

Summary

INVESTIGATION ON CURRICULUM DECISION AND INSTRUCTION IMPLEMENTATION OF MATHEMATICS REMEDIAL INSTRUCTION AT AFTER-SCHOOL ALTERNATIVE PROGRAM IN ELEMENTARY SCHOOLS

INTRODUCTION

An after-school remedial instruction program has been implemented in Taiwan since 2006 to give remedial instruction to students who are behind in school learning, provide all students with an opportunity for fruitful learning, and fulfill the goal of education equity. Mathematics, in particular, is one main subject of the remedial instruction program. However, previous research in Taiwan rarely probed into how the mathematics remedial curriculum was determined by a teacher and how a teacher implemented mathematics remedial instruction. Considering that curriculum decisions and the implementation of instruction are key influencing factors of whether the instruction of remedial mathematics is effective, we propose to center on curriculum decisions and the implementation of instruction in this study, understand how teachers give mathematics remedial instruction and teachers' concerns in the instruction by means of observation and interview, as well as find out how teachers determine the content of mathematics remedial curriculum by means of questionnaire surveys, how teachers carry out remedial instruction, and difficulties encountered in the two dimensions of remedial instruction in order to have a better understanding of the current status of mathematics remedial instruction in Taiwan.

METHODS

Data for this study was collected in the 2010 academic year. A total of eight teachers participated in the observation and interview while 300 teachers participated in the questionnaire survey. With reference to a framework for observing mathematics instruction proposed by Artzt and Armour-Thomas (2002) and Stein, Remillard and Smith (2007) emphasis that mathematical problems should be the core of mathematics instruction, we formulated a scale for observing mathematics remedial instruction and proposed to understand

the current status of mathematics remedial instruction from the three perspectives: Mathematical problem, learning environment, and discourse. A semi-structured interview was employed, and the outline of the interview encompassed three aspects: Teachers' considerations in deciding the content of mathematics remedial curriculum, the implementation of mathematics remedial instruction and assessments, and difficulties that teachers perceived in course of instruction. In addition to teachers' basic information (gender, teaching experiences, educational degree, *etc.*), the questionnaire covered 11 question items in the three aspects: Curriculum decision, instruction implementation, and difficulties encountered in curriculum and instruction. Subsequently, statistical analysis was performed based on the number and percentage of teachers' answers to the questionnaire.

RESULTS

1. Implementation of Mathematics Remedial Instruction and the Teachers' Concerns

Mathematics remedial instruction of the eight teachers who were selected as subjects in this study is presented in Table 1. Judging from the data in Table 1, mathematical symbols were heavily used to present mathematical problems by the eight teachers when giving mathematics remedial instruction, mathematical problems involving mathematical calculations accounted for the majority of all mathematical problems, and the instruction was largely given straightforwardly. With respect to instruction methods and teacher-student interaction, most teachers explained and demonstrated to the entire class before letting students practice solving mathematical problems individually and giving students individualized instruction, and there was no interaction among students. Factors in relation to instruction and curriculum were teachers' most frequent concerns when giving mathematics instruction, respectively accounting for 22.7% and 18.5% of all teachers' concerns. Teachers' third concern was students' learning performance and attitudes, which accounted for 16.6% of all teachers' concerns. The three concerns all together accounted for 57.8% of the interviewed teachers' responses, indicating that the three factors were teachers' foremost concerns when giving mathematics remedial instruction.

Table 1

The statistical table of teachers' mathematics remedial instruction

Dimension / Teacher	ObT1 ₍₆₎	ObT2 ₍₆₎	ObT3 ₍₄₎	ObT4 ₍₆₎	ObT5 ₍₃₎	ObT6 ₍₆₎	ObT7 ₍₂₎	ObT8 ₍₄₎
The number of questions	2	NJ	3	2	12	6	40	6
Problem Representation	S	NJ	P	P	S	S, P	S	S
Motive	D	D	D	D	B-D	D	E	B-D
Type	A	NJ	A	R	C, A	R	A	C
Mode of instruction	L-G	G	L-G	L-G	L-G	L-G	L-G	L-G
Discourse	W-I	I	W-I	W-I	W-I	W-I	W-I	W-I

Note 1: ObT1₍₆₎ stands for the observation of T1 teacher's instruction of 6th grade, and so forth.

