITY WORK BY GIVING ATTENTION TO EMOTIONAL HUE AND TONE OF VOICE IN THE ACT STORYTELLING.....	3-43
---	------

Rachel Helme

STUDENT BEHAVIOR WHILE ENGAGED WITH FEEDBACK -ENHANCED DIGITAL SORTING TASKS	3-51
--	------

Arnon HersHKovitz, Michal Tabach, Norbert Noster and
Hans-Stefan Siller

COMPARING STUDENT VALUES AND WELLBEING ACROSS MATHEMATICS AND SCIENCE EDUCATION	3-59
---	------

Julia L. Hill, Margaret L. Kern, Wee Tiong Seah and Jan van Driel

THE CONNECTION BETWEEN MATHEMATICS AND OTHER FIELDS:THE DISCIPLINE OF MATHEMATICS VS. MATHEMATICS EDUCATION	3-67
Anna Hoffmann and Ruhama Even	
COMPARING TEACHER GOALS FOR STUDENT FOCUSING AND NOTICING WITH STUDENT OUTCOMES FOR FOCUSING AND NOTICING.....	3-75
Charles Hohensee, Sara Gartland, Yue Ma and Srujana Acharya	
WHY MANY CHILDREN PERSIST WITH COUNTING	3-83
Sarah Hopkins, James Russo and Janette Bobis	
INFLUENCE OF FIELD-DEPENDENCE-INDEPENDENCE AND SYMMETRY ON GEOMETRY PROBLEM SOLVING: AN ERP STUDY	3-91
Hui-Yu Hsu, Ilana Waisman and Roza Leikin	
CULTURAL VARIATIONS IN THE QUALITY AND QUANTITY OF STUDENTS' OPPORTUNITIES TO PARTICIPATE IN CLASSROOM DISCOURSE	3-99
Jenni Ingram	
SNAPSHOTS OF CURRICULAR NOTICING: PLANNING A SUBTRACTION ALGORITHM LESSON IN PRIMARY EDUCATION	3-107
Pedro Ivars and Ceneida Fernández	
THE DEVELOPMENT OF CONCEPTIONS OF FUNCTION - A QUALITATIVE LONGITUDINAL STUDY ON THE TRANSITION FROM SCHOOL TO UNIVERSITY	3-115
Tomma Jetses	
LEARNING ABOUT STUDENT'S STRATEGIES BASED ON AUTOMATED ANALYSIS: THE CASE OF FRACTIONS	3-123
Amal Kadan-Tabaja and Michal Yerushalmy	
HOW A TEACHER'S PROFESSIONAL IDENTITY SHAPES PRACTICE: A CASE STUDY IN UNIVERSITY MATHEMATICS.....	3-131
Thomais Karavi	
INETWORKING THE VARIATION THEORETICAL PRINCIPLES IN A PROBLEM-SOLVING BASED MATHEMATICS INSTRUCTION TASK DESIGN STUDY	3-139
Berie Getie Kassa and Liping Ding	
MATHEMATICAL PROVING FOR SUBVERSIVE CRITICAL THINKING	3-147
Elena Kazakevich and Nadav Marco	

