K-8 Preservice Teachers' Numeracy Understanding Using the IKAN Survey

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PRESENTATION GOALS

- Share preliminary results on K-8 Preservice Teachers' (PSTs') numeracy understanding
- Identify gaps PSTs may have had
- Implications for our program in terms of how to improve instruction

BACKGROUND (GNP)

Georgia Numeracy Project (GNP)
- Based on the New Zealand curriculum project
- Free, optional, evidence-based resource provided by the Georgia Department of Education and used by K-8 schools and districts
- Initial professional development available at state math conference (GCTM)
- One goal is to develop students' understanding of numbers and their ability to use numbers to solve problems and provide resources to support the building of students' numeracy skills
- 4 part process: GloSS/JAM, IKAN, Numeracy Intervention Instrument, and Intervention Activities.
- Uses two instruments to assess students:
  1. Global Strategy Stage (GloSS) for grades 3-8 **OR** Junior Assessment of Mathematics (JAM) for grade K-2
     - Individual assessment between teacher and student
  2. Individual Knowledge Assessment of Number (IKAN) for K-8
     - Can be taken as a whole class, timed test, numeracy knowledge test
     - Used in the GNP to diagnose students' numeracy knowledge and inform teaching strategies moving forward
     - IKAN consists of 2 different instruments: Counting Interview or Written Instrument.
     - The Counting Interview assesses numeracy concepts students should master by Grade 2 (Stages 1 - 3).
     - 8 stages of number knowledge assessed: Stages 1-3 with counting for K-2 and Stages 4-8 written for grades 3-8

GEORGIA SOUTHERN (GS)

Reasons to Implement the GNP at GS
- USG mandate to work on improving 3rd grade mathematics scores
- GS chose to work on numeracy
- Collaboration between College of Education and College of Science and Mathematics Faculty
- Work on increasing PSTs' ability to teach numeracy literacy
- Numeracy skills are foundational for our PSTs' teaching, so it is important for us (teacher educators) to understand PSTs' strength and weakness in this area
- To identify PSTs' number knowledge (number order and sequence, basic facts, fractions, and place value) and strategy stages.
- Chose IKAN because many of our PSTs will teach in Georgia
  - It is reasonable to assess their mathematical content knowledge using an assessment instrument adopted by the state
  - Students see how their own data affects instructional decisions and learning.
  - Experiencing activities and strategies from the GNP is beneficial to PSTs' future teaching
- To prepare PSTs to work with the GNP and corresponding resources in their own classrooms
- Allow PSTs to see the data collection and implementation process

YEAR ONE IMPLEMETATION

Participants in Spring 2020
- Elementary Math Methods class (*n=26*)
- Mathematics Content classes (*n = 27*)

Instrument: IKAN Written Test
- Assesses 4 knowledge domains: Number Sequence and Order, Fractions, Place Value, and Basic Facts
- Stages 4-8 of number knowledge assessed.
- Assesses numeracy concepts students should master in Grades 3 - 8
- Four versions of the written IKAN
- IKAN 1 written assessment was used

Instructional Decisions:
- Meeting as a team to discuss data and options for instruction
- COVID limitations on instructional delivery for Fall 2020

FINDINGS

Findings (Spring 2020 Data)

Mathematics Classes (N = 27)

Stage 4	Stage 5	Stage 6	Stage 7	`Stage 8
26%	56%	19%	0%	0%

Elementary Mathematics Methods Classes (N = 26)

Stage 4	Stage 5	Stage 6	Stage 7	`Stage 8
77%	15%	0%	8%	0%

- Most methods course PSTs were at stage 4, but PSTs immediately completing the content course at stage 5.
- Stage 4 is the beginning of part-whole relationship and is assumed to be the goal for PSTs by the end of Grade 3 (8-9 year olds).
- Results indicate PSTs who took the IKAN assessment reached the *third grade* goals of numeracy, but the test does not provide more information about what or how students know the concepts.
- PSTs should be at Stage 8 by the time they begin university coursework. Our PSTs would be considered "at risk" for their numeracy skills if they were at Stage 6 or below by eighth grade based on the IKAN results.

