Direction of Research in Math. Ed. & Trend of International Collaborative Research in Korea

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Expectation

Keynote speaker: Shares one’s research → expertise & specification

Reality

Direction of research in math. ed. & trend of international collaborative research in Korea → overall trend & objectivity

Theme

Reflect on my research for 20 years

Example

Analyze research papers published in Korea for recent 20 years

From Joy to Challenge
Overview: Korean research

I. Brief Background Information

II. Analysis on Research Papers

- Overall Trend
- International Research

Direction? Issues?

Example
I. Background Information:

- The oldest academic society of math. ed. in Korea
- Members: mathematicians & math educators
- Holds biannual conferences & international conferences
- Publishes 5 journals

Korean Society of Mathematical Education

Series A: The Mathematical Education
Series C: Education of Primary School Math.
Series E: Communications of Math. Ed.

Founded
1962 1963 1997 2019
I. Background Information:

- Advance research findings on practical issues in mathematics education in Korea
- Members: math educators
- Holds biannual conferences & intensive seminars
- Publishes two journals

Korean Society of Educational Studies in Mathematics

Journal: School Mathematics

Founded

Journal of Educational Research in Mathematics

1991 1999 2019
II. Analysis on Research Papers

7 domestic professional journals

- Listed on the Korea Citation Index: Maintained!

3 journals from KSME
- The Mathematical Education (1999~)
- Communications of Mathematical Education (2007~)
- Education of Primary School Mathematics (2010~)

2 journals from KSESM
- School Mathematics (2002~)

2 other journals
- Journal of Elementary Mathematics Education in Korea (2008~)

3044 peer-reviewed papers!!!
(published by June of 2019)
II. Analysis on Research Papers

- Publication years
- Topics
- Research methods
- Target research population
- International research

Analytic elements
II. Analysis on Research Papers

1. Publication years

- 2 journals listed on the KCI in 2002
- 3 new journals listed on the KCI in 2007, 2008, & 2010
II. Analysis on Research Papers

2. Topics

- General Research 11.73%
- Learners’ abilities or characteristics 23.62%
- Instruction 19.46%
- Teacher Education 15.95%
- Curriculum or Textbooks 16.89%
- Assessment 5.37%
- Technology or Manipulatives 6.98%

Example

• Students’ understandings or knowledge of mathematical concepts (11.20%)
• Students’ mathematical competencies (5.17%)
• Students’ attitudes or belief (3.76%)
II. Analysis on Research Papers

Children’s understanding of the equal sign, expressions, & equations (Gr. 2~6, n=695)

(Kim, Choi, & Pang, 2016)
II. Analysis on Research Papers

III. Results:

Teacher learning

Equation Structure Items

- Grade-related: High percentage of the correct answers.
  → Development of understanding equations

- Difficult items even for upper graders
  → Items testing advanced relational thinking

Grade 2 | Grade 3 | Grade 4 | Grade 5 | Grade 6 | Total
---|---|---|---|---|---
1(1) | 1(2) | 1(3) | 1(4) | 1(5) | 1(6) | 2(1) | 2(2)
3 | 4 | 5 | 6 | 7 | 8

Equation Structure Items
### II. Analysis on Research Papers

#### Item 6

2 x 3 = 6 is true.
Is 2 x 3 x 4 = 6 x 4 true or false?
How do you know?

<table>
<thead>
<tr>
<th>Responses</th>
<th>Gr. 2 (%)</th>
<th>Gr. 3 (%)</th>
<th>Gr. 4 (%)</th>
<th>Gr. 5 (%)</th>
<th>Gr. 6 (%)</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incomplete explanation</td>
<td>13 (9.9)</td>
<td>15 (10.7)</td>
<td>14 (10.1)</td>
<td>26 (18.1)</td>
<td>13 (9.6)</td>
<td>81 (11.8)</td>
</tr>
<tr>
<td>Relational thinking</td>
<td>0 (0)</td>
<td>12 (8.6)</td>
<td>25 (18.0)</td>
<td>38 (26.4)</td>
<td>41 (30.1)</td>
<td>116 (16.8)</td>
</tr>
<tr>
<td>Computation</td>
<td>6 (4.6)</td>
<td>44 (31.4)</td>
<td>61 (43.9)</td>
<td>63 (43.8)</td>
<td>67 (49.3)</td>
<td>240 (34.8)</td>
</tr>
</tbody>
</table>
II. Analysis on Research Papers

Item 12

Is this a good definition of the equal sign?
Circle good or not good.

(1) The equal sign means the same as.
(2) The equal sign means add.
(3) The equal sign means the answer to the problem.

<table>
<thead>
<tr>
<th>Items</th>
<th>Correct Answer (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gr. 2</td>
</tr>
<tr>
<td>(1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>70 (53.4)</td>
</tr>
<tr>
<td>(2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>97 (74.0)</td>
</tr>
<tr>
<td>(3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>30 (22.9)</td>
</tr>
</tbody>
</table>
II. Analysis on Research Papers

Equation mostly in a standard format

**Textbook 1-1**

- **쓰기**: $3 + 1 = 4$
- **읽기**: 3 수는 4와 같습니다.
  3과 1의 합은 4입니다.

- **쓰기**: $6 - 2 = 4$
- **읽기**: 6 - 2는 4와 같습니다.
  6과 2의 차는 4입니다.

Equal Sign Items

III. Results:

Teacher learning
II. Methodology

II. Analysis on Research Papers

2. Topics

- Development & analysis of mathematical tasks or activities for more effective lesson (8.77%)
- Teaching methods to foster students’ mathematical knowledge or skills (3.88%)
- Analysis of curriculum or textbooks focused on teaching methods (5.75%)
- Overall changes or issues related to the revisions of curriculum or textbooks (4.07%)
- Analysis of curriculum or textbooks focused on mathematical terms (3.55%)
II. Analysis on Research Papers

2. Topics

- Teacher Education (15.95%)
- Example

- Teachers’ understandings or knowledge of mathematical concepts (4.88%)
- Teacher preparation programs or PD of in-service teachers (4.37%)
- Teachers’ belief or values (3.02%)
To explore teachers’ perspectives of effective math teaching

(Pang & Kwon, 2015)

Subjects

Stratified cluster random sampling

Group 1
135 from elementary school teachers

Group 2
132 from middle school math teachers

Group 3
124 from high school math teachers
II. Analysis on Research Papers

Questionnaire

Part I
Describe any aspects they regarded as important to an effective math lesson & aspects which led to not-good lessons

Part II
Check how much they agree on the 48 items related to effective math teaching
Remarkably similar trends among three groups of teachers

Teachers’ perspectives: entrenched in their socio-cultural contexts

(Pang & Kwon, 2015, p.149)
II. Analysis on Research Papers

Top 5 items of effective math instruction

1. Teaching by re-constructing the mathematics curriculum tailored to students’ various levels
2. Teaching by interaction between the teacher and students
3. Teaching to improve students’ self-directed learning ability
4. Providing students with appropriate feedback
5. Teaching the essential concepts in math

(Pang & Kwon, 2015)

Recognize the importance of doing meaningful math > teaching a math topic
II. Analysis on Research Papers

2-1. Topics by periods

- General Research
- Curriculum or Textbooks
- Learners' abilities or characteristics
- Instruction
- Assessment
- Technology or Manipulatives
- Teacher Education
II. Analysis on Research Papers

2-2. Topics by curriculum

Why?
II. Analysis on Research Papers

- **Importance**

  - **Existence & Uniqueness**
    - Only one series of elementary mathematics textbooks, workbooks, & teacher manuals for Grades 1 to 6

  - **Use of instructional materials**
    - Main resources for pre-service teachers to pass NTET
    - Main resources for in-service teachers to teach mathematics

Effort to develop best materials!
II. Analysis on Research Papers

- **Activities**
  - Do the instructional materials provide key activities tailored to the math topic to be taught regardless of the curriculum changes?

- **Knowledge**
  - Do they provide necessary knowledge for teachers?

- **Students’ thinking**
  - Do they help teachers be sensitive to students’ different responses to the same task?

