

# Direction of Mathematics Curriculum Reform in Korea

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# Curriculum Revision in Korea

- Since 1945, Korean mathematics curriculum has been revised 9 times with a period of 5-10 years.
- Currently, we revised in 2007 and 2011. And, we revised again in 2015. The period is just 4 years.
- Many math teachers worry that this period is too short to manage curriculum steadily. More serious is that we have to develop new textbooks in period of 4 years.

# Curriculum revision in Korea

- There were only three time of major revisions in 1973, 1997 and 2011.
- The other revisions had a relatively small scale of change.
- According to the chair of revising committee (Park, 2014), the 2015 revision has also small scale of change to reflect only some key points.

# What is the hope?

- How to make an easier, a more interesting, a more meaningful mathematics for students?
- This point is based on the **assumption** that mathematics is necessary for promoting national and individual development and mathematics is important for all students.

# Curriculum Revision in Korea

- If we could agree to this assumption “roughly”, how to realize the hope through curricula?
- Today, I want to introduce the main direction of the newly developed curriculum, which is to reflect **the current hope** of the society and the cumulative result of history of curricular reform.

# Major Revision in Korea

- There were only three time of major revisions in 1973, 1997 and 2011.
- The 3rd curriculum of 1973 emphasized theoretical mathematics and strongly adopted the philosophy of "new math" which was designed for reflecting **the pure mathematics that rapidly developed in the 20th century** at the school level.

# Major revision in Korea

- Since the 4<sup>th</sup> curriculum of 1980, the basic position of mathematics education had slowly been changed toward focusing on practical aspects such as problem solving, application and the use of calculators.
- Based on this slow change, the 7th curriculum of 1997 made a big change to focus on practical mathematics, which sharply contrasted with the 3rd curriculum.

# The 7<sup>th</sup> curriculum

- In the 7th mathematics curriculum, students were expected:
  - to be able to mathematically organize real world phenomena, (**application & modeling**)
  - to understand mathematical relations of concepts and principles by the process of abstraction based on their own concrete operations, (**understanding**)
  - to promote mathematical reasoning abilities by way of solving various problems using mathematical knowledge and skills they have already acquired, and (**reasoning & problem solving**)
  - Finally, to acquire a positive attitude toward mathematics (**attitude**)

# Inconvenient Truth

- However, traditionally, the most serious problem in Korean mathematics education is that mathematics is considered as a mere tool subject for students to prepare for the college entrance examination.

# Math Culture

- Such emphasis on test preparation without internal motivation for learning has made it **difficult for students to obtain a real understanding** and to develop reasonable and productive thinking abilities.
- It demands students to mechanically accept undigested contents organized around topics frequently appearing in the examination.

# Changing culture

- As a result, it has become almost impossible for students to nurture mathematical thinking and desirable mathematical attitude.
- This is a reason why almost of all students including high achievers dislike mathematics.
- Since 1997, Korean government has tried to change the culture toward focusing mathematical attitude and interest as well as problem solving and modeling.

# Other Key competencies

- In addition, 21<sup>st</sup> century future-oriented society requests students become not only more **creative** in their work but also considerate towards other people and comply with the rules and order of the greater society: **a good personality.**

# Curriculum of 2011

- The “Future-oriented” mathematics curriculum of 2011 had the aim of nurturing youth equipped with mathematical creativity and sound personality.

# 2012 Policy for mathematics education

- The MOE announced a policy on advanced mathematics education on January in 2012.
- This is because Korean students had a low interest, value and confidence in mathematics even though ranking the highest grades at international mathematics tests.

# Key Point of 2015 curriculum

- Making students more interesting, easier, more meaningful in mathematics!!
- How?
- Weakening of Difficult Contents: Proof
- Strengthening of Operation: Technology
- Reducing complex calculation

# Weakening of Difficult contents: Proof

- Although proving has always been acknowledged as a compulsory part of mathematical education, the teaching of proof within school mathematics has not been as successful as expected.
- That is owing to, not only the lack of knowledge of the concepts in geometry, but also the difficulty of systematically connecting propositions by logical rules within the axiomatic system.

# Proof

- The reason why students have difficulty with proving or are not able to achieve the expected goals in geometric education is because of formal logical proof.
- Logical proving in geometry education involves describing geometric knowledge according to logical formats, but students are not thoroughly trained of logical formats.

# Proof

- students' arguments are considered to be justified if they provide proper reasons in the problem solving process regardless of the absence of logical formats.
- Customizing logical proof to the process of objective justification to match students' levels provides students with the opportunity to actively utilize their reasoning abilities as well as to enjoy mathematics.

# Delay one or two years of Proof

- Now we teach proof from 8<sup>th</sup> grade. But, in the 2015 curriculum we will delay one or two years to avoid the students' cognitive difficulty.
- In Korea, we teach Euclidean geometry before going to

# Technology

- To understand mathematics well and increase problem solving ability, students has to increase gradually the degree of abstractness and have a chance to explore problems or to find solution based on concrete operation.
- However, practically, technology use in mathematics classroom seems to be far less than expected

# Technology

- Because a paper textbook is usually well organized in itself, teachers generally depends on the textbook's order and contents.
- Because basically a paper textbook is designed to teach well without computer, teachers prefer the traditional "chalk and board" in their classrooms.

# Technology

- Furthermore, students see teacher's explanation through screen and there is no chance to enjoy operation because every classroom has only one PC, projector and screen.
- "Teachers talk and show and students see and hear": Long tradition to mislead mathematics education in Korea!!

# Technology



- This is the **Trojan Mouse**.
- This symbolizes **"computer in classroom"**
- A strategy to reform math classrooms where teachers are too conservative to change their teaching styles.

We have succeeded infiltration of the tool like a Trojan Horse. But, nobody guarantees its successive mission because in the Mouse, there is no army, dislike Trojan Horse

# Technology

- All students have to do something rather than seeing. We need a dynamic textbook for all students to explore something on tablet PC rather than just seeing teacher's explanation.
- Together with curriculum revision, we are preparing the era of the digital textbook. We have to prepare many things to do from authoring tool, budget and teacher preparation etc.

# Reduction of complex calculation

- We will reduce complex calculation or move to higher grades.
- We will move fractional multiplication to 6<sup>th</sup> grade from 5<sup>th</sup> grade and mixing calculation of fraction and decimal numbers to middle school from 6<sup>th</sup> grade

# Conclusion

- I have introduced curriculum revision developed in 2015.
- Challenge is to make mathematics more meaningful, more interesting, easier.
- It might be to follow rainbow!!
- But, it is urgent because very few students like mathematics.
- In 21<sup>st</sup> century mathematics is more important than the previous century.

We have a dream....



# Microworld



Euclid explores something with compasses with his colleagues and students.

# Conclusion

- In this school, students and teachers have curiosity in learning and look happy in communicating each other.
- Of course, it is a just hope and there is no royal road to reach at the final goal but we still have to keep going on although it is very rough and tough.
- It might be destiny of Korean math education society for their students.