JICA’s Technical Cooperation in Math and Science Education

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Structure of the Presentation

1. Basic features of JICA’s TC projects on M&S in Africa
   a. Major achievements
   b. Major challenges
   c. Lessons learned

2. Based on the lessons learned, Emerging areas for technical cooperation

This presentation is developed based on the one presented at ADEA Triennale 2017 by Matachi et al, "JICA's Support to Education in Africa: Focusing on Mathematics and Science Education."
1. Basic Features of JICA’s TC Projects on MSE in Africa

**<Teaching and learning approach>**
To develop skills of teachers to conduct *lessons that allow students to think and develop conceptual understanding*

**<CPD/INSET systems>**
To *establish a system for continuous professional development* for M&S teachers
What is the area of a parallelogram?

Area of a parallelogram

= base \times \text{ height}

= 8 \times 5

= 40

Why can we find the area of a parallelogram by base \times \text{ height}?
How can students have conceptual understanding?

① Connection among each grade or topic.

- Pupils construct new knowledge based on prior knowledge.

Example

- Connecting area of a triangle (prior knowledge) and area of a parallelogram (new knowledge).
- Connecting area of a rectangle (prior knowledge) and area of a parallelogram (new knowledge).
② Open-ended approach / Problem solving approach

- More actively engage learners in thinking
- Offer opportunities to extend mathematical thinking

Q. Find the area of the parallelogram.

Area of a parallelogram = Base × Height
ASEI lesson: that allows students to think and find solutions on their own (developed by Kenya SMASSE)

- Lecture-based
- Activity-based
  - Teacher provides solutions
  - Students find solutions
- Theory-based
- Experiment-based
  - Conventional apparatus
  - Improvised materials
CPD/INSET systems
Cascading Approach

National Trainers

Regional Trainers

Teachers

National Training
(1 time/year)

Regional Training
(1 time/year)

Practice at School
CPD/INSET systems
School/Cluster-based CPD/INSET

Cluster-based CPD/INSET

School-based CPD/INSET

School A

School B

School C

School D
Lesson Study

What lesson shall we deliver?

Let us conduct the lesson in the actual classroom!

Plan → Do → See → Improve

Let us modify the questions!

How learners understand the lesson?
8 Step Cycle of Lesson Study in Zambia

1. Defining Problems
2. Planning a Lesson
3. Conducting the Lesson
4. Debriefing the Lesson
5. Revising the Lesson
6. Conducting the revised Lesson
7. Reviewing the Lesson
8. Compiling Learning
Advantages of Lesson Study

- **Flexible:** Low cost & highly scalable
- **For Long-term:** Continuous growth of teachers
- **By Teachers:** Empower teachers as main actors & enhancing management skills of INSET managers
Factors motivating/demotivating teachers in Lesson Study in Zambia

- Learning new knowledge and skills (47%)
- Learning how to handle difficult topics (10%)
- Interaction with fellow teachers (7%)
- Students improvement in performance (6%)
- Other (30%)

- Lack of teaching and learning materials (24%)
- Lack of financial assistance (15%)
- High load to teach class and conduct school events (14%)
- Lack of support from School and fellow teachers (14%)
- Learners lose time to learn (14%)
- Other (19%)
Scale-up of School-based Lesson Study in Zambia

(MGE & JICA, 2015, Completion Report of STEPS Project)

- 1,989 teachers
- 213 schools
- 1 province

- 560,000 pupils
- 14,035 teachers
- 1,057 schools
- 3 provinces

- 1,640,000 pupils
- 46,058 teachers
- 3,121 schools
- 10 provinces

Plan

- 3,800,000 pupils
- 100,000 teachers
- 9,500 schools

- 20,000 pupils
- 2006

- 1,057 schools
- 2011

- 46,058 teachers
- 2015

- 3,800,000 pupils
- 2023
### M&S (Teacher) Education Projects in Africa Supported by JICA

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- **School/Cluster-based INSET with Lesson Study**
- **Cascading INSET**
1. **INSET systems established**
   a. 6/15 countries sustain regular INSET programme after the project period.
   b. 6/15 countries are still implementing projects.
   c. 3/15 countries may have ceased.

2. **Lesson delivery improved**
   a. Based on the results of lesson observations, 9/13 countries observed improvements in lesson delivery between pre-test and post-test.
## Major Challenges of TC Projects Supported by JICA

1. **Incentive is not enough for teachers to continuously participate in INSET.**

<table>
<thead>
<tr>
<th>Reason/Cause</th>
<th>Area</th>
<th>Measures</th>
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<tbody>
<tr>
<td>- No INSET policy.</td>
<td>Policy</td>
<td>- To formulate INSET/CPD policy/Framework.</td>
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2. **Teaching methods learned at INSET is not implemented in the classroom as expected.**

<table>
<thead>
<tr>
<th>Reason/Cause</th>
<th>Area</th>
<th>Measures</th>
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<tbody>
<tr>
<td>1. Cannot finish the syllabus.</td>
<td>Policy</td>
<td>• To streamline the curriculum.</td>
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<td>2. Examinations focus on lower order thinking skills such as factual knowledge.</td>
<td>Policy</td>
<td>• To revise examination items.</td>
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<td>3. Requires longer time to prepare a lesson.</td>
<td>Teacher</td>
<td>• To streamline the process of preparation for lessons.</td>
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<td>4. Difficult in dealing with a large class.</td>
<td>Teacher/Policy</td>
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3. Although changes in lesson delivery are observed, many of them do not lead to improving students’ understanding.

