

Pedagogical Content Knowledge on Algebra for Secondary School Teachers

Shin Hyunyoung (Korea National University of Education)

I. Introduction

We are mathematics teachers.

1. Students

- (1) To be taught to think logically and reasonably
- (2) To be taught to solve problems

2. Mathematics

- (1) Efficient language for understanding and explaining the nature
- (2) Cultural inheritance for solving problems

3. Teacher

- (1) Knowing, feeling, doing, and teaching mathematics
- (2) Most important factor for the successful education

II. Pedagogical Content Knowledge

Integrated Knowledge for Teachers

1. Understanding Students
 2. Knowing Mathematics
 3. Teaching Mathematics
- (figure)

Each strand of the above should not be separated from others.

All strands need to be simultaneously considered in any course during teacher education.

III. Understanding Students

1. Who are the children(students)?

(1) "I can read all of this(a 6-year child)."

(figure)

(2) There are 37 bicycles and tricycles. The total number of cycles are 86. How many tricycles are there?

(solution of a child)

2. What are recommended for children?

(1) Mathematics in everyday life

(example)

(2) Mathematics in history

(example)

(3) Mathematics through reading books which are not mathematics itself but of mathematical contents.

IV. Knowing Mathematics

Mathematics teachers know mathematics as much as possible.

Among the three strands, this is the most important.

V. Teaching Mathematics

(1) Curriculum

Teachers understand the curriculum completely.

(2) Textbooks

Teachers understand the contents of textbooks on higher point of view.

(3) Related Books

Teachers read as many books as possible.

(example)

VI. Examples of PCK

1. Classroom Based Algebra

(1) When we teach how to solve the linear equation $x + 3 + x = 2 + 3$, we remember the ring structure: operations (addition, multiplication), additive and multiplicative associativity, additive and multiplicative identity, additively and multiplicatively inverse element, additive and multiplicative commutativity, and distribution) even though we do not mention it in the classroom.

(2) In general, to teach the rule '(negative) \times (negative) = (positive)' is not easy. Each teacher has her(his) own teaching skill. However, we need to know the algebraic explanation of the rule.

(3) Associativity, commutativity, and distribution may not be valid in infinite world.

(example)

2. Knowledge Web

Knowledge tree is good. Knowledge web is better.

(figure)

(example)

VII. Conclusion

'Don't you understand? I am a teacher. Every day, through my students, I touch the future(S. C. C. McAuliffe).'

In these days there are fascinating topics for mathematics teachers. Dimension, infinity, probability, and verification schemes are some of them.