STRATEGIES FOR PROOF CONSTRUCTION (SELF-REPORTS VS PERFORMANCE) - IS PRIOR KNOWLEDGE IMPORTANT?.....	3-155
Katharina Kirsten and Silke Neuhaus-Eckhardt	
EFFECT OF REPRESENTATION FORMATS ON STUDENTS' SOLVING PROPORTION PROBLEMS	3-163
Tadayuki Kishimoto	
OPEN-ENDED TASKS WHICH ARE NOT COMPLETELY OPEN: CHALLENGES AND CREATIVITY	3-171
Sigal Klein and Roza Leikin	
THE DISCOVERY FUNCTION OF PROVING BY MATHEMATICAL INDUCTION	3-179
Kotaro Komatsu	
PRE-SERVICE TEACHER TRAINING WITH AI: USING CHATGPT DISCUSSIONS TO PRACTICE TEACHER-STUDENT DISCOURSE.....	3-187
Ulrich Kortenkamp and Christian Dohrmann	
TEACHING MATHEMATICS WITH TECHNOLOGIES: PROFILES OF TEACHER CHARACTERISTICS.....	3-195
Timo Kosiol and Stefan Ufer	
RELATIONSHIPS BETWEEN PROSPECTIVE TEACHERS' HEART RATE VARIATION NOTICING OF CHILDREN'S MATHEMATICS	3-203
Karl W. Kosko and Richard E. Ferdig	
IN-THE-MOMENT TEACHER DECISION MAKING AND EMOTIONS	3-211
Styliani-Kyriaki Kourti and Despina Potari	
ROCK'N'ROLL – EMERGENT AFFORDANCES AND ACTIONS DURING CHILDRENS' EXPLORATION OF TOUCHTIMES	3-219
Christina M. Krause and Sean Chorney	
JUDGEMENT ACCURACY: COMPARING OPEN REPORTS AND RATINGS AS INDICATORS OF DIAGNOSTIC COMPETENCE.....	3-227
Stephanie Kron, Daniel Sommerhoff, Christof Wecker and Stefan Ufer	
INTERACTIONAL FORCES IN MULTILINGUAL DISCOURSES – A TEACHERS' PERSPECTIVE ON LEARNERS' AGENCY	3-235
Taha Ertuğrul Kuzu	
DRAWING ON CULTURAL STRENGTHS FOR COLLECTIVE COLLABORATION	3-243
Generosa Leach, Viliami Latu and Roberta Hunter	

BUILDING BRIDGES: THE IMPORTANCE OF CONTINUOUS MAGNITUDES IN EARLY MATHEMATICS EDUCATION FROM TWO PERSPECTIVES.	3-251
Tali Leibovich-Raveh	
ENHANCING STUDENTS' CONCEPTUAL KNOWLEDGE OF FRACTIONS THROUGH LANGUAGE-RESPONSIVE I NSTRUCTION. A FIELD TRIAL.....	3-259
Katja Lenz, Andreas Obersteiner and Gerald Wittmann	
ADULTS' AWARENESS OF CHILDREN'S ENGAGEMENT WITH GEOMETRICAL ACTIVITIES	3-267
Esther S. Levenson, Ruthi Barkai, Dina Tirosh, Pessia Tsamir, and Shahd Serhan	
A TEACHING INTERVENTION WITH DYNAMIC INTERACTIVE MEDIATORS TO FOSTER AN ALGEBRAIC DISCOURSE	3-275
Giulia Lisarelli, Bernardo Nannini and Chiara Bonadiman	
MORE THAN JUST THE BASIC DERIVATION FORMULA: THE IMPACT OF PRIOR KNOWLEDGE ON THE ACQUISITION OF KNOWLEDGE ABOUT THE CONCEPT OF DERIVATIVE	3-283
Kristin Litteck, Tobias Rolfes and Aiso Heinze	
SECONDARY-TERTIARY TRANSITION OF INTERNATIONAL STUDENTS: ONE STUDENT'S EFFORTS TO OVERCOME THE CHALLENGE OF LEARNING MATHEMATICS IN ENGLISH	3-291
Kim Locke, Igor' Kontorovich and Lisa Darragh	
SHIFTS IN LOCAL NARRATIVE IDENTITIES: A CASE OF LOW ACHIEVING STUDENTS.....	3-299
Elena Macchioni	
ALGEBRAIC STRUCTURE SENSE IN A BLIND SUBJECT	3-307
Andrea Maffia, Carola Manolino and Elisa Miragliotta	
TEACHERS' LEARNING THROUGH ITERATIVE CONTEXT-BASED MATHEMATICAL PROBLEM POSING.....	3-315
Nadav Marco and Alik Palatnik	
TOWARDS THE NOTION OF CONCEPT GESTURE: EXAMINING A LECTURE ON SEQUENCES AND LIMITS	3-323
Ofer Marmur and David Pimm	
THE ROLE OF TOPOLOGY IN TWO-VARIABLE FUNCTION OPTIMIZATION	3-331
Rafael Martínez-Planell, María Trigueros and Vahid Borji	

