Mathematics Education in Japan: Through reconsideration of problems

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Area of work
Mathematics education, Teachers education, Quality of education, Project/ Program management

Project experience
Kenya SMASSE Project, Bangladesh Primary Education Project

Often to view education in Japan from outsider’s perspective
Self Introduction No.2

Research Topics of my Students

- Effectiveness of In-service Teachers’ Training Program for Primary Mathematics in Bangladesh
- The Impact of In-service Teacher Training Through an Outreach Program on the Content Knowledge of Basic School Mathematics Teachers in Ghana
- A Study on the Concept of Equity in Reform of Mathematics Education
- 3-dimensional Consideration of Lesson towards Construction of Evaluation Framework of Teaching Competency in Primary Education in Bangladesh
- Influence of Japan on Modernization of Mathematics Education in China
- Consideration of Resource Center as a Way of Educational Development
Three levels of Curriculum

Exhibit 1: TIMSS Curriculum Model

- National Social and Educational Context
- School, Teacher and Classroom Context
- Student Outcomes and Characteristics

Intended Curriculum

Implemented Curriculum

Attained Curriculum
1. Attained Curriculum

Problems of Attained curriculum

- Lowering scores of achievement (Many scholars claim this.)
- Low affective aspect (TIMSS, 1999)
- Low perception of relation between mathematics and society (TIMSS, 1999)
- Educating children morally and emotionally (Many sad news)
Low affective aspects
<table>
<thead>
<tr>
<th></th>
<th>Russia, Singapore, Malaysia</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Japan, Czech, Latvia, Slovenia, Taiwan, Korea, Finland, Australia, Hungary, USA, Bulgaria, Slovakia, Belgium</td>
</tr>
<tr>
<td>C</td>
<td>Moldova, Rumania, Lithonia, New Zealand</td>
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<td>***</td>
<td>Chile, Thailand, Italy</td>
</tr>
<tr>
<td>D</td>
<td>Turley, Tunisia, Israel, Cyprus, England, Indonesia, Iran, Macedonia, Philippines, Jordan, South Africa, Morocco</td>
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</tbody>
</table>
Reconsideration of Problems of Attained curriculum No.1

- Lowering scores of achievement (Many scholars claim this.)
  Timing of discussion is at economic depression.
  Is there a claim based on statistically sampled data?
  Difference in educational objectives
- Low affective aspect (TIMSS, 1999)
  Validity of data
  why affective aspect and performance are inversely related
Reconsideration of Problems of Attained curriculum No.2

- Low perception of relation between mathematics and society (TIMSS, 1999)
  What is characteristics of mathematics
  Why Low perception-High performance

- Educating children morally and emotionally (Many suicidal cases very recently)
  Is it only a problem of children?
Breakfast and Achievement
### Problems of Attained curriculum in the history: Gakuryoku debate

<table>
<thead>
<tr>
<th>Survey by Tanaka</th>
<th>Total Score 161 points</th>
<th>Survey by Kubo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 5</td>
<td>71.28 (44.27%)</td>
<td>Grade 6</td>
</tr>
<tr>
<td>Grade 6</td>
<td>84.04 (52.20%)</td>
<td>61.34 (38.10%)</td>
</tr>
</tbody>
</table>

Survey by Kubo Grade 6
Learning Gap to Teaching Gap
2. Characteristics of Implemented Curriculum
Teaching from Edo to Meiji
Video Viewing
## Comparison between Class in Japan and that in USA

<table>
<thead>
<tr>
<th>Country</th>
<th>Japan</th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Characteristic</strong></td>
<td>「Structured problem solving」</td>
<td>「Learning terms and doing exercises」</td>
</tr>
</tbody>
</table>
| **Type of lesson (Stages)** | Review of previous lesson  
Problem posing  
Individual or group work  
Discussion on solution  
Summary | Review of previous lesson  
Posing solution  
Exercise of similar problems  
Checking and homework |