Note 2: NJ stands for "unable to determine"; S stands for "symbolic representation", P stands for "iconic representation"; D stands for "starting directly"; B-D stands for "reviewing prerequisite knowledge prior to starting directly"; E stands for "life experience"; C stands for "conceptual problems", A stands for "calculation problems", R stands for "application problems"; L stands for "giving a lecture to the entire class", G stands for "individualized instruction", L-G stands for "giving a lecture to the entire class prior to giving individualized instruction"; W stands for "interacting with the entire class", I stands for "interacting with individuals", W-I stands for "interacting with the entire class prior to interacting with individuals".

2. Teachers' Curriculum Decision and Instruction Implementation of Mathematics Remedial Instruction

Given that only 277 out the 300 teachers who participated in the questionnaire survey had performed mathematics remedial instruction, we only analyzed the 277 teachers' answers to the questionnaire. Teachers' thoughts on curriculum decisions of mathematics remedial instruction and results of teachers' contemplation are shown in Table 2, which revealed that teachers set the objectives of a remedial curriculum primarily based on students' existing mathematical knowledge and skills and secondarily on teachers' previous teaching experiences. With respect to teachers' decisions on the curriculum content, most teachers used textbooks for students in that grade as the core content of remedial instruction and added supplementary teaching materials now and then. Meanwhile, 25.3% of teachers used textbooks for students in other grades as materials for remedial instruction to better suit students' existing mathematical knowledge and skills.

Table 2

The statistical table of teachers' curriculum decisions of mathematics remedial instruction

Dimension	Decisions on curriculum objectives				Decisions on curriculum content			
	Objectives of curriculum	Objectives of teaching	Personal teaching experiences	Students' performance	Textbooks of students' grade	Textbooks of other grades	Self-designed	Textbooks and supplementary teaching materials
Frequency	82	88	145	245	176	70	88	172
Percentage	29.6	31.8	52.3	88.4	63.5	25.3	31.8	62.1

The statistical results of the implementation of mathematics remedial instruction are revealed teachers' remedial instruction centered on enabling students to understand mathematical concepts and performing basic mathematical calculations, emphasized on association with students' life experiences, and adopted individualized instruction as the principal mode of instruction. Except for differences in the presentation of instruction and results at the stage of observation, both the focuses of instruction and the implementation of instruction were consistent with results of observation. Also, 85.6% and 77.6% of teachers expressed encountering difficulties in remedial curriculum decisions and the implementation of remedial instruction, the primary reason being a great divergence in individual students' mathematical knowledge and skills.

CONCLUSIONS AND SUGGESTIONS

1. Conclusions

- (1) Mathematics remedial instruction for elementary school students in Taiwan is largely about mathematical concepts and operational skills, and the instruction starts with lecturing to all students in a class before proceeding to giving individualized instruction and allowing practices individually.
- (2) Materials for mathematics remedial instruction are predominantly textbooks designed for students in that grade instead of materials which are designed to better suit students' mathematical knowledge and skills.

- (3) The great divergence in students' mathematical knowledge and skills give teachers a hard time in making remedial curriculum decisions and giving remedial instruction.

2. Suggestions

- (1) The implementation of mathematics remedial instruction should incorporate both teacher-centered and student-centered approaches and students should be given opportunities to express their own ideas.
- (2) Actions should be taken to plan and develop appropriate mathematics remedial curriculum to fit for students' prior knowledge and skills.
- (3) Action research may be conducted to solve difficulties encountered by teachers in giving remedial instruction.