REASONING AND LANGUAGE IN RESPONSES TO READING QUESTIONS IN A LINEAR ALGEBRA TEXTBOOK	3-339
Vilma Mesa, Thomas Judson and Amy Ksir	
DEVELOPING AN INTERNATIONAL LEXICON OF CLASSROOM INTERACTION.....	3-347
Carmel Mesiti, Michèle Artigue, Valeska Grau, and Jarmila Novotná	
MEASURING DATA-BASED MODELING SKILLS IN A COLLABORATIVE SETTING	3-355
Matthias Mohr and Stefan Ufer	
ANALYSIS OF HOW PRE-SERVICE MATHEMATICS TEACHERS INCLUDE SRL IN THEIR TEACHING PROPOSALS	3-363
Hidalgo Moncada, D., Díez-Palomar, J. and Vanegas, Y.	
LESSON STUDY AND IMPROVISATION: CAN TWO WALK TOGETHER, EXCEPT THEY BE AGREED?	3-371
Galit Nagari-Haddif, Ronnie Karsenty and Abraham Arcavi	
ATTENDING TO ARGUMENTATION: EXPLORING SIMILARITIES AND DIFFERENCES BETWEEN MATHEMATICS PRE-SERVICE AND IN-SERVICE SECONDARY TEACHERS	3-379
Samaher Nama, Maysa Hayeen-Halloun and Michal Ayalon	
A CARTESIAN GRAPH IS “A THING OF MOVEMENT”	3-387
Bernardo Nannini and Giulia Lisarelli	
INSTRUCTIONAL SHORT VIDEOS IN CALCULUS: THE MATHEMATICAL DIDACTICAL STRUCTURES AND WATCHING PATTERNS	3-395
Eli Netzer and Michal Tabach	
CONSTRUCTING A PROOF AFTER COMPREHENDING A SIMILAR PROOF – RELATION AND EXAMPLES	3-403
Silke Neuhaus-Eckhardt and Stefanie Rach	
THE ROLE OF TEACHERS’ PERSON CHARACTERISTICS FOR ASSESSING STUDENTS’ PROOF SKILLS	3-411
Michael Nickl; Daniel Sommerhoff, Elias Codreanu, Stefan Ufer and Tina Seidel	

ZPD NOTICING – A VIGNETTE-BASED STUDY INTO PRE-SERVICE TEACHERS’ ANALYSIS OF AN ALGEBRA CLASSROOM SITUATION	3-419
Yael Nurick, Sebastian Kuntze, Sigal-Hava Rotem, Marita Friesen, and Jens Krummenauer	
ON THE CONNECTION BETWEEN BASIC MENTAL MODELS AND THE UNDERSTANDING OF EQUATIONS	3-427
Reinhard Oldenburg and Hans-Georg Weigand	
MOTIVATIONAL AND EMOTIONAL ENGAGEMENT MEDIATES THE EFFECT OF FEATURES OF EDUCATIONAL TECHNOLOGY IN MATHEMATICS CLASSROOMS	3-435
Maria-Martine Oppmann and Frank Reinhold	
HOW DOES MATHEMATICAL KNOWLEDGE FOR UNDERGRADUATE TUTORING DEVELOP? ANALYSING WRITTEN REFLECTIONS OF NOVICE TUTORS	3-442
Tikva Ovadiya and Igor’ Kontorovich	

TABLE OF CONTENTS

VOLUME 4

RESEARCH REPORTS (P-Z)

TOWARDS A SPECIFICATION OF DIGITAL COMPETENCES FOR STEM TEACHERS IN AN EDUCATIONAL CONTEXT. ELICITING EXPERTS' VIEWS	4-3
--	-----