Structured Problem Solving (Stigler, Hiebert, 1999)
Characteristics of lessons

- Cohesiveness: Mathematical problem is posed so that students investigate it based on the previous topics and knowledge.
- Extensive discussion: Teacher moving around the students and later act as an facilitator of mathematical discussion about various solutions.
- Usage of Blackboard: Various solutions are presented on the board and they stimulate students to discover new ideas through discussion.
3. Improving Quality of Implemented level: Lesson Study (Jugyou-kenkyu)

Quality of education (UNESCO, 2005)
Process of Lesson Study

Study of Teaching Materials (Plan)  
(Identification of theme, compilation of lesson plan)

Lesson (Do)

Meeting on lesson (See)  
(Lesson evaluation and reflection)
Historical development of lesson study in Japan

- Meiji (first half): Concrete embodiment of the courses of study
- Meiji (last half): The transmission and development of teaching skill and the formation of the image of a teacher
- Taisho: Demonstration of new education model
- Showa (after war): The formation of ability and self-confidence in teachers through collaboration
Taisho Period

Hyogo Normal School

Eight Educational Ideas
# Types of lesson study

<table>
<thead>
<tr>
<th></th>
<th>In school</th>
<th>Head teachers and teachers in public schools</th>
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<tbody>
<tr>
<td>2</td>
<td>Study group on prefectural and municipal level</td>
<td>Teachers in public schools</td>
</tr>
<tr>
<td>3</td>
<td>Study group on prefectural and municipal level</td>
<td>Education board</td>
</tr>
<tr>
<td>4</td>
<td>All over the country</td>
<td>Head teachers and teachers in attached school</td>
</tr>
<tr>
<td>5</td>
<td>All over the country</td>
<td>Academic association, private companies</td>
</tr>
</tbody>
</table>
Topic 2: Long-term Effects through Transmittance of Teachers’ Image

Why do you want to be a teacher?

40 students (Third year students at Faculty of Education) in 2004

Security of job (8)
- Influence by teachers (20)
- Experience to teach friends (13)
- Sports related job (3)
- Language based job (2)
4. Characteristics of Intended curriculum

- Four Content Areas
  Number and Calculation, Measurement and Quantity, Geometrical Figures, Quantitative Relations

- Four Perspectives of Evaluations
  Attitudes/Willingness/Interests, Mathematical Thinking, Representational Skills, Knowledge and Understanding
USA Standards

Contents Standards
- Number and operations
- Algebra
- Geometry
- Measurement
- Data analysis and probability

Process standards
- Problem solving
- Reasoning and proof
- Communication
- Connection
- Representation
（1）課題  「$a$ と $b$ は，$c$ という関係があります。」  この文章の $a$ と $b$ は，下にあげた 8 つの数のどれかを表しています。また，$c$ は，その 2 つの数の関係を表しています。2 つの数の組 $a, b$ とその関係 $c$ をできるだけたくさんあげなさい。ただし，$c$ という関係があたはまる $a$ と $b$ が 2 組以上あるものとします。

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<tbody>
<tr>
<td>4</td>
<td>-9</td>
<td>-1/4</td>
<td>9</td>
</tr>
<tr>
<td>-1/9</td>
<td>-4</td>
<td>1/9</td>
<td>1/4</td>
</tr>
</tbody>
</table>
New Approaches No.2

To ask Attitudes/Willingness/Interests and Mathematical Thinking

- Various solutions
- Relation with real life
- Let students make a problem
- Let students state the reason for solution

To open learning(s) and connect them

- Similarity and difference between different solutions
- Beyond some routine approach
- Beyond given problem
- Beyond school compound
- To appreciate power of mathematics
5. Very recent development

Influence of New Public Management (Outcome, Competitiveness)

Disruption of classroom
Unsuitable teachers, retraining program
Renewal system of teaching license

30% cut in teaching contents
Gakuryoku dispute
Revision of course of studies
National assessment
Reflection of Result of national assessment on budget
A way of conclusion

- What is the real problem?
- How can we improve the present situation?

- There is no easy road to EDUCATION.