(Pang, 2018)
II. Analysis on Research Papers

Directions of writing textbooks

- Curriculum: major emphases
- Introductory book: theoretical foundation
- Research papers: implications
- Textbook & White paper: trends & background

Comparative analysis: Alternative approaches

(Pang, 2016)
II. Analysis on Research Papers

3. Research Methods

- Document Analysis: 32.98%
- Qualitative Research: 30.16%
- Quantitative Research: 24.70%
- Mixed Methods: 12.16%
II. Analysis on Research Papers

3. Research Methods

- Pedagogical analysis: 26.54%
- Survey: 10.25%
- Experimental: 7.29%
- Case study: 18.92%
- Mixed: 7.72%
- Quan. & Qual.: 26.54%

- Instruction
- Learners’ abilities or characteristics
- General research
- Teacher education
- Learners’ abilities or characteristics
- Curriculum or textbooks
- Teacher education
- Learners’ abilities or characteristics
II. Analysis on Research Papers

4. Target Research Population

- Elementary: 973
- Secondary: 956
- University: 284
- Etc: 170
II. Analysis on Research Papers

4. Target Research Population

<table>
<thead>
<tr>
<th>Category</th>
<th>Papers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher</td>
<td>112</td>
</tr>
<tr>
<td>Student</td>
<td>534</td>
</tr>
<tr>
<td>T+S</td>
<td>588</td>
</tr>
<tr>
<td>Curriculum/Textbooks</td>
<td>266</td>
</tr>
<tr>
<td>etc</td>
<td>124</td>
</tr>
<tr>
<td>etc</td>
<td>124</td>
</tr>
<tr>
<td>etc</td>
<td>124</td>
</tr>
<tr>
<td>Teacher</td>
<td>188</td>
</tr>
<tr>
<td>T+S</td>
<td>202</td>
</tr>
<tr>
<td>Curriculum/Textbooks</td>
<td>81</td>
</tr>
<tr>
<td>etc</td>
<td>25</td>
</tr>
<tr>
<td>etc</td>
<td>25</td>
</tr>
<tr>
<td>Pre-service ET</td>
<td>1</td>
</tr>
<tr>
<td>Pre-service ST</td>
<td>44</td>
</tr>
<tr>
<td>etc</td>
<td>44</td>
</tr>
<tr>
<td>(E+S) Teacher</td>
<td>60</td>
</tr>
<tr>
<td>(E+S) Student</td>
<td>60</td>
</tr>
<tr>
<td>(E+S) Materials</td>
<td>60</td>
</tr>
<tr>
<td>etc</td>
<td>60</td>
</tr>
</tbody>
</table>

Elementary/Secondary/University/Other
II. Methodology

II. Analysis on Research Papers

5. International Research

- Foreign documents/participants (9.53%)
- Co-authored by scholars in other countries (1.28%)

Domestic 88.11%

International 11.89%

☐ Comparative studies > collaborative studies
II. Analysis on Research Papers

5. International Research

- General research related to the curriculum/textbooks
- Analysis of curriculum or textbooks focused on teaching methods

An analysis of the elementary math textbooks in Singapore: Focused on the model method (Pang & Kim, 2017)

An analysis of mathematical processes in elementary math curricula of Korea, China, Japan, & the US (Pang, Lee, Lee, Park, Kim, Choi, & Sunwoo, 2015)
An analysis on the prospective elementary teachers’ knowledge in the case of division of fractions (Pang & Li, 2008)

Case study of mathematical pedagogy for prospective elementary teachers in the US (Pang, 2011)
II. Analysis on Research Papers

5. International Research

- Pedagogical analysis: Comparative research of curriculum/textbooks with Korean
- Development research related to teacher education
II. Analysis on Research Papers

Other studies e.g.

Mathematical discourse for teaching (MDT) & technology-based MDT (Kim, Shin, Lim, & Lee)

Perceptions on proof & the teaching of proof: A comparison across preservice secondary teachers in Australia, USA & Korea (Lesseig, Hine, Na, & Boardman, 2019)

Math conceptual knowledge for teaching: Helping prospective teachers know math well enough for teaching (Li, Pang, Zhang, & Song, in press)

Culturally supporting Latinas & Korean girls in math (Lim, Lee, & Guerra, 2019)

Teacher learning of subject matter knowledge through an educative curriculum (Noh & Webb, 2014)

Core mathematical knowledge & cross-cultural teaching practices in algebraic & functional relations (Son & Kim)

Collaboration with Korean scholars in the US

Collaboration with foreign scholars via conferences
ありがとうございます

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Thank you