Rouven Pankrath and Anke Lindmeier

STUDENTS' USE OF UNNECESSARY BRACKETS AS A WAY OF EXHIBITING STRUCTURE-SENSE	4-11
--	------

Ioannis Papadopoulos and Athina Thoma

TYPES AND FEATURES OF DIALOGICAL TASKS FROM MATHEMATICS TEACHERS' PERSPECTIVE	4-19
---	------

Reut Parasha and Boris Koichu

ARE EXPERTS' NOTICING FOCUSES REGARDING THE LEARNING POTENTIAL OF TASKS AND ITS USE CONSISTENT ACROSS INSTRUCTIONAL SITUATIONS? A SECONDARY ANALYSIS	4-27
--	------

Josephine F. Paul, Anika Dreher, Ting-Ying Wang, Feng-Jui Hsieh,
Linn Hansen, Anke Lindmeier

GENDER-RELATED BELIEFS OF PROSPECTIVE MATHEMATICS TEACHERS	4-35
--	------

Georg Pfeiffer and Daniela Assmus

REPRESENTING COVARIATION FUNCTIONAL SITUATIONS IN A TABLET-ENABLED DIGITAL LEARNING ENVIRONMENT	4-43
---	------

Marios Pittalis, Eleni Demosthenous and Ute Sproesser

A META-DISCIPLINARY REFLECTION ON A STEAM SCHOOL ACTIVITY: THE ROLE OF MATHEMATICS	4-51
--	------

Gabriella Pocalana, Ornella Robutti and Giulia Bini

UNIT STRUCTURES RARELY ARTICULATED: TEACHERS' EXPLANATIONS OF MEANINGS OF MULTIPLICATION	4-59
--	------

Susanne Prediger and Anke Wischgoll

STUDYING THE ROLE OF PSEUDO-OBJECTS IN PROOF BY CONTRADICTION	4-67
---	------

Kostas Probonas and Giorgos Psycharis

LEVELS OF MATHEMATICAL KNOWLEDGE IN LINEAR ALGEBRA FOR ENTERING UNIVERSITY	4-75
Kolja Pustelnik, Stefanie Rach, Daniel Sommerhoff, and Stefan Ufer	
PROSPECTIVE PRIMARY TEACHERS' UNDERSTANDING OF ONE-DIMENSIONAL PHENOMENA: LINE, RAY AND SECTION	4-83
Simone Reinhold and Bernd Wollring	
THE ROLE OF LANGUAGE-AS-RESOURCE AND LANGUAGE- AS-POLITICAL IN COLLEGE MATHEMATICS COURSES	4-91
Jocelyn Rios	
EMBODIED CURIOSITY: A FRAMEWORK FOR MATHEMATICAL MEANING-MAKING	4-99
Sheree Rodney	
HIGH SCHOOL STUDENTS' PERCEPTIONS OF THE RELEVANCE OF MATHEMATICS IN HIGHER EDUCATION	4-107
Dunja Rohenroth, Irene Neumann and Aiso Heinze	
INTRODUCTION AND THEORETICAL BACKGROUND	4115
Joshua M. Ruk and Laura R. Van Zoest	
TEACHER CHANGE AND INCLUSIVE INTERVENTIONS FOR LEARNERS WITH MATHEMATICS DIFFICULTIES	4-123
Robyn Ruttenberg-Rozen and Marc Husband	
WHAT IS A “GOOD” ARGUMENTATION IN MATHEMATICS CLASSROOM?	4-131
Saccoletto Marta	
DIDACTIC-MATHEMATIC KNOWLEDGE TRAITS OF PRE-SERVICE TEACHERS WHEN POSING AND SOLVING ROBOTIC PROBLEMS	4-139
Gemma Sala-Sebastià, Adriana Breda, Alicia Sánchez and Vicenç Font	
INDIVIDUAL CONCEPTION FRAMES AS A CONCEPT FOR THE ANALYSIS OF MATHEMATICAL LEARNING	4-147
Alexander Salle and Marcus Schütte	
DIGITAL MONITORING OF FRACTION LEARNING: ADAPTING A TEST FOR KNOWLEDGE OF FRACTION SUBCONSTRUCTS	4-155
Constanze Schadl, Anke Lindmeier	
CHARACTERIZING EXTERNAL VISUALIZATION INTERVENTIONS: A SYSTEMATIC LITERATURE REVIEW	4-163