Mapping of IKAN 1 Questions to Domains

Domain	Stage 4 Questions	Stage 5 Questions	Stage 6 Questions	Stage 7 Questions	Stage 8 Questions
Number Sequence and Order	1 (100%) 2 (100%)	1 (100%) 2 (96%)	1 (96%) 2 (67%)	1 (93%) 2 (78%)	None
Fractions	3 (100%) 4 (96%)	3 (48%) 4 (78%)	3 (78%) 4 (78%)	3 (74%) 4 (7%)	1 (74%) 2 (63%)
Place Value	5 (100%) 6 (78%)	5 (33%) 6 (56%)	5 (19%) 6 (4%)	5 (93%) 6 (7%)	3 (0%) 4 (78%)
Basic Facts	7 (100%) 8 (93%)	7 (93%) 8 (96%)	7 (96%) 8 (89%)	7 (74%) 8 (74%)	5 (33%) 6 (30%) 7 (26%) 8 (22%)

- Our PSTs struggled most with Fractions, Place Value, and the last stage of "Basic Facts."
- Most of our PSTs (74%) were able to identify the greatest fraction in a list (Stage 8 Question 1) but had difficulty identifying the least (Stage 7 Question 4 - 7%). 78% were able to order fractions (Stage 5 Question 4; Stage 6 Question 3). PSTs struggled with other fraction conceptions such as: *Write the fraction for five quarters* (48%).
- Most of our PSTs (93%) were able to round a simple decimal to the nearest tenth. Most (78%) were also able write a number halfway between 4.8 and 4.7. However, PSTs struggled when asked questions that pushed them to use knowledge of groups of tens flexible such as: *How many thousands are in all of 6 456 894?* and *How many hundredths are in all of 6.073*?
- Finally, the four basic facts PSTs struggled with the most were converting between fractions, decimals, and percentages and identifying the least common multiple and greatest common factor of two numbers.

CONCLUSIONS

- PSTs' daily math vocabularies could be enhanced. For example, some of them didn't know the meaning of "quarters" and wrote "25" instead of ¼
- The weaker domains focus on place value, especially when involving decimals, and division/conversion/LCM/GCF (these topics are taught in the first Mathematics Content course)
- The use of rigorous mathematical language matters in teaching place value (e.g., 1.3 should be read as one and three tenths)
- There might be a disconnect between the concrete understanding (using manipulatives) or representational understanding (drawings of those manipulatives) to the abstract (IKAN problems) in our teaching
- PSTs understand the "place" but not the relationships (place value tasks may help students to see different representations and understand the relationships)
- We can teach our PSTs to use the numeracy project in their own teaching
- Professional Development for current Mathematics Teacher Educators: ways to incorporate appropriate vocabulary into their classes

Future Steps
- Giving a pretest and posttest for all sections of the first Mathematics Content course (5 sections)
- Focusing on flexible representations for place value
- Continued professional development for math content instructors in teaching strategies, vocabulary instruction

RESOURCES

Questions and Answers for IKAN 1

	Part 1	Part 2	Part 3	Part 4	Part 5
1	What number is one more than 49? **50**	What number is one more 599? **600**	What number is one more 439 999? **440 000**	Which decimal is the biggest, 0.639, 0.9, 0.84? **0.9**	Which fraction is the biggest, ⅜, 73/100, 7/10? **3/4**
2	What number is less than 30? **29**	What number is one less than 1000? **999**	What number is one less than 801 000? **800 999**	Which decimal is the smallest, 2.4, 2.71, 2.084? **2.084**	Which is the smallest? 2/3 , 0.6 or 70 % **0.6**
3	Write the fraction for one half. **1/2**	Write the fraction for five quarters. **5/4**	Write these fractions in order of size, smallest to biggest. 1/5, 1/7, 1/6 **1/7, 1/6, 1/5**	Which number is the same as 3/5? 5/3, 12/20, 1 2/3 4/6 **12/20**	How many hundredths are in all of 6.073? **607 or 607.3**
4	Write the fraction for one fifth. **1/5**	Write these fractions in order of size, smallest to biggest. ¾, ¼, 2/4 **1/4, 2/4, 3/4**	Write 4 and 1/5 as a fraction. **21/5**	Which fraction is the smallest, 3/8 4/10 1/3 ? **1/3**	What number is half way between 4.8 and 4.7? **4.75**
5	How many tens are in 80? **8**	How many tens are in all of the number 832? **83 or 83.2**	How many hundreds are in all of this number, 53 605? **536 or 536.05**	Round the following decimal to the nearest tenth. 6.49 **6.5**	What is the simplest fraction for 80%? **4/5**
6	What is the number for nine groups of ten? **90**	What is the number for 49 groups of ten? **490**	How many tenths are in all of the number, 5.8? **58**	How many thousands are in all of 6 457 894? **6457 or 6457.894**	What is 1.3 written as a percentage? **130%**
7	7 + 7 = ? **14**	7 + 9 = ? **16**	15 – 8 = ? **7**	63 ÷ 9 = ? **7**	What is the least common multiple of 6 and 9? **18**
8	Half of 18 is ? **9**	5 x 7 = ? **35**	6 x 7 = ? **42**	What number divided by 7 gives 6? **42**	What is the highest common factor of 36 and 48? **12**

Link:
https://nzmaths.co.nz/ikan-forms

Or QR Code: