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A Study of Current Work in Curriculum Development for School Mathematics in Korea towards the 21st Century[1]

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The curriculum differentiation is supposed to maximize individual strength and possibilities of the students, and to maximize educational efficiency by differentiating the instructions according to students' abilities, aptitudes, needs and interests. The Ministry of Education has suggested a stepwise model for school mathematics. This model is named "Stepwise Curriculum Differentiation" (**段階別 教育課程 差別化**).

In this paper, we would like to make a specific proposal for the 7th curriculum. Our proposal reflects fully the guidelines of the Ministry of Education. It is also based on the national curriculum history up to the present time. It could be used as a reference for the continuing work of curriculum reformation.

We suggest dividing the contents of mathematics for 1–10th graders into about 15 steps, to use the step-based textbooks instead of the grade-based ones, and to prepare evaluation standards for each step. We also suggest that the classes for grades 11–12 be organized according to their optional courses and/or their steps.

INTRODUCTION

The desire of Koreans for quality education was the major driving force for national development. Education in Korea made a remarkable advance in quantity as well as quality over the last five decades.

Korean students seem to be relatively good at solving mathematical tasks given in school mathematics. In fact, according to the recent IEA (The International Association for the Evaluation of Educational Achievement) studies on mathematics, Korean eighth graders (14 years old) obtained the second highest achievement scores, next to Taiwan, of all 15 countries participating (Im and Kim 1995).

Although the IEA result seems to indicate success and perhaps honor for not only

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Korean students but also mathematics educators, the author suspects that the story might describe only a limited aspect of students's understanding of school mathematics. Students' understanding may be a superficial one, which would not be revealed by a conventional assessment instrument such as IEA studies.

The government of the Republic of Korea has started "eveling" of the secondary school in 1969. To get uniformity of the elementary and middle school education, entrance examinations for middle and high schools are abandoned in early 1970s.

However, the uniformity of education programs gave us another problem. Educational programs, which are presently offered by schools, neglected individual differences in interest, ability, aptitude and other personal attributes.

1. FRAMEWORKS OF THE CURRICULUM REFORMATION

A national-wide movement of curriculum reformation for the 21st century has been initiated in Korea. The 7th mathematics curriculum has begun to be discussed. The Third Presidential Report (February 9, 1996) provides the guidelines for the 7th curriculum. According to the Report, the 7th curriculum should:

1) be a basic common curriculum for 1–10th graders;
2) provide options for secondary school students;
3) give consideration to the senior high schools such as occupational, science, or foreign language high schools which were founded with special purposes; and
4) focus on the curriculum differentiation.

Each student has to belong to an appropriate group, according to his/her step, organized within a classroom or across several classrooms. The first 10 of the 15 steps are the minimum requirements during the 10 year-long education. In other words, the minimal competencies in mathematics are taught from grade 1 to grade 10. For the 11th and 12th graders, each school should offer various optional courses, reflecting their abilities and interests, so the students can select courses suitable for their careers and abilities.

Any student who has passed the highest step (the 10th step) can take optional courses for the 11th and 12th graders regardless of their age.

The reason why the Ministry of Education want to put the elective courses (for the seventh amendment) for all levels of students is to respect the individual differences in ability of mathematical thinking.

2. Several Principles of the Content Construction

1. Premise

The classes for grades 1–10 are organized according to their grades (school years). The groups are organized within a class or across several classes. The grouping may be different according to the subject matter and how it differentiates the learning programs.

The classes for grades 11–12 are organized according to their optional courses and/or their steps.

2. Curriculum Management

The basic 10 steps (Basic Steps 1–10) are made up of knowledge and basic skills in mathematics. The minimum level of each step should be identified by teachers at the school level as Basic-step-enhancement criteria. In other words, students who satisfy the criteria can progress to the next step. Some supplements should be provided to students who fail the Basic-step-enhancement test and then they have to take the test again. Students who fail twice in a step have to stay there one more term, however their grades (school years) become the next ones. Special programs for the gifted should be designed within each step.

The advanced 5 steps (Adv. Steps 1-5) are prescribed for students who have passed the basic steps (See Table 1).

The Adv.-step-enhancement or achievement evaluations in the advanced steps are determined at city-level or province-level tests and the Basic-step-enhancement test scores are recorded on the Personal General School Recorder. Supplements are also to be provided to students who fails the Adv.-step-enhancement test. Special programs for the gifted students should be designed.

The optional courses in high school consist of algebra, analysis I/II, geometry, probability & statistics, and discrete mathematics. Students can take thesis courses in accordance with their career and needs regardless of their grades.