Johanna Schoenherr and Stanislaw Schukajlow	
TEACHERS' DIAGNOSTIC ACTIVITIES DURING TASK-BASED ASSESSMENTS IN A DIGITAL SIMULATION	4-171
Christian Schons, Andreas Obersteiner, Frank Fischer and Kristina M. Reiss	
STATISTICAL THINKING AND VIEWING PATTERNS WHEN COMPARING DATA DISTRIBUTIONS: AN EYE-TRACKING STUDY WITH 6 TH AND 8 TH GRADERS	4-179
Saskia Schreiter and Markus Vogel	
HOW DO MATHEMATICS TEACHERS LEARN TO CREATE A MATHEMATICAL STORYLINE IN PROBLEM-BASED LESSONS?.....	4-187
Gil Schwarts, Patricio Herbst and Amanda Brown	
MATHEMATICAL REASONING TYPES AS GENDERED? VIEWS FROM PALESTINIAN/ARAB ISRAELI TEACHERS	4-195
Juhaina Awawdeh Shahbari, Laurie Rubel and Fatema Kabha	
DYNAMIC VISUALIZATION AND EMBODIED DESIGN FOR TRIGONOMETRY LEARNING: LOOKING OR DOING?	4-203
Anna Shvarts and Linda Zenger	
STRATEGY USE IN NUMBER LINE TASKS OF STUDENTS WITH AND WITHOUT MATHEMATICAL DIFFICULTIES: A STUDY USING EYE TRACKING AND AI.....	4-211
Anna Lisa Simon, Parviz Asghari, Achim J. Lilienthal, & Maike Schindler	
A NOVICE TEACHER'S IDENTITIES – FROM LOSING HER BALANCE TO REGAINING HER CONFIDENCE	4-219
Charlotte Krog Skott and Jeppe Skott	
DIDACTIC SUITABILITY CRITERIA IN TEACHERS' PRACTICAL ARGUMENTATION IN THE PHASE OF DESIGN OF A LESSON STUDY CYCLE ABOUT FUNCTIONS	4-227
Telesforo Sol ¹ , Alicia Sánchez, Adriana Breda and Vicenç Font	
FOSTERING STUDENTS' KNOWLEDGE ABOUT PROOF	4-235
Femke Sporn, Daniel Sommerhoff and Aiso Heinze	
FROM 2D TO 3D: SUPPORT of a 3-Dimensional DYNAMIC GEOMETRY ENVIRONMENT IN LEARNING proof	4-243
Camilo Sua, Angel Gutiérrez and Adela Jaime	

CHINESE LANGUAGE LEARNERS' READING COMPREHENSION WHEN SOLVING MATHEMATICAL WORD PROBLEMS	4-251
Emily S. W. Sum, Miranda, K. Y. Wong, Antonia, Y. T. Yip and Wee Tiong Seah	
ENHANCING SPATIAL REASONING THROUGH GEOMETRY TRANSFORMATION INSTRUCTION IN GHANA	4-259
Mawuli Kofi Tay and Armando Paulino Preciado Babb	
CONNECTING MATHEMATICS LEARNING TO LEARNING ABOUT STRUCTURAL RACISM IN THE UNITED STATES.....	4-267
Eva Thanheiser and Molly Robinson	
APPLETS AND PAPER & PENCIL TASKS AS RESOURCES FOR WORKING WITH MATHEMATICAL REPRESENTATIONS.....	4-275
Odelya Tzayada and Michal Tabach	
GROUNDING CHINESE NEW STANDARDS' FOCUS ON COUNTING- UNITS IN A CONSTRUCTIVIST, UNITS-AND-OPERATIONS MODEL.....	4-283
Ron Tzur, Rui Ding, Yunpeng Ma, Rongjin Huang and Bingqian Wei	
ANALYSING THE QUALITY OF ADVANCED MATHEMATICS LECTURES REGARDING THE PRESENTATION OF THEOREMS AND PROOFS – THE CASE OF REAL ANALYSIS LECTURES	4-291
Karyna Umgelter and Sebastian Geisler	
STRATEGY USE IN NUMBER LINE ESTIMATIONS OF FRACTIONS – AN EXPLORATORY STUDY IN SEARCH FOR ADAPTIVE EXPERTISE	4-299
Wim Van Dooren	
MAKING SENSE OF ZERO TO MAKE SENSE OF NEGATIVE NUMBERS	4-307
Joëlle Vlassis and Isabelle Demonty	
THE DISCOURSE MAPPING TREE AS A TOOL FOR ANALYZING THE POTENTIAL AND IMPLEMENTATION OF LINEAR ALGEBRA TASKS.....	4-315
Miriam N. Wallach, Einat Heyd-Metzuyanin and Ram Band	
ANSWER PATTERNS OF JAPANESE SECONDARY SCHOOL STUDENTS IN TIMSS 2015 MATHEMATICS SURVEY.....	4-323
Koji Watanabe	
REPRESENTING 'TALL AND SHORT' IN DRAWINGS – PRE-SCHOOL TO YEAR 2	4-331
Jennifer Way	