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<th>Reason/Cause</th>
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<th>Measures</th>
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<tr>
<td>1. Training once a year is not enough to change teaching. It requires</td>
<td>Policy</td>
<td>• To provide teachers with school-based CPD to internalize the skills and knowledge</td>
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<td>continuous efforts.</td>
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<td>2. Teachers’ understanding about pedagogical content knowledge (PCK) is not</td>
<td>Teacher/Learner</td>
<td>• To provide teachers with opportunities to strengthen PCK (e.g., Lesson Study)</td>
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<td>enough.</td>
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<td>• To strengthen PRESET.</td>
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<td>3. Learners’ basic skills and knowledge (e.g., numeracy skills) are insufficient.</td>
<td>Learner</td>
<td>• To develop remedial workbooks for learners to strengthen numeracy skills.</td>
</tr>
</tbody>
</table>
1. For teachers to use learner-centered approach, examination is critical.

2. Pedagogical Content Knowledge (PCK) is needed by teachers to conduct effective lessons.

3. Basic knowledge and skills such as numeracy skills are the foundation for further study of mathematics.

4. Collaboration between PRESET and INSET is important to propagate Learner-centered approach.
Ethiopia’s Case

Project for Capacity Development for Improving Learning Achievement in Mathematics and Science Education (LAMS Project: 2014-17)

- To ensure the coherence of the three levels of curriculum

- To improve the quality of assessment (test) by improving the quality of test items for item pools
Ethiopia’s Case

Curriculum

By changing lessons

Teacher training

Classroom teaching

LAMS Project

Assessment

Classroom teaching

By improving question items
52. The process of photosynthesis takes place in:
   A. palisade, sponge and guard cells
   B. lower epidermis and upper epidermis
   C. palisades and epidermis cells
   D. mesophyll cells and cuticle
Ethiopia’s Case

1. The figure is an experimental apparatus to show that oxygen is produced during photosynthesis. What will you observe if you increase the light intensity?

A. The bubbles decrease
B. The bubbles increase
C. No change is observed
D. The light destroys the bubbles
Items have been developed which are appropriate for measuring specific skills/knowledge.

Capacity of test item developers has been strengthened.

12. When \( \frac{3\frac{1}{12} + \frac{1}{6}}{\frac{1}{5} \times \frac{5}{12}} \) is computed it gives:
   - A. 35
   - B. 37
   - C. 26
   - D. 25

1. \( 2\frac{4}{5} \times \frac{5}{14} \) is equal to
   - A. \( \frac{3}{7} \)
   - B. \( \frac{4}{7} \)
   - C. 1
   - D. 2
Implementation Structure

National Steering Committee
State Minister: Oversight
EPRMD: Project Management

Technical Committee
National Coordinator

REBs
MSIC
NEAEA
CDID
TELDD

Working Groups
Mathematics
Biology
Chemistry
Physics
Assessment/Evaluation

EPRMD: EMIS, Planning and Resource Mobilization Directorate
Niger’s Case

Minimum Package to strengthen basic mathematical skills of primary pupils with remedial workbooks

- Developed **self-learning** materials for pupils to strengthen the understanding of **basic principles** of calculation; and to internalize the skills of calculation.

- **Increased study hours** with the help of the communities.
Niger’s Case

Achievement test

Remedial workbook Activity

Sharing results with the community

Major outcomes:
Percentage of correct answers increased by 20% between Pre- and Post-tests for 1\textsuperscript{st} - 5\textsuperscript{th} graders.
Other examples

- **Zambia**: Lesson Study for CPD and strengthening collaboration between Pre-service institutions and schools to improve quality of Lesson Study

- **Malawi**: Action Research for improving INSET and PRESET curriculum

- **Morocco**: Improving academic performance by using diagnostic assessments of learners.

- **Senegal**: Improving basic mathematical skills by using remedial workbooks for learner..
Thank you for listening

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Japan International Cooperation Agency

References:
Reference

The History of Japan’s Educational Development (Book):


ADEA 2017 Triennale JICA presentations
Mr. Matachi presentation
https://www.jica.go.jp/information/seminar/2016/ku57pq00001zpe2a-att/20170317_01_03.pdf

Summary paper “JICA’s Support to Education in Africa”

Mr. Taguchi presentation