Table 1. Time Allocations in the Stepwise Curriculum Differentiation Model

Grade / Course	1	2	3	4	5	6	7	8	9	10	11	12
	Elementary School						Junior High			Senior High		
Basic steps*	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	See Table 2 Below	
Class hrs/wk	3	3	3	3	3	3	3	3	3	3		
Adv. Steps**	Adv.-**1**				Adv.-**2**		Adv.-**3**		Adv.-**4**	Adv.-**5**		
Class hrs/wk	4				4		2		2	3		

* prescribed course

** courses permitting partial shortage

Table 2. Optional Courses in Senior High School (Grades 11 and 12).

Optional course* **	alg.	anal. I	anal. II	geo.	stat. I	stat. II	disc. math.
Class hrs/wk	2	3	4	2	1	1	2

*** prescribed or free optional courses

The achievement evaluations in the optional courses are determined at city-level or province-level tests. These scores are recorded on the Personal General School Recorder to be used as a predictor for college entrance examination as well as the Adv.-step-enhancement test scores.

The test items, which are provided at city-level or province-level, may consist of essay test in the mathematics area. Mathematically gifted students are allowed to take college mathematics courses before they enter college.

3. Details of the Optional Mathematics Course

Tables 2 and 3 show a suggestion about optional mathematics course selections for 11–12 graders who are planning to enter colleges.

Table 3. The Optional Course Selection for Each Line: An Illustration

Course / Line	Basic Steps 1–10	Adv. Steps 1–5	Alg. (4 cr.)	Anal. I (6 cr.)	Anal. II (8 cr.)	Geom. (4 cr.)	Stat. I (2 cr.)	Stat. II (2 cr.)	Disc. Math. (4 cr.)	Credits ○+△+○
Sc. & Tech.-A	○	○	○	○	○	△	○	△	○	24+6+0
Sc. & Tech.-B	○	○	○	○	○	△	○	△	△	20+10+0
Eco. & Mg.	○	○	○	○	⊙		○	△	⊙	12+2+12
Social Sc.	○	●	⊙	⊙			○	⊙	⊙	2+0+16
Lang. & Lit.	○	●	⊙	⊙						0+2+10
Arts & Athl.	○	●	⊙	⊙						0+0+10

○ prescribed course ● individually partial shortage △ prescribed option ⊙ free option

Science and Technology Line A (Sc. & Tech.-A; see Table 1): mathematics, physics, electronic technology, chemical technology, civil engineering, etc.

Science and Technology Line B (Sc. & Tech.-B): chemistry, biology, earth science, computer science, architecture engineering, food science, agricultural science, industrial

science, medical science, etc.

Economic and Management Line (Ec. & Mg.): economics, trade, management, accounting, etc.

Social Science Line (Social Sc.): administration, political science, jurisprudence, etc.

Languages and Literature Line (Lang. & Lit.): linguistics (Korean, English, French, Spanish, Italian, Dutch, Russian, Chinese, Japanese, etc.), literature, history, geology, etc.

Arts and Athletic Line (Arts & Athl.): fine arts, music, industrial arts, athletics, dramatics, etc.

4. The Time Allocations in the Stepwise Curriculum Differentiation Model

Tables 1 and 2 on the previous page show suggestions for the time allocations in the stepwise model.

3. Conclusion

Korean mathematics education has been influenced by Japan, America and many other countries, but there has been little attempt to formulate a Korean model, Not much research has been done on the basis of historical background and the need for the present and future society.

Because Korea is one of the well-developed countries, there is a need to undertake research to develop a Korean model instead of copying foreign models. To do that, we must have clear goals and objectives.

> Why are we teaching mathematics?
> What are the goals and the objectives of mathematics education?
> What kind of mathematics is necessary, and for whom?

Without setting the goal and objectives clearly, Korean mathematics education will merely end up emulating others.

With clear goals and objectives, Korean mathematics education can move forward to overcome the challenges of bureaucratic ideas and the misleading influence of college entrance examinations. If the mathematics tests continue just to measure skills, mathematics education will continue to follow the wrong path.

We need, therefore, to investigate more closely what Korean students really understand, and also to identify either deceptive or simplistic factors lying behind Korean students' apparent mathematical efficiency.

In conclusion, Korean mathematics educators must begin to undertake practical research to assist in the setting of clear goals, contents, objectives, and methodology, and the government should provide sound policy to support the dissemination of the research

results, and to lead mathematics education in appropriate direction.

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