APPLYING A COGNITIVE-BASED FRAMEWORK TO PROMOTE TEACHERS' COMMUNICATION ABOUT REASONING AND PROVING Merav Weingarden and Orly Buchbinder	4-339
FROM UNIVERSITY TO SCHOOL: EXPLORING BEGINNING TEACHERS INTEGRATING REASONING AND PROVING	4-347
Merav Weingarden and Orly Buchbinder	
LEARNING ABOUT DIGITAL TECHNOLOGIES OF THE WORKING WORLD IN REGULAR MATH CLASSES? TEACHING COMPOSITE BODIES WITH 3D PRINT AS A LEARNING CONTEXT	4-355
Mira H. Wulff, Anika Radkowsch and Aiso Heinze	
TEACHERS' MULTIPLE AND ADAPTIVE NOTICING DRIVEN BY THEIR FRAMING OF PROFESSIONAL OBLIGATIONS IN THE CONTEXT OF A PROVING ACTIVITY	4-363
Mei Yang, Andreas J. Stylianides and Mateja Jamnik	
ELEMENTARY PRESERVICE TEACHERS' NOTICING OF EXEMPLARY LESSONS: A COMPARISON OF NOTICING FRAMEWORKS	4-371
Qiaoping Zhang, Yicheng Wei and Jing Liang	
EXPLORING THE ROLE OF PEDAGOGY IN MATHEMATICAL CREATIVITY VIA MULTIPLE SOLUTION TASKS: A COMPARATIVE STUDY OF TWO SCHOOLS IN CHINA	4-379
Ying Zhang	
SIXTH GRADERS' LEARNING OF MULTIPLICATIVE STRUCTURE PROBLEMS THROUGH THE VARIATION PRINCIPLE	4-387
Cristina Zorrilla, Ceneida Fernández, Anna-Katharina Roos, Salvador Llinares, and Susanne Prediger	

THE PME 46 CONFERENCE COMMITTEES

COMMITTEES OF PME 46

The International Program Committee of PME 46 in Israel consists of:

The International Program Committee (IPC)

Conference Chair	Michal Ayalon	LOC	University of Haifa, Israel
Co-Chair	Roza Leikin	LOC	University of Haifa, Israel
	Boris Koichu	LOC	Weizmann Institute, Israel
	Laurie Rubel	LOC	University of Haifa, Israel
	Michal Tabach	LOC	Tel Aviv University, Israel
PME President	Wim Van Dooren	PME	KU Leuven, Belgium
	Ceneida Fernández	PME	University of Alicante, Spain
	Jodie Hunter	PME	Massey University, New Zealand
	Daniel Sommerhoff	PME	Leibniz Institute for Science and Mathematics Education, Kiel, Germany

The Local Organizing Committee of PME 46 in Haifa consists of:

Conference Chair	Michal Ayalon	University of Haifa, Israel
Co-chair	Roza Leikin	University of Haifa, Israel
Members	Amira Abed	University of Haifa, Israel
	Orit Goldberg	University of Haifa, Israel
	Mayssa Hayeen-Halloun	University of Haifa, Israel
	Einat Heyd-Metzuyanin	Technion – Israel Institute of Technology, Israel
	Boris Koichu	Weizmann Institute of Science, Israel
	Anatoli Kouropatov	The Academic College Levinsky-Wingate, Israel
	Tali Leibovich-Raveh	University of Haifa, Israel
	Esther Levenson	Tel Aviv University, Israel
	Talli Nachlieli	The Academic College Levinsky-Wingate, Israel
	Elena Naftaliev	Achva Academic College, Israel
	Samaher Nama	University of Haifa, Israel
	Shai Olsher	University of Haifa, Israel
	Alik Palatnik	The Hebrew University of Jerusalem, Israel
	Sigal Rotem	National and Kapodistrian University of Athens, Greece; University of Haifa, and Achva Academic College, Israel
	Laurie Rubel	University of Haifa, Israel
	Juhaina. A. Shahbari	Al-Qasemi Academy, Israel
	Osama Swidan	Ben Gurion University of the Negev, Israel
	Michal Tabach	Tel Aviv University, Israel
	Ilana Waisman	University of Haifa
	Shula Weissman	Gordon College of Education, Israel

ARCHITECTURAL DRAWING AND MATHEMATICAL MODELLING: CONICS, GEOGEBRA AND MORE

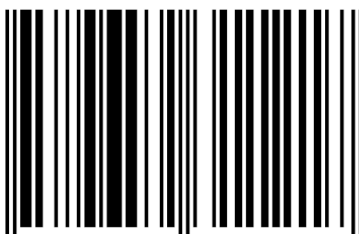
Caterina Cumino, Martino Pavignano, & Ursula Zich

Politecnico di Torino (Italy)

This contribution is part of an ongoing research and concerns the 2D graphic representation of a 3D object. The participants are the students of a course of architectural drawing and survey, in the first year of an architecture bachelor's degree. In such an extra-mathematical educational environment, a mathematical modelling perspective of prescriptive type (Niss, 2015) appears as a tool of investigation and as an educational goal, since students are involved in solving mathematical problems in the design phase of an architectural project, developing a rudimental modelling cycle to go from a real-world object to its mathematization and to the critical interpretation of modelling outcomes. The research questions are: Which are students' recurring misconceptions and difficulties intertwined with mathematical thinking? How to improve students' understanding of drawing as a tool to communicate and visualize objects and their geometrical properties? A joint intervention of teachers of architectural drawing and mathematics took place during regular drawing lessons on conics and surfaces; a GeoGebra applet was proposed to show an ellipse as draggable object to highlight shape variations and invariant properties with respect to movements of the foci. At the end of the first teaching period, students' understanding was tested, asking for a 2D representation of a barrel vault with a semi-elliptical cross section, covering a rectangular base gallery. Two surveys were conducted: a satisfaction one and a questionnaire with dichotomous and multiple-choice questions about synthetic 2D/3D geometry. It seems that students' main difficulties lie in a lack of identification of mathematical objects and in the inability to use their mathematical knowledge in the critical interpretation of their outcomes. This may be since mathematics traditionally is thought at any level as a separate discipline and calls for further investigations. The satisfaction questionnaire shows a positive attitude about the joint intervention: 98% of them think that it is useful to better understand other topics of the course and 93,8% of them find the use of a dynamical geometric software (like GeoGebra) very helpful.

REFERENCES

Niss, M. (2015). Prescriptive modelling-challenges and opportunities. In G. A. Stillman, W. Blum, & M. S. Biembengut (Eds.), *Mathematical modelling in education research and practice: Cultural, social and cognitive influences* (pp. 67-79). Springer.



9 7 8 9 6 5 9 3 1 1